

# MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 18-352 (project 478) | July 2018

## Long-Term Behavior of Precast Concrete Bridges



### the **ISSUE**

Precast deck bulb tee girders are an efficient element for accelerated bridge construction. However, there has not been significant research on the long-term performance of bridges using these elements. Most research has been conducted on conventional bridges with cast-in-place decks.

### the **RESEARCH**

The objective of this research was to monitor actual behavior of the deck bulb tee bridge girders during curing and while in service. The behavior of these girders can then be compared with predictive methods according to current design standards. Differences can be quantified and recommendations can be provided to more accurately predict bridges of this type. The Utah Transportation Center (UTC), in partnership with the Mountain-Plains Consortium, sponsored a study to investigate the changes in prestress and temperature for the Millville Bridge over the Blacksmith Fork River. To accomplish the goals of the study, the bridge was instrumented with 16 vibrating wire strain gauges located at four cross-sections. An additional 50 thermocouples at five cross-sections were installed. Four of the thermocouple locations are at the same locations as the vibrating wire strain gauges. These instrument locations were placed at the mid-span and end of an exterior and center girder to effectively measure the bridge response in one quarter of the bridge superstructure. These instruments were tied to the reinforcing steel before the concrete was poured at the precast plant.



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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



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### Project Title

Long-Term Behavior of  
Precast Concrete Bridges

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### Sponsors | Partners

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Nibley City, In-kind

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## the FINDINGS

1. Over the long-term, the measured prestress losses followed a nearly linearly increasing relationship during the course of this study, with higher daily fluctuations as the ambient temperature increased in the spring. The total percent loss of the jacking stress at the end of the study was 15.0% and 17.8% for Girder 1 and Girder 5, respectively.
2. The temperature gradients predicted with the AASHTO LRFD Bridge Design Specifications proved conservative over the length of this study. As the length of the study was approximately three months, it is assumed that the measured temperature gradients will likely be closer to the design temperature gradients. The percent errors for the temperature gradient comparisons for this study were 58.0% and 1.3% for the maximum and minimum temperature gradients, respectively.

## the IMPACT

Accurately predicting short-term losses is significant because, not only does doing so provide a more accurate long-term loss calculation, but it also helps camber prediction, which is essential for serviceability. We found that using the high-strength equation for elastic modulus can improve percent errors of short-term losses from approximately 6 to 8%.

For more information on this project, download the entire report at <http://www.ugpti.org/resources/reports/details.php?id=909>

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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