Laboratory Evaluation of Advanced NDE Inspection Tools for Historic Covered Bridges

Bridge inspectors are assigned the difficult task of assessing the integrity and safe load-carrying capacity of our Nation's highway bridges. This task becomes even more challenging in the case of historic covered timber bridges. Most engineers are not adequately trained for inspecting timber structures and typically tend to be overly conservative in their assessments. When relying solely on visual inspection techniques, they don't always recognize the signature indicators of internal decay and/or deterioration in timber bridge components. Many advanced tools are available in the marketplace to supplement visual inspection data, but most require complicated data interpretation, which limits their use in routine bridge inspections.

Interior view of the Dick Huffman Covered Bridge, a Howe timber truss originally constructed in 1880, located in Putnam County, Indiana.

Background

Nondestructive evaluation (NDE) and structural health monitoring technologies have been used on a limited basis for condition evaluation of timber bridges. Visual inspection (VI) is the predominant method used for inspection of timber bridges, as it is with concrete, steel, and masonry bridges. However, VI, in conjunction with probing and picking tools, is subjective and qualitative in nature, and its limitations for inspection of the aging infrastructure have been well recognized. Well-established technologies are used to inspect other materials, but their application for timber covered bridges has been quite limited. Additionally, in the past 10 to 15 years, many advanced digital signal processing tools have been developed that have substantially improved the imaging and interpretation of field inspection data sets.

Objective

This study will assess, validate, and adapt a few advanced imaging tools and techniques for field condition assessment of wooden covered bridge members.

Approach

This research will be accomplished through a series of interrelated tasks. The first task will be to conduct a comprehensive literature review of state-of-the-art technologies to help identify the most promising NDE inspection technologies. Next, an initial screening of these technologies will be conducted to determine if they are able to see artificial voids in large-cross-section bridge members. Then an in-depth investigation of two or three of these NDE inspection technologies will be conducted to determine their effectiveness at detecting internal deterioration and/or moisture

pockets. Finally, a comprehensive report will be drafted that describes the various inspection tools and the laboratory testing.

Expected Outcomes

This work will result in a set of new NDE condition assessment tools that can be used to better characterize the internal condition of bridge components.

Timeline

This project will commence in October 2012 and is scheduled to be completed by September 2016. Initial assessment of NDE tools and comprehensive literature review is scheduled for completion by spring 2014.

Cooperators

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