National
Wood In Transportation
Information Center

CROSSINGS

NEWSLETTER OF THE WOOD IN TRANSPORTATION PROGRAM

Editor - Tinathan Coger | Issue 30 | May 1998

Fifth National Timber Bridge Design Competition Results Announced

Teams of students from sixteen universities across the United States and Canada matched wits to devise a better way to "get to the other side" during the Fifth National Timber Bridge Design Competition. Open to student chapters of the American Society of Civil Engineers (ASCE) and the Forest Products Society (FPS), the competition was made possible by a grant from the USDA Forest Service through its Wood In Tranportation program. Southwest Mississippi Resource Conservation and Development (RC&D), Inc., coordinated the competition, with the Civil Engineering Department at Mississippi State University providing technical assistance. Each team designed, constructed, and tested their bridges on their home campus, then submitted documentation of their activities and results to a panel of judges for review.

First Place winner was a joint entry from **West Virginia's ASCE and FPS Chapters**. Their bridge featured three king-trusses (one inverted) with steel tension cables supporting a tongue-and-groove deck of yellow poplar.

The **Univeristy of Missouri at Kansas City ASCE student chapter** captured **Second Place** with their entry using three built-up girders supporting 3/4-inch tongue-and-groove cedar planks.

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Synopsis of the Wood In Transportation Demonstration Projects Funded in Fiscal Year 1998

During the first seven years of the Wood In Transportation program, the cost-share demonstration component of the Program focused on building awareness, development and construction of innovative bridge designs, and utilization of local timber resources. In fiscal year 1996, a new cost-share program component, commercialization projects, was started. This grant component assists in:

1. Commercialization of modern timber bridge technology that has successfully been developed.
2. Innovation that leads to cost-saving strategies.
3. Innovation that leads to improving the performance of existing designs.

The purpose of this component of Wood In Transsportation's cost-share demonstration program is to foster the commercialization of wood-in-transportation technology that results in the most cost-effective, structurally sound bridges being built and demonstrated – preferably using local timber resources as well as local businesses and employees.

A commercialization project is defined as an effort which has area-wide or regional significance. This area may be as small as a county, or as large as an entire state. An example of a commercialization project is constructing four bridges of a standard design in a given area. A key concept of these projects is the development of cooperative partnerships between public and private entities that will promote productive efforts to satisfy local transportation needs and stimulate local economic vitality.

In fiscal year 1998, the primary focus of WIT's cost-share demonstration program is on funding and implementing

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Third Place was awarded to the **Ohio State University ASCE chapter**. Their entry used three box beams to support a 1-inch by 6-inch tongue-and-groove deck.

Ohio State also won the **Special Award for Most Economical Design**. The **Special Award for Most Aesthetic Design** went to **Mississippi State ASCE** for their design using two arched laminated beams. **Marquette University ASCE** used three glue-laminated girders braced with solid wood diaphragms to support a 1-inch by 4-inch tongue-and-groove pine deck in winning the **Special Award for Design Most Adaptable to Real-Life Construction**. **The Most Innovative Design** award went to the **University of British Columbia FPS** for their use of three fiberglass-wrapped glulam beams supporting a longitudinal deck over transverse floor beams.

Other schools entering the competition were Virginia Polytechnic Institute and State University - FPS, Oregon State University - ASCE/FPS, Rose-Hulman Institute of Technology - ASCE, Merrimack College - ASCE, University of Idaho - FPS, San Jose State University (2) - ASCE, Washington State University - ASCE, University of California-Berkeley - ASCE, and Washington University at St. Louis - ASCE. Judges for the competition were Paula Hilbrich Lee and Jim Wacker of the USDA Forest Service, Forest Products Laboratory, and Ken Johnson of Wheeler Consolidated.

The competition's objectives were to promote interest in the use of wood as a competitive bridge construction material, to generate innovate and cost-effective timber bridge design techniques, and to develop an appreciation of the engineering capabilities of wood among future transportation and forest products engineers.

The test bridges were approximately 10-feet long and 4-feet wide and were loaded with a test weight of approximately 4,400 pounds. Average weight of the bridge models was 159 kg. At full loading, maximum deflection ranged from 1.09 mm to 7.21 mm. The amount of non-wood materials in the bridges ranged from 0.57 percent to 11.9 percent. Entries were judged with 40 percent of the score based on maximum deflection, 30 percent on bridge weight, 20 percent on final report, and 10 percent on the percentage of non-wood materials in the bridge.

Special thanks is extended to the Department of Civil Engineering, Mississippi State University, for their assistance in preparation of the guidelines.

For additional information on the designs referenced in this article, or for information on competition rules and instructions for the 1998 competition, contact the Southwest Mississippi RC&D, Inc., 747 Industrial Park Road, N.E., Brookhaven, MS 39601, phone: 601-833-5539, FAX: 601-835-0054.

— Bennie F. Hutchins
RC&D Coordinator
Southwest Mississippi RC&D, Inc.

Salt Storage Facility

In 1996, the Limestone Bluffs Resource Conservation and Development (RC&D) Area and the Cedar County engineering staff hired a contractor to build a salt storage facility in Cedar County, Iowa. This structure was built using native cottonwood from Iowa. The purpose of this project was to demonstrate the use of cottonwood in structures other than bridges. A fiscal year 1995 grant from the USDA Forest Service's Wood In Transportation Program partially funded this "special" project. Special projects assist in demonstrating new technologies or methods for improving transportation system efficiencies.

The *Salt Storage Facility* brochure describes the facility and the use and benefits of it. To obtain a copy of the publication, please contact the National Wood In Transportation Information Center, 180 Canfield Street, Morgantown, WV 26505; Phone: 304-285-1591. For more information, you may also contact the Limestone Bluffs RC&D, 1000 East Platt Street, Suite 4, Maquoketa, IA 52060; Phone: 319-652-5104.

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commercialization projects.

A brief description of each project is described below:

Richland County, OH, project: This project will replace four small, single span bridges (18-20 feet) with new stress-laminated superstructures. The design will include a crash tested bridge rail that complies with AASHTO Performance Level 1 standards. The design load rating is HS-20-44, and the timber species is southern pine. The design will build upon the "Standard Designs for Southern Pine Bridges" publication developed by the USDA Forest Service's Forest Products Laboratory, University of Alabama, and Southern Pine Council. The preservative treatment will be Alkaline Copper Quat (ACQ). In addition, at least one bridge will use stressing cable instead of threaded stressing rods.

Mat-Su Borough, AK, project: This project will construct four small, single span stress-laminated bridges (18-24 feet). The design load rating is HS-20-44, and the timber species is Alaskan spruce. The design will build upon prior stress-laminated research and demonstration projects. The preservative treatment will be copper sulfate and sodium fluoride (double diffusion). The project will demonstrate the commercial use of local timber and labor using standardized designs and drawings to construct timber bridges to meet infrastructure and access needs of residents of the Matanuska-Susitna Borough.

Monongalia County, WV, project: This project will lead to the construction and demonstration of 10 portable timber bridges that will be used primarily for temporary access during timber harvesting activities. These stress-laminated bridges will be used in the states of Maryland, Ohio, Pennsylvania, and West Virginia. The final design for these bridges is the result of a cooperative applied research effort among the WV Division of Forestry, West Virginia University, local forest products industry, and the USDA Forest Service. The timber species is southern pine, and the preservative treatment will be chromated copper arsenate (CCA). In addition, an installation manual and companion video will be developed.

Ida County, IA, project: This project will replace five bridges (30-50 feet) with glue-laminated panel decks over steel girders (4 structures) or glue-

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Commercialization Projects Funded In Fiscal Year 1998:

State and County	Federal Contribution	Cooperator Contribution	Fiscal Year	Planned Project Outcomes
Ohio — Richland	$100,000	$343,470	1998	4 vehicular timber bridges
Alaska – Mat-Su	$100,000	$128,745	1998	4 vehicular timber bridges
West Virginia – Monongalia	$85,750	$102,125	1998	10 pedestrian timber bridges
Iowa – Ida *	$124,500	$124,500	1997	5 vehicular timber bridges

* Project was originaly funded in fiscal year 1997 in Johnson County, IA. The project was cancelled and then funded in fiscal year 1998 in Ida County, IA

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laminated wooden beams (1 structure). The design load rating for all bridges is HS-20-44. This project builds upon prior glue-laminated research and demonstration projects. Cottonwood, provided by local Iowa sources, will be the timber species used, and the preservative treatment will be creosote. The intent of this project is to demonstrate and develop glue-laminated cottonwood timber bridges in standard sizes that are readily useable by local governments.

All four 1998 commercialization projects will build upon prior activities of the Wood In Transportation program. Each project focuses on the commercial viability of timber structures in a local area. Every project will result in a final report that will include design and cost information for each structure. When completed, the final reports will be available through the National Wood In Transportation Information Center. Normally, these projects take two to three years to complete. Questions or comments about the projects listed above or about the Wood In Transportation Program, may be directed to:

National Wood In Transportation Information Center
USDA Forest Service
180 Canfield Street
Morgantown, WV 26505
Phone: 304-285-1593
FAX: 304-285-1505

A Letter to the Editor

The article "De-icing Salts, Timber Decks, and Steel Beams" in Issue 29 of *"Crossings,"* provides some good guidelines for the use of timber decks in conjunction with weathering steel beams. *"Crossings"* is not a newsletter for the weathering steel industry. Although, people who read this article may assume that if they solve the weathering steel corrosion problems which arise from the timber deck, they will not have any other weathering steel corrosion problems. Individuals who believe this should read cover-to-cover the National Cooperative Highway Research Program (NCHRP) Report 314, Guidelines for the Uses of Weathering Steel in Bridges, which is the first publication referenced by the authors of this article. Particular attention should be paid to one of the last paragraphs in Report 314, found on page 93:

> *"Debris of flaky, granular, or fibrous material that holds water in place on horizontal surfaces of weathering steel bridges can lead to conditions resembling immersion and result in corrosion rates much higher than are found in atmospheric corrosion. Common forms of debris are accumulations of granules and flakes of rust that weathering steel continuously sheds, windblown dust and roadway debris at bearings, pigeon excrement, construction materials left behind in the interior of box girders, and bird nests."*

Obviously weathering steel is not the simple panacea it was once hoped to be. However, thoughtful engineering use of weathering steel can still take advantage of its beneficial properties.

— Alan D. Fisher, P. E.
Chief Structural Engineer
Cianbro Corporation
328 West Commercial Street
Portland, ME 04102
Phone: 207-773-5852
FAX: 207-773-7617

Geotextile Fabrics

The following information is condensed from chapter 11 of the USDA Forest Service, Timber Bridges, Design, Construction, and Maintenance, EM-7700-8, pages 11-9 through 11-11, and 11-17.

Geotextile fabrics are synthetic engineering fabrics originally developed to provide additional stability and load distribution in numerous geotechnical (soils) and hydraulic applications. Specialized paving fabrics have been used for several years to improve pavement performance and longevity. When properly placed between the bridge deck and asphalt pavement, geotextile fabrics can improve the bond between the asphalt and the deck surface, provide increased moisture resistance of the surface, and reduce or eliminate pavement cracking at glulam panel joints.

Geotextile fabrics for bridge paving are available in two types: plain and asphalt impregnated. The plain type consists only of a nonwoven geotextile fabric commonly available in rolls 12 feet wide. Impregnated fabrics have a layer of rubberized asphalt bonded to one side and are normally available in 12'-and 36'-widths. The impregnated fabrics are most commonly used on timber decks where heat from the asphalt causes the rubberized asphalt layer to bond to the deck. This provides improved adhesion and an impermeable barrier to moisture.

Paving with geotextile fabrics involves the same deck surface preparation previously discussed (refer to Chapter 4 and Chapter 11). After the deck is free of excess preservative and debris, the fabrics can be placed. A tack coat is necessary before placing plain fabrics but is not required for impregnated fabrics. The fabric is rolled on the deck with an overlap between adjacent strips of 2 to 3 inches. On transverse glulam decks, the narrow-width impregnated fabrics also can be placed transverse over panel joints only (Figure 11-6). After the fabric is rolled in place, a tack coat between the fabric and asphalt concrete layer is required for both plain and impregnated fabrics. This generally consists of an asphalt emulsion spread to achieve a residual asphalt layer of 0.10 to 0.15 gal/yd^2 (this may vary among fabric brands and should be verified with the manufacturer). Pavement is then applied to the surface in the usual manner.

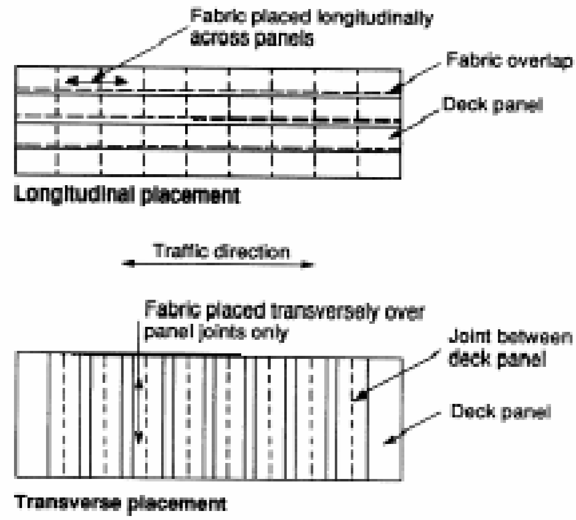
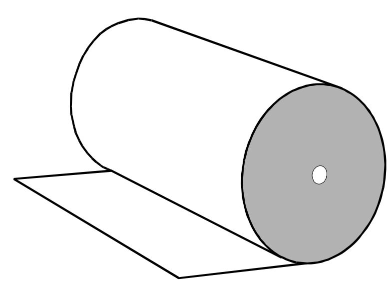


Figure 11-6. — Placement of impregnated geotextile fabric on transverse glulam deck panels.

Engineering judgement should be exercised to determine whether goetextile fabric is needed for waterproofing and/or to prevent reflective cracking. Improper use of a geotextile fabric can cause significant paving problems. Treated timber decks must be thoroughly cleaned, and free of surface treatment deposits. Care must be taken to ensure that compatible products are used for treatment, paving fabric, tack coats, chip seals, and/or asphalt pavements. Contact product suppliers to make sure of compatibility. Paving fabrics have been found to work best when placed between two layers of asphalt paving. An upcoming article will discuss this process in greater detail.



NEW PUBLICATIONS

Field Performance of Timber Bridges — 15. Pueblo County, Colorado, Stress-Laminated Deck Bridge

The Pueblo County 204B bridge was constructed in March 1990 in Pueblo, Colorado, as a demonstration bridge under the USDA Forest Service Timber Bridge Initiative. The stress-laminated deck superstructure is approximately 10 m (33 ft.) long, 9 m (29.5 ft.) wide , and 406 mm (16 in.) deep, with a skew of 10 degrees.

Performance monitoring was conducted for three years, beginning at installation, and involved gathering data on the moisture content of the wood deck, the force level of the stressing bars, the behavior of the bridge under static load conditions, and the overall condition of the structure. In addition, long-term performance data were gathered on the force level of the stressing bars six years after installation. Based on monitoring evaluations, the bridge is performing well, with some crushing of the bearing plates into the outside laminations but no other [evidence of] structural or serviceability deficiencies.

To obtain a copy, please contact the National Wood In Transportation Information Center at 304-285-1591.

Field Performance of Timber Bridges — 16. North Siwell Road Stress-Laminated Bridge

The North Siwell Road bridge was constructed during December 1994 in Hinds County, Mississippi. The bridge is a single-span, stress-laminated T-beam structure that measures 9.1 m (30 ft.) long and 8.7 m (28.5 ft.) wide.

Performance of the bridge was monitored for 24 months, beginning at the time of installation. Monitoring involved gathering and evaluating data relative to the moisture content of the wood components, force level of stressing bars, and behavior of the bridge under static load conditions. In addition, comprehensive visual inspections were conducted to assess the overall condition of the structure. Based on field evaluations, the bridge is performing well.

To obtain a copy, please contact the National Wood In Transportation Information Center at 304-285-1591.

Article contributions, questions or comments may be sent to Ed Cesa, Program Manager, National Wood In Transportation Information Center or Ms. Tinathan A. Coger, Information Assistant; USDA Forest Service; 180 Canfield Street; Morgantown, WV 26505; Phone: 304-285-1591 or 304-285-1596; or FAX: 304-285-1505; or E-mail to tcoger/na_mo@fs.fed.us.