

MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-546 (project 675) | August 2024

Transition of Allowable Stress Rating to Load and Resistance Factor Rating for Timber Bridges



the ISSUE

Currently, there is no consensus on measuring a timber bridge's ability to safely carry predetermined truck loads. The most notable concern is that a weight limit varies with rating methods, and state departments of transportation estimate the limit based on past experience without scientific rationale. Two rating categories are available: Allowable Stress Rating (ASR), which was widely used when most timber bridges were constructed; and the Load and Resistance Factor Rating (LRFR), which the FHWA has required for bridge design since 2007. However, transportation agencies do not have sufficient information whether ASR furnishes a better rating for timber bridges compared with LRFR or vice versa. Without an understanding of how these ratings apply to timber bridges, agencies cannot properly manage bridges and efficiently allocate funds for maintenance and traffic control.

the RESEARCH

The research focused on rating timber bridges with and without hollow structural steel beam repair. On the basis of previously performed laboratory and field tests plus finite element modeling, load effects were computed for two benchmark bridges utilizing three categories of 17 rating vehicles in conjunction with published rating manuals.



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



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Project Title

Transition of Allowable
Stress Rating to Load and
Resistance Factor Rating for
Timber Bridges

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the FINDINGS

Upon elucidating the flexural behavior of timber bridges, live load-carrying capacities were quantified by the ASR and the LRFR methods. Parametric studies were carried out to explore the repercussions of average daily truck traffic, which is one of the principal factors degrading bridge structure performance.

the IMPACT

The research clarifies the technical appropriateness of ASR and LRFR through three-dimensional finite element analysis and establishes the foundation of understanding rating protocols for timber bridges. Based on the research, and to facilitate a convenient transition from LRFR to ASR, a conversion factor was proposed.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1186>

For more information or additional copies, visit the Web site at 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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