Appendix I. Bridge Plans

In Chapter 16, Trail Bridges, a variety of trail bridge designs were reviewed. Regardless of the design, it must be properly engineered to be considered safe for public use. It must accommodate the Department's minimum standards for live load (anticipated weight of bridge users), dead load (weight of the bridge's superstructure), snow load (maximum anticipated snow fall on the bridge), wind shear (wind force against the bridge), and the level of seismic activity in the geographic area of the bridge. The ability of a bridge to accommodate these engineering requirements is dependent on the design of the bridge and the materials used to construct it.

The log, milled wood, and laminated wood ("glulam") bridge stringer charts in Chapter 16 were developed by qualified licensed engineers to meet a minimum live weight load rating of 100 pounds per square foot as well as the dead load rating associated with each particular design. These bridge stringer charts do not account for snow load, wind shear, or seismic conditions.

A bridge that exceeds the lengths or the dead load weights of these drawings must be designed and stamped by an appropriately licensed structural engineer. Most wooden bridge manufacturers will provide engineered and stamped plans as part of the purchase price.

When purchasing customized bridge stringers from a vendor, it is important to provide the vendor with the information necessary to design and fabricate bridge components that will meet the needs of the project. Whether it is a wooden glulam or all weather steel I beam bridge, the following information should be supplied to the manufacturer.

1. Span length (overall span and free span between sills)
2. Bridge width (outside to outside measurement of stringers)
3. Beam seat design: mudsill, concrete sill, and concrete beam seat
4. Basic drawing of bridge superstructure including the bridge components, dimensions, and materials (e.g. 4- x 6-inch redwood posts, 4- x 6-inch redwood railings, 3- x 12-inch pressure treated Douglas fir decking, etc.)
5. Required live load of bridge (100 pounds per square foot)
6. Estimated snow load, if applicable (obtain from local county building department)
7. Estimated wind shear and seismic conditions, if applicable (obtain from a certified engineer)
8. Railing post layout for post drilling schedule (i.e., the location for pre-drilled holes used to attach the posts) in stringers, angle clips (fiberglass I beam), and metal gussets (all weather steel I beam)

Bridge Superstructure Materials ("Dead Load")

To assist the engineer in calculating the dead load (weight of materials used to construct the bridge), provide the dimensions and species of lumber used for the bridge components that will apply weight to the bridge stringers. This information along with

the bridge span, width, and post layout will enable engineers to calculate the bridge's dead load.

Decking material: redwood, cedar, or pressure treated Douglas fir
3 in. x 12 in. x 72 in. (rough sawn) pedestrian
4 in. x 12 in. x 72 in. (rough sawn Douglas fir) equestrian

Post material: redwood or cedar
4 in. x 6 in. x 72 in. (S4S) pedestrian
4 in. x 6 in. x 96 in. (S4S) equestrian

Top railing material: redwood or cedar
4 in. x 6 in. x 10 ft. (S4S)

Diagonal Railing material: redwood or cedar
4 in. x 6 in. x 12 ft. (S4S)

Decking nailer material: pressure treated Douglas fir (used in steel, aluminum, and fiberglass bridge designs)
3 in. x 6 in. (full dimension) pedestrian
4 in. x 6 in. (full dimension) equestrian

Soil Dam material: redwood, cedar or pressure treated Douglas fir
3 in. x 12 in. x 12 ft. (rough sawn)

Department's Engineered and Stamped Bridge Plans

Engineered stringer charts for log, milled wood, and glulam bridges are available. Custom glulam bridge packages can be engineered by the manufacturer for these types of bridges. In addition, engineered and stamped bridge plans for fiber reinforced plastic I beam, all weather steel I beam, and aluminum truss bridge designs are available. These plans use the superstructure materials and dimensions listed above to determine the dead load. The equestrian lumber dimensions for decking, posts, and nailers are used to ensure that the dead load applies to both pedestrian and equestrian bridges.

Fiber Reinforced Plastic (Fiberglass) I Beam Bridge
The Department has developed engineered plans for fiber reinforced plastic (FRP) I beam bridge stringers less than or equal to 30 feet in length, which can be given to bridge manufacturers for bid and fabrication. This bridge design also utilizes a 4- x 6-inch nailer that is bolted to the top of the I beam. There are also engineered plans for low profile fiberglass stringers (12 inches high), which are less than or equal to 20 feet in length. This bridge design does not utilize a nailer because the decking is bolted directly to the I beam. The nailer was eliminated to lower the bridge height. Links to plans and calculations are provided below.

- FRB Trail Bridge Calculations

- FRB Trail Bridge Design
- FRB Trail Bridge Calculations – Low Profile

All-Weather Steel I Beam Bridge

The Department has developed engineered plans for all weather steel I beam bridge stringers up to 60 feet in length, which can be given to steel fabricators for bid and fabrication. Bridge spans longer than 30 feet are designed with I beam segments that are up to 20 feet long to facilitate transportation to the bridge site. This bridge design also utilizes a 4- x 6-inch nailer that is bolted to the top of the I beam. Links to plans and calculations are provided below.

- All-Weather Steel I Beam Bridge Drawing
- All-Weather Steel I Beam Bridge Calculations

Aluminum Truss Bridge

The Department has developed engineered plans for aluminum truss bridges from 30 to 60 feet in length, which can be given to bridge or aluminum product manufacturers for bid and fabrication. The trusses are segmented with no individual segment exceeding 22 feet in length. This bridge design also utilizes a 4- x 6-inch nailer that is bolted to the top of the I beam. Links to plans and calculations are provided below.

- Aluminum Truss Bridge Drawing
- Aluminum Truss Bridge Calculations

Even when using the Department's engineered bridge plans, the bridge needs to be fabricated by a qualified and properly licensed vendor. Other agencies should review and approve these plans prior to use.

In addition to the Department's engineered bridge plans, attached are plans for the construction of a pipe, hip truss, and overhead truss bridges (also reviewed in chapter 16). These plans have not been engineered and stamped and should be reviewed and approved by a qualified engineer prior to use. Plans can be viewed through the links below.

- Pipe Trail Bridge Drawing
- Hip Truss Trail Bridge Drawing
- Overhead Truss Trail Bridge
- Overhead Truss Trail Bridge Design, 1
- Overhead Truss Trail Bridge Design, 2
- Overhead Truss Trail Bridge Design, 3