Research on Timber Bridges
and Related Topics

prepared by

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INTRODUCTION

Timber bridges represent approximately 10% of the total bridges in the United States as stated in the 1994 National Bridge Inventory. In addition there area large number of bridges classified as steel, etc. that contain timber decks. For the most part these bridges are older structures that have lasted a number of years beyond the design life of the structure. States and local authorities continue to build bridges out of wood, as wood is considered a viable material for short span structures. Although wood has been used for a number of years, there are issues that need to be addressed through research as with any other material. The primary response to these issues has been the Timber Bridge Initiative passed by Congress in 1988. More recently, Section 1039 of the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) has included provisions for research and technology transfer into timber structures. The Timber Bridge Initiative has been charged to the USDA - Forest Service; while the ISTEA program is the responsibility of the Federal Highway Administration (FHWA).

In order to form a coherent research program, the USDA - Forest Service - Forest Products Laboratory (FPL) and the FHWA have implemented a joint program involving wood utilization in transportation structures. By combining funds, a national research program has been developed and implemented based on analysis of research needs.

In addition to the FPL/FHWA program, there are other research studies by State DOTs, etc. Previous versions of this research summary documented these studies in addition to the FPL/FHWA program. However due to difficulties in obtaining information in a timely manner, this and subsequent reports will address only the joint FPL/FHWA program.

FPL/FHWA PROGRAM

The timber bridge research activity under the FPL/FHWA research program is divided into the following 6 research areas identified in the ISTEA legislation:

Area I:	System development and design
Area II:	Lumber design properties
Area III:	Preservatives
Area IV:	Alternate transportation system timber structures
Area V:	Inspection/rehabilitation
Area VI:	Technology and information transfer

The research studies are cooperative studies with universities, local government agencies, and industry. In addition to the funding provided by the program, there is a minimum 20% match from research organizations receiving the cooperative agreements as mandated in the legislation. Specific research projects under the FPL/FHWA program come from the extensive survey of research needs conducted by Iowa State University, and summarized in report no. FPL-GTR-74, “Development of a Six-Year Research Needs Assessment for Timber Transportation Structures. ” New studies are identified each year based on this report, and are solicited through a competitive announcement. Current program highlights within the 6 major categories are described in the following sections. Information on specific projects may be obtained through the FPL contact at (608) 231-9200, or FHWA contact at (703) 285-2087.

Area I: System Development and Design

1. National bridge monitoring program

Field performance of timber bridges including stress-laminated decks, T, and box designs constructed of sawn lumber, glued laminated timber and structural composite lumber is being investigated. These structures are located across the United States and include bridges constructed as demonstration bridges as well as those built by local governments and the Forest Service. Monitoring activities for each bridge typically include a 2-3 year assessment of wood moisture content and bar force levels, two or more load tests and intense visual inspections. Additional information is also collected depending on specific site requirements. The information obtained from these activities is being used to develop improvements in design, fabrication, and construction procedures. At the present approximately 35 bridges are being monitored in over 20 States (Cooperators: numerous governmental agencies and universities).

Contact: Mike Ritter or James Wacker, FPL
Sheila Rimal Duwadi, FHWA

2. Field evaluation of a timber bridge constructed with metal plate connected trusses (FP-93-1972)

The objective is to evaluate the field performance of the first timber bridge in the U.S. constructed of metal plate connected trusses. This is a two span bridge where the first span is constructed of stress-laminated trusses, and the second span is constructed of truss girders with a bolt-laminated lumber deck. The final load test and conclusion of the field evaluation is planned for Fall, 1995. (Cooperator: Mike Triche, University of Alabama).

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

3. Construction and evaluation of a cottonwood stress-laminated bridge deck (FP-90-1352)

This project involves design, construction, and field evaluation of a two span stress-laminated bridge constructed of eastern cottonwood lumber in Centerville, Iowa. The objective is to provide information on the feasibility of using cottonwood lumber and similar secondary commercial species for bridge construction. Field evaluation has been completed and a final report has been prepared. (Cooperators: City of Centerville, Iowa; Iowa DNR; Iowa DOT; Iowa Department of Economic Development; Chariton Valley, Iowa, RC&D).

Contact: Mike Ritter, FPL

4. Develop long-span timber bridge systems using glued laminated timber (FP-90-1352, FP-92-1875)

This study is aimed at developing stress-laminated box beam bridges using glued laminated timber. The first phase involved evaluation of individual box and I sections to establish behavioral characteristics. This second phase involves developing analytical methods for analyzing multi-cell

box beam bridges and formulating recommended design guidelines. The research work has been completed and the final report is being prepared. (Cooperator: Mike Oliva, University of Wisconsin).

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

5. **Development of stress-laminated truss bridges using light-frame metal plate connected trusses (FP-90-1409, FP-92-1871, FP-94-2309)**

This research is aimed at developing stress-laminated truss bridges using light-frame metal plate connected (MPC) trusses. The study includes evaluation of cyclic moisture content, preservative treatment, fatigue load effects on connections, and connection durability under environmental conditions. (Cooperator: Habib Dagher, University of Maine).

Contact: Ron Wolfe, FPL
Sheila Rimal Duwadi, FHWA

6. **Development of fastener systems for stress-laminated decks (FP-89-1156; FP-90-1359; FP-91-1529)**

The objective of this study is to evaluate various connection systems for attaching wood decks to steel stringers for modular stress-laminated deck systems used on high-volume roads through fatigue tests. Promising connection systems were evaluated in 3 full size cyclic load tests under simulated service conditions. A final report has been prepared by the Cooperator, and field evaluation of this system in demonstration bridges has been planned. (Cooperator: Hota GangaRao, West Virginia University).

Contact: Russ Moody, FPL

7. **Wood-nonwood composites (FP-91-1587; FP-92-1845; FP-93-2107)**

This project involves investigation of the use of composites of wood and fiber-reinforced plastics (FRP) for bridge applications. The FRP offers the potential for significantly increasing the strength of glulam timber members. Various adhesives are being investigated that provide adequate bond between the FRP and wood. (Cooperator: Julio Davalos, West Virginia University).

Contact: Bryan River or Russ Moody, FPL

8. **Yellow poplar decks (FP-92-1844)**

This study involves laboratory investigations of the performance of yellow poplar lumber for both stress-laminated and glue-laminated decks in order to develop efficient design values. The strength and stiffness of the deck systems are being investigated. (Cooperator: Julio Davalos, West Virginia University).

Contact: Russ Moody, FPL

9. Composite action in T-beam systems (FP-92-1846; FP-93-2075)

The objective is to examine composite action between the web and the flange of stress-laminated T-beam bridges. Laboratory tests involve two series of T-beams, with southern pine glulam webs and stress-laminated red oak flanges. (Cooperator: Hota GangaRao, West Virginia University).

Contact: Russ Moody, FPL

10. Effect of temperature reduction on interlaminar stress retention in stress-laminated deck bridges (4-92-33)

This study is investigating the effects of temperature on the level of prestress in stress-laminated bridge decks. Testing is being conducted on 4 deck specimens of various species and preservative treatments to assess temperature reduction effects at various prestress levels and moisture contents. Additionally, several bridges have been instrumented and monitored with remote sensing equipment to determine the effects of temperature reduction. To date 4 bridges have been instrumented.

Contact: Mike Ritter, FPL

11. Evaluate cold temperature effects on stress-laminated timber decks (FP-92-1874)

This research study is investigating the effects of cold temperatures on the performance of stress-laminated timber decks. The study involves several stress-laminated decks constructed of Red Pine lumber which will be evaluated under controlled laboratory conditions to determine temperature effects for different temperature ranges and moisture contents. Results of this work wili be combined with results from the previous study to formulate design recommendations for stress-laminated bridges used in cold regions. (Cooperator: Bob Seavey, University of Minnesota).

Contact: James Wacker, FPL
Sheila Rimal Duwadi, FHWA

12. Fatigue strength of stress-laminated bridge decks (FP-91-1632; FP-92-1891)

The objective is to develop a nonlinear fatigue damage model for predicting fatigue strength and life of stress-laminated timber bridge decks. Different fatigue stress ranges, prestress levels and butt joint arrangements will be used as variables in conducting the fatigue tests. These tests will also differentiate between creep behavior and fatigue behavior. This study is complete and a final report is being prepared for publication. (Cooperator: Hota GangaRao, West Virginia University).

Contact: Larry Soltis, FPL

13. Dynamic evaluation of timber bridges (FP-92-1877)

This study is evaluating the dynamic behavior of timber bridges through analytical and field evaluations of superstructures constructed of sawn lumber, glued laminated, and stressed laminated

timber. Results will be used to improve design procedures and formulate recommendations for changes to the current AASHTO specifications (Cooperator: Terry Wipf, Iowa State University),

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

14. Field evaluation of glulam bridge superstructures in Alabama (FP-93-2081)

This study is evaluating the field performance of several glued laminated timber bridges in Alabama. The bridges consist of glulam girders with transverse glulam decks and range in span from 26 ft to over 100 ft. Monitoring is focused on dimensional stability, wood moisture content, general condition and load test behavior. (Cooperator: Mike Triche, University of Alabama).

Contact: Mike Ritter. FPL

15. Load distribution in plank decks (FP-93-2074)

The objective is to determine the wheel load distribution criteria for transverse plank decks. Currently, there are thousands of plank decks in service that do not meet current design criteria, yet continue to perform in an acceptable reamer with no detectable structural problems. The study involves both analytical and field work, and will examine plank width and thickness combinations to develop recommendations for revised design criteria. (Cooperator: Andrzej Nowak, University of Michigan).

Contact: Mike Ritter, FPL

16. Portable wood bridge systems (FP-93-2072)

This study will develop portable wood bridge systems for use in temporary applications. These bridges are intended for use on roads where temporary access is required or where a bypass is necessary for the repair or replacement of existing structures. Preliminary design criteria have been formulated and initial designs are being developed. Analytical and laboratory testing will be completed on one or more designs and a field structure will be constructed for further evaluation. At the conclusion of the study, a report and recommended design drawings will be available (Cooperator: Steve Taylor, Auburn University).

Contact: Mike Ritter, FPL

Area II: Lumber Design Properties

1. Application of acoustic grading on red oak lumber (FP-89-1155; FP-90-1420)

This study is investigating the application of acoustic grading on red oak lumber. Study results indicate that acoustic emission technology can be used to sort red oak lumber. These results establish baseline information on acoustic emissions that may be useful when directly applied to in-situ timber

bridges. A paper outlining the study results has been submitted for publication (Cooperator: Roger Chen, West Virginia University).

Contact: Kent McDonald, FPL

2. Structural lumber yield and properties from railroad switch ties of five hardwood species (FP-90-1360; FP-91-1569)

This study involves determining the yield of structural lumber grades from railroad switch ties of five hardwood species. The species are northern red oak, hickory, red maple, yellow poplar, and beech. The study is aimed at identifying a source of hardwood structural lumber that is not competitive with sources used by the furniture industry. A paper reporting the yield results has been submitted for publication. (Cooperators: Curt Hassler, West Virginia University).

Contact: David Green or Kent McDonald, FPL

3. Effect of treatment processes on the flexural properties of red oak structural lumber (FP-89-1155; FP-90-1490)

This study involves evaluating the effects of preservative treatment and moisture content on the bending properties of West Virginia Northern Red Oak lumber. The effect of preservative treatment process on bending strength or stiffness of the lumber, the bending properties, and the effect of moisture content (MC) on the modulus of elasticity (MOE) will be evaluated. This study is necessitated because of the importance of MC effects on MOE for the production of oak MSR lumber and for adjustment of lumber properties when estimating bridge performance. The study is complete and a final report is being prepared (Cooperators: Curt Hassler and John Akande, West Virginia University).

Contact: David Green, FPL

4. Shear design procedures for glued laminated timber

The objective of this research is to determine if shear strength correlation exists for glued laminated timber. Over 200 Southern pine and Douglas Fir beams were tested and data analyzed. A relationship between shear strength and beam size has been developed that uses ASTM shear block strength as the control. The study is complete and reports have been published.

Contact: Larry Soltis, FPL

5. Shear strength of sawn lumber beams (FP-94-2266)

The object of this study is to determine the shear strength of non-checked and checked solid sawn lumber beams in order to develop the AASHTO shear design criteria for beams subjected to edgewise bending. Tests will be conducted on three species and will involve beam tests, shear block tests and fracture constant tests. Revised AASHTO criteria will be applicable both to the design of new

bridges and the analysis and load rating of existing structures. (Cooperator: David McLean, Washington State University)

Contact: Doug Rammer, or Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

Area III: Preservatives

1. Preservative treatment of Red Maple (FP-92-1807)

The objective of this study is to investigate the treatability of Red Maple heartwood with generic representatives of oilborne and acidic or alkaline waterborne preservatives. Laboratory tests with small wood specimens indicate that some preservatives will be more effective in protecting Red Maple from attack by soft rot fungi than chromated copper arsenate (CCA) This information will contribute to future consideration of this wood species in timber bridge applications. A final report has been prepared and is being reviewed. (Cooperator: William Smith, State University of New York).

Contact: Rod De Groot, FPL

2. Performance of a stress-laminated bridges constructed of CCA treated Southern Pine lumber (FP-89-1235; FP-91-1616)

This project is evaluating stress-laminated deck bridges constructed of Southern Pine lumber treated with CCA. The bridges include both simple and multiple-span continuous superstructures with various types of wearing surfaces, including asphalt pavement with a waterproof geotextile membrane. Results of this project will be used to formulate recommendations on the use of waterborne preservatives in stress-laminated bridge applications (Cooperators: Ken Long, Georgia Southern University; Nur Yazdani, Florida A&M University; Southern Forest Products Association).

Contact: Mike Ritter. FPL

3. Accelerated laboratory testing of new wood preservatives- ecosystem studies (FP-93-2022)

This project will test 10 different wood preservatives that currently are in use or show promise for bridge applications. Accelerated testing using small wood beams are being conducted under laboratory and field conditions to determine efficacy for protecting various softwood and hardwood species commonly used for timber bridges. The specimens will be subjected to complexes of wood degrading fungi and to termites. The results of this study are necessary for the formulation of proposed treatment specifications for bridge members (Cooperator: Peter Laks, Michigan Technological University).

Contact: Rod De Groot, FPL
Sheila Rimal Duwadi, FHWA

4. Accelerated laboratory testing of new wood preservatives - pure culture studies (FP-93-2023)

The objective is to test 16 different wood preservatives that currently are in use or show promise for bridge applications. Accelerated testing using small wood specimens will be conducted under laboratory conditions to determine efficacy for protecting seven softwood and eight hardwood species commonly used for timber bridges. The results of this study are necessary before field trials can be completed for code acceptance (Cooperator: Jeff Morrell, Oregon State University).

Contact: Rod De Groot, FPL
Sheila Rimal Duwadi, FHWA

5. Treatments and methods for field treating bridge members (FP-93-2024)

This study will develop treatments and methods for field treating bridge members. It will identify and/or develop equipment, preservative formulae and procedures for effectively treating field cuts, bore holes and other breaks in preservative treatment encountered during bridge construction and maintenance operations. The project will result in a comprehensive users guide to remedial treatments for timber bridges (Cooperator: Jeff Morrell, Oregon State University).

Contact: Rod De Groot, FPL
Sheila Rimal Duwadi, FHWA

6. Performance characteristics of various wood preservatives for stress-laminated bridge applications (FP-92-1880)

This project is evaluating the effects of various wood preservatives and anchorage configurations on the dimensional stability of stress-laminated decks constructed of Southern Pine lumber. Seven different wood preservative formulations and three anchorage systems are being evaluated using full-scale stress-laminated decks. (Cooperator: Nur Yazdani, Florida A&M/Florida State University).

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

7. Preservative treatment evaluation of red maple and yellow poplar with ACQ-B (FP-93-2091)

The objective is to develop methodology for treating red maple and yellow poplar lumber with an ammoniacal, waterborne preservative, ACQ-B. A data base on field durability of the treated products will also be developed. This information will be used to support the acceptance of these treated hardwoods by standards-setting organizations such as the American Wood Preservers' Association (Cooperator: Doug Gardner, West Virginia University).

Contact: Rod De Groot, FPL

8. Manual on wood preservatives for transportation structures

The objective is to develop a comprehensive manual on the use of wood preservatives for wood transportation structures. The manual will provide a practical background on wood deterioration processes, wood preservatives and environmental issues, and guidelines for specifying and using treated wood. In addition, information will be included for wood treaters including recommendations for processes and procedures for treating wood for transportation structure applications (Cooperator: Dave Webb, Koppers Inc.).

Contact: Mike Ritter, FPL

9. Treatability of heartwood (FP-94-2271)

This study will evaluate the treatability and durability of heartwood in various softwood and hardwood species as applicable for utilization in transportation structures through analysis of existing data. It will consider both emerging and conventional wood preservatives including oilborne and waterborne systems. (Cooperator: John Z. Wang, Michigan Technological University)

Contact: Rod De Groot, or Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

10. Copper Naphthenate Preservative for Bridge Applications

Naphthenic acid, as commercially derived from crude oil, is a complex mixture of saturated monocarboxylic acids containing one or more cycloalkane rings. Naphthenic acid is used as one of the basic components in manufacturing copper naphthenate, an important wood preservative. However, it is currently difficult to determine the relative composition of naphthenic acids, and the effectiveness of the components of copper naphthenate wood preservative against wood decay fungi. The objective of this research is to develop a means for quantitative separation of naphthenic acid components and to evaluate the effectiveness of the components against decay fungi. This project will be awarded in fiscal year 1995.

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

Area IV: Alternate Transportation System Timber Structures

1. Development of crashworthy bridge rail systems; PL-1 (FP-89-1183-A1,A2)

This study is complete. The following bridge rail systems for use on longitudinal timber decks have been successfully crash tested at AASHTO Performance Level (PL-1):

1. Glued laminated timber rail with curb;
2. Glued laminated timber rail without curb;
3, Steel rail without curb;
4. Approach rail transition for a glued laminated timber rail to a steel approach rail.

Several preliminary reports have been published. The final report, and drawings are currently being

reviewed. (Cooperators: Ron Faller, University of Nebraska, Lincoln; American Institute of Timber Construction).

Contact: Mike Ritter, FPL

2. Development of crashworthy bridge rail systems; PL-2 (FP-89-1183-A3)

This study is also complete. It included the development and testing of the following AASHTO Performance Level-Two (PL-2) bridge rails and transition for use on longitudinal deck timber bridges:

1. Glued laminated timber rail with curb;
2. Steel rail without curb;
3. Steel approach rail transition for use on the glued laminated timber rail.

Both bridge rails and the transition were successfully crash tested. Reports and drawings are being reviewed (Cooperator: Ron Faller, University of Nebraska, Lincoln).

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

3. Bridge rails for low-volume roads by full-scale crash testing; TL-1 (FP-93-2089)

This study is developing crash-tested bridge rails for low-volume roads. The study involves the development and testing of one curb system and two bridge rail systems. Evaluation of the curb system will be based on low-volume road criteria which was developed as a part of the study to represent single-lane forest roads. Evaluation of the two railing systems will be based on the new Test Level-One (TL-1) criteria presented in NCHRP Report 350 (Cooperator: Ron Faller, University of Nebraska).

Contact: Mike Ritter, FPL

4. Analysis and design of timber bridge rails (FP-93-2068)

The objective of this study is to develop a procedure to evaluate and design bridge rails for timber bridges without having to crash test each rail system. The procedure will be similar to that currently used for earthquake analysis and will be consistent with the philosophy and methodology of the LRFD limit states design approach. Equivalent static forces will be developed for various impact conditions and railing types considering specific design details, geometric discontinuities, and retrofit options. This will provide bridge engineers with a more rational and accurate method for designing new bridge rails and a reliable procedure evaluating existing railings for replacement or retrofitting (Cooperators: Barry Rosson and Ron Faller, University of Nebraska).

Contact: Mike Ritter, FPL

5. Timber bridge rail testing and evaluation - transverse deck; PL-1

This study is complete. Three different bridge rails and one transition, for use on transverse deck timber bridges, were successfully crash tested to meet PL-1 criteria. The final report is under review. (Principal Investigator: Hota GangaRao, West Virginia University)

1. PL-1 glulam bridge rail on transverse glulam deck supported by steel beams.
2. PL-1 glulam transition rail.
3. PL-1 glulam bridge, rail on transverse glulam deck supported by glulam beams.
4. PL-1 steel rail on transverse glulam deck supported by steel beams.

Contact: Sheila Rimal Duwadi, FHWA

6. Delaware and Raritan Canal Project

The objective of this study is to develop timber bridge rails for approximately 24 historical bridges on the Delaware and Raritan Canal, New Jersey. The State has contracted with A.G. Liechtenstein & Associates to develop the rails. The rails will be crash tested at the Pennsylvania Transportation Institute, in accordance with NCHRP Report 350. Pendulum tests and rail crash tests are planned to be conducted.

Contact: Romeo Garcia, FHWA - New Jersey Division
Sheila Rimal Duwadi, FHWA

7. Development of Sound Barriers

This study will evaluate and develop designs of wood sound barriers with an emphasis on acoustic characteristics, stability and longevity. The study will consider various wood products and will result in recommended design criteria and designs for wood sound barriers, including proposed changes to national standards. (Cooperator: Dr. Thomas Boothby, Pennsylvania State University)

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

8. Development of Crash-Tested Bridge Railings - Transverse Deck; TL-4

The FHWA has officially adopted the NCHRP 350 report as the primary document for evaluating bridge rails for use on bridges on the National Highway System. The criteria in NCHRP 350 differs from the current AASHTO criteria. Whereas AASHTO defined test levels as Performance Level One (PL-1), PL-2, and PL-3; NCHRP 350 defines it as Test Level One (TL-1), TL-2, up to TL-6. The objective of this project is to develop and successfully crash test two TL-4 bridge rails and approach rail transitions for use on timber bridges with transversely laminated decks. TL-4 would be approximately equivalent to a PL-2 level rail. This project will be awarded in fiscal year 1995.

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

Area V Inspection/Rehabilitation

1. Nondestructive evaluation of green wood using a stress wave timer (FP-93-1956)

The objective is to investigate the potential use of stress wave NDE techniques for evaluating stiffness of green hardwood lumber. These techniques have historically shown promise for assessing the strength and stiffness of softwood solid sawn lumber. This study will determine the applicability of previously developed technologies for use in assessing the stiffness of green hardwood lumber. Testing has been completed, and a final report is being prepared (Cooperators: U. Halabe and Mike Walcott, West Virginia University).

Contact: Bob Ross, FPL

2. In-place evaluation of timber bridges using stress wave technology (FP-93-2025)

The objective is to develop guidelines for applying existing nondestructive testing technology for in-place evaluation of timber bridges. The study will develop and present guidelines for equipment use and interpretive procedures for evaluation of various bridge components based on field and laboratory research. (Cooperator: Roy Pellerin, Washington State University).

Contact: Bob Falk, FPL
Sheila Rimal Duwadi, FHWA

3. Equipment and methods for determining the in-place stiffness of stress-laminated timber decks constructed of sawn lumber

The objective of this staff study is to adapt existing NDE technology to develop a simple procedure for determining in-place stiffness of individual laminations within existing stress-laminated lumber bridges. This information will be used to evaluate field performance and assess structural integrity.

Contact: Bob Ross or Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

4. Guidelines for the design and application of waterproof asphalt wearing surfaces for timber decks. (FP-94-2272)

This project will examine the behavioral characteristics of various types of timber deck systems and develop recommendations for the design and application of waterproof asphalt wearing surfaces using membranes and/or geotextile fabrics. (Cooperator: Richard Weyers, Virginia Polytechnic Institute)

Contact: Kim Stanfil-McMillan, or Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

5. Manual for timber bridge inspection

The objective of this research is to develop a comprehensive manual for the inspection of timber bridge superstructures, and substructures that will supplement the FHWA's Bridge Inspectors Training Manual 90. The manual will document and explain the causes and processes of timber deterioration

and the traditional procedures and equipment for inspection. It will also present an overview of the Non Destructive Evaluation techniques that can be used for inspection. This project will be awarded in fiscal year 1995.

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

Area VI: Technology and Information Transfer

1. Meetings toward development of AASHTO Specifications for timber bridge design

This project is set up to sponsor meetings to develop proposed revisions to the AASHTO Standard Specifications for Highway Bridges related to timber structures.

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, FHWA

2. Standard plans for Southern Pine bridges (FP-93-1959; FP-93-1972)

This project, with the Southern Forest Products Association and the University of Alabama, will develop standard plans for Southern Pine bridge superstructures. The plans will include stress-laminated decks constructed of sawn lumber and glued laminated timber and solid sawn stringer bridges with plank decks. Drawings are complete and are currently being reviewed (Cooperators: Southern Forest Products Association; Michael Triche, University of Alabama).

Contact: Paula Hilbrich Lee, FPL

3. Standard plans and specifications for timber bridge superstructures (FP-93-2021)

This project will develop standard plans and specifications for the following types of timber bridge superstructures:

Glulam beams with transverse glulam deck
Longitudinal glulam deck
Longitudinal stress-laminated deck
Longitudinal spike-laminated deck
Longitudinal nail-laminated deck
Transverse nail-laminated deck
Timber decks on steel beams

The design details and specifications will be available as half-size drawings and on computer disks for use in computer aided drafting systems (Cooperator: Matt Smith, Laminated Concepts, Inc.).

Contact: James Wacker, FPL
Sheila Rimal Duwadi, FHWA

4. National Bridge Inventory assessment (4-92-31)

The objective of this study is to provide insight into the longevity, distribution and type of timber bridges built in the U.S. through analysis and assessment of the National Bridge Inventory. Additionally, the analysis identifies areas where improvements in inventory coding and bridge inspection methodology may be improved. The final draft of the report is complete. (Cooperator: Edward Cesa, TBIRC).

Contact: Kim Stanfill-McMillan, FPL

5. Computer analysis, design, rating and drafting of wood bridge superstructures (FP-93-2090)

This study will develop computer programs for design of the following wood bridge superstructures:

Glulam beams with transverse glulam deck
Longitudinal glulam deck
Longitudinal stress-laminated deck
Longitudinal spike-laminated deck
Longitudinal nail-laminated deck

The programs will be developed using both allowable stress design, and load and resistance factor design methods; and will offer interactive analysis, design and load rating methods. Additionally, the programs will provide output information for computer aided design drawings (Cooperator: Jay Puckett, University of Wyoming).

Contact: Mike Ritter, FPL

7. Timber as a base course material for highway pavements (FP-92-1889)

This study is evaluating the suitability of wood as a material for roadway pavement subgrades. Wood offers the potential to reduce reflective pavement cracking and is less susceptible to freeze-thaw and deicing chemicals than substrates of concrete and soil (Cooperator: Hems Siriwardane, West Virginia University).

Contact: Kim Stanfill-McMillan, FPL

8. Economics of Timber Bridges (FP-94-2288)

The objective of this study is to determine the costs of timber bridges compared to similar bridges constructed of other materials. Cost comparison between timber bridges (exclusive of deficient and demonstration bridges) built after 1980 with an assigned design load rating will be compared with similarly rated steel and concrete bridges (Cooperator: John Z. Wang, Michigan Technological University).

Contact: Kim Stanfil-McMillan, FPL

9. National Conference on Wood Transportation Structures

The FHWA and FPL are jointly sponsoring a conference on Wood Transportation Structures. The conference will present state-of-the-art information on wood utilization in transportation applications including bridges, noise barriers, and marine facilities. The conference will be held in Madison, Wisconsin, October 23-25, 1996.

Contact: Mike Ritter, FPL
Sheila Rimal Duwadi, or John Hooks, FHWA

FHWA DEMONSTRATION PROGRAM

Section 1039 of the 1991 ISTEA, also established a timber bridge construction grants program. The candidate bridges must meet the eligibility criteria of the Highway Bridge Replacement and Rehabilitation Program, 23 U.S.C. 144. Four criteria are listed for the selection and approval of grants, and deal with the structural integrity of designs, the use of native timber species, innovative designs, and environmental factors. Construction of these bridges are to start the same year as the grants. An amount of $7 million was authorized for fiscal year 1992; for fiscal years 1993 through 1997, the amount available is $7.5 million per year. The DOT 1993 Appropriations Bill modified the ISTEA to allow construction grants for timber bridges on any public road if otherwise eligible for the bridge program. Candidate projects are selected by State highway agencies and submitted to the FHWA for the final decision. In FY92 & 93, the FHWA regions subjectively ranked applicant bridges on how well each fulfilled the above criteria. Starting FY94, selection is made based on a Priority Rating Factor computed by a formula derived by considering, for the most part, the four approval criteria set by Congress. The call for candidates are usually in February with the allocation of grants in November. At the beginning of fiscal years 1992, 1993, 1994, and 1995 grants were given to 34, 45, 27, and 36 projects, respectively.

Contact: Robert C. Wood, FHWA (202) 366-4617

FOREST SERVICE DEMONSTRATION PROGRAM

The FS demonstration timber bridge program has been ongoing since 1989 with passage of the Timber Bridge Initiative by the US Congress. To date, 348 demonstration vehicular and pedestrian timber bridges have been funded in the 48 states and the District of Columbia. Bridges are evaluated by a national review panel from various parts of the country, knowledgeable in timber and related disciplines. Thirty six, 20 vehicular & 9 pedestrian bridges, and 7 special projects are being funded at a cost of $914,429 in FY95. The amount was matched with $1.7 million of state and local funds. Approximately 88 proposals were evaluated.

Contact: Edward Cesa, FS - Timber Bridge Information Resource Center
(304) 285-1591

Publications

The following publications related to timber bridge research are available:

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