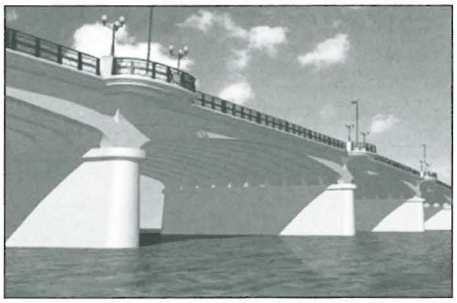
All concrete bridge meets architectural demands of historic district



Rendering of the new High-Main bridge, a five-span, prestressed and spliced, post-tension continuous concrete grider bridge

The High-Main Street Bridge is set in the heart of the City of Hamilton, OH and its Historic Civic Center. It is a vital link between the High and Main Street downtown districts, and carries 40,000 vehicles per day on the City's main thoroughfare, SR129, over the Great Miami River. A project is now underway to replace the existing historic bridge with a new structure while maintaining traffic and utility service.

History

The bridge is located at the former site of Historic Fort Hamilton (active from 1791 through 1796), and a concrete replica of the old log fort wall flanks the east bank bridge abutment. The four-story tall Sailors and Soldiers War Monument and Hamilton Municipal Building dominate the landscape at the eastern end of the bridge.

The existing structure is a spandrel filled concrete arch bridge with 5 spans at 95 feet each between support. Built in 1914-15 to replace the previous single span steel truss bridge that washed away in the Great Flood of 1913, it is heavily deteriorated and is structurally and functionally obsolete. The bridge is eligible for the National Register of Historic Places and is a contributing structure in the Hamilton Civic Center Historic District. Earlier predecessors at this site include a suspension bridge (built in 1867) similar in style to the Roebling Bridge in Cincinnati, OH, a wooden covered bridge (built in 1819), and initially a ferry.

Planning the replacement

The Federal Highway Administration (FHWA), Ohio Department of Transportation (ODOT) and City of Hamilton cooperated with the Ohio State Historic Preservation Office to develop a plan to replace the bridge. A series of workshops and public information meetings were held to determine the type of bridge.

The project scope involved replacing the existing deficient four-lane bridge with a new six-lane bridge while satisfying aesthetics, hydraulic performance, maintenance of traffic and utilities, alignment and profile. The structure design needed to accomplish the fundamental project requirements while keeping construction schedule and cost in balance.

From workshops and public information meetings, a consensus was reached for a 5-span arrangement (three full-arch spans and

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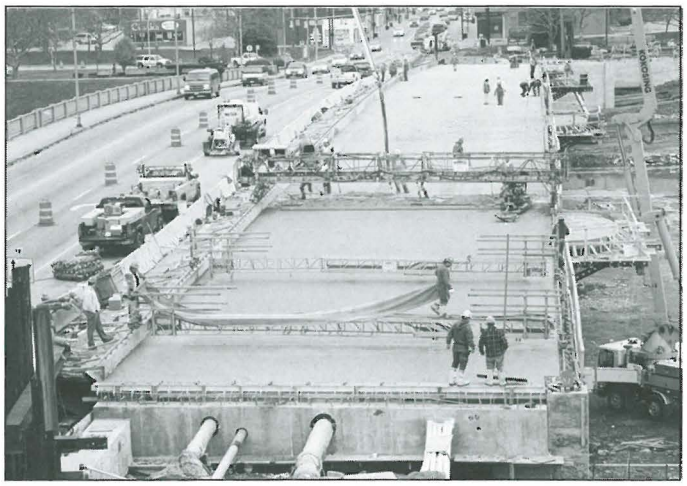
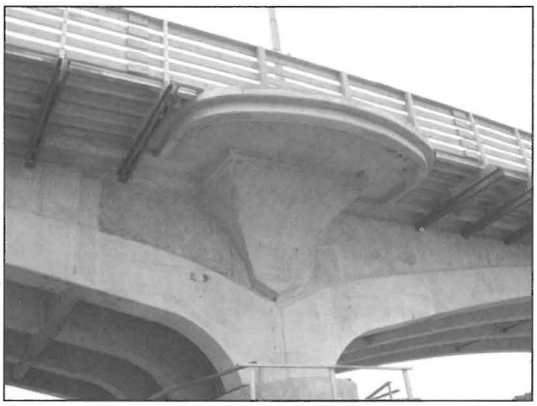


Casting 8½ inch thick reinforced concrete bridge deck for High-Main Street Bridge in Hamilton, OH

All concrete bridge, Continued from page 7

half-arch end spans) with elliptically shaped arches similar in depth to that of the existing spandrel filled concrete arch bridge. Balcony overlooks at the piers were also envisioned.

This project is under the jurisdiction of the Miami Conservancy District (MCD), who further stipulated that the bridge replacement, including anticipated temporary construction conditions cause no increase in backwater for their plan flood, which is greater than a 500-year frequency storm event. This requirement turned out to be one of the most critical factors in conjunction with aesthetics for determining the proposed structure type.



Cast-in-place balcony-overlook at pier

The need to maintain traffic and utilities during construction and holding essentially the same roadway alignment as the existing bridge dictated that the proposed structure type be well suited for part-width construction in phases. To lessen the impact on local businesses in close proximity to the project, ODOT and the City of Hamilton committed to a 2-year construction schedule for completion of the new bridge while maintaining traffic.

The preferred span arrangement resulted in spans of 77.5 ft - 128 ft - 134 ft - 128 ft - 75.5 ft for a total bridge length of nearly 550 ft. The proposed roadway and sidewalk widths demanded an overall bridge width of 103 ft. The preferred superstructure arch profile ranged from about 3.5 ft deep at the apex of each span to about 15 ft deep at the piers.

Design

Spliced precast concrete girder construction was selected for this project because of the need for longer spans than that normally used for precast, rapid erection with conventional size cranes, and flexibility to craft special aesthetic features.

Eleven girder lines were chosen, spaced at 9.25 ft on center. This spacing was deemed optimum for accommodating part-width phased construction of the bridge. The basic girder segments consisted of pier, end-span and drop-in (interior span) segments. The pier segments varied in depth from 15 ft maximum at the pier to 8.5 ft at the splice.

The end-span and drop-in segments varied up to 96 feet in length and in depth from 3.5 ft at the apex to 8.3 ft at the splice. The splice locations were chosen to limit the height and length of the drop-in segments to allow normal truck transport methods. The pier segments were also configured so they could be laid horizontally and transported by truck as an extra wide load. The project plans were set up to allow the contractor the option of casting the pier segments on site, recognizing that some transport routes might be problematic depending on the point of origination.

Concrete compressive strength specified for the girders is 7000 psi, with an allowable compressive strength at release of 5500 psi. Prestressing strands are 0.5 in. diameter, 270 ksi, low relaxation strands. Post-tensioning tendons are 9-0.6 in. diameter, 270 ksi, seven-wire, low-relaxation strands. (Spliced precast girder construction was developed with the primary intent of extending the range of application for concrete girders to longer span bridges. With the use of high strength and lightweight concretes for precast, prestressed girders, spliced girders typically are found to be appropriate in bridges with spans in excess of 160 ft up to nearly 300 ft.)

The spliced girders were designed with all post-tensioning force applied prior to casting the deck slab, in accordance with the owner's request. The deck slab uses mild reinforcement and contains no post-tensioning. The owner's preference for this type of design/detailing was predicated on their desire to simplify future deck replacement work.

The erection of the spliced girder segments was designed to proceed using crawler cranes positioned on a construction causeway in the river. After all segments, splice closures, cross frames and contractor temporary bracing are installed, temporary tie-downs and shim blocks at piers will be removed and the continuity post-tensioning tendons will be stressed from both ends of bridge. Then the concrete diaphragms and concrete deck will be cast.

Construction

Construction began for the project in early spring of 2004 and is scheduled for completion in the summer of 2006. The total construction cost awarded for the project is $16.4 million, including demolition of the existing bridge and construction of approach roadway, lighting and landscaping. The award amount attributed to the bridge superstructure (excluding ornate bridge railing, decorative sidewalks, and balcony overlooks) is $6.0 million, or $106 per square foot of bridge deck. The general contractor is Kokosing Construction Company, of Fredericktown OH.

The precast girder fabricator and detailer is Prestress Services, of Columbus, OH and Janssen & Spaans Engineering, Inc., of Indianapolis, IN. Concrete for the precast girders was supplied by Anderson Concrete Corp., of Columbus, and concrete for the substructure and deck is being supplied by Moraine Materials Co., of Franklin OH, from their plant in Middletown.

Concrete replica of the old log fort by historic bridge in Hamilton, OH

The project was designed by a joint venture of prime consultant Burgess & Niple, and subconsultants Rosales Gottemoeller & Associates, Parsons Transportation, and Resource International, all of Columbus, OH. Information for this article was provided by John Shanks, of Burgess & Niple, from his formal presentation about the project at the 2005 International Bridge Conference in Pittsburgh.