



12-9 DESIGN CRITERIA FOR TEMPORARY PREFABRICATED MODULAR STEEL PANEL TRUSS BRIDGES

GENERAL

This memo addresses design criteria for temporary prefabricated modular steel panel truss bridges constructed within the state right-of-way. These types of bridges are built on the project site from an engineered system of ready-to-assemble standardized prefabricated components.

A bridge is defined as “temporary” when it is anticipated to be in service less than 5 years. Temporary bridges are usually used for emergencies, maintenance projects, and traffic detours or for construction operations. These bridges are either specified in the contract documents or are proposed by the contractor.

The following terms are used in this memo:

Modular Bridge—A temporary prefabricated modular steel panel truss bridge.

Modular Highway Bridge—A modular bridge built for carrying vehicular traffic.

Modular Construction Bridge—A modular bridge built exclusively for use during the construction of transportation projects that is not accessible to the public.

Modular Pedestrian Bridge—A modular bridge built for pedestrians, bicyclists, equestrian and light maintenance vehicle traffic.

MODULAR BRIDGE CLASSIFICATIONS

The bridge classifications herein are used by the Division of Engineering Services in determining the design criteria for modular bridges.

A modular bridge must be classified as either a “standard bridge” or a “minor bridge”.

A modular bridge is designated as a standard bridge when it satisfies one or more of the following:

- The bridge carries vehicular traffic.
- The bridge crosses over state highways, local roads, or railroads.

A modular bridge not meeting the designation of a standard bridge should be designated as a minor bridge.



DESIGN REQUIREMENTS

Modular highway bridges must be designed in accordance with the current Caltrans adopted *AASHTO LRFD Bridge Design Specifications and California Amendments (AASHTO-CA LRFD BDS)* for the limit states: Strength I, Strength II, Strength III, Strength V, Fatigue I, Extreme Event I, Extreme Event II, Service I, and for Stability.

Modular construction bridges must be designed in accordance with *AASHTO-CA LRFD BDS* for the limit states: Strength I, Strength II, Strength III, Strength V, Fatigue I, Extreme Event I, Extreme Event II, and for Stability.

Modular pedestrian bridges must be designed in accordance with the current *AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges (AASHTO LRFD GSDPB)* for the limit states: Strength I, Strength III, Extreme Event I, Extreme Event II, Service I, and for Stability.

Bearings, substructures and foundations must be designed in accordance with the *AASHTO-CA LRFD BDS* for the limit states as mentioned above.

Strength I

For modular highway bridges, and modular construction bridges carrying vehicular traffic and crossing over state highways, local roads, or railroads, the design vehicular live load must be HL-93 as specified in *AASHTO-CA LRFD BDS* Article 3.6.1.2.

For modular pedestrian bridges, pedestrian loading, vehicle load, and equestrian load must be as specified in *AASHTO LRFD GSDPB* Article 3.

Strength II

For modular highway bridges, design permit vehicle must be taken as the first five axles of Permit Truck, P15 as shown in *AASHTO-CA LRFD BDS* Figure 3.6.1.8.1-1.

For modular construction bridges, the design vehicular live load and special equipment loads are specified by the contractor. Load factors for Strength II as specified in *AASHTO-CA LRFD BDS* must be applied.

Strength III

For modular highway and construction bridges, wind load must be as specified in *AASHTO-CA LRFD BDS* Article 3.8.1.2 multiplied by a reduction factor of 0.84 corresponding to 10% probability of exceedance in 10 years.



For modular pedestrian bridges, the wind load must be as specified in *AASHTO LRFD GSDPB* Article 3 multiplied by a reduction factor of 0.84 corresponding to 10% probability of exceedance in 10 years.

Strength V

For modular highway and construction bridges, the wind load must be as specified in *AASHTO-CA LRFD BDS* Article 3.8.1.

Fatigue I

For modular highway bridges, and modular construction bridges carrying vehicular traffic and crossing over state highways, local roads, or railroads, the infinite fatigue life design requirements as specified in *AASHTO-CA LRFD BDS* Article 6.6.1.2.2 must be applied.

Extreme Event I

For modular bridges designated as “standard”, seismic load must be as specified in Caltrans *Memo to Designers 20-2 “Site Seismicity for Temporary Bridges and Stage Construction”*. Elastic Dynamic Analysis as specified in Caltrans *Seismic Design Criteria* must be used to determine force demands. Force demands may be divided by a response modification factor of 2.0. Force capacities must be based on the expected material properties in accordance with Caltrans *Seismic Design Specifications* for Steel Bridges.

Extreme Event II

Vehicular Railing

In the interim during the development of MASH-compliant physically crash-tested and approved bridge railing systems for modular bridges, the following criteria are required:

Vehicular railing must be designed for TL-4 design forces as specified in *AASHTO-CA LRFD BDS* Article A13.2. The regulatory speed limit must be posted for 45 MPH or less.

All components in the load path of the modular bridge system must be designed for TL-4 design forces as specified in *AASHTO-CA LRFD BDS* Article A13.2.”

The post spacing of the vehicular railing must not exceed 10 ft as shown in Figure 12-9.1. The top surface of the top railing must be a minimum of 3 ft above the roadway surface and

the top traffic side face of the railing must be set a minimum offset distance of 15 in. in front of the truss as shown in Figure 12-9.2. If the top surface of the top railing is 4 ft or higher above the roadway surface, the top traffic side face of the railing must be set a minimum offset distance of 8 in. in front of the truss as shown in Figure 12-9.3. If the transom spacing exceeds 10 ft but is less than or equal to 15 ft, an additional post must be installed at the midpoint and designed for TL-2 loading. The maximum clear opening below the bottom rail, the setback distance, and the maximum opening between rails must satisfy requirements in the *AASHTO-CA LRFD BDS* Article A13.1.1.

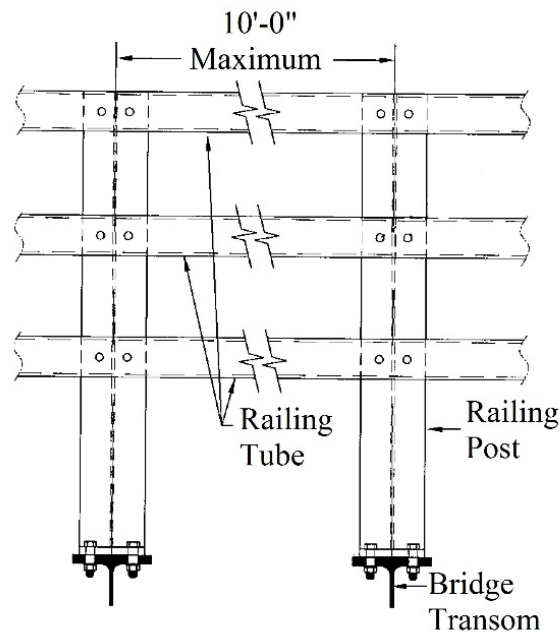


Figure 12-9.1 Vehicular Railing Elevation

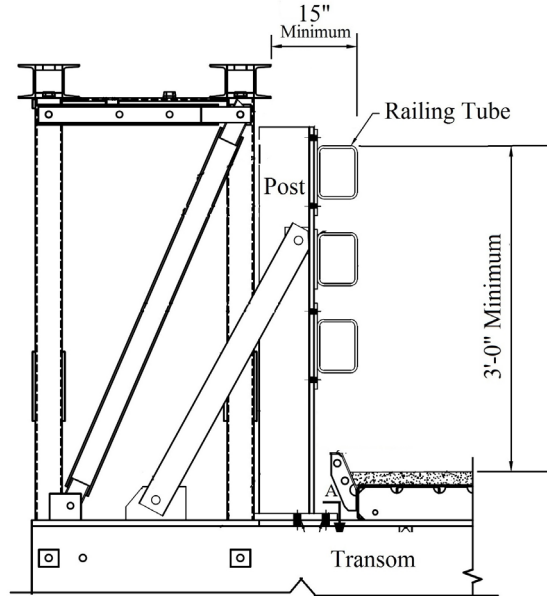


Figure 12-9.2 Vehicular Railing Offset Requirement for Railing Height of 3 ft

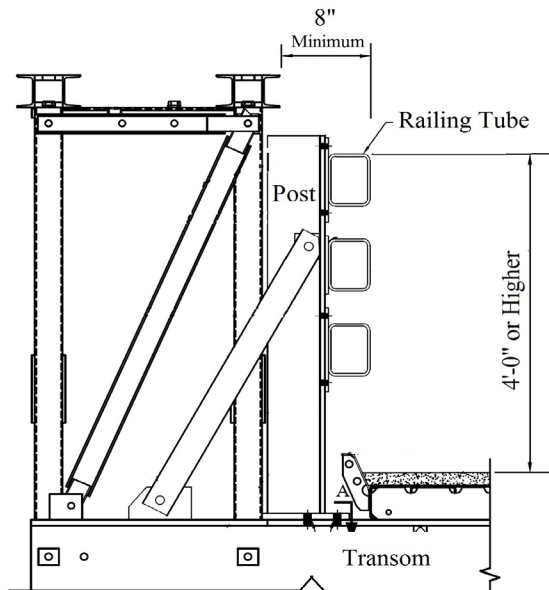


Figure 12-9.3 Vehicular Railing Offset Requirement for Railing Height of 4 ft



Pedestrian and Bicycle Railing

Exterior and interior pedestrian and bicycle railings for a prefabricated sidewalk must meet all geometric and load requirements specified for pedestrian railing from the *AASHTO-CA LRFD BDS* and the tubular hand railing, tubular bicycle railing, and chain link railing in *Caltrans Standard Plans, Bridge Standard Detail Sheets (XS Sheets), and Highway Design Manual*. Exterior pedestrian and bicycle railings must be a minimum of 42 in. above the bridge deck finish surface except when over a railroad for which the minimum standard is 10 ft. Exterior pedestrian and bicycle railings for bridges over a railroad must meet all railroad requirements and *Caltrans Bridge Design Details Section 12: Railroads*.

If an exterior pathway on a bridge carries both pedestrian and bicycle traffic, then the exterior railing must have a 48 in. height minimum per *AASHTO-CA LRFD BDS* Section 13.

Service I

For modular highway bridges designated as “standard”, the vehicular live load HL-93 deflection must not exceed the limit of span length/800.

For modular pedestrian bridges designated as “standard”, the deflection and vibration requirements specified in *AASHTO LRFD GSDPB* Articles 5 and 6 must be applied.

Stability

For modular highway and construction bridges, requirements specified in *AASHTO-CA LRFD BDS* Article 6.14.2.9 must be applied.

For modular highway and construction bridges, the top chord must be considered as a column with elastic lateral supports at the panel points. The compression resistance must be in accordance with the *AASHTO-CA LRFD BDS* using either the effective length factor or the second-order analysis procedure as specified in the *AASHTO-CA LRFD BDS* Articles 4.6.2.5 and C4.6.2.5.

For modular pedestrian bridges, the stability requirements specified in the *AASHTO LRFD GSDPB* Article 7 must be applied.

Original signed by Thomas A. Ostrom

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