

Case Study



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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.

CONCRETE OVERLAY WORTH COUNTY, IOWA, HIGHWAY 105 Concrete on Asphalt–Unbonded (Existing Composite Pavement with Nonwoven Geotextile)

Unbonded concrete overlays do not rely on composite behavior between the overlay and the underlying pavement for structural capacity. In the case of unbonded concrete overlays of asphalt pavement, the strength and thickness of the concrete slab is typically sufficient to prevent cracks in the existing pavement from reflecting through to the new concrete surface. This case study summarizes the design and performance of an unbonded concrete overlay on an existing composite pavement using a nonwoven geotextile interlayer.

PROJECT DETAILS

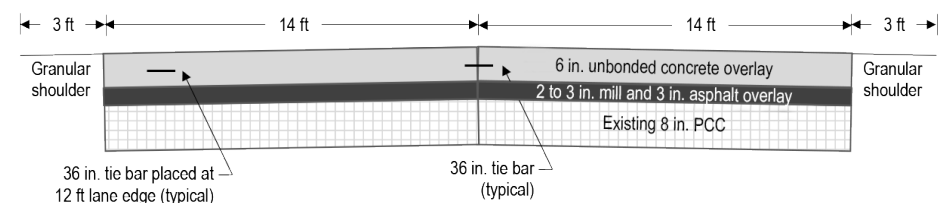
Worth County, Iowa, has been actively engaged in the construction of concrete overlays since 2009, when the Worth County Board of Supervisors approved the resurfacing of several miles of deteriorated roads. Based on both initial and life-cycle costs, the county chose to rehabilitate its roads using unbonded concrete overlays. According to the county, the typical cost to construct a 4-inch concrete overlay on a 22-foot-wide road in Worth County has been well under \$200,000 per mile. The majority of the county's unbonded concrete overlays have involved a 4-inch concrete layer over an existing asphalt pavement.

County Highway 105 is a former State highway transferred to Worth County in the mid-1990s. This project is located between Wheelerwood Road and the city limits of Northwood, Iowa. The total project length is approximately 6.1 miles. The existing pavement structure on both County Highway 105 and Wheelerwood Road largely consisted of a 2- to 3-inch asphalt overlay (placed in 1995) over 8 inches of jointed plain concrete pavement (JPCP) and an aggregate base of unknown depth.

OVERLAY INFORMATION

The project on County Highway 105 was constructed in 2019 and included widening the two travel lanes to 14 feet with 3-foot granular shoulders and placing a 6-inch unbonded concrete overlay using a nonwoven geotextile interlayer (Figure 1).

Prior to placement of the geotextile interlayer (Figure 2), the existing pavement received approximately 24 square yards of full-depth repair. A total of 77,734 square yards of concrete were placed for the 6-inch overlay. The slab dimensions were 11 feet long (between transverse joints) by 12 feet wide. Joints were formed using early-entry saws, dowel bars were not included at the transverse joints, and the joints were filled with hot-poured asphalt. The transition from the existing pavement to the overlay section used an asphalt taper of 50 feet per 1 inch of thickness. Figure 3 shows the completed overlay.



NCE (2020)

Figure 1. Typical cross section of County Highway 105 after placement of a 6-inch unbonded concrete overlay

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

KEY WORDS

composite pavement, concrete overlay unbonded, nonwoven geotextile interlayer

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Worth County, Iowa (2019)

Figure 2. Geotextile interlayer placement



Figure 3. Completed overlay

The concrete mixture included 4 pounds per cubic yard of macrofibers. In addition, a 600-foot-long research section was constructed using approximately 7.5 pounds per cubic yard of macrofibers and no sawing of transverse joints.

Traffic control during construction was carried out in accordance with Iowa Department of Transportation (DOT) Standard Specification 1107.08. The specification requires the contractor to provide a construction staging plan to allow safe (e.g., with minimal equipment on the roadway, no drop-offs) and convenient (e.g., with work performed from sunrise to sunset, detours provided) local access during construction.

TRAFFIC CONDITIONS

As of 2018, the estimated average annual daily traffic was 1,700 vehicles per day, according to a traffic flow map created by the Iowa DOT. Information regarding percent trucks is unknown, but assuming 20 percent trucks, a 2 percent growth rate, and 1.5 equivalent single axle loads (ESALs) per truck, the estimated ESALs for one direction of travel since construction was approximately 290,000.

PERFORMANCE

As of 2020, the county reports that the overlay is performing well, with cracking observed in fewer than 1 percent of slabs. The test section with a higher macrofiber content and unsawed joints is also performing well, with minimal distress. However, parallel cracking has occurred at several of the transverse cracks (Figure 4).



Richard Brumm (2019)



Iowa Concrete Paving Association (2020)

Figure 4. Typical transverse crack (left) and parallel cracking (right) of unsawed joint in test section with higher macrofiber content