I-39/KISHWAUKEE RIVER BRIDGE STRENGTHENING

BY ANDREW HAUTER

The Kishwaukee River Bridge in Rockford, IL, is a post-tensioned (PT) precast segmental concrete box-girder bridge that opened to traffic in 1980. The bridge has five spans with lengths of 170 ft (51.8 m), three at 250 ft (76.2 m), and one at 170 ft (51.8 m). The Kishwaukee River Bridge engineers chose the design of a single shear-key joint usually located close to the centroid of the cross section. The overall length of the deck is 1096 ft (334 m) and was built using the balanced cantilever method. Each cantilever consists of 17 segments 7.05 ft (2.15 mm) long and one pier segment 3.5 ft long (1.07 m). Cast-in-place closures are 3.23 ft (0.98 m) long.

In the early 2000s, the owner—the Illinois Department of Transportation (IDOT)—decided on a strengthening program to extend the design life of the bridges. The strengthening design required an additional twenty-four twelve strand external post-tensioning tendons of various lengths in each bridge.

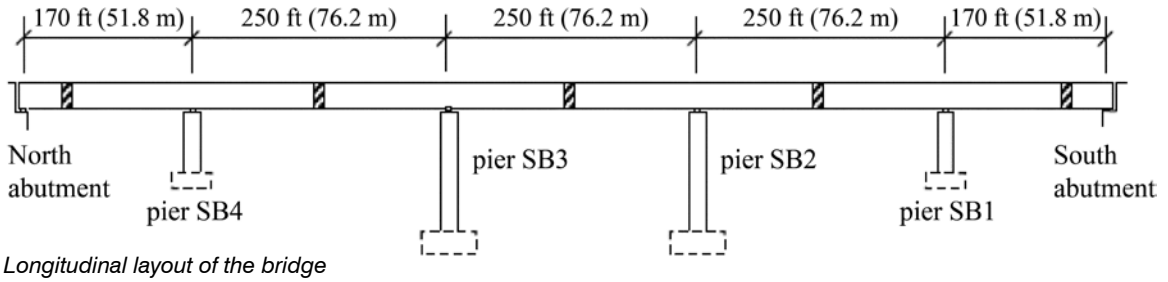
In 2007, IDOT awarded the contract through competitive bidding to the same team as 28 years previously. The owner's schedule required all work to be completed within a very short time, as they wanted to keep bridge closure to a minimum due to I-39 being a high traffic route, especially for Chicago-area residents traveling to Wisconsin during the weekends.

CHALLENGES

Design practice of the 1970s did not require the inclusion of provisions for future additional PT tendons; therefore, new deviators had to be constructed throughout the bridge as well as new PT anchorage zones at the diaphragms and abutments. The new anchor zones and deviators were cast in place within the segmental box and then post-tensioned. Instead of using steel pipes at the deviators, continuously curved voids (diablos) were cast in the deviation diapraghm to allow large deviations from the theoretical tendon profile.

To meet the higher standards of today's post-tensioning technology, the post-tensioning was designed with a continuous air-tight, high-density polyethylene (HDPE) pipe from anchor to anchor, then grouted with high-performance grout and equipment. Due to the diablos and continuous HDPE pipe requirements, specially-designed

The Kishwaukee River Bridge



Longitudinal layout of the bridge

PT anchors were installed at the faces of the existing diaphragms. The location of the new anchors was made more difficult by the tight constraints of the existing reinforcement and post-tensioning.

The project team worked very closely due to the complex three-dimensional (3D) geometry and challenges of accommodating the tendon paths throughout the existing bridge. To assist with this task, a ground-penetrating radar was used to locate the existing post-tensioning and reinforcing in the diaphragms and abutments so crews could follow closely behind with coring of the holes (in 3D) for the tendon paths. After casting, the post-tensioning installation crew went to work installing the new anchors and the HDPE pipe, overcoming the challenges compounded by the largely deviated tendon paths and tendon lengths of over 770 ft (235 m). In addition, the tendon stressing was difficult due to the location of the tendons in the upper corners of the box, along with the congestion of the new tendons and new anchors.

The project was successfully completed within the owner's schedule in September 2008.

Kishwaukee River Bridge

OWNER
Illinois Department of Transportation

DESIGNER
Parson Transportation Group

GENERAL CONTRACTOR
Edward Kraemer and Sons

PT SUPPLIER, GPR, AND PT INSTALLER
Dywidag Systems International

Anchorage zone

Installed tendon profiles

*ICRI member **Andrew Hauter** is a Sales and Project Manager for Dywidag Systems International Repair and Strengthening Unit. He has worked on a number of large-scale strengthening and repair projects on a variety of structures, from bridges to parking garages, and silos to tanks. He has also participated in the inspection and evaluation of post-tensioning systems in concrete and steel structures. Some of the recent projects Hauter has completed include the I-39 Kishwaukee River Bridge; the Midway Airport Garage Strengthening for the new baggage handling system; and the Poplar Street Bridge Seismic Retrofit in East St. Louis, IL.*