Research in Progress

National Center for Wood Transportation Structures
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Performance Monitoring of Geosynthetic Reinforced Soil Abutment Timber Bridges

The current National Bridge Inventory (NBI) includes nearly 475,000 bridge structures.[1] As part of the Bridge of the Future Initiative, the Federal Highway Administration (FHWA) developed the Geosynthetic Reinforced Soil (GRS) Integrated Bridge System (IBS).[2,3] Geosynthetic-reinforced soil walls (originally referred to as geotextile-reinforced walls) were first constructed by the U.S. Forest Service in 1974.[4] The GRS–IBS uses reinforced soil as part of an economical bridge system. The GRS–IBS was developed to be of lower cost, faster construction, and better durability than other single-span bridge construction. Typically, steel and concrete bridge superstructures have been used with GRS–IBS. To date, only one GRS–IBS superstructure is built using wood. This project aims to design, construct, and monitor in-service performance of glulam girder bridge superstructure and wood timber facing elements in conjunction with a GRS–IBS.

Background

The GRS–IBS was developed by FHWA to fulfill the need for a bridge abutment that is durable, quick to construct, and low cost. The GRS–IBS has several benefits that make it attractive: it has high durability, it is built using readily available materials, it is constructed using common construction equipment and does not require highly skilled labor, it has design flexibility that allows for easy adaptation on site if necessary, and its construction has low environmental impact. A typical GRS–IBS abutment is shown in Figure 1.

The NBI indicates that 9% of 475,000 highway bridges have wood decks. Wood superstructures offer several advantages over those built of steel and concrete, including renewable and sustainable material, lighter weight, lower energy use to manufacture, and better durability in areas where winter salts are used, to name a few. The combination of low environmental impact of the GRS–IBS construction and low energy cost and renewable materials making up the wood superstructure results in a viable bridge system for the future.

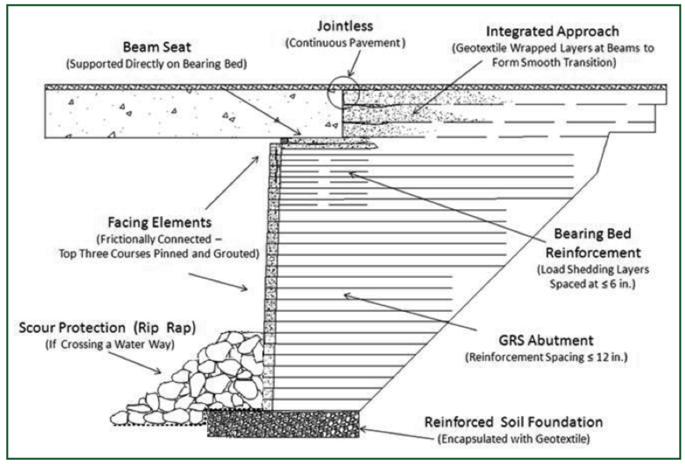

Figure 1. Typical GRS–IBS abutment cross section.[2,3] (Used with permission of FHWA, concrete deck abutment shown here.)

Objective

The primary objective of this study is to design and build a bridge system that will be instrumented to record several performance parameters used to evaluate and understand the behavior of all parts of the GRS–IBS abutments and bridge superstructure (deck superstructure, approach roadway, abutment back wall, and reinforced soil abutment). The construction phase will be documented with photographic and video equipment so that it may be publicized by the FHWA's Every Day Counts Initiative.

Partners of the National Center for Wood Transportation Structures

Iowa State University of Science and Technology
Forest Products Laboratory
National Park Service
U.S. Department of Transportation Federal Highway Administration

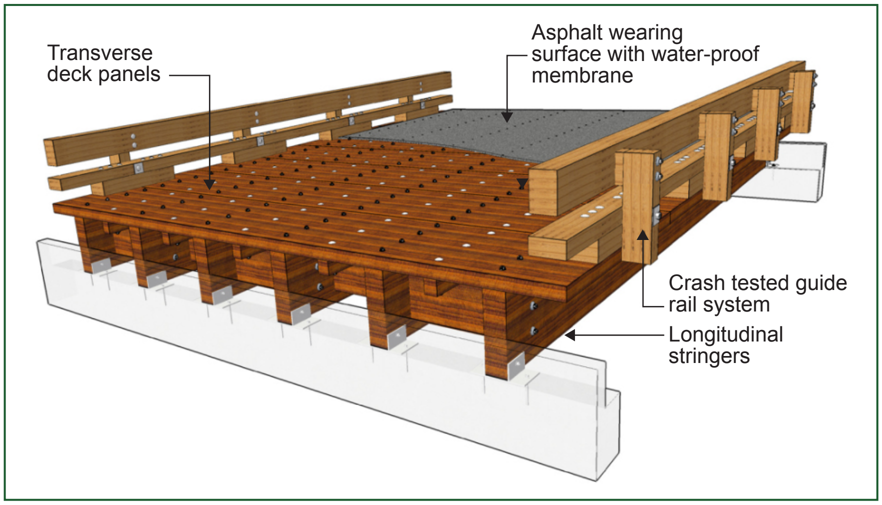

Figure 2. Glulam girder bridge superstructure (shown on concrete sill abutments). (Used with permission of Laminated Concepts, Inc.)

Approach

A GRS–IBS with a glulam girder superstructure and abutments will be constructed and instrumented with sensors to monitor its in-service behavior over a period of up to three years.

Expected Outcome

A GRS–IBS bridge design and a glulam girder bridge design will be developed. A bridge matching those designs will be constructed east of the city of Waterloo in Buchanan County, Iowa. A comprehensive report summarizing design, construction, and bridge behavior is planned.

Timeline

The type of monitoring sensors to be used will be decided by December 2015. The GRS–IBS design will be completed by October 2015. Bridge construction is scheduled for April 2016 with completion in June 2016. Monitoring of the bridge will begin after construction and continue through September 2018. The construction period and subsequent monitoring dates are subject to change based the actual start of construction date.

Cooperators

Iowa State University

USDA Forest Service, Forest Products Laboratory

Laminated Concepts, Inc.

Turner–Fairbank Highway Research Center—FHWA

Buchanan County (Iowa) Highway Department

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