Psychology of Bridge Design

The segmental box-girder design of Ohio's Jeremiah Morrow Bridge provides lessons about the challenge of familiarity and how changes can impact drivers' perceptions

by Daniel P. Mendel, Ohio Department of Transportation

The new Jeremiah Morrow Bridge over the scenic Little Miami River in Warren County, Ohio, is the tallest bridge in Ohio and the first owned by the Ohio Department of Transportation (ODOT) with cast-in-place concrete segmental box girders. The twin structures and six-year construction plan created opportunities to improve from one structure to the next, but ODOT learned that care must be taken in applying those efficiencies. ODOT also learned about some intangible aspects of driver psychology.

Construction began in March 2010 and was finished in July 2016, with completion of paving, grading, and demolition of the original bridge, although it only opened to traffic in December 2016. The first structure (southbound) represented ODOT's introduction to segmental design using the balanced-cantilever method, which was required at 239 ft above the valley floor. The six-span twin bridges have three 440-ft-long main spans, one 416-ft-long interior span, and side spans of 229 and 270 ft. A variable-depth, single-cell box-girder cross section with cantilevered deck overhangs provides a 52-ft-wide roadway with a 42-in.-tall concrete barrier.

Experience from the first bridge was applied to the second one, but new challenges were created by assuming the learning curve had plateaued. The long schedule and use of new personnel on the second bridge, coupled with the desire to improve by using what had been learned, led to some issues that required adjustment.

Efficiencies Added

A number of efficiencies were introduced for the second bridge, leading the team to believe it understood the process completely. As a result, diligence on evaluations that were double- and triple-checked on the first bridge were reduced in some cases. As an example, vibration activities of fresh concrete were lessened to save time, creating some honeycombs and the need to patch portions, negating the time saved upfront.

One benefit of the design ODOT had not anticipated has come through feedback from drivers. The original steel truss bridges had load limits and were narrow, with an aging, lower parapet, creating some anxiety for travelers, especially due to the height of the bridge above the river below. The new design features a barrier wall that is 6 in. taller (42 in. instead of 36 in.) and wider lanes with a 6-ft-wide shoulder on one side and a 10-ft-wide shoulder on the other. The design eliminated the fear factor, drivers report, which had not been part of the considerations.

Jeremiah Morrow Bridge, with cast-in-place concrete segmental box girders, is the tallest bridge in Ohio. All Photos: Ohio Department of Transportation

The Jeremiah Morrow Bridge was an exciting project because it gave new insights into the segmental design concept and expanded ODOT's capabilities for meeting new challenges. The next project using the segmental design will be as exciting, but it will be constructed with the knowledge of new efficiencies and where shortcuts can or can't be taken to speed construction. A

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EDITOR'S NOTE

Following the completion of the first of the dual bridges, the Jeremiah Morrow Bridge was featured in the Winter 2014 issue of ASPIRE℠.