Project Summary

Texas Department of Transportation

0-4751: Impact of LRFD Specifications on the Design of Texas Bridges

Background

The Texas Department of Transportation (TxDOT) has historically designed highway bridge structures using the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges. However, the agency is in the process of transitioning to the use of the AASHTO Load and Resistance Factor (LRFD) Bridge Design Specifications.

Do the LRFD Specifications result in significant changes in the design of typical Texas bridges as compared to the Standard Specifications? To help answer the question, this research project focused on typical Texas prestressed concrete bridge girders because of the prevalence of these elements in standard TxDOT bridge designs.

What the Researchers Did

Researchers worked with TxDOT personnel to establish parameters for typical bridge girders. Detailed design examples were developed to illustrate the design calculations for bridge girders following both the AASHTO *Standard Specifications for Highway Bridges* (17th edition) and the *AASHTO LRFD Bridge Design Specifications* (3rd edition).

Researchers also produced two reports:

- *Impact of LRFD Specifications on Design of Texas Bridges, Volume 1: Parametric Study.*
- *Impact of LRFD Specifications on Design of Texas Bridges, Volume 2: Prestressed Concrete Bridge Girder Design Examples.*

For specific structural elements, researchers focused on evaluating the impact of adopting the LRFD Specifications for typical prestressed concrete bridge girders. A parametric study was conducted for several girder types: Type C, AASHTO Type IV, and Texas U54 girders.

What They Found

The following general observations indicate findings regarding the components investigated in this project. Details of all project conclusions are provided in the project reports.

Type C and AASHTO Type IV Girders

- The overall impact of the LRFD Specifications on the flexural service load design of Type IV and Type C prestressed concrete bridge girders is relatively small.

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- The effect of the LRFD Specifications on the maximum span length is negligible.
- The required transverse shear reinforcement area increased in most of the cases (up to 300 percent) when using the LRFD Specifications.
- The required interface shear reinforcement area increased significantly (up to 200 percent for roughened surfaces and up to 400 percent for unroughened surfaces) for LRFD designs.
- The interface shear provisions approved by Technical Committee T-10 in 2004 yield shear reinforcement areas that are comparable to the Standard Specifications when using a roughened surface. The provisions for unroughened surfaces are essentially the same as those for the 2004 LRFD designs.

Following this project, new interface provisions were approved for inclusion in the 2007 LRFD Specifications. These provisions are very similar to the 2004 LRFD Specifications, with differences in the cohesion and friction factors for roughened surfaces. The factors for unroughened surfaces are not changed. The approved provisions are not expected to change the T-10 interface shear trends noted above.

Texas U54 Girders

The trends for Texas U54 girders do not always follow those noted above for Type C and AASHTO Type IV girders.

- The overall impact of the LRFD Specifications on the flexural service load design of Texas U54 prestressed concrete bridge girders is small.
- The effect of the LRFD Specifications on the maximum span length varies with support skew, strand diameter, and girder spacing.
- For all skews and both strand diameters, the transverse shear reinforcement area values calculated for LRFD designs are smaller than for Standard designs.
- The interface shear reinforcement area for LRFD designs increases significantly relative to Standard designs.

What This Means

TTI researchers have verified that the flexural design requirements for typical prestressed concrete bridge girders in Texas are not significantly impacted by a transition from the Standard Specifications to the LRFD Specifications. However, changes in the provisions for transverse and interface shear design have led to increased shear reinforcement requirements. This increase is addressed in part by the new interface shear provisions that have been approved for the 2007 LRFD Specifications.

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