RESEARCH
PROJECT CAPSULE [14-1ST]
August 2014
TECHNOLOGY TRANSFER PROGRAM

Evaluating Louisiana New Deck Continuity Detail for Precast Prestressed Concrete Girder Bridges

JUST THE FACTS:

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30 months

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Funding:
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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

The goal of everyone in the transportation community is to build bridges that are economic, easy to construct, and durable. Therefore, accelerating bridge construction through the use of precast concrete or prefabricated steel girders is a common practice for the majority of bridge projects. If left unconnected, each span will become simply-supported, which forfeits the structural advantages that continuous structures offer (i.e., smaller straining actions). Furthermore, joints between adjacent spans lead to a host of issues such as increased maintenance costs over the life of the project, deterioration of structural elements in the joint's vicinity due to water leakage through the joint, and reduced riding quality. Therefore, developing details to connect adjacent spans has been an active area of research for a long time.

The Bridge Design Section in the Louisiana Department of Transportation and Development (DOTD) is in the process of developing a new Bridge Design and Evaluation Manual (BDEM). In the BDEM, a new continuity detail will be adopted, one that differs from the current standard continuity detail as it does not call for any connection between adjacent girders. The detail relies solely on a continuous deck slab that spans the gap between adjacent girder ends. The portion of the slab providing continuity is often called the Link Slab (LS). The new continuity detail is a simplified detail compared to other details such as those recommended in NCHRP Report 519, whose goal is to achieve full integration between adjacent girders by extending positive moment reinforcement out of the girders bottom flanges into a continuity diaphragm. Many spans in the design/build John James Audubon (JJA) Project employed the NCHRP detail, which is also different from the current standard continuity detail. The Louisiana Transportation Research Center (LTRC) funded Project 08-1ST, which was supplemented by Project 12-1ST, to evaluate the performance of the NCHRP full continuity detail of skewed spans with bulb-T girders using a field monitoring system similar to the one proposed herein. Findings from the first project (08-1ST) were published in LTRC Report 477. The two main outcomes of the study were: (1) thermal effects can cause large straining actions on continuity details, and (2) positive moment reinforcement due to girder creep and thermal variations cause stress concentration in girder bottom flanges that may lead to cracking.

This proposal aims at evaluating the performance of the new LS continuity detail that will be adopted in the new Louisiana BDEM. Based on the field study, the design procedure and the detailing of the LS will be critiqued and modified if required.

OBJECTIVE

The main objective of the proposed research is to evaluate the field performance of a continuity detail that will be included in the new Louisiana BDEM. The new detail is different from the standard continuity detail in the current Bridge Design Manual. It will be employed in a new bridge in Catahoula parish. The research plan will achieve the following goals: developing a comprehensive monitoring system that is capable of capturing the key behavioral parameters needed to evaluate the LS detail and to assist in the procurement and overview of the installation of the monitoring system; and collecting data from an installed monitoring system over an extended period starting as early as the pouring day until the end of the project period. Collected data will be analyzed and interpreted to understand the behavior and performance of the LS detail, developing a user-friendly monitoring software tool to assist in managing big data expected from long-term monitoring. The software tool will be developed with a Graphical User Interface (GUI) to assist users in manipulating, viewing, post-processing, and analyzing data using sophisticated scripts in a transparent way to the user.

In addition, the ultimate goal of the project is to provide the DOTD with useful information on the performance of the LS detail to assist in validating the simplified design procedure currently used to determine link slab reinforcement. Such information will help improve the LS detail and permit the comparison of its performance with other continuity details.

METHODOLOGY

Work on this project will comprise the following tasks:

- Develop a Detailed Instrumentation Plan.
- Develop Monitoring System Specifications.
- Develop a Data Management Software Tool.
- Monitor and inspect the installation of instrumentation.
- Conduct live load testing of the bridge.
- Carry out data collection, processing, and LS evaluation.

IMPLEMENTATION POTENTIAL

The findings from this project will help DOTD in understanding the behavior of the LS detail and establish reliable design procedures and details. The findings from the project will impact the development of the new Louisiana BDEM, where the adopted continuity detail will become the standard for future bridges to be built in Louisiana.