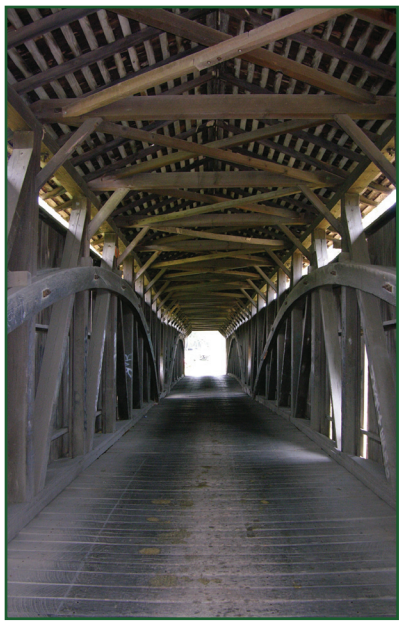
RESEARCH in Progress

NATIONAL CENTER FOR WOOD TRANSPORTATION STRUCTURES

Improved Ratings for Covered Bridges by Load Testing

According to the Federal Highway Administration (FHWA), approximately 880 historical covered timber bridges remain in the United States. These magnificent bridges were built with several types of heavy timber trusses that were developed during America's first century (1776–1876). These examples of early-American bridge building traditions are mostly located in the northeastern United States but are also found in significant numbers in the Pacific Northwest. Pennsylvania, Ohio, Indiana, Vermont, and Oregon have the largest inventories of surviving covered timber bridges. Efforts to preserve these structures have largely been driven by local fundraising efforts until recently. In 2000, FHWA established a National Program for the Historic Preservation of Covered Timber Bridges. The program provides grant funding opportunities for states to protect, restore, preserve, or rehabilitate their historical covered timber bridges. These bridge preservation efforts are guided by the Secretary of Interior's Guidelines for Historic Preservation.



Pine Grove Bridge, located between Lancaster and Chester Counties in the Commonwealth of Pennsylvania, has burr-arch trusses in a two-span configuration.

Background

Most engineering analyses of historic covered timber bridge trusses are based solely on routine site inspections. In addition, assumptions about the behavior of connections and support conditions are made during the systemic analysis stage. This approach can lead to inaccurate and, in most cases, overly conservative load-capacity ratings for these historic structures. By conducting live-load testing to assess the overall performance of the superstructure system, engineers will be able to perform structural analyses in a more reliable fashion. The measured live load response should also provide a measure of the effectiveness of various structure modeling techniques. The end result should be a more reliable approach to assigning safe load-capacity ratings for historic covered bridges.

Objectives

This study will develop and establish new load-rating procedures (based upon live-load vehicle testing) for reliably determining safe load-carrying capacity of historic covered bridges.

Approach

- Develop field protocols for live-load testing of historic covered bridges, in conjunction with analytical modeling data requirements
- Conduct live-load testing on several bridges representing the main truss types that have been preserved
- Analyze load testing field data and disseminate data to analytical modeling efforts
- Develop a rationale for incorporating physical test data into existing load-rating procedures

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Agriculture
Forest Service - Forest Products Laboratory
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Of Science and Technology

- Prepare a comprehensive final report that documents recommended procedures for live-load testing and enhanced load rating of historic covered bridges

Expected Outcomes

A comprehensive final report will document recommended procedures for live-load testing and enhanced load rating of historic covered bridges. The final report will include recommendations for (a) setting the maximum experimental load that can be safely applied to the structure; (b) methods of loading the bridge; (c) selection and placement of instrumentation; (d) procedures for ensuring quality data; and (e) procedures to analyze collected data and establish load ratings. These recommendations will be prepared in a format similar to existing rating guides.

Timeline

Preliminary planning for field activities will take place in fall 2009. Field work, including live-load testing, will take place during summer and fall 2010. Drafting of the final report will be completed by December 2011.

Cooperators

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