DEMONSTRATION *in Progress*

NATIONAL CENTER FOR WOOD TRANSPORTATION STRUCTURES

Construction of a Field Test Bridge for Evaluating Deck Design Details

When properly designed and protected from elements such as water, insects, and fire, timber is a structurally capable, cost-effective, and aesthetically pleasing material suitable for many structural applications. However, when not properly designed or protected, timber structures become susceptible to deterioration, which may result in decreased structural capacity. As a result of accelerated and repeated deterioration of wearing surfaces on timber bridges (for example, transverse cracking along deck panel joints), the perception of these structures has consistently remained less than acceptable, despite their excellent structural performance. The unacceptable performance of timber bridge wearing surfaces, typically constructed of asphalt, has raised concerns regarding performance of the underlying superstructure and its effect on the wearing surface performance. For timber bridges to be an acceptable and competitive design alternative for bridge owners and designers, timber bridges and their wearing surfaces must be designed so that deterioration and maintenance are minimized.

Demonstration bridge located in Delaware County, Iowa.

Background

Previous research conducted by Iowa State University involved load testing of eight glued-laminated timber girder bridges in the mid-1990s and again in 2003. Results indicated that the severity of wearing surface deterioration varies from bridge to bridge and results from several factors. However, two factors seemed to be most commonly associated with wearing surface deterioration: diminished physical condition of the glued-laminated deck panels and differential panel deflection. Differential panel deflection, the deflection of one panel relative to an adjacent panel, increases the magnitude and frequency of stress reversals in the wearing surface. Consequently, the most common and severe deterioration found was cracking at deck panel joints—transverse cracking on bridges with transverse decks and longitudinal cracking on longitudinal deck panel bridges. Results and recommendations from previous research were published in eight bridge performance reports and a final summary report. A follow-up laboratory study, for which a full-scale timber bridge was constructed at the Iowa State University Structural Engineering Laboratory, developed several design details for the purpose of limiting differential panel deflection. These details were tested under simulated truck loadings and compared with a no-treatment (control) condition; several details reduced differential deflection by 50%, to below the recommended design limit. They were also evaluated for constructability and cost effectiveness. Following this evaluation, a site-specific bridge was designed and constructed in Delaware County, Iowa. This design is a two-span bridge that will utilize one of the developed details in one span and conventional construction in the other. This approach will allow direct comparison of the effectiveness of the developed detail.

Coalition for Advanced Wood Structures
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USDA

U.S. Department of Agriculture
Forest Service - Forest Products Laboratory
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Objective

The objective of this project is to construct a timber bridge with one of the developed and laboratory-tested design details.

Approach

This work will consist of constructing and evaluating a glued-laminated timber bridge in Delaware County, Iowa.

Expected Outcomes

This work will likely result in the development of standard design details for panel decks. The benefactors of this work will be bridge owners and designers, who should be more interested in using timber when they see the enhanced durability characteristics of the improved design.

Timeline

Bridge construction will be completed by July 2009.

Cooperators

Iowa State University, Bridge Engineering Center
U.S. Forest Service, Forest Products Laboratory

Contact Information

Brent M. Phares
Iowa State University, Bridge Engineering Center
Ames, Iowa
(515) 294-5879; bphares@iastate.edu