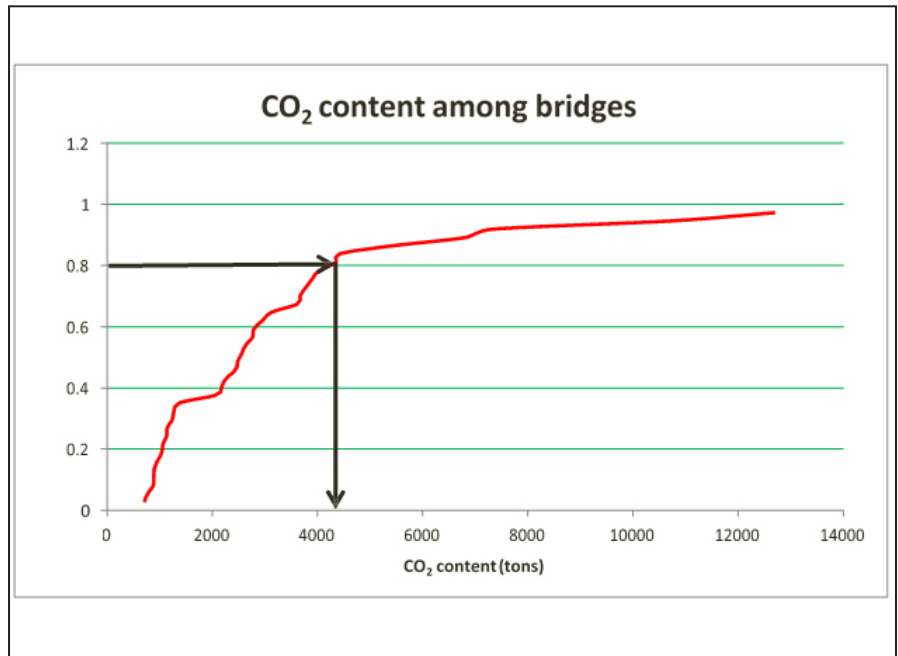


# MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 18-360 (project 414) | September 2018

## Quantifying Sustainability Metrics for Trunk Line Bridges in the Mountain Plains Region



### the ISSUE

The production of millions of cubic yards of concrete and steel used to support the U.S infrastructure may result in a significant negative impact on the environment. CO<sub>2</sub> released by construction processes, as well as material production, is taking a substantial toll on the environment. To date, there has been no sustainability rating for bridges.

### the RESEARCH

This study seeks to develop a system to rank bridges based on their CO<sub>2</sub> emissions. First, in order to accomplish this objective, rating systems for buildings around the world were analyzed for common attributes applicable to bridges. Second, a sample of bridges from the state of Colorado was selected and analyzed for sustainability by considering only their primary materials. This sample served as the first step in developing a sustainability rating system for bridges in Colorado.



A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University  
North Dakota State University  
South Dakota State University

University of Colorado Denver  
University of Denver  
University of Utah

Utah State University  
University of Wyoming



### Lead Investigator(s)

John W. van de Lindt  
jvw@engr.colostate.edu  
Colorado State University

### Project Title

Quantifying Sustainability Metrics for Trunk Line Bridges in the Mountain Plains Region

### Research Assistant(s)

Vaishak Gopi, GRA  
Bolivar Senior, GRA

### Sponsors | Partners

USDOT, Research and Innovative Technology Administration

## the FINDINGS

With the goal of developing a ranking system for sustainability of trunkline bridges, the bridges in the sample size obtained were analyzed for their CO<sub>2</sub> contribution. The main assumption being CO<sub>2</sub> contribution from bridges is an indicator of its sustainability along with other assumptions and by using the analysis method described in study, the bridges in the sample size were analyzed. After the analysis of each bridge, its CO<sub>2</sub> consumption was tabulated along with the CO<sub>2</sub> data from other bridges. The results were rank ordered to develop empirical cumulative distribution function. This approach of rank ordering and selecting an exceedance probability for bridge sustainability is unique to this project.

## the IMPACT

From analyzing the ranking of bridges, it was found that prestressed bridges have the least amount of CO<sub>2</sub>/sq foot compared to steel bridges for this simplified approach. Among bridges ranked superior to excellent, 66.7% were prestressed bridges and 33.3% were steel bridges. Similarly, among bridges ranked from acceptable to poor, prestressed bridges comprised 14.3% of the sample size and the remaining 85.7% were steel bridges. The results of this study are preliminary and not intended to be used for applications related to design selection. However, the research is a first step toward quantifying and ranking sustainability factors associated with components of transportation infrastructure.

For more information on this project, download the entire report at <http://www.ugpti.org/resources/reports/details.php?id=919>

For more information or additional copies, visit the Web site at [www.mountain-plains.org](http://www.mountain-plains.org), call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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