Truss Bridges in Railway Infrastructure: 3-D Frame Behavior and Field Load Testing

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Abstract:

This study focuses on railway truss bridge load rating using full-scale diagnostic load testing and 3-D finite element analysis. There were forty-eight Canadian National Railway bridges studied in this practice, eight of which underwent load testing. One of the main areas of focus in this work was to evaluate the impact of a collision strut member (CS) on the behavior of primary truss members, especially the end post L0U1. In traditional methods, the CS member is generally ignored for simplicity of design and 2-D truss load rating analysis. Here, the CS member is identified as an element which contributes to increased live load stress by producing bending; neglecting this effect would lead to an unconservative rating. Furthermore, it is demonstrated the components of these spans behave more like frames rather than purely axial force-contributing elements. As part of the 3-D behavior, out-of-plane bending of the primary truss members is also investigated in this study. By addressing previously ignored bending in truss models, a multiplicative adjustment factor (AF) has been accordingly developed and proposed as a realistic technique to improve load rating and design of a significant number of truss bridges in the infrastructure network. The outcomes of this research have been implemented in practice and can be useful for the design and assessment of truss bridges worldwide for stress calculation in both strength and fatigue limit states.

Bio:

Dr. Faeze Khademi has been a bridge rating engineer with CN Railway since August 2017. In addition to her core responsibilities at the company, she has been an instructor for the Bridge Inspection Workshop series held by CN on a regular basis, entrusted by Human Resources (HR) to serve on the company's interview panel for employment opportunities, and regularly sought-after to attend university career fairs as an ambassador to both represent CN and inspire interest from potential talent.

She received her M.Sc. and Ph.D. degrees in 2015 and 2017, respectively, in civil (structural) engineering from Illinois Institute of Technology. Additionally, she earned her second M.Sc. degree in industrial engineering, from the University of Illinois Chicago (UIC) in 2022.

Dr. Khademi is the author of multiple highly-cited articles in addition to acting as a technical manuscript reviewer for prominent scientific journals, including those published by ASCE and Elsevier. She received the "Publons Peer Review Awards 2018" for being among the top 1% of reviewers due to her extensive peer review records on the platform's reviewer database. She has also been a member of the SEAOI annual bridge symposiums' organizing committee since 2020. Once established in academia, she was awarded the National Interest Waiver of the United States for her remarkable contributions to the field of civil engineering.

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1310 Yeh Student Center