DEMONSTRATION in Progress

NATIONAL CENTER FOR WOOD TRANSPORTATION STRUCTURES

Evaluation of a Timber Bridge for the Secondary Road System Using FRP-Reinforced Glulam Girders

In recent years, the concept of an economical, durable, short-span bridge that reduces construction time has become to the county engineer more of a necessity than a goal. In addition, county engineers are seeking these same qualities in methods to repair and strengthen existing bridges on the secondary road system. This is just one of the goals that the Innovative Bridge Research and Construction (IRBC) Program, sponsored by the Federal Highway Administration (FHWA), wishes to achieve through sponsored research projects. Delaware County, Iowa, took a step in that direction through the construction of a 64-ft-long bridge using glued-laminated timber girders reinforced with fiber-reinforced polymer (FRP) and a transverse glued-laminated timber deck. The bridge was fabricated by Alamco Wood Products, Inc., of Albert Lea, Minnesota. Prior funding for the design, construction (including materials), and monitoring/evaluation of this project has been obtained through the IBRC Program with the assistance of Curtis Monk, Division Bridge Engineer with the Iowa Division of the FHWA.

Completed FRP reinforced glulam girder bridge with condition monitoring sensors attached.

Background

For centuries, engineers have been using timber bridges to span short crossings on our nation's secondary roads. However, changes in the dynamics and demand of traffic, hydraulics, aesthetics, and economics have forced today's engineer to be more creative and to develop methods to carry increased traffic across longer spans in a more efficient and cost-effective manner. In addition, engineers are seeking methods to improve or increase the strength and performance of current structures to handle these changes. The benefits of using FRP materials to strengthen and repair bridges has been realized and accomplished very effectively on various steel and concrete bridges in the past. Although strengthening of timber bridges with FRP is not a new topic, limited information exists on short- and long-term effectiveness of using FRP reinforcement for these types of structures. Thus, this project was intended to evaluate the in-service structural performance of the bridge. Field load tests and inspections were performed each year for 2 years after construction of the bridge, and immediately after construction, to establish a data base of information to address both short- and long-term performance using FRP plates to reinforce glued-laminated timber girders on a 64-ft simple span bridge.

Objective

The objective of this project was to construct a timber bridge with FRP-reinforced glued-laminated timber girders and evaluate its in-service structural performance.

Approach

This work consisted of constructing and evaluating a FRP-reinforced glued-laminated timber girder bridge in Delaware County, Iowa.

Coalition for Advanced Wood Structures a university, industry, government partnership

USDA Forest Service

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Expected Outcomes

The successful implementation of this technology has far-reaching benefits because innumerable bridges in the State of Iowa and nationwide could benefit from an efficient, cost-effective, and structurally sound means of upgrading their live load capacity. This project addresses the goal of demonstrating the effectiveness of innovative materials for the repair and rehabilitation of existing bridge structures.

Timeline

Bridge construction and initial field load testing of the structure was completed in fall 2004; subsequent tests were completed in 2005 and 2006.

Cooperators

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

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