TBIRC
Timber Bridge Information Resource Center

CROSSINGS

Editor Tinathan Royce *Issue 4* *May 1991*

Cost Analysis of Timber Bridges

A study was undertaken in New Hampshire in 1989 to investigate the economics of timber bridge superstructures versus traditional steel and concrete and prestressed concrete alternatives in the short-span range of 20-60 feet (6.1 to 18.3 m). Only superstructure costs were considered because substructure and abutment costs are highly site-specific. A lack of definitive data regarding service lives and maintenance costs precluded a defensible life cycle cost study; thus, only initial costs were compared. (This limitation does not severely compromise the overall value of this study because initial costs are currently used by many municipalities as the primary criterion for short- span bridge construction and replacement decisions.)

Representative superstructure designs were obtained for timber, steel and concrete (steel stringers below a concrete deck), and prestressed concrete bridges at 20-, 40-, and 60-foot spans. Five to six northern New England general contractors performed cost estimates on these designs. Also, nine timber bridge designs, three at each span length, received cost estimates from three different timber bridge suppliers.

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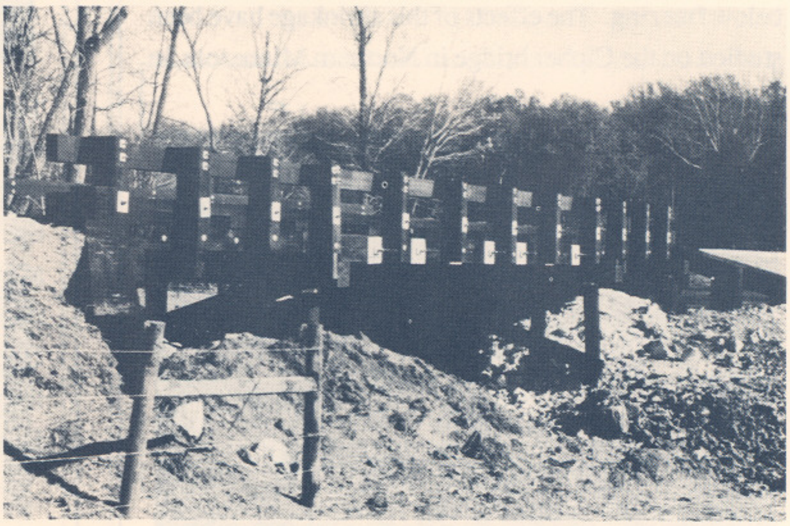
Timber Bridge Construction Grants Awarded

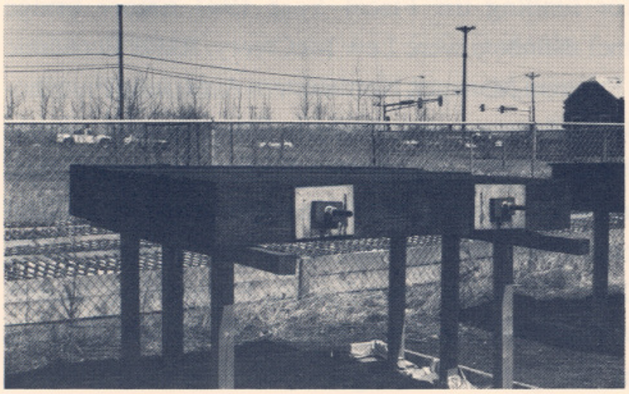
The timber bridge proposal evaluation panel met February 19-21, 1991 at Morgantown, West Virginia to review and recommend for funding the Fiscal Year 1991 timber bridge recipients. Panel members were Lew McCreery, Rural Economic Revitalization Program Manager, Northeastern Area; John Pasquantino, Information, Planning, and Analysis Group Leader, Northeastern Area; Edward Pepke, Coordinator, Northern Representative; Robert Westbrook, Coordinator, Southern Representative; William Von Segen, Coordinator, Western Representative; Stephen Bunnell, Washington Office, National Forest System, Engineering; Russell Moody, Forest Products Laboratory, Research, Engineered Wood Products; Tom Snellgrove, Washington Office, Research, Forest Products and Harvesting; John Sebelius, Washington Office, State and Private Forestry, Cooperative Forestry; and John Crist, Facilitator, Northeastern Area. A total of 129 proposals were evaluated and 49 proposals were selected for funding for Fiscal Year 1991. Total dollar amount awarded was $2,000.000. On page 4 is a list of the approved 49 bridges.



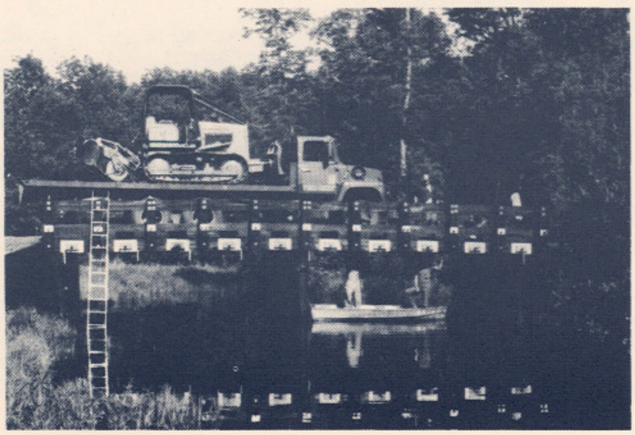
List of Approved Demonstration Bridges for Fiscal Year 1991 — Page 4

Your University at Work

The timber bridge research at the University of Minnesota has been directed by Drs. Bruno Franck and Robert Erickson. This project has focused on three areas of investigation: the effect of coldness-induced shrinkage on bridge performance, the effect of long-term creep when wood is subjected to cyclic equilibrium moisture content conditions, and the examination that Dr. Franck has been pursued recently concerning the application of alternative technologies to timber bridge design.



The effects of coldness-induced shrinkage have been studied as part of this project. It is known that there is a thermal expansion and contraction coefficient associated with steel rods and with the wood in the bridge deck. Furthermore Hans Kubler has reported additional shrinkage in wood when it is subjected to temperatures below freezing. The effects of this shrinkage have been studied on the Cipher bridge in Northern Minnesota, in a laboratory test using a freezer to simulate winter temperatures and on two test bridge decks that were set up on the St. Paul Campus of the University of Minnesota.



Another area of the research at Minnesota has been the effect of creep or long-term deformation on bridge performance. This part of the study has utilized small samples and 2x4 beams. The samples were subjected to cyclic EMC conditions, with either the tension face, the compression face or both faces open to the surrounding air.

The good news from the results show that the samples with the tension face open return to nearly the same condition once the load is removed. The bad news is that the samples with the compression face open tend to hold the deflection after the load is removed. Moreover, with repeated cycles of high and low EMC, the deflection increases over time.

The results from this part of the study indicate that long term deflection is an important aspect of timber bridge design. While problems may not show up immediately, the performance of the bridge in later years may be affected by creep. These problems may result in negative camber, added maintenance, or shorter service life. One factor that would improve this situation would be the use of an impermeable barrier over the compression face or the top of the bridge deck.

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Your University at Work

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One of the great strengths of the timber bridge effort has been the willingness and interest to examine new design concepts. The national awards competition for timber bridges and the development of box beam and t-beam designs are evidence of this position. During fall of 1990 and winter of 1991, Dr. Franck has been working with Julius Naterer at the Swiss Federal Institute of Technology, Naterer has been widely acclaimed for his innovative designs of timber bridges and other timber structures. Dr. Franck has been working with Naterer to develop expert system programs to be used to increase the creativity and the performance of timber designs. This work has opened new and very exciting possibilities of applying proven European designs to timber bridges in America.

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Cost Analysis of Timber Bridges

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As shown in Figure 1, cost data from general contractors indicated that short-span timber bridge superstructures were cost competitive with steel/concrete and were less expensive than prestressed concrete. Data from the timber bridge suppliers showed distinct initial cost advantages for timber bridges over both steel and concrete and prestressed concrete. The study indicated the initial cost effectiveness of modern, short-span timber bridges in northern New England. Region-dependent cost differences could be addressed with similar studies conducted for other regions of the United States.

NOTE: For more detail, see "Cost Comparison of Timber, Steel, and Prestressed Concrete Bridges," by R.A. Behr, E.J. Cundy, and C.H. Goodspeed in the ASCE Journal of Structural Engineering, Vol. 116, No. 12, December, 1990, pp. 3448-3457.

— ***Richard A. Behr, Ph.D., P.E.***
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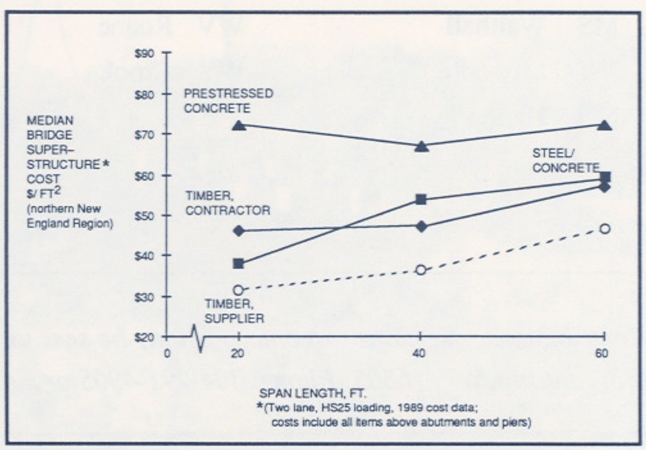

Figure 1 - Median Bridge Superstructure Cost Versus Span Length

Timber Bridge Construction Grants Awarded

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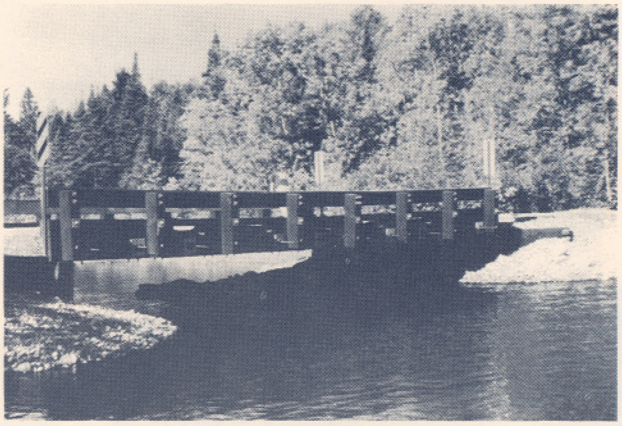
State	County	State	County
AK	Fairbanks	NE	Dawes
AL	Butler	NJ	Sussex
AL	Tuscaloos	NY	Allegany
AR	Pulaski	NY	Allegany
AZ	Santa Cruz	NY	Allegany
AZ	Yuma	OH	Carroll
CO	Eagle	OH	Lawrence
CO	Grand	OK	Lincoln
CT	Hartford	PA	Warren
GA	Gwinnett	SD	Lawrence
GA	Union	TN	Claiborne
ID	Custer	WA	Jefferson
ID	Teton	WA	Franklin
IL	Stephenson	WI	Marinette
IL	Woodford	WI	Richland
KS	Sumner	WV	Cabell
LA	E. Baton Rouge	WV	Doddridge
MD	Garrett	WV	Fayette
MI	Baraga	WV	Ohio
MN	Anoka	WV	Lewis
MS	Copiah	WV	McDowell
MS	Leake	WV	Putnam
MS	Walthall	WV	Roane
MT	Missoula	WY	Crook
ND	Hatton		

Timber Bridge Specialist Retires

March 9, 1991, marked the retirement date for John B. Crist. John served his last few years with the Forest Service as the Program Manager for the Timber Bridge Information Resource Center and as the National Timber Bridge Specialist. We wish him well in his future endeavors.



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