Florida Department of Transportation Research

Precast Element Evaluation for the US-90 Bridges over Little River and Hurricane Creek

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Current Situation

The Federal Highway Administration's (FHWA) Every Day Counts (EDC) program identifies and deploys innovation that shortens project delivery, enhances roadway safety, and protects the environment. EDC includes Accelerated Bridge Construction (ABC), which includes use of Prefabricated Bridge Elements and Systems (PBES). These programs motivated the Florida Department of Transportation (FDOT) to design a new bridge system that could be built, and possibly standardized, using PBES. During the design phase, a mock-up and testing program was conducted at the FDOT Marcus H. Ansley Structures Research Center (SRC) in Tallahassee, Florida, to improve constructability and refine the project specifications. The US-90 (SR-10) bridge replacement project, located east of Quincy in Gadsden County, Florida, was a good opportunity to implement this system. The bridge incorporated the following precast concrete elements: intermediate bent caps, prestressed girders, non-prestressed deck panels, and prestressed deck panels.

A worker examines a precast panel.

Research Objectives

Researchers at the FAMU-FSU College of Engineering monitored the US-90 (SR-10) bridge replacement construction project to collect evidence of the benefits of using the new precast components, to observe contractor means and methods, as well as to identify challenges associated with fabrication and construction of the elements.

Project Activities

During construction, the researchers documented the the bridge contractor's construction activities, schedule, and methods used to fabricate and construct the precast elements. They also documented the contractor's grouting demonstration test, inspected the haunches, evaluated core samples of the pockets and joint, and measured the performance of the bridges by load testing before they were placed in service. Once the bridge decks were in service, they were inspected every three months for two years to determine whether cracks were occurring or growing. The bridges were load tested after being in service for 19-25 months.

Research Findings

There was a learning curve during construction, particularly in forming and grouting the panel connections. The non-prestressed panels exhibited significantly more cracking than the prestressed panels, with cracks forming almost exclusively in the longitudinal direction. The girder and panel load response remained linear with increasing load. Deflections and strains were mostly consistent and repeatable from one bridge to another. The load response of the bridges with non-prestressed panels was similar to those with prestressed panels. Calculated distribution factors from strain and deflection data showed that AASHTO equations are conservative. Composite action at the service level was achieved between the girders, deck panels, and joints. The precast bent caps seemed to perform well and, overall, to be a viable option for use in Florida bridges.

Project Benefits

Understanding the behavior of the in-service bridges will help FDOT to make an informed decision about implementing and promoting use of these new bridge elements in future projects.

For more information, please see fdot.gov/structures