RESEARCH in Progress

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Development of Lightweight Deck Systems for Historic Covered Bridge Rehabilitation

Floor systems of historic timber covered bridges are often replaced due to deterioration, excessive wear, or structural damage after 30 to 40 years of service. During deck replacement, damage may also be found in longitudinal and transverse floor beams, requiring replacement or repair. In many cases, the floor system controls the bridge's load capacity, creating a unique opportunity to upgrade the entire structural system during rehabilitation. Covered bridges are unique, and the general replacement systems in use vary widely. These systems, however, have seen little change after many years of implementation, creating an opportunity to develop new lighter-weight replacement flooring systems that improve the deck system and overall structural performance.

Background

Historic timber bridges use heavy timber trusses to carry loads over rivers or valleys. The most common longitudinal timber truss types include kingpost, queenpost, Burr arch, Town lattice, Long truss, and Howe truss designs (Fig. 1).

Floor systems consist of combinations of transverse beams, longitudinal beams, distribution beams, and deck systems. These materials historically were solid-sawn lumber but over time have transitioned to include glulam beams and glulam decking. An example of a sawn lumber flooring system is shown in Figure 2.

Objective

The objective of this research is to develop, evaluate, and test different types of lightweight deck systems that can be used in the replacement of decks and flooring systems in historic covered bridges.

Figure 1. The Warren Covered Bridge in Vermont consists of a historic queenpost timber truss configuration.

Approach

To help ensure that developed systems meet the needs of various floor system geometries, the project team will assess in-service historic covered bridges to determine current floor framing types and conduct a review of floor systems used in other types of wood bridges. This information will guide the development and analytical assessment of new floor system approaches for covered bridges. The behavior and strength of the most promising systems will be evaluated through controlled laboratory testing in the FPL Centennial Research Facility. One follow-up phase of this work may involve design and implementation of one or more of the developed systems on actual covered bridges. The team will seek solutions that are compatible with historic preservation and authenticity guidelines.

Expected Outcomes

The primary outcome of this study will be a comprehensive final report that will include summaries of

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Figure 2. Existing deck/floor system from the Warren Covered bridge in Vermont.

current decking systems used for in-service historic covered bridges and key information on design, properties and potential installation of lightweight replacement deck systems.

Timeline

Started in September 2011, the project duration is expected to be 22 months. Deck replacement design and testing will occur from June to December 2012, and a comprehensive final report draft will be completed by June 2013.

Cooperators

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