Identifying Number MPC-343

Project Title:

Laboratory Testing of Innovative Steel Bridge Designs

University:

Colorado State University

Principal Investigators:

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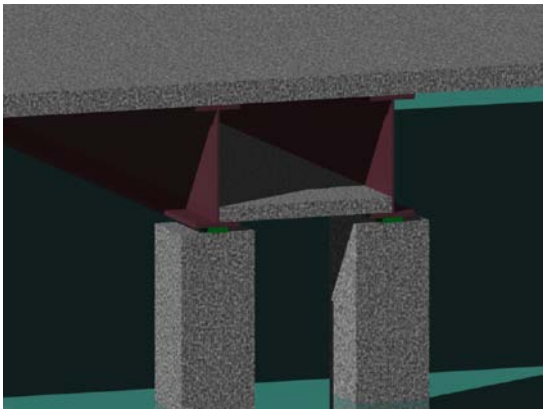
Description of Research Problem:

Ongoing research at CSU has considered innovative approaches to design of steel bridges for the Colorado Department of Transportation. An initial study considered the application of compact rolled steel sections to simple made continuous design [1]. A follow-up study is considering steel plate girders along with innovations such as (1) external post tensioning using either steel or FRP rods; (2) use of hybrid steel girders to enable the use of high performance steel in key regions of the girders; (3) use of double composite steel-concrete bridges (see figure below); and (4) application of a FRP cover plate to the bottom flange using epoxy to optimize the cross section. The study currently underway is purely analytical. In order to put these innovative bridge design and construction techniques to use, the analytical models need to be verified by laboratory experiments.



Solid model illustration of two steel plate girders forming a double composite section.

Research Objectives:

The goal of this series of projects is to facilitate the use of innovative methods for steel bridge construction in Colorado. This project contributes to that goal with the objective of conducting experimental verification of analytical models for two types of innovative bridge designs.

Research Approach / Methods:

Four innovative steel bridge techniques are the current subject of analytical study. Based on preliminary results of this study, the two promising methods will be chosen for experimental study. This selection will be based on design and economic considerations. Research specimens will be designed based on the existing laboratory capabilities and in order to address any particular questions that were raised during analytical study. Specimens will then be constructed in the Structural Engineering Laboratory at CSU's Engineering Research Center. The specimens will be tested to failure, and measurements will be taken in order to determine their stiffness. The study will also include qualitative assessments as to the performance of the specimens and the failure modes to consider during design.

MPC Critical Issues Addressed by the Research:

1. Improved Infrastructure Design

Contributions / Potential Applications of Research:

The use of steel for bridge structures throughout the U.S. is extensive. There are a significant number of advantages that often make it a viable alternative. There have been recent developments in steel bridge design and this is an opportunity to investigate those with the specific needs of the state of Colorado in mind.

Potential Technology Transfer Benefits:

This research project will be conducted in cooperation with CDOT, which will ensure that they are able to implement and take full advantage of these

cutting edge discoveries. The results of this study will also be disseminated through journal publications.

Time Duration:

July 1, 2010 – June 30, 2011

Total Project Cost:

$94,036

MPC Funds Requested:

$52,000

Source of Matching Funds:

In-kind contributions, some hard match from PI Start-up: $42,036

TRB Keywords: Bridge engineering, Steel, Experiments

References:

1. Stone, A., J.W. van de Lindt, and S. Chen. (2009). "Design and Costs for Rolled Section Simple-Made-Continuous Steel Bridges: A Literature Review." ASCE Practice Periodical on Structural Design and Construction, In Press.