Case Study

U.S. Department of Transportation
Federal Highway Administration

AUGUST 2022
FHWA-HIF-22-049

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.

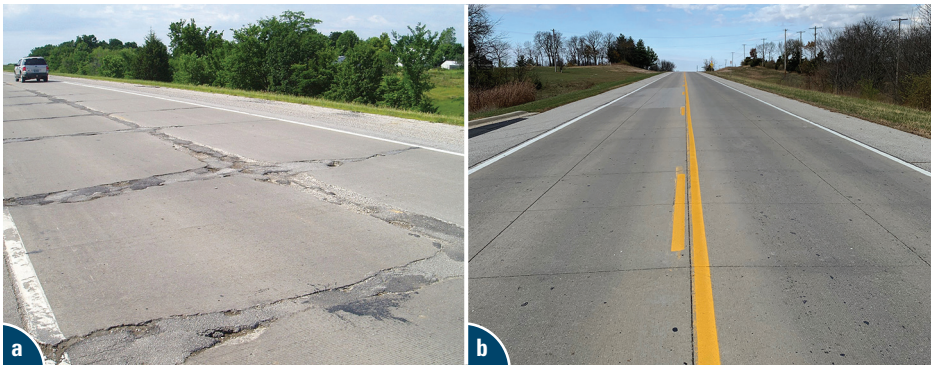
The EDC-6 program launched on September 23, 2020. One of the innovation areas is Targeted Overlay Pavement Solutions (TOPS).

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.

TOPS
Targeted Overlay Pavement Solutions

CONCRETE OVERLAY
MISSOURI ROUTE D
Concrete on Concrete–Unbonded

Unbonded concrete overlays of concrete include the placement of a separation layer prior to placement of a new concrete overlay. The separation layer provides a shear plane to prevent cracks in the existing pavement from reflecting through the new concrete surface. This case study summarizes the design, construction, and performance of an unbonded concrete overlay of an existing severely distressed jointed reinforced concrete pavement (JRCP) using a nonwoven geotextile separation layer.



Todd LaTorella, ACPA, MO/KS Chapter

Figure 1. Missouri Route D: (a) condition of JRCP in 2007 before overlay construction and (b) unbonded concrete overlay in 2020 after 12 years in service

PROJECT DETAILS

With a length of 3.7 centerline miles, this project is located on Missouri Route D in Cass County, Missouri, between Lohman and US-54 southeast of Jefferson City. This roadway is classified as a secondary state highway and consists of one lane in each direction with 6-foot shoulders. This segment was originally constructed in 1986 with 8 inches of JRCP over 4 inches of aggregate base. Before the overlay was placed in 2008, the existing pavement was severely distressed with spalling and D-cracking (Figure 1).

OVERLAY INFORMATION

The Missouri Department of Transportation (MoDOT) commonly constructs three types of concrete overlays:

1. Unbonded overlays to restore or increase structural capacity in pavements with moderate to severe distress. Typically 8 inches thick with a panel size of 15 feet long by 12 feet wide and placed over an asphalt or geotextile interlayer.
2. Big block overlays, or unbonded overlays typically 5 inches thick with a panel size of 6 feet by 6 feet. Placed either without an interlayer or over an asphalt or geotextile interlayer.
3. Bonded overlays on asphalt to add structural capacity to an existing pavement in fair or better condition. Typically 4 inches thick with a panel size of 4 feet by 4 feet.

For the distressed segment on Missouri Route D, MoDOT selected the second option. In 2008, the agency designed a 5-inch-thick concrete overlay (with an as-built thickness of 6 inches) with slab dimensions of 6 feet by 6 feet to be placed on a nonwoven geotextile interlayer. Prior to placement of the interlayer, the existing pavement received minor full-depth patching at the transition areas on either end of the overlay.

The interlayer consisted of two nonwoven geotextiles. These geotextiles were used due to limited availability of other products.

FHWA CONTRACTING OFFICER'S REPRESENTATIVE
Robert Conway
Sr. Pavement & Materials Engineer
Federal Highway Administration
1200 New Jersey Avenue, S.E.
Washington, DC 20590
202-906-0536, robert.conway@dot.gov

AUTHORS
Linda M. Pierce, Principal
Tom Van Dam, Principal
Nichols Consulting Engineers, CHTD

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

KEY WORDS
concrete overlay unbonded, nonwoven geotextile interlayer

Cackler 2017, National CP Tech Center

Figure 2. Placement of a concrete overlay on a nonwoven geotextile separation layer

(Refer to MoDOT Standard Specification 1011.3.7 for current geotextile requirements in Missouri.) The geotextile was anchored using nails and washers. Daylighting was used to provide an outlet for interlayer moisture (Figure 2).

In total, 45,000 square yards of concrete were placed for the overlay. Transverse and longitudinal joints were sawcut at a 6-foot spacing, dowels were not included at the transverse joints, and joints were left unsealed.

TRAFFIC CONDITIONS

The average annual daily traffic volume in 2008 was 9,300 vehicles, with approximately 200 trucks per day. The estimated equivalent single axle loads (ESALs) from the time of construction to 2020 were approximately 2,200,000 (assuming 2 percent growth and 1.5 ESALs per truck).

PERFORMANCE

As of 2020, repairs have included minor full-depth patching at the transition areas on either end of the overlay. Fewer than 1% of the overlay slabs are cracked, as shown in Table 1. Figure 3 shows the current condition of the roadway.

Table 1. Overlay characteristics (2021 and 2017)

Overlay Location	IRI (in./mi)	Faulting (in.)	Cracked Slabs (%)	Patched Slabs (%)
Northbound (2021)	105	0.02	N/A	N/A
Southbound (2017)	87	0.01	0.8	0.6

Todd LaTorella, ACPA, MO/KS Chapter

Figure 3. Current condition of unbonded concrete overlay: (a) 0.25 miles from south end of project looking south and (b) 0.25 miles from south end of project looking north