Case Study

U.S. Department of Transportation
Federal Highway Administration

TOPS
Targeted Overlay Pavement Solutions

CONCRETE OVERLAY
ARKANSAS I-40
Continuously Reinforced Concrete (CRC) on Concrete–Unbonded

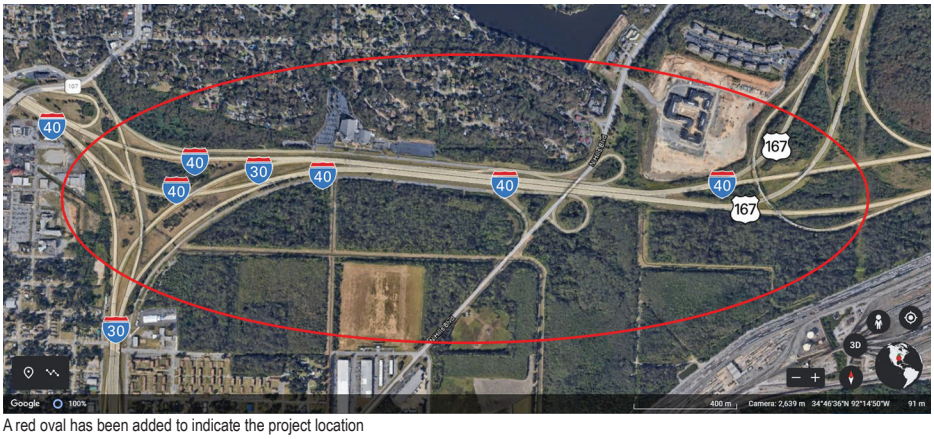
Continuously reinforced concrete (CRC) overlays leverage the investment already made in the existing pavement structure while potentially reducing the need for significant preservation activities and reducing lane closure durations. This case study summarizes the design, construction, and performance of an unbonded CRC overlay of an existing jointed concrete pavement (JCP).

INTRODUCTION

Every two years, the Federal Highway Administration (FHWA) works with State transportation departments, local governments, tribes, private industry, and other stakeholders to identify and champion a new collection of innovations that merit accelerated deployment through the Every Day Counts (EDC) program.

The EDC-6 program launched on September 23, 2020. One of the innovation areas is Targeted Overlay Pavement Solutions (TOPS).

Many pavements in the highway system have reached or are nearing the end of their design life while carrying traffic that exceeds their initial design criteria. TOPS can help agencies retain their investment in the engineered layers of existing pavement structures while creating longer-lasting, safer roadways. Concrete overlays can extend the service life of existing asphalt, concrete, and composite pavements without reconstruction, thereby improving safety for workers and roadway users. Finally, concrete overlays can help to reduce the life-cycle cost of pavement ownership.



A red oval has been added to indicate the project location

Figure 1. Map of I-40 project limits (within the red oval)

PROJECT BACKGROUND

The overlay was constructed in 1988 along the Dark Hollow section of I-40 in North Little Rock, Arkansas. The existing JCP had been constructed in the late 1960s and consisted of three lanes in each direction of travel with asphalt concrete (AC) shoulders. The three JCP lanes were each 12 feet wide and 10 inches thick.

The Arkansas Department of Transportation (ARDOT) decided to rehabilitate a 2.9-mile-long section of the JCP between I-30 and US 167 using an unbonded CRC overlay. Figure 1 shows the project limits.

PROJECT DETAILS

The CRC overlay was 6 inches thick and was placed over a 1-inch thick AC interlayer. According to ARDOT practices for 6-inch thick overlays in the 1980s, the design details were as follows:

- Longitudinal steel: 0.6 percent (No. 4 bars at 5.375-inch spacing).
- Longitudinal bar lap splice: 16 inches.
- Transverse steel: No. 4 bars at 30-inch spacing.
- Tie bars: No. 4 bars at 30-inch spacing.
- End terminals: W58x12 wide-flange beam expansion joints.
- Concrete compressive strength: 3,000 pounds per square inch at 28 days.

As part of the 1988 rehabilitation, a fourth lane was added in each direction, and new 10-foot-wide and 10-inch-thick concrete shoulders were constructed on either side of the travel lanes in each direction of travel to replace the existing asphalt shoulders. The new concrete shoulders were tied to the existing JCP lanes using 24-inch-long No. 5 bars spaced at 30 inches. A 6-foot-wide portion of each outside shoulder was placed over a granular base.

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FHWA CONTRACTING OFFICER'S REPRESENTATIVE
Sam Tyson, Concrete Pavement Engineer
Federal Highway Administration
1200 New Jersey Avenue, S.E.
Washington, DC 20590
202-366-1326, sam.tyson@dot.gov

AUTHOR
Shiraz Tayabji
Advanced Concrete Pavement Consultancy, LLC

DISTRIBUTION AND AVAILABILITY
This case study is available for free download on FHWA's website.

KEY WORDS
concrete overlay unbonded, continuously reinforced concrete, jointed concrete pavement

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The CRC overlay in each direction consisted of a total of four 12-foot-wide lanes, a 10-foot-wide inside shoulder, and a 10-foot-wide outside shoulder. The total width of the overlay in each direction was 69 feet 4 inches, which includes 68 feet for the travel lanes and shoulders plus a width of 1 foot 4 inches under the median barrier. Figure 2 shows the traffic lane and shoulder configurations for the eastbound lanes of I-40. The same configurations were used for westbound I-40.

PROJECT PERFORMANCE

In 2018, the CRC overlay on I-40 was carrying about 131,000 vehicles per day in both directions, with 6 percent trucks. In recent years, the overlay has been repaired to treat spalling at crack and transverse construction joint locations. Additionally, several full-depth patches have been installed to repair punchout areas, as shown in Figure 3. The terminal areas have also exhibited significant distresses.

However, testing in 2018 using a falling weight deflectometer indicated low mid-slab (between-crack) deflections of about 2 to 7 mils under a nominal loading of 9,000 pounds per foot.

According to ARDOT, the CRC overlay has performed well over more than 30 years, indicating that thinner unbonded CRC overlays can be an effective strategy for rehabilitation of distressed jointed concrete pavements.

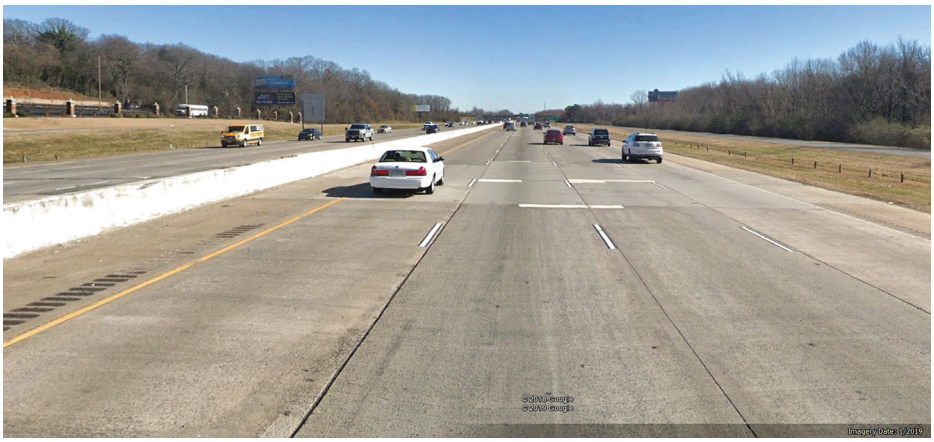

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Figure 2. Eastbound I-40 showing CRC overlay in 2019

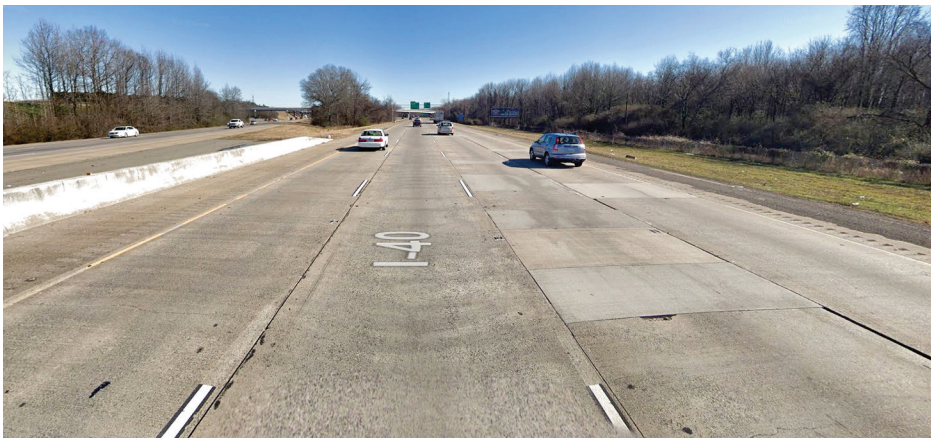

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Figure 3. Full-depth patches in eastbound I-40