

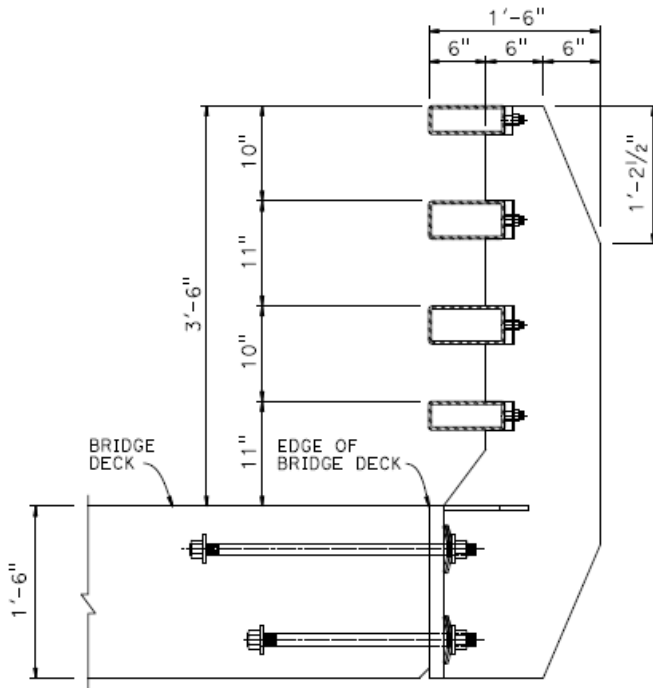
Section 16 – Barriers & Railings

California ST-70SM Side Mounted Bridge Rail

XS Sheet Numbers

XS16-115-01, 02, 03, 04, 05, and 06

Description of Component



TL-4 rating, applicable for high speed locations, greater than 45 mph, and can therefore also be used in TL-2 low speed locations (speed limits equal to or less than 45 mph).

Steel post and beam style bridge rail

Approved per MASH 2016 (AASHTO Manual for Assessing Safety Hardware), initially posted to Bridge Standard Detail Sheets web page on January 2019.

4-Tube steel Combination Railing (vehicular/bicycle)

Hollow Structural Section (HSS) steel tube railing mounted on steel plate posts on steel anchor plates that are side mounted to deck slab or approach slab.

Connected to outside face of bridge deck slab or approach slab over wingwalls with reinforcing, anchor bolts, and anchor plates.

Height is 42 inches

Width is 1 foot – 6 inches (measured from the outside face of the concrete deck slab)

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Post Spacing is 10 feet maximum. Post spacing between BB and EB should be equal spacing. Post spacing on wingwalls may be different than on bridge deck.

Aesthetic See-Through Railing

Standard Drawing Features

XS16-115-01

- General notes
- Shim Details
- HSS steel tube cross-section with welded studs
- Elevation View & Plan View on Bridge

XS16-115-02

- Notes
- Cross-section of ST-70SM mounted to side of approach slab over wing wall
- Elevation view of Base Plate and Disc spring mount to the outside face of deck slab or approach slab
- Plan view and Elevation view of additional transverse slab reinforcement at post location
- Cross-Section of a Concrete Anchor Block transition details on an approach slab
- Cross-section of ST-70SM attached to outside face of bridge deck slab

XS16-115-03

- Notes
- Multiple views of Standard Sleeve & Expansion Sleeve details
- Elevation View of Standard Splice and Expansion Splice Details
- Alternate HSS steel tube welded standard splice
- XS16-115-04 Post Elevation View and Post cross-section view
- HSS steel tube rail end and cap plate details
- Cross-section of the anchor bolts and disc springs
- Cable end details for bicycle clear opening compliance
- Multiple details for Disc springs to be mounted on anchor bolts

XS16-115-05

- Parapet shoe details including elevation views, section views and isometric view

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The parapet shoe is the welded steel assembly that provides a tapered surface between the clear openings of the steel bridge rail where the HSS steel rail tubes meet the concrete end blocks. The parapet shoe ensures that any portion of an impacting vehicle that has crushed into the clear openings will be smoothly redirected back out to the traffic face of the bridge rail/concrete end block.

XS16-115-06

- MASH compliant details for approach end block details and features the vertical slotted holes to aid with the constructability of Transition Railing (Type AGT) and MGS.

Caltrans is adapting bridge approach end block per the crash tested and approved details developed by the Midwest Roadside Safety Facility (MwRSF) at the University of Nebraska (TRP 03-367-19-R1) for the MwRSF Pooled Fund of which Caltrans is a member State DOT.

The end of the approach end block tapers down in height to 35" above shoulder FG.

Design/General Notes

- Design: AASHTO LRFD Bridge Design Specifications, 8th Edition with California Amendments.
- Live Loading:
 - HL 93 and permit design load.
- Vehicular Collision Force:
 - Test Level TL-4
- Concrete:
 - $f_y = 60$ kips per square inch (ksi) (ASTM A706/706M, Grade 60)
 - $f'_c = 3.6$ ksi
 - $n = 8$
- Structural Steel:
 - Posts & Plates: $f_y = 36$ ksi min. (ASTM A709/A709M, Grade 36 or Grade 50, ASTM A36/A36M or ASTM A572/A572M, Grade 42 or Grade 50)
 - Rails: $f_y = 46$ ksi (ASTM A500/A500M Grade B or ASTM A1085/A1085M)
 - Anchor Bolts: ASTM 1554, Grade 55
 - Structural steel bridge rail elements, anchor bolts, and associated hardware must be galvanized per Standard Specifications 75-1.02B "Galvanizing".

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Designers must ensure that any supporting structures, such as the deck or overhang, meet the requirements in the AASHTO LRFD Bridge Design Specifications, Appendix in Section 13, Railings, as amended by Caltrans' California Amendments.

There are three applicable load cases:

- Case 1: Extreme Event II (transverse and longitudinal forces)
- Case 2: Extreme Event II (vertical forces)
- Case 3: Strength I

Disc springs shall be pretensioned to total 10,000 lbs. per anchor rod.

For projects located in a corrosive environment, refer to the AASHTO LRFD Bridge Design Specification Section 5.10 for using epoxy-coated rebar and Standard Specifications 2023 section 52-2.

Crashworthiness:

Refer to the [Division of Research, Innovation and System Information Research Final Reports](#) for the Vehicular Crash Tests of the California ST-70SM Bridge Rail Final Report (it is listed under "Task 2557 - Compliance Crash Testing of a Manual for Assessing Safety Hardware (MASH) 2009 Test Level 4 Side Mounted Bridge Rail (PDF) - February 2017").

Additional Drawings Needed to Complete PS&E

If the bridge rail concrete transition end blocks for a project are going to connect to something other than the guardrail transition Standard Plans for either Transition Railing (Type AGT) or Midwest Guardrail System, then special designed details will be required.

Contract Specifications

Caltrans Standard Specifications: Section 51 Concrete Structures, Section 52 Reinforcement, Section 55 Steel Structures, Section 59 Structural Steel Coatings, Section 75 Miscellaneous Metal, Section 83 Railings and Barriers, and Section and 91 Paint.

Restrictions on Use of Standard Drawings

- A special design is required if CA ST-70SM Side Mounted Bridge Rail is mounted on a barrier moment slab or earth retaining system.
- Sound walls cannot be mounted on the CA ST-70SM Side Mounted Bridge Rail.

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- A special design is required to mount a Chain Link Railing (CLR) to the CA ST-70SM Side Mounted Bridge Rail. It is generally recommended not to attach chain link railing to ST-70SM because it is counterproductive to the concept of see-thru/clear view, but CLR is required where a bridge crosses over railroad tracks.
- A special design is required for retrofitting this bridge rail onto an existing slab bridge deck with the approval of the Caltrans/Division of Engineering Services/Office of Design & Technical Services, Bridge Rail Technical Specialist. Retrofitting this bridge rail should not be considered onto existing barrier moment slab because it will require the replacement of the entire existing barrier moment slab.
- This bridge rail meets the minimum bicycle railing height requirement of 42” so it was not crash tested with any separate bicycle railing attachment (see AASHTO LRFD Bridge Design Specifications Section 13). If a specific bridge at a specific location called for a bicycle railing height greater than 42”, then a special design would be required.

Special Considerations

It is strongly recommended that the first two or three projects to use the CA ST-70SM Side Mounted Bridge Rail be done as demonstration projects. These demonstration projects will be to monitor the disc springs and the bolt/nut/washer assemblies after any vehicular impacts to detect any deformation or change in pre-tensioning called for on the standard details. To improve the odds of collecting useful data, the ideal locations would be slab bridges on a roadway section on a sharp curve.

Aesthetic see-through bridge railings such as the CA ST-70SM are preferred by the California Coastal Commission for use within the Coastal Zone but may be selected for any location where a Context Sensitive Solution is warranted.

Regarding aesthetics:

- All the steel railing components require a galvanized coating, galvanized steel railing components can be painted. There are no restrictions on choice of paint color for the steel elements, except that yellow cannot be used because the MUTCD reserves that color for the median striping (cannot have a yellow-colored bridge rail at outside edge of structure/roadway). Common choices are: the galvanized dull grey (unpainted but coated with copper sulfate solution), the galvanized chrome grey (unpainted), Natina Stain (rusty brown or mottled rusty

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brown) over the galvanized steel railing, or white, light blue, green, black, brown or Golden Gate orange paint over the galvanized steel railing.

- To match a design of a custom pedestrian or bicycle railing on the bridge or some feature near the bridge, an aesthetic metal bar design can be added in between the steel tubes. If this is desired, it must be attached behind the traffic-side of the steel posts.

The height above Finish Grade for bridge railing at completion of construction contract cannot be less than the heights shown on the Standard Plan sheets for CA ST-70SM. For example: 4 inch height above concrete deck with no overlay, or 42 inch height above the Finish Grade of a polyester concrete overlay.

If an overlay is planned for a bridge deck with an existing CA ST-70SM Bridge Rail, the deck surface should be removed to an equivalent depth of the overlay thickness for the height above Finish Grade to remain the same. The other option is for the planned deck overlay to taper down and end 3 feet away from the toe of the traffic-side of the bridge rail.

Conduits for utilities cannot be attached to the CA ST-70SM.

All project-specific modifications to the CA ST-70SM must be reviewed by the Bridge Railing Technical Specialist in the [Office of Design and Technical Services](#).