The roadway curve, hill, and adjacent intersection created a challenge for the design.

PRESERVING A Community Gateway

by Mark P. Henderson, LJB, Inc.

The 1939 bridge was in need of replacement.

Dry Fork Creek in Hamilton County, Ohio, is recognized as one of the state's cleanest streams, holding many species of fish that the county and local park district are interested in preserving. Crossing Dry Fork Creek was the original West Road Bridge, which was badly in need of replacement. So, in addition to the standard challenge of designing a new bridge structure that is affordable, functional, and aesthetically pleasing for the community, LJB Inc.—a Dayton, Ohio-based full-service consulting firm—also had larger responsibilities.

Design Considerations

In its original condition, the West Road Bridge, which was built as a Works Progress Administration structure in 1939, featured a curved three-span, reinforced concrete T-beam superstructure supported on reinforced concrete cap and column piers with wall-type abutments. In evaluating the appropriate design for the new bridge, two structure types were considered—a single-span structure and a three-span structure. The evaluation also took into account the impact to nearby roads, the existing hydraulic conditions, and improved functionality.

A single-span structure was considered in an attempt to avoid the creek and its wildlife as much as possible. To execute this option, though, the horizontal alignment would have to be adjusted, and the road's profile would have to be raised. This significant change was not possible due to an adjacent intersection.

The option of a three-span bridge allowed for a reduced superstructure

profile

WEST ROAD BRIDGE / HAMILTON COUNTY, OHIO
ENGINEER: LJB, Inc., Dayton, Ohio
PRIME CONTRACTOR: Sunesis Construction, West Chester, Ohio

A three-span cast-in-place reinforced concrete bridge provided an affordable, functional, and aesthetically pleasing solution

The replacement three-span structure was selected to preserve the surrounding environment.

depth, which meant that the vertical alignment of the road did not have to change and the length of affected roadway could be minimized. LJB then considered eliminating the curve of the bridge, which would improve the alignment, while simultaneously simplifying the design and construction. The design team determined that a cast-in-place concrete slab bridge could easily be constructed on the curve, so the roadway would not have to be realigned. As a result, the three-span reinforced concrete slab option provided a viable solution that met the basic needs of the project. This structure type also allowed for aesthetic enhancements to maintain much of the same look and feel that community members and park visitors enjoyed with the existing bridge.

Because the creek level rises significantly during high water, the proposed bridge could not create an additional restriction to the water flow. To maintain the environmental integrity of the surroundings, this project required various hydraulic analyses and extensive coordination with the Federal Emergency Management Agency (FEMA).

Design began in June 2003 and was complete by the following April. Construction began in November 2004, and the bridge was completed and opened to traffic in July 2005. All aspects of the project went smoothly, despite the project's design and construction challenges.

The Solution

Today, the new West Road Bridge is 132 ft long and includes three spans with lengths of 40, 50, and 40 ft. The bridge is supported on cast-in-place reinforced concrete wall-type piers and semi-integral abutments behind mechanically stabilized earth (MSE) retaining walls. The abutments are jointless rigid stub abutments on two rows of piles. At each abutment, the approach slab and superstructure slab sit on and are tied

A nearby park makes this an important community thoroughfare.

CAST-IN-PLACE BRIDGE / HAMILTON COUNTY, OHIO, OWNER

BRIDGE DESCRIPTION: 132-ft long, three-span cast-in-place concrete slab bridge

TOTAL PROJECT CONSTRUCTION COST: $1,196,000

to an end diaphragm that slides across the top of the abutment on laminated elastomeric bearing pads. The detail still allows the bridge to expand and contract, but eliminates the expansion joint. This support is a unique detail developed by LJB specifically for this project.

The MSE walls supporting the abutments are large and deep. The wall at the rear abutment is approximately 100 ft long, and the wall at the forward abutment is approximately 75 ft long. Both walls are embedded deep into the creek bed due to scour concerns, with each wall being more than 26 ft tall. One of the MSE wingwalls also functions as a retaining wall to support a private drive at the northwest quadrant of the bridge.

The bridge carries two 10-ft-wide traffic lanes with a 6-ft-wide shoulder on each side to accommodate bicycle and pedestrian traffic. The deck was cast with Hamilton County's high performance concrete mix design, which includes fiber reinforcement, silica fume, and a corrosion inhibitor. This mix was developed to provide a minimum service life of 75 years, maximizing the longevity of the bridge.

Pretty and Practical

The bridge's owner, Hamilton County, also wanted to provide an aesthetically pleasing structure for the community since it is the gateway to the nearby Miami Whitewater Forest Park. LJB worked with the park district and the county engineer to match the aesthetics of the existing bridge's Texas-style railing. In addition, variable depth haunches along each slab fascia, cast integrally with the slab superstructure, add visually to the bridge elevation as seen from the park. A stone pattern form liner used on both the cast-in-place concrete piers and the precast concrete MSE wall panels also gives the effect of a stone finish. Finally, using two colors for the sealing of concrete surfaces—including the rails, fascias, piers, abutments, and MSE walls—adds additional aesthetic appeal and ties the bridge into its natural surroundings.

The new bridge provides ample space for vehicles, pedestrians, and bicycles.

The bridge's owner wanted an aesthetically pleasing structure.

The new West Road Bridge over Dry Fork Creek protected the wildlife interests and the aesthetics of the community, while still achieving the functional and budgetary goals set forth by the project. With a short 9-month construction schedule, the new bridge not only created a safer environment for travelers, but also maintained the appearance the community had come to appreciate.

Mark P. Henderson is a Managing Principal with LJB, Inc. in Dayton, Ohio.

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

LJB worked with FEMA and the local park district to maintain the creek environment.