Case Study

U.S. Department of Transportation
Federal Highway Administration

TOPS
Targeted Overlay Pavement Solutions

CONCRETE OVERLAY
FLORIDA US 92
Precast Concrete on Concrete–Unbonded

Unbonded precast concrete 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 precast concrete overlay of an existing jointed concrete pavement.

FDOT

Figure 1. US 92 (FL-600) west of Daytona Beach, Florida: (a) condition of the existing jointed concrete pavement before overlay construction and (b) overlay condition as of February 2021

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.

PROJECT BACKGROUND

The overlay was constructed in 2012 along a section of westbound US 92 (FL-600) west of Daytona Beach, Florida. At the project location, US 92 is a four-lane divided highway that in 2009 had an average daily traffic in both directions of 13,000 vehicles per day, with 5.5 percent trucks. The traffic level was expected to increase to 21,200 vehicles per day by 2031.

The eastbound lanes were constructed in the 1970s at a higher elevation than the westbound lanes. The westbound lanes were constructed in the 1940s over soft, organic subgrade soils, and as a result the concrete pavement has experienced excessive distress. The westbound lanes have also been prone to flooding.

The existing concrete pavement was 9 inches thick at the edges tapering to 7 inches at the center, and the plans show that the panels were 20 feet long by 11 feet wide (equal to one lane width). The base was a stabilized subgrade, and the shoulders were asphalt concrete (AC).

In 2009, the Florida Department of Transportation (FDOT) decided to rehabilitate a 10-mile-long section of westbound US 92 (Figure 1) to correct poor ride quality, repair damaged slabs and joints, and alter the grade of the roadway to reduce the occurrence of flooding. The agency applied for and was awarded funding assistance in 2009 through the Federal Highway Administration's (FHWA's) Highways for Life (HFL) program to construct an unbonded precast concrete overlay on a 793-foot section of the roadway.

FDOT had not used precast concrete pavement (PCP) previously. This demonstration project was an opportunity for FDOT staff to gain firsthand knowledge in designing and constructing PCP and to ascertain the viability of using PCP on high-volume roadways in Florida.

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PROJECT DETAILS

FDOT opted to use a post-tensioned PCP design, which incorporates multiple series of precast panels into post-tensioned sections, with expansion joints between each section. Expansion joints were also used between the transitions from and to the existing pavement. The existing concrete pavement was to remain in place, and the following design was used for the overlay section:

1. AC interlayer: 2 to 6 inches thick to correct for grade, with a single layer of polyethylene sheeting placed over the surface of the AC interlayer.
2. Post-tensioned sections: three 264-foot-long sections, each section comprised of 22 panels.
3. Panel design: 9 inches thick by 12 feet long by 24 feet wide, with panel types including base panels (the majority of panels), central prestressing panels to allow post-tensioning to be applied, and expansion joint panels at the ends of each section.
4. Prestressing design: six 0.6-inch strands per panel in the longitudinal direction with a bonded tendon design.

Construction of the precast concrete overlay began on January 2, 2012, and was completed on January 13, 2012. During construction, the westbound traffic was diverted to the inside eastbound lane. Construction began with the placement of the AC interlayer followed by the polyethylene sheet. Then the panels were placed, as shown in Figure 2. When all 22 panels per section had been placed, post-tensioning was applied from the central stressing panels. Expansion joints, as shown in Figure 3, were installed between the post-tensioned sections and at the beginning and the end of the post-tensioned PCP overlay section.

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Figure 2. Placement of a precast panel

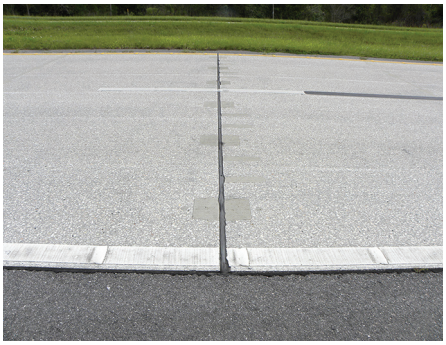

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Figure 3. Expansion joint

PROJECT PERFORMANCE

According to FDOT, the concrete overlay on US 92 is performing well after nine years in service (Figure 1).

According to FDOT, the overlay has improved the grade and eliminated roadway flooding. The as-constructed smooth ride has remained, and only minor maintenance has been performed at the expansion joints at the beginning and the end of the test section. In 2019, the traffic in the westbound direction was 8,100 vehicles per day, with 5.4 percent trucks. The overlay's International Roughness Index (IRI) value measured in February 2019 was 58 inches per mile.