CASE STUDY
LEEPER BRIDGE

Owner: Indiana Department of Transportation Indianapolis, IN
Project Engineer/Designer: Butler, Fairman and Seufert, Inc., Indianapolis, IN
Repair Contractors: Northern Indiana Construction, Company, Inc. Mishawaka, IN
F.E. Gates Co., Division of Blakely Corp., Indianapolis, IN
Material Supplier/Manufacturer: Sika Corporation, Lyndhurst, NJ

INTERNATIONAL CONCRETE REPAIR INSTITUTE

ICRI Award Winner
Award of Merit
Historic Category

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Background

The Leeper Bridge is a 3 span spandrel filled arch bridge structure built in 1915. It was designed by a well-known Indiana Engineer, C.W. Cole. The bridge is located on SR 933 over the St. Joe River in South Bend, Indiana just south of the University of Notre Dame campus. It has a Bedford limestone façade, neoclassical décor; keystone inserts on the arch rings, decorative emblems on the pilasters, and open arch rail panels. It is one of only 8 SELECT* concrete arch bridges in the country. Some initial fixes were made in 2006 including new steel reinforced pavement/sidewalk and injection of epoxy into cracks and delaminations in the arch ring and railing. However, during a routine inspection in 2011, cracks were noticed on the bridge deck and a detailed inspection ensued to assess and implement a repair program to preserve the structure.

The Problem

In order to determine the source of the random cracking in the deck, a portion of the new deck was removed down to the top of the arch ring. As a result of the investigation, it was determined that the top of the arch ring was in good condition and the cracking in the deck was a result of improper placement of the slab reinforcement. The reinforcing steel was placed in the bottom of the slab instead of the top. After further investigation and mapping of the cracks on the underside of the arch rings, it was determined that the additional transverse cracks were present at the time of the last repair in 2006. The cracks probably occurred due to the additional settlement of the north pier during a large flood which occurred after field inspection in 2002 and before reconstruction in 2006. It was discovered that very few of the cracks and arch delaminations were epoxy injected as specified in the 2006 contract documents.

Spalling of the stone façade on the arch ring

The Sika Solution

Partially completed installation

Due to the cracking and sagging of the arch rings, a full structural analysis was performed on the structure for both the HS 20 truck loading (maximum load without special permit) and toll road truck loadings (heavier loads). The analysis indicated the bridge was adequate for the HS 20 truck loading, but fell short of the toll road truck loading specifications due to settlement of pier #3. Therefore it was decided to strengthen the bridge by pressure injecting all visible cracks in the bottom of the arches with Sikadur® 52 and applying one layer of SikaWrap® Hex 103C to the arch surface. The goal was an anticipated toll road truck loading factor increase from 0.82 to 1.04. Further repairs made in 2012 including the replacement of the existing concrete rail panels between the intermediate stone columns with new, heavily reinforced concrete panels that duplicated the original profile and appearance of the railing. The intermediate stone columns were taken apart and the stone re-laid back to their original, vertical orientation. The last step involved the application of Sikagard® 670W, anti-carbonation coating, to bridge archway in order provide a protective coating to the concrete and to provide an aesthetic cover to the repairs and strengthening.

Epoxy injection of arch ring

**The term SELECT indicates the bridge is an excellent example of its type and according to a Memorandum of Agreement (M.O.A.)*

Sikagard® 550W Elastocolor and 670W - protect concrete facades from the damaging effects of carbon dioxide (carbonation), water and pollutants. Either crack-bridging (550W) or rigid (670W), both are high-performance protection coatings, available in a variety of decorative colors.

Sikadur® - epoxy resins help restore structural integrity by injection into cracks and voids - The most comprehensive range of epoxy products for structural bonding and grouting.

SikaWrap® - Carbon and Glass Fiber Fabrics wrap around concrete and masonry structures for repair and strengthening.

SikaTop® Plus Mortars - two component polymer modified materials containing Sika FerroGard®-901 corrosion inhibiting admixture.

Sika FerroGard®-903 - as a dual action corrosion inhibitor, will reduce corrosion currents by penetrating through the concrete and forming a protective coating on the embedded steel bars.

Sikaflex®, High Performance Sealants - are premium-grade polyurethane joint sealants that are fully compatible with Sika's concrete repair systems.

Sikadur® Combiflex® - a unique strip and seal system used to seal problem joints and cracks, even those undergoing extreme movement.

Sika Armatec® 110 EpoCem® - protects rebar in areas of inadequate cover.

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