Paper Reference: T134-1 (*quote when citing this paper*)
Structural Engineering World Wide [Abstracts Volume]
ISBN:0-08-042845-2

Emerging Timber Bridge Technology in the United States [abstract]

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ABSTRACT
Timber has been successfully used as a bridge material in the United States for hundreds of years. Historically, most timber bridges have been conventional beam or deck superstructures manufactured from softwood sawn lumber or glued laminated timber (glulam). Since 1988, two legislative acts have been passed by the U.S. Congress to establish national programs aimed at improving timber utilization in transportation structures, As a result, timber bridge research has increased, which is leading to significant technological advances. These advances have been well received, and many bridges utilizing new technology have been constructed.

Construction materials can have a significant effect on the performance, longevity, and cost of timber bridges. Historically, most timber bridges in the USA have been constructed from two primary softwoods: Douglas-fir and Southern Pine. Although many other species are plentiful, their use in bridges has been limited. In the late 1980's, a directed effort was initiated to further the use of underutilized, non-traditional secondary softwoods and hardwoods in bridge applications. This applied to sawn lumber as well as glulam and resulted in the construction of over 200 bridges built from hardwood and secondary softwood species. There has also been an increase in the use of structural composite lumber (SCL) for bridge construction, and design values for this material have been included in bridge design specifications.

Most umber bridges in the USA are conventional beam or deck superstructures constructed of sawn lumber or glulam. Over the past decade, emphasis has been placed on developing new designs which allow for improved timber utilization. Emphasis has also been placed on evaluating the more traditional timber bridge designs to improve efficiency related to performance, economics, and longevity. The majority of research related to new timber bridge systems has focused on the concept of stress laminating for deck bridges and T- and box-beam bridges. Work is currently concluding to define more accurate wheel load distribution criteria, to quantify the effect of butt joints on strength and stiffness, and to develop alternative prestressing elements. In addition to developing technology for new systems, considerable research has also been directed at refining and improving traditional timber bridge designs. Primary efforts have focused on the behavior of timber bridges under dynamic truck loading and the distribution of vehicle wheel loads.

Since the early 1990's, there has been increasing emphasis on full-scale crash testing as a means of evaluating bridge railing performance. For timber bridges to be viable and competitive with bridges of other materials range of crash-tested bridge railings for different wood bridge types is required. Based on this need, national emphasis was placed on developing a number of crash-tested railings at different performance levels for different types of timber bridges. This railing development and testing program is over 50% complete and several crashworthy bridge railings are now available for timber bridges.