Civil Engineering Seminar

New Approaches for Rapid Fabrication and Construction of Resilient Steel Bridges

Ashley P. Thrall, PhD

Location: DOW 875
Time: Oct 6th 11:00 am to 12:00 pm
Brief lunch including pizza and beverages will be served

Dr. Ashley P. Thrall is the Myron and Rosemary Noble Collegiate Professor of Structural Engineering in the Department of Civil & Environmental Engineering & Earth Sciences at the University of Notre Dame where she directs the Kinetic Structures Laboratory. Her research investigates the behavior of modular, rapidly constructable, and deployable structures using numerical and experimental approaches. She is the recipient of several distinguished honors, including the American Institute of Steel Construction Early Career Faculty Award, the Hangai Prize from the International Association for Shells and Spatial Structures, and being elected a Fellow of the National Academy of Inventors. Dr. Thrall earned her PhD and MSE in Civil & Environmental Engineering from Princeton University and her BA in Physics from Vassar College.

Abstract

Harnessing innovative fabrication techniques and modular design approaches offers enormous potential for the rapid construction of resilient steel bridges. This presentation will focus on two research projects that incorporate fabrication (i.e., cold bending) as an integral part of structural design, use modularity for its benefits in cost and time savings, and incorporate structural redundancy for improved safety: (1) steel truss bridges made up of modular joints and (2) built-up, press-brake formed tub girder (PBTG) bridges.

The modular joint for truss bridges introduces a new paradigm in modular design: where the joint – a steel nodal connector made up of a weldment/built-up section of webs and flanges fabricated using cold bending – is the module and the members are standard rolled wide flange sections. Flanges and webs are connected independently through bolted splices, forming a moment-resisting connection that provides system redundancy as the structure can tolerate member loss. The presentation will include numerical investigations into behavior.

Research in built-up PBTGs – made up of cold bent webs bolted to flat, top and bottom flange plates – aims to reduce the time for fabrication through taking advantage of adjacent industries (i.e., transmission pole manufacturers). As compared to PBTGs that are formed from a single steel plate, built-up PBTGs offer (1) increased span length as deeper and thicker flanges can be used and (2) enhanced resiliency as the bolted-up section provides internal member redundancy. This is a modular, kit-of-parts approach, where the "part" is the cold bent web. The presentation will focus on the behavior of two demonstration bridges built in Indiana, including numerical predictions and measured live load behavior.

Together, these projects demonstrate the potential for the rapid fabrication and construction of resilient steel bridges, incorporating fabrication via cold bending and modularity.