National
Wood In Transportation
Information Center

CROSSINGS

NEWSLETTER OF THE WOOD IN TRANSPORTATION PROGRAM

Issue 32 Winter 1998

In This Issue

Michigan Timber Bridge Program

During October 1989, a group of individuals from Michigan interested in modern timber bridge technology witnessed the completion of the first stress-laminated timber bridge built in Michigan. The bridge was built over the Sturgeon River in Otsego County. This was a cooperative effort between the Otsego County Road Commission and the USDA Forest Service's National Timber Bridge Initiative. The completion of the bridge successfully ended months of planning and set the stage for the Michigan Timber Bridge Program.

About the same time, several Huron Pines Resource Conservation and Development (RC&D) Council members attended a national timber bridge conference in West Virginia. Believing that this new bridge technology would fill a niche to utilize some of Michigan's lower-value timber resources, Huron Pines decided there was a need to spread the word state-wide about the advantages of modern timber bridges. An advisory committee was formed in 1990 with members from all the RC&D Councils in the state, the Michigan Department of Transportation, the Michigan Department of Natural Resources, University of Michigan, Michigan State University, Michigan Technological University, Michigan Department of Corrections, USDA Natural Resources Conservation Service, Michigan Department of Agriculture, private industry including wood preservative plants, the timber industry, county road engineers, and consulting engineers.

The Michigan Timber Bridge Program (MTBP) committee met and set goals and objectives. The prime objective was to develop a timber bridge industry that marketed an all-Michigan product, from the trees to the finished bridge. This would include the timber, design, engineering, fabrication, preservative treatment, and construction.

Continued on page 3

Results of the 6th National Timber Bridge Student Design Competition

Eleven teams of students from nine universities across the United States and Canada matched wits to devise a better way to "get to the other side" during the Sixth National Timber Bridge Student Design Competition. Open to student chapters of American Society of Civil Engineers (ASCE) and Forest Products Society (FPS), the competition was made possible by a grant from the USDA Forest Service through its Wood In Transportation Program. Additional financial support was provided by the Southern Pine Council of the Southern Forest Products Association and Unit Structures, Inc., of Magnolia, AR. 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 timber bridges on their home campus, then submitted documentation of the activities and results to a panel of judges for review. This year, for the first time, the competition went on-line via the Internet, as each team was required to post design drawings, test results, and project highlights on the World Wide Web at www.msrcd.org. Following judging, the information was made available on-line for all to review and learn from.

In the **Performance Category**, the joint entry from **Oregon State University's ASCE and FPS Chapters** captured **First Place**. This excellent entry also received awards for **Best Design, Most Aesthetic Design and Most Innovative Use of New or Nontraditional Materials**. It was a great example of what can be achieved when engineers and wood products specialists work together to maximize the engineering capabilities of wood. The bridge's twin, parabolic, tapered glue-laminated arch stringers were of center vertical grain (CVG) Douglas Fir composition. The deck was longitudinal splined and finger-jointed CVG Sitka Spruce, fluted for one-way action and supported by floor beams of modified manufactured I-joists with carbon tensile reinforcing laminations. High-strength, 1/2-inch steel rods connected the suspended structure to the arches.

First Place Winner — Oregon State ASCE Student and Forest Products Society Chapters

Second Place Performance Award as well as **Most Practical Design** was awarded to **Mississippi State University's ASCE** entry. The design incorporated a tongue and groove lumber deck supported by two box-beam stringers reinforced with high-strength steel rods on the tension side.

Clarkson University's ASCE Chapter captured the **Third Place Performance Award** with an entry that utilized a simple undertruss with 3/8-inch A36 steel roundstock bottom chord supporting micro-lam 2-inch x 4-inch stringers below numerous 2-inch x 4-inch transverse floor beams.

Other schools entering the competition were Rose-Hulman Institute of Technology ASCE, Merrimack College ASCE, University of Idaho FPS, Cooper Union ASCE, San Jose State University ASCE, and University of British Columbia FPS.

The competition's objectives are to promote interest in the use of wood as a competitive bridge construction material, to generate innovative 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.

Continued on page 3

6th National Timber . . . *continued from page 2*

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 137 kg. At full loading, maximum deflection ranged from 2.67 mm to 6.73 mm. Percent non-wood materials in the bridges ranged from one percent to eleven percent. Maximum allowable deflection was 8 mm. Maximum percent non-wood materials allowed was 25 percent by weight. Entries were judged with 40 percent of the score based on maximum deflection, 20 percent on bridge weight, 20 percent on final report, and 20 percent on Judges' Review. A total of 82 students spent 2,530 hours on the competition.

Fifth Place Winner — University of Idaho Forest Products Society Student Chapter

Seventh National Timber Bridge Student Design Competition for 1999: The Seventh National Timber Bridge Student Design Competition for 1999 is open to student chapters of American Society of Civil Engineers and Forest Products Society. Joint or cooperative entries are eligible and encouraged. **The deadline for submittal is April 16, 1999**. For additional information on the designs referenced or for information on competition rules and instructions for the **1999 competition**, contact Southwest Mississippi RC&D, Inc., 747 Industrial Park Road NE, Brookhaven, MS 39601, phone: 601-833-5539, fax: 601-835-0054, e-mail: southwest@msrcd.org, or keep an eye on the website at www.msrcd.org. Rules for 1999 are listed at the website
.

For this competition to continue to grow to its rightful status, additional financial support is needed from private and corporate sponsors such as wood products groups and associations, private industry, and engineering and construction firms, etc.

Additional funds are needed to offer regional and national on-site competitions and to increase amount of awards. Interested potential sponsors are encouraged to contact Bennie Hutchins at the address above.

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

Michigan Timber Bridge Program . . .

continued from page 1

The MTBP committee has begun to achieve its primary objective. The MTBP committee now meets to promote timber bridges, set standards, and monitor the quality of design and construction. The MTBP committee also reviews all applications for USDA Forest Service funding, sets priorities, and assures that innovative engineering and construction are part of the application. All grant applications for the entire state are processed by the MTBP committee. To date, over 25 timber structures have been completed with MTBP assistance.

Education has been a big part of the MTBP committee's function. Two conferences have been held; one aimed at non-technical people in September 1989 and the other to acquaint engineers with timber bridge construction in April 1992. A third conference was held in November 1995. This covered wood preservatives and their application to timber bridges. Numerous speaking engagements and field trips have helped spread the word of the worthiness of timber bridges.

In 1995, a study was initiated to determine the number of bridges in need of replacement in the state and to assess attitudes and knowledge about

Continued on page 5

NEW PUBLICATIONS

Field Performance of Timber Bridges — 17. Ciphers Stress-Laminated Deck Bridge

In September 1989, the Ciphers bridge was constructed within the Beltrami Island State Forest in Roseau County, Minnesota. The bridge superstructure is a two-span continuous stress-laminated deck that is approximately 12.9 m long, 5.49 m wide, 305 mm deep (40 ft. long, 18 ft. wide, and 12 in. deep), The bridge is one of the first to utilize red pine sawn lumber for a stress-laminated deck application. The performance of the bridge was monitored continuously for 24 months beginning July 1993, approximately 46 months after installation. Performance monitoring involved evaluating data relative to the moisture content of the wood deck, the force level of stressing bars, and the behavior of the bridge under static load conditions. In addition, temperatures were collected from the bridge superstructure and ambient air. Based on field evaluations, the Ciphers bridge is performing satisfactorily with no structural or serviceability deficiencies.

If you would like a copy of this publication, please contact the National Wood In Transportation Information Center at 304-285-1591 and request publication number WIT-06-0037.

Plans for Crash-Tested Wood Bridge Railings for Concrete Decks

As part of a continuing cooperative research effort among the Midwest Roadside Safety Facility (MwRSF); the USDA Forest Service, Forest Products Laboratory (FPL); and the Federal Highway Administration (FHwA), several crashworthy wood bridge railings and approach railing transitions have been adapted for use on concrete bridge decks. These railings meet testing and evaluation criteria outlined in the National Cooperative Research Program (NCHRP) Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, and include a glued-laminated timber (glulam) rail, with and without a curb, at Test Level - 2 (TL-2), a glulam rail with curb at TL-4, and a glulam curb rail for low-volume roads at TL-1. In adapting the railings from a wood deck to a concrete deck, the critical consideration was railing attachments to the deck. A comparable connection was obtained by an analysis of maximum loads measured by field instrumentation during crash testing or by equating the ultimate capacity of connections used on the wood deck to those required for a concrete deck. For the convenience of the user, full drawing sets are provided in customary U.S. and S.I. units.

If you would like a copy of this publication, please contact the National Wood In Transportation Information Center at 304-285-1591 and request publication number WIT-02-0046.

Continued on page 6

Article contributions, questions or comments may be sent to Ed Cesa, Program Manager, National Wood In Transportation Information Center or Mr. Chris Grant, Program Assistant, USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505; Phone: 304-285-1591 or FAX: 304-285-1564; or E-mail to cgrant/na_mo@fs.fed.us.

Crossings **is a service of the USDA Forest Service, Northeastern Area, State and Private Forestry, and is distributed quarterly to individuals and organizations without fee. Products, designs, and treatments mentioned by contributors from outside the USDA are not necessarily endorsed by the USDA, nor do statements made herein reflect the policy of the USDA. In all cases, consult with appropriate professional and state or local regulatory agencies for conformance to applicable laws and regulations.**

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint, write the Secretary, U.S. Department of Agriculture, Washington, DC 20250, or call 1-800-245-6340 (voice), or 202-720-1127 (TDD). USDA is an equal employment opportunity employer.

Michigan Timber Bridge Program . . .

continued from page 3

using timber for bridges. The results were published in the report *Manufacturing and Marketing Opportunities for Modern Timber Bridges in Michigan*. For a copy of this report, please contact the Huron Pines RC&D Council office at 517-348-9319 or the National Wood In Transportation Information Center at 304-285-1591.

In order to accomplish timber bridge projects in Michigan, cooperative partnerships were created to secure funding to cover total costs for bridge projects. Partners vary, but typically include county road commissions, conservation organizations, state agencies, industries, and lake or river associations. Each partner agrees to provide funding and/or services.

Red pine has been the primary timber species used because it is plentiful and accepts preservative treatment well. Other species used have been hemlock, pin oak, and red maple. Most bridges have been built using various adaptations of stress-laminating technology. Overall, results have been positive.

Preservative treatment from Michigan has proven to be a minor roadblock as there are no creosote treating plants in the state. While creosote is still the preservative of choice, chromated copper arsenate (CCA) is currently specified more often as this treatment is readily available.

From the beginning, it was difficult to identify a local business to fabricate timber bridges and prove that the technology was within their reach. The Michigan Department of Corrections stepped in and used inmate labor working under the direction of a civil engineer to fabricate several bridges. The intent of this effort was to demonstrate and pass this technology onto private industry.

Using initial information available on stress-laminating technology at the end of the 1980's, the Oscoda County Road Commission, was the first county crew in Michigan to build a stress-laminated bridge. Doing all the work from the procurement of timber to the fabrication and erection of the bridge, County Road Engineer Luke Houlton was pleased with the results.

Demonstration bridges have now been built in counties from the Indiana border to the far western Upper Peninsula of Michigan using grants from the USDA Forest Service and the Federal Highway Administration. Most rewarding, however, is to see how others have embraced the technology to build numerous timber bridges throughout the state. The longest bridge, a 150-foot, three-span structure crossing the Manistique River in the Upper Peninsula, was built by the Michigan Department of Natural Resources (MIDNR). Most recently, two bridges have been built by the Michigan National Guard at their training site near Grayling. These are substantial structures capable of carrying military tanks and tank retrievers.

In retrospect, a large MTBP committee could have been cumbersome, but this was not the case. The MTBP committee has produced a cornucopia of ideas and an effective method of implementing the timber bridge program throughout the state. Each member has and continues to contribute much from his/her own area of expertise. Dan Sikarskie, Huron Pines RC&D Coordinator, has played a key role in coordinating the Committee's activities and keeping the program focused. Jack Pilon, Forester with the MIDNR, has provided valuable technical support, and Howard Haselschwardt, P.E., of Northwest Design Group, has provided much of the engineering and design work that has enabled the construction of quality bridges.

The MTBP committee has had a few setbacks, all financially related. Nevertheless, the bridge program has developed far beyond the expectations of the original participants and the end product has been the result of a real team effort.

For additional information about the Michigan Timber Bridge Program, please contact: Dan Sikarskie, Huron Pines RC&D Council, 501 Norway Street, Grayling MI 49738; Phone: 517-348-9319; or Jack Pilon, MI DNR – Forest Mgmt. Division, P.O. Box 128, Roscommon, MI 48653; Phone: 517-275-5151.

—— **Roger Rasmussen**
Forestry Committee Chairman
Huron Pines RC& D Council
Grayling, MI

NEW PUBLICATIONS

Modern Timber Bridges: An Attractive Option (Video)

The Alabama Forestry Commission has produced a 16 minute video about modern timber bridges. The video includes statistical information on structurally deficient bridges, reasons for choosing modern timber bridges, design standards, bridge components, and construction footage of a glulam bridge that is being installed.

If you would like a copy of this video, please contact the National Wood In Transportation Information Center at 304-285-1591 and request video number WIT-97-0014 or contact the Alabama Forestry Commission at 205-631-2552.

Hardwood and Softwood Structural Lumber Grading and Sawing Workshop

The workshop will be held on June 1-2, 1999. It is being cosponsored by the Wood In Transportation Partnership, New York State Department of Environmental Conservation, and Timber Harvester, Inc. The goal of the course is to provide a basic overview of Structural Lumber Grading and how to saw for structural grades. The course will feature hands-on sawing and grading practice using logs cut on the spot with a small band mill, but sawing strategies for circular mills will also be taught. The course cost is $99.00. Conveniently located lodging is available. For more information about this course, contact Ken Kasprzyk at 716-372-0888 or Roger Nelson at 1-800-343-2969.

Plans for Crash-Tested Bridge Railings for Longitudinal Wood Decks on Low- Volume Roads

The plans for crashworthy bridge railings for low-volume roads were developed through a cooperative research program involving the USDA Forest Service, Forest Products Laboratory (FPL); the Midwest Roadside Safety Facility , University of Nebraska-Lincoln (MwRSF); and the USDA Forest Service, National Forest System, Engineering staff. Three railings were developed and successfully tested in accordance with National Cooperative Research Program (NCHRP) Report 350 Test Level - 1 requirements. The fourth system was developed for a lower test level based on criteria developed by the USDA Forest Service for single-lane bridges on very low-volume roads. For the convenience of the user, full drawing sets are provided in customary U.S. and S.I. units.

If you would like a copy of this publication, please contact the National Wood In Transportation Information Center at 304-285-1591 and request publication number WIT-02-0047.

NOTE: Timber Bridge Data Sheet Insert

The next several issues of crossings will include at least one insert that provides information aabout a demonstration modern timber bridge constructed as demonstration project of the Wood In Transportation Program. This issue's insert highlights one of the 28 completed modern timber bridges in Michigan

NOTE: The National Wood In Transportation Information Center's staff is in the process of making some minor changes to *Crossings*. The intent of this effort is to provide an improved newsletter to you, our valued customer. If you have suggestions or comments during this process, please let us know.