Glued-Laminated Timber Bridges

Glulam designs are the most commonly used modern timber bridge designs

The first glulam bridges were built in the mid-1940's. Since that time, they have become the most common type of timber bridge in both single and multi-span configurations. Glulam beam bridges are completely prefabricated in modular components and are treated with preservatives after fabrication. When properly designed and fabricated, no field cutting or boring is required, resulting in a service life of 50 years or more.

**GLULAM BEAM SYSTEMS**

Glulam beam bridges consist of a series of transverse glulam deck panels supported on straight or slightly curved beams (Figure 1). They are the most practical for clear spans of 20 to 100 feet and are widely used on all size roads and highways. Glulam has proved to be an excellent material for beam bridges because members are available in a range of sizes and grades and are easily adaptable to a modular or systems concept of design and construction. Although glulam can be custom fabricated in many shapes and sizes, the most economical structure uses standardized components in a repetitious arrangement, an approach that is particularly adaptable to bridges.

**DESIGN OF GLULAM DECKS**

Glulam decks are constructed of panels manufactured of vertically laminated lumber. The panels are placed transverse to the supporting beams and loads act parallel to the wide face of the laminations. The two basic types of glulam decks are the non-interconnected deck and the doweled deck (Figure 2). Noninterconnected decks have no mechanical connection between adjacent panels. Doweled decks are interconnected with steel dowels to distribute loads between adjacent panels. Both deck types are stronger and stiffer than conventional nail-laminated lumber or plank decks, resulting in longer deck spans, increased spacing of supporting beams, and reduced live load deflection. Additionally, glulam panels can be placed to provide a watertight deck, protecting the structure from the deteriorating effects of rain and snow.

Glulam decks are generally 5-1/8 inches (5 inches for Southern Pine) or 6-3/4 inches thick. Increased thickness up to 14-1/4 inches are available but are seldom necessary.

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*Figure 1: Typical glulam beam bridge configuration*
required. Panel width is a multiple of 1-1/2 inches, the net width of the individual lumber laminations. The practical width of the panel ranges from approximately 30 to 55 inches; however, the designer should check local manufacturing and treating limitations before specifying widths over 48 inches. Panels can be manufactured in any specified length to be continuous across the structure. It is common practice to vary adjacent panel lengths to provide a drainage opening under curbs (Figure 3).

The performance and economy of glulam deck panels can be significantly affected by the configuration and materials specified in design. The most economical design is the one that uses a modular-type system with two or three standardized panels in a repetitious arrangement. Panel width and configuration are usually based on criteria for curb or railing systems. When the bridge length is not evenly divisible by the selected panel width, odd-width panels are placed on the approach ends of the deck.

**NONINTERCONNECTED GLULAM DECKS**

Noninterconnected glulam decks are the most widely used type of glulam deck in modern timber bridge construction. They are economical, require little fabrication, and are easy to install with unskilled labor and without special equipment. Because the panels are not connected to one another, each panel acts individually to resist the stresses and deflection from applied loads.

**DOWELED GLULAM DECKS**

Doweled glulam decks consist of a series of glulam deck panels interconnected at the panel joints with steel dowels (Figure 4). The dowels transfer loads between panels and reduce relative displacements and rotations between adjacent panels. As a result, doweled decks generally have lower live load deflections and may result in longer deck spans or thinner panels than noninterconnected decks. These advantages can be significant in some cases but may not be sufficient to offset the increased costs required for dowel installation.

The suitability of a doweled deck for a specific application depends on the design requirements of the structure and the economics of fabrication and construction. Doweled panels are more expensive than noninterconnected decks because they require precise fabrication for proper installation and performance. As a general

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rule, they are the most practical when an asphalt wearing surface is used and the de­
flexion at the panel joints must be limited to prevent cracking. However, it may be
more cost effective to use a nonintercon­
nected deck and limit deflections by using a thicker deck or decreased deck span. When
paving is not planned, noninterconnected
panels will generally provide the most
economical deck.

The above was selectively excerpted from Timber Bridges: Design, Construction, Inspection, and Maintenance published by the US Department of Agri­
culture, Forest Service, June, 1990, EM 7700-8. For a copy of this very comprehen­sive manual contact the Technology Transfer Center at 1-800-423-0060.

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Figure 3: The length of glulam deck panels may be varied between adjacent panels to provide a drainage opening under the curb

Figure 4: Primary and secondary directions for doweled glulam deck panels