Research Project

06-3ST

C a p s u l e

LTRC

Technology Transfer Program

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Field Verification for the Effectiveness of Continuity Diaphragms for Skewed Continuous Precast Prestressed Concrete Girder Bridges

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Louisiana Transportation Research Center

Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

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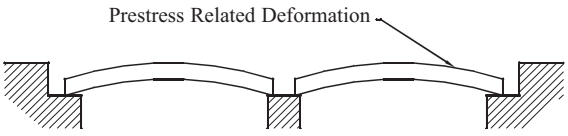
Problem

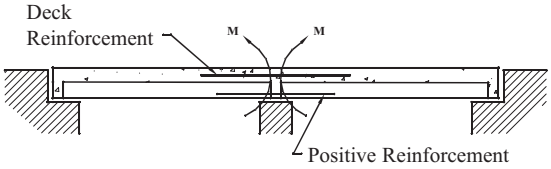
Most highway bridges are built as cast-in-place reinforced concrete slabs and prestressed concrete girders. Composite action between the slabs and girders is assured by the shear connectors on top of the girders. The AASHTO design guidelines for bridges indicate that diaphragms should be installed for T-girder spans but may be omitted where structural analysis shows adequate strength. Furthermore, the effects of diaphragms are not accounted for in the proportioning of the girders. Continuity diaphragms used in pre-stressed girder bridges on skewed bents cause difficulties in detailing and construction. Details for small skewed bridges have not been a problem for DOTD, but as the skew angle increases (>30°) or the girder spacing decreases, the connection and construction become more difficult. Even the effectiveness of the diaphragms is questionable at these high skews.

Objectives

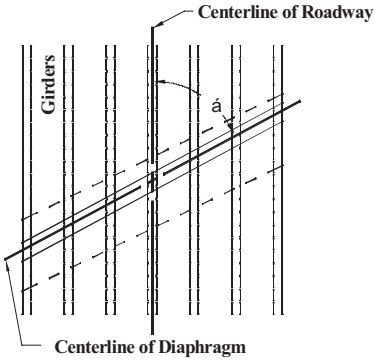
The results of LTRC Project 01-1ST, Continuity Diaphragm for Skewed Continuous Span Precast Prestressed Concrete Girder



Simply supported girders: stage one of construction.



Casting of deck slab and diaphragm for continuity: stage two of construction.



The skew angle of the diaphragm is the angle between the centerline of the diaphragm and the roadway centerline.

Bridges, indicated that the continuity diaphragms could be eliminated without any significant effects on the stresses or deflections in the bridge girders. At the conclusion of that study, the researcher recommended that field measurements be considered to verify the theoretical results.

This study will now focus on two of the bridges used in Project 01-1ST—the Kelly Bayou Bridge and approaches in Caddo Parish and the BNSS Overpass (Jennings) in Jefferson Davis Parish. The investigator will perform the field verification for Project 01-1ST and provide DOTD with an implementation plan.

Description

The bridge parameters to be considered include skew angle, length of the span, beam spacing, the ratio of beam spacing to span (aspect ratio), and the ratio of the stiffness of the girder to that of the slab. The Kelly Bayou Bridge or BNSS Overpass Bridge will cover the range of these parameters.

A monitoring system and work plan will be designed detailing all the steps needed regarding the instrumentation and data collection for these bridges. The design and work plan will be approved by the PRC before any actual work is carried out.

To assess the need of continuity diaphragms, data collection and recalibration of the Finite Element Model(s) for the bridges will be performed. The dynamic test will be used to calibrate the FEMs for the bridge, data will be collected, and the finite element analysis will be refined. The field information will be compared to the analytical results; specifically, the stresses in the girders, bridge deck, and continuity diaphragm. Conclusions and recommendations on the use of diaphragms on highway bridges will then be made.

Implementation Potential

High skew bridges are built every year in Louisiana. The results from this project will lead to more efficient bridges, reducing their construction and maintenance costs for both Louisiana and the rest of the United States.

For more information about LTRC's research program, please visit our Web site.

www.ltrc.lsu.edu