

An artist's rendering shows the bridge from the West Virginia side.



State Partnership Creates Cable-Stayed

Ohio DOT builds bridge connecting states, then turns over operation to West Virginia

When the steel cantilever through-truss steel bridge over the Ohio River between Pomeroy, Ohio, and Mason, W.Va., was judged functionally and structurally deficient by the Departments of Transportation of Ohio (ODOT) and West Virginia (WVDOT), deciding to replace it was an easy decision. But how best to design and construct it was far from an obvious choice, says Dave Jeakle, lead engineer from the Tampa office of URS Corporation. Because it

spanned the Ohio River between the two states, both states were involved in the decisions—and created a unique partnership.

The Ohio River at the bridge location lies within West Virginia's boundaries. Since the bridge's construction and traffic affect both states, both the ODOT and WVDOT were involved. But rather than divide the construction responsibility between the two states, a unique

profile

POMEROY-MASON BRIDGE / POMEROY, OHIO TO MASON, W.VA.

ENGINEER OF RECORD: URS Corporation, Tampa, Fla.

CONSTRUCTION ENGINEERING: Janssen & Spaans Engineering Inc., Indianapolis, Ind.

CONSTRUCTION INSPECTION: Michael Baker Jr. Inc., Pittsburgh, Pa.

PRIME CONTRACTOR: C.J. Mahan/National Engineering (a joint venture of C.J. Mahan Construction Co., Grove City, Ohio, and National Engineering & Contracting Co., Westerville, Ohio)



A major consideration, especially for West Virginia, was to minimize long-term maintenance.

"We evaluated several systems to determine the best choice, with plenty of input from both states," says Jeakle. "A major consideration, especially for West Virginia, was to minimize long-term maintenance."

Among the systems discussed were a simple tied arch; a three-span, continuous, parallel-chord steel truss; and a three-span, cast-in-place concrete cable-stayed bridge. The cable-stayed option was chosen, primarily because of the design's aesthetics. "Although construction cost was definitely a factor in the decision-making process, when we compared all of the various options, none stood out as being more cost efficient than another." The final design represents a consensus from both departments, including a variety of officials, adds Michael Zwick, a senior project manager in URS's Cincinnati office, who shepherded the project.

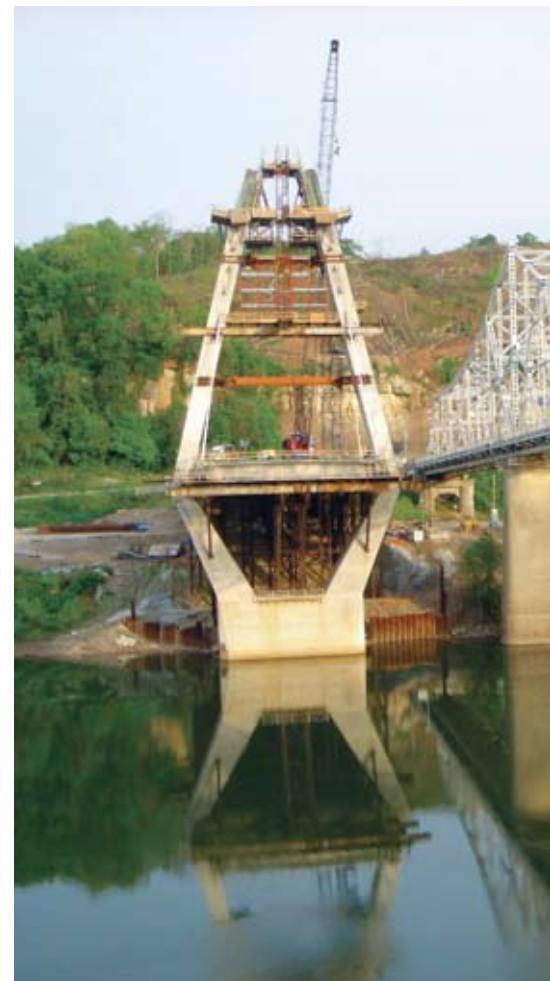
75-Year Service Life

Longevity was another key factor in choosing the concrete, cable-stayed design, says Zwick. "We project a minimum 75-year service life, provided that certain routine maintenance tasks are performed. In that time, we would expect that the stay cables will need to be replaced once and expansion joints and bearings will need to be changed twice. Also, the silica fume concrete overlay will need to be redone approximately every 20 years."

Officials at the two highway departments asked designers to study three different types of cable-stayed bridges. The first type featured a single-tower, unsymmetrical design

The new Pomeroy-Mason Bridge begins to take shape alongside its predecessor at the right.

The new bridge, over the Ohio River between Pomeroy, Ohio and Mason, W.Va., is just 110 ft upstream from the functionally obsolete steel structure it replaces to carry Ohio Route 33 over the Ohio River. All photos: Bob Henry, Michael Baker Jr. Inc.



Bridge

by Wayne A. Endicott

arrangement for its construction was reached.

In this arrangement, the bridge is being built by the ODOT. On completion, ownership and responsibility for maintenance of the bridge will pass to the WVDOT. Virtually all decisions on the bridge, such as its location and design, were hammered out between the two departments. The bridge is expected to be completed this fall.

CAST-IN-PLACE SEGMENTAL CABLE-STAYED BRIDGE / WEST VIRGINIA DEPARTMENT OF HIGHWAYS, CHARLESTON, W.VA., OWNER

STAY-CABLE SUPPLIER: Dywidag-Systems International, Bolingbrook, Ill.

BRIDGE DESCRIPTION: 1163-ft-long, three-span, symmetrical cable-stayed concrete bridge with a 675-ft-long center span and two 244-ft-long side spans

POST-TENSIONING SUPPLIER: Dywidag-Systems International, Bolingbrook, Ill.

BRIDGE CONSTRUCTION COST: \$45.8 million (including approach spans)

The 675-ft-long main span uses cast-in-place concrete edge girders with concrete transverse floor beams, constructed using form travelers.



The cast-in-place segmental concrete bridge progresses outward from the delta-shaped towers.

with span lengths of 566 ft and 671 ft. The second type called for a three-span, unsymmetrical design with spans of 340 ft, 671 ft, and 244 ft long. If this type had been selected, the West

Virginia tower would have been taller than the one on Ohio's end. The third type provided a three-span, symmetrical design, and this design was eventually chosen.



Concrete for the main span was delivered over the side spans and pumped into place.

The design required a superstructure consisting of concrete edge girders, 5-ft 6-in. deep by 5 ft wide, with 1-ft 9-in.-wide transverse floor beams in each segment. The transverse beams each contain two 19-strand post-tensioning tendons. The 244-ft-long side spans and the first 40 ft of the main span were cast on falsework. Typical segment lengths are 26-ft 6-in. long in the main span and 17-ft 10-in. long in the side spans.

Because the side spans are shorter than desired for a cable-stayed bridge, it was necessary to add a significant amount of ballast in each side span to eliminate uplift and balance the long main span, Zwick says. For this reason, the transverse floor beams in the side spans are 9 ft thick to balance the main span's weight.



Construction proceeds simultaneously from both sides of the Ohio River.

Two Identical Towers

The two delta-shaped towers are geometrically identical. Tower foundations consist of a waterline footing supported by six 8-ft-diameter drilled shafts. Ohio River water levels at the bridge's location can fluctuate significantly, Jeakle notes, with variations from normal pool to 100-year flood stage varying by as much as 38 ft. For this reason, the footing caps were shaped to create snag-free elements for vessels plying the river. The footing cap tapers from 30 ft wide at the top of the shafts to 16 ft wide at the bottom of the tower legs.

Possible barge collisions are a concern, especially at the two towers. To address this, the tower legs below the bridge deck are solid concrete, while the tower legs above the deck are hollow and contain the stay-cable dead-end anchorages. A fully post-tensioned cross strut at deck level of each tower resists the tension force created through the angle change in the tower legs.



The stay cables consist of 0.6-in.-diameter greased and sheathed strands within an ungrouted HDPE casing. Non-linear viscous dampers are connected to all cables at deck level to minimize cable vibrations from wind and rain.

The bridge provides an undivided roadway consisting of four 12-ft-wide lanes. Also included are two 4-ft-wide shoulders and a 6-ft-wide sidewalk, creating a total width of approximately 74 ft. The roadway alignment is on a tangent for the bridge's full length, except for a J-hook on the Ohio side of the river. This 180-degree turn in the roadway, beginning approximately 150 ft inland from the river bank, is made necessary by the steep rocky hillside that parallels the Ohio shoreline.

The navigational channel of the river, on the Ohio side, provides a minimum of 645 ft of horizontal clearance and 55 ft of vertical clearance, which is consistent with the clearances provided at other Ohio River bridges, Jeakle says.

High Performance Concrete

The cast-in-place concrete specification for the bridge's superstructure called for a concrete mixture with a compressive strength of 6000 psi and a low permeability of 1000 coulombs. The mix contains fly ash and a high-range water-reducing admixture. The 11-in.-thick deck will be permanently protected by an overlay consisting of a silica fume concrete that meets the standard ODOT specifications.

When completed this fall, the bridge will have white stay cables and all white concrete surfaces, except the roadway deck, which will be painted with an off-white epoxy urethane.

The bridge represents a spirit of cooperation between governmental bodies, which frequently can have their own agendas, says Jeakle. "Probably the biggest challenge in completing this project was whether the two states could come to a consensus on a design concept agreeable to both. When it opens to traffic this fall, I believe that that question will be answered positively."

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



The new bridge takes shape upstream from the existing bridge, which remains open to traffic.



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