FIELD INSTRUMENTATION AND ANALYSIS OF THE ARKANSAS RIVER BRIDGE

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RESEARCH

Introduction

The four-lane Arkansas River Bridge is located on K-96 highway in Hutchinson, Kansas, and has experienced fatigue cracking throughout its lifetime.

Project Objective

This report consists of a field instrumentation analysis comparing the predicted internal stresses based on computational analysis to actual measured field measured conditions. The primary purpose of the report was to measure the stress range before and after retrofit.

Project Description

Extensive work applying fatigue and fracture mechanics, as well as an ANSYS coarse model to sub-model computational analysis, was performed to predict internal stresses at critical locations where the exterior floor-beam connections have experienced fatigue cracks at the stiffener plates. In addition to predicting internal stresses, Dr. Roddis and Dr. Zhao have provided a retrofit concept to extend the fatigue life of the exterior floor-beam connections. Strain gages were installed before and after retrofit of the Bridge.

Project Results

Before retrofit, the measured stresses match the computational ANSYS results at the stiffener plate. Fatigue life calculations for the retrofitted detail indicated a time range to crack initiation of 25 to 65 years. Calculated fatigue lives are inherently uncertain due to variability in measured stresses, traffic forecast, and construction details. Because the inspected and repaired cracks had not propagated into the web of the main beams before the retrofit, it is reasonable to conclude that when a fatigue crack reinitiates, stable crack growth will remain in the stiffener. This retrofit of softening the connections was successful, both in repairing existing cracks which were growing in the heat-affected zone of the welds and in softening the connection to mitigate the out-of-plane distortion driven strain-induced fatigue.

Report Information

For technical information on this report, please contact: Civil, Environmental, and Architectural Engineering Department, University of Kansas, 2150 Learned Hall, 1530 W. 15th Street, Lawrence, Kansas 66045-7609; Phone: 785-864-2928; Fax: 785-864-5631.

For a copy of the full report, please contact: KDOT Library; 700 SW Harrison Street, Topeka, Kansas 66603-3754; Phone: 785-291-3854; Fax: 785-291-3717; e-mail: library@ksdot.org.