Kansas Department of Transportation

TECHNICAL SUMMARY

Repair of Distortion-Induced Fatigue Damage in Bridge No. 135-87 (043SB and 044NB) Using Newly-Developed Strengthening Schemes

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Introduction

A steel girder twin bridge structure located near Park City, Kansas, has experienced extensive distortion-induced fatigue cracking in its web-gap regions. Due to the bridge's skewed, staggered configuration, the majority of these cracks have occurred in the bottom web-gap region. The bridge was previously the subject of a series of detailed finite element analyses that investigated the effectiveness of several types of retrofits in repairing its distortion-induced fatigue cracks. One of these retrofits, the "angles-with-plate" retrofit, was developed and tested at the University of Kansas as a new retrofitting technique aimed at providing a more economical and easy-to-install distortion-induced fatigue cracking repair. The retrofit is made up of a pair of angles and a backing plate that connect the cross-frame connection plate and girder web in order to stiffen the web-gap region. Results from the finite element analyses determined that the angles-with-plate retrofit was the most effective and economical choice for repairs in the bridge, and plans were made for its installation.

Example of the Types of Cracks Occurring in Kansas Bridges

Project Description

To investigate the performance of the angles-with-plate retrofit, two field tests were performed that monitored behavior of the bridge both before and after the retrofit was installed. Results from these field tests were compared with results from complementary finite element analyses to determine the overall effectiveness of the retrofit. In the bottom web-gap region, where cracking is most prevalent in the bridge, the angles-with-plate retrofit was successful at lowering stress demands that would lead to crack propagation. The same conclusion could not clearly be made for all cases in the bridge's less problematic top web-gap region, so a secondary set of finite element analyses was performed to gain a better understanding of what was happening in that region. Further analyses of the two common types of distortion-induced fatigue cracking determined that, while not always large, the angles-with-plate retrofit was successful in reducing stress demands in the top web-gap region.

Project Results

It was concluded that the angles-with-plate retrofit was an effective repair for the problematic bottom web-gap regions of the bridge, and if needed, can be used effectively in the less demanding top web-gap region.

Project Information

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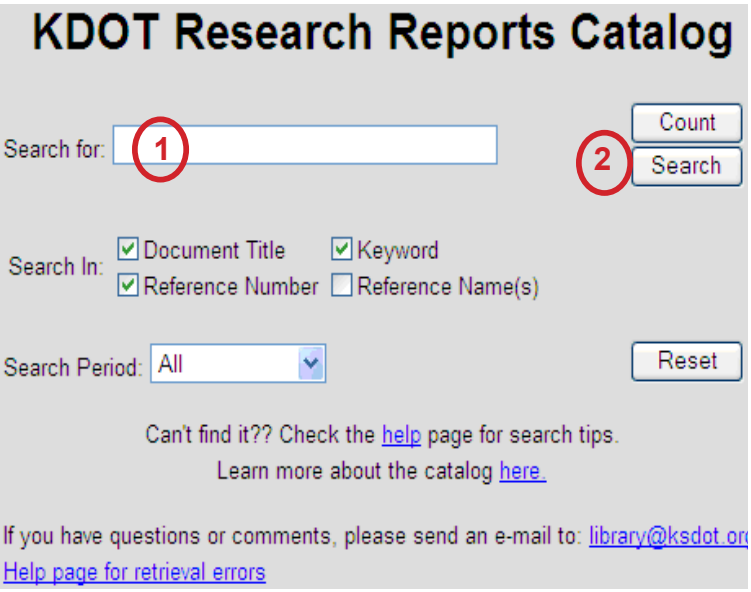

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