Kansas Department of Transportation

TECHNICAL SUMMARY

Skewed Steel Bridges, Part II: Cross-Frame and Connection Design to Ensure Brace Effectiveness

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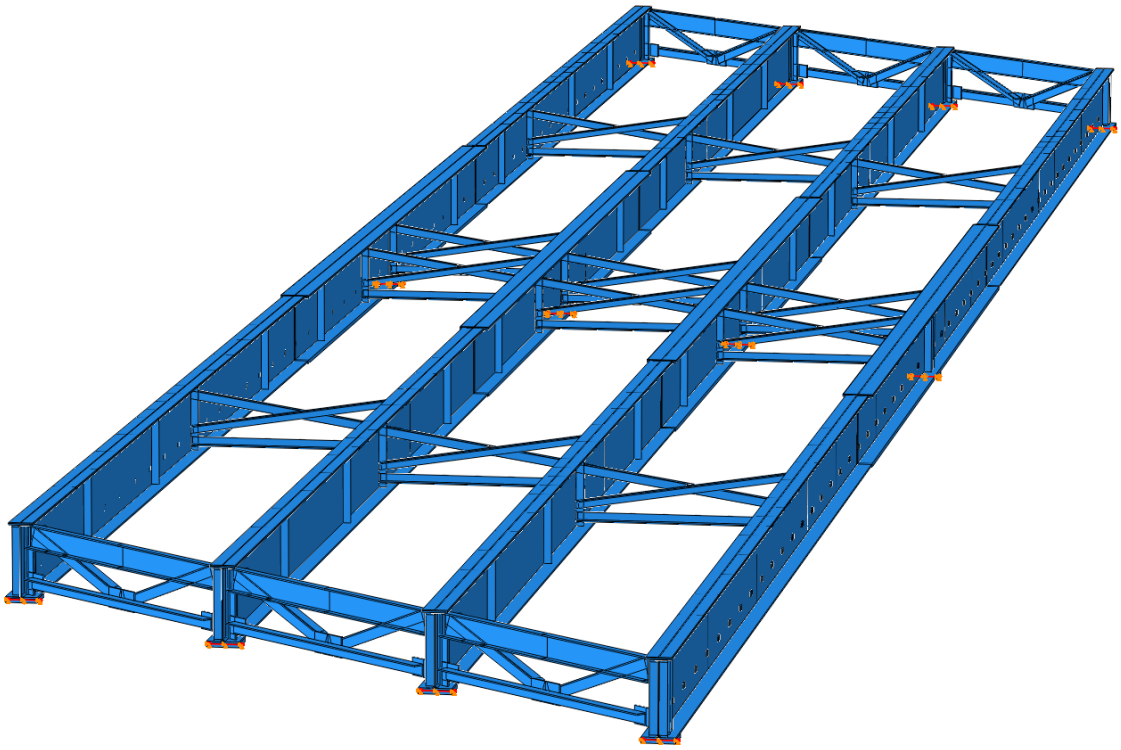
Introduction

Skewed bridges in Kansas are often designed such that the cross-frames are carried parallel to the skew angle up to 40°, while many other states place cross-frames perpendicular to the girder for skew angles greater than 20°. Skewed-parallel cross-frames are longer and may require different connections than cross-frames oriented perpendicular to the girder. Therefore, it is important to determine whether the cross-frames and their corresponding connecting elements placed in a parallel-to-skew configuration are sufficiently designed to resist lateral torsional buckling demands using current KDOT practices.



3D Finite Element Model Geometry of Skewed-Staggered Bridge Configuration

Project Description

The authors have performed a study to investigate the effect of cross-frame orientation, skew angle, and cross-frame connection upon bridge system behavior and cross-frame stresses. In a suite of detailed 3D, solid finite element analyses models of skewed bridge systems, cross-frame layout, connection thickness and type, and skew angle were varied. Skewed bridge systems with cross-frames placed parallel to the skew angle as well as systems with cross-frames arranged in a staggered configuration were considered. Varying bent plate connection thicknesses and a half-pipe connection were also analyzed. Cross-frame spacing of 4.6 m [15 ft] and 9.14 m [30 ft] were examined; severe cross-frame spacing of 13.7 m [45 ft] was also considered to examine behavior at very long unbraced lengths.

Project Results

The findings of this study showed that skew angle, skew configuration, and connection type all influenced the strength and stiffness of system. The data showed that cross-frame placed parallel to skew up to an angle of 40° performed similar or better than cross-frames oriented perpendicular to skew for every given skew angle and connection type.

Project Information

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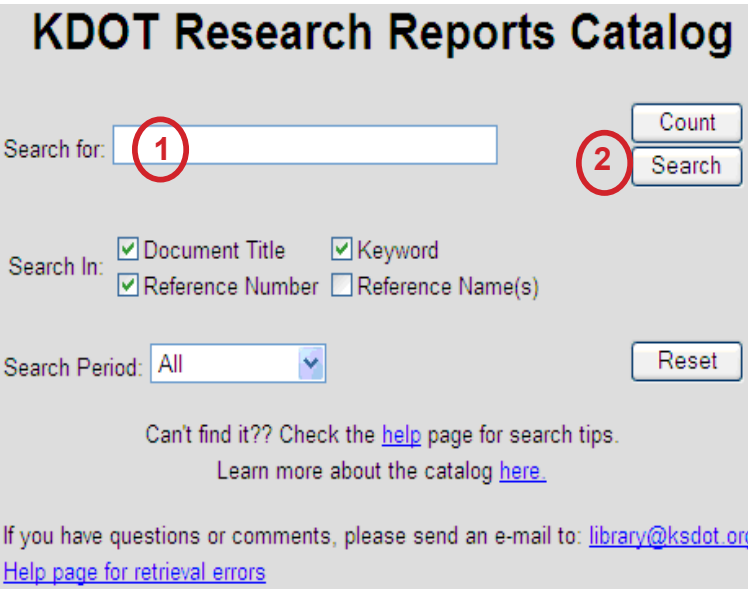

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