

# MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 19-389 (project 523) | July 2019

## Methodology for Load Rating Double-Tee Bridges



### the **ISSUE**

Load rating of a damaged bridge requires accurate estimation of damaged member capacities and the knowledge of live load distribution and demands. The literature and current specifications are lacking a systematic method to include the damage of bridge components in load rating equations.

### the **RESEARCH**

Quantitative definitions were proposed to identify all damage types and condition states specific to South Dakota double-tee bridges. Subsequently more than 370 inspection reports were reviewed to determine the frequency of damage types and condition states, bridge span length, bridge number of spans, girder depth, and bridge skew conditions. The statistical database was then used to identify bridge candidates for field and strength testing. Ten double-tee bridges were identified as suitable for field testing and two bridges were selected for field testing. Girder distribution factors (GDFs) and dynamic load allowance (IM) were measured during the field testing of the two bridges. To verify the available moment and shear capacity estimation methods, two 45-year old double-tee girders, one 50-ft (15.24-m) long and another 30-ft (9.14-m) long were extracted from a bridge located on Nemo Road, SD, and were strength tested at the Lohr Structures Laboratory at South Dakota State University. A four-point loading configuration was selected for the strength testing. The measured data was used to validate the capacity estimation methods. Subsequently, the verified methods were utilized to calculate the shear and moment capacities of all 23 different double-tee sections, which have been used in South Dakota.



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

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### Project Title

Methodology for Load Rating  
Double-Tee Bridges

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## the FINDINGS

The most common damage type found on double-tee girders is the cover deterioration. Most of double-tee bridges in the state are single span with a span length of 40 ft. to 60 ft. The field testing of the two double-tee bridges revealed that current AASHTO LRFD specifications are sufficient to determine the bridge live load parameters if the girder-to-girder joint damage has a condition state of 3 or less. A conservative recommendation was proposed for the joints with damage condition state 4. The strength testing of the two salvaged double-tee girders provided sufficient information to validate the shear and moment capacity estimation methods, which were used in an extensive analytical study to reduce girder capacity based on damage type and condition state. Based on the statistical, experimental, and analytical studies, a methodology was proposed for damaged double-tee bridges to relate damage to the load rating parameters.

## the IMPACT

Researchers developed a visual load rating method for double-tee bridges that maximizes the use of existing double-tee bridges while providing safe travel and preserving the bridge investment.

For more information on this project, download the entire report at <http://www.ugpti.org/resources/reports/details.php?id=956>

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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