Case Study

U.S. Department of Transportation
Federal Highway Administration

TOPS
Targeted Overlay Pavement Solutions

CONCRETE OVERLAY
ALABAMA I-59
Concrete on Concrete–Unbonded

Concrete on concrete–unbonded (COC–U) overlays leverage the investment already made in the existing pavement structure while eliminating the need for extensive preservation activities. This case study summarizes the design, construction, and performance of a COC–U overlay of an existing jointed concrete pavement.

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) Shiraz Tayabji and (b) FHWA

Figure 1. I-59 (MP 184 to MP 194) in Etowah County, Alabama: (a) in 2009 before overlay construction and (b) in 2020 after 8 years of service

PROJECT BACKGROUND

This project was located along a section of I-59 (MP 184 to MP 194) in Etowah County, Alabama, that extends from south of the northern city limits of Attalla to the bridge over County Road 276 (Stephen Gap Road). The existing concrete pavement was constructed in 1964 with a 25-foot joint spacing; as of 2006, the concrete pavement was exhibiting slab cracking and joint and crack faulting (Figure 1).

The Federal Highway Administration sponsored a workshop on concrete overlays in Guntersville, Alabama, in 2006. At the time, the Alabama Department of Transportation (ALDOT) was evaluating alternatives to improve the I-59 roadway. Based on discussions at the workshop and further evaluation of alternatives, ALDOT decided to construct a concrete overlay over the 40-plus lane-miles (two lanes in each direction) of the roadway.

The decision to use a COC–U overlay preserved the original pavement structure without the need for costly preservation activities, including grinding of severe faulting at every joint, full-depth repair of mid-slab cracking in many of the slabs, replacement of shattered slabs, and restoration of surface characteristics, including smoothness and friction. ALDOT chose to use a concrete overlay for the following reasons:

1. Ability to use the existing pavement as base layer and a construction platform
2. The sustainability benefits of a major rehabilitation project that did not involve disposal of the existing pavement material
3. The opportunity to update transverse grades (superelevation) on curved sections by utilizing variable thicknesses in the asphalt concrete interlayer, an integral part of the COC–U overlay design
4. Relatively short construction time

The construction on I-59 started in June 2010 and was funded by the American Recovery and Reinvestment Act of 2009. This was the first major concrete pavement constructed in Alabama since 1980.

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

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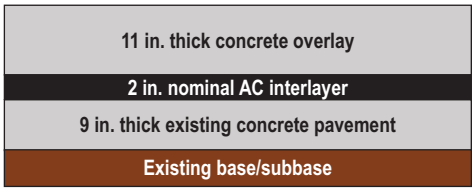
PROJECT DETAILS

Based on the condition of the existing concrete pavement and future traffic projections, ALDOT developed the following pavement design for the roadway section (Figure 2):

- New 11-inch-thick concrete overlay with 15-foot joint spacing and concrete shoulders
  - – Outside lane width of 14 feet
  - – Inside lane width of 12 feet
- Asphalt concrete (AC) interlayer with a nominal thickness of 2 inches and additional thickness as needed to correct transverse grades on curved sections
- Existing 9-inch-thick jointed concrete pavement with 25-foot joint spacing and AC shoulders
- Existing aggregate base/subbase



Shiraz Tayabji

Figure 2. Diagram of pavement cross-section with concrete overlay

The construction contract was awarded in April 2009, and the contract completion date was June 15, 2011 (Figure 3). In addition to placing the overlay, the contract work included bridge raising and widening. Traffic for the northbound lanes was shifted to the southbound lanes during construction of the northbound lanes and vice versa for construction of the southbound lanes.

ACPA

Figure 3. Concrete overlay placement in 2011

After performing some full-depth repairs to the existing concrete pavement, the hot-mix AC interlayer was placed. The interlayer thickness varied from about 2 inches (nominal) to about 12 inches to correct transverse grade deficiencies along the curved superelevated sections. The overlay concrete was placed in a two-lane width (26 feet) using a spreader and a slipform paver that was equipped with two smoothness indicators to help achieve the stringent smoothness levels specified in the design. A mobile concrete plant was located near the midpoint of the project. Test data indicated that the concrete compressive strength at 28 days exceeded the 28-day compressive strength requirement of 4,000 pounds per square inch.

Because there were no accessible haul roads along the roadway, the overlay concrete had to be deposited in front of the slipform paver. This meant that the dowel baskets had to be positioned and pinned at the transverse joint locations just ahead of the concrete placement operation. Dowel alignment testing indicated that the dowel bars met ALDOT's specifications. The tie-bar baskets along the centerline longitudinal contraction joint were also placed just ahead of the concrete placement operation.

PROJECT PERFORMANCE

In 2009, this section of I-59 was carrying about 8,000 vehicles per day (2.9 million vehicles per year), including 35 percent trucks in each direction. In 2019, the traffic along this section of I-59 was still about 2.9 million vehicles per year in each direction, including 32 percent trucks.

After more than eight years in service, the I-59 concrete overlay is performing as expected according to ALDOT (Figure 1). The project has maintained the as-constructed smooth ride and has undergone only minor maintenance activities. The concrete overlay has improved rideability and safety for road users.