



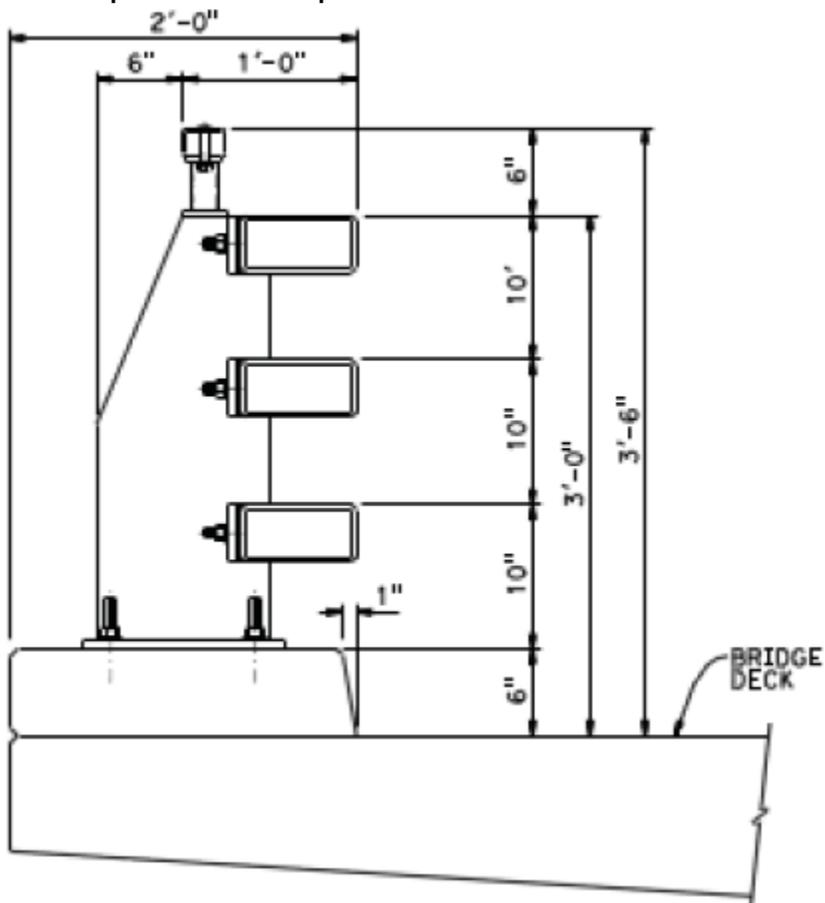
Caltrans® User Guide to Bridge Standard Detail Sheets

Section 16 – Barriers and Railings California ST-75 Bridge Rail

XS Sheet Numbers

xs16-116-1, xs16-116-2, xs16-116-3, and xs16-116-4

Description of Component



California ST-75 Bridge Rail

Replaces California ST-70 Bridge Rail, California ST-20S Bridge Rail, California ST-10 Bridge Rail, and California ST-30 Bridge Rail.

Approved per MASH 2016 (AASHTO Manual for Assessing Safety Hardware)

3 Tube Combination Railing (vehicular/bicycle)

Approved to TL-4 high speed locations (speed limits 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).



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Post and Beam style metal bridge rail on concrete curb that is connected to bridge deck, wingwall, retaining wall, concrete barrier moment slab, structure approach slab, or special designed top slab of concrete box culvert where the top slab acts as the vehicular riding surface. This bridge rail is connected to the structure it is mounted on with reinforcing, anchor bolts, and anchor plates.

Vehicular height is 3 feet – 0 inches above the bridge deck or Finish Grade. Bicycle railing height is 3 feet – 6 inches above the bridge deck or Finish Grade.

Width is 2 feet – 0 inches.

Post spacing is 10 feet – 0 inches maximum.

Aesthetic see-through railing.

Standard Drawing Features

All four of the Bridge Standard Detail Sheets must be included in the contract plans:

Sheet Number: xs16-116-1

Includes typical rail system, anchor plates, base plate, shim plate details, and additional transverse deck rebar needed at post locations.

Sheet Number: xs16-116-2

Includes steel post and end block side view and Plan view. Elevation view of steel rail on concrete curb with approach and departure concrete transition end blocks. And rail end cap details.

Sheet Number: xs16-116-3

Includes steel post elevation view and side view, and bicycle railing connection details.

Sheet Number: xs16-116-4

Includes details for standard sleeves and expansion sleeves, and Elevation view of standard splices and expansion splices and open joint in curb for the bridge rail.

Design/General Notes

Design Criteria:



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AASHTO LRFD Bridge Design Specifications 6th edition with California Amendments:

Live Loading

- HL 93 and permit design load

Vehicular Collision Force

- Test Level 4

Concrete

- $f_y = 60$ ksi (ASTM A706/706M, Grade 60)
- $f_c = 3.6$ ksi
- $N = 8$

Structural Steel

- Posts & Plates: $f_y = 36$ ksi (ASTM A709/A709M, Grade 50)
- Rails: $f_y = 46$ ksi (ASTM A500/A500M Grade B)
- 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.

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.

Supporting elements, such as the deck and overhang, must be designed to three applicable load cases:

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

The clearance to reinforcement in the concrete curb is 2 inches at the traffic face and back face, and 1 inch on the top. The clearance to reinforcement in the concrete transition end blocks at the approach and departure ends is 1 inch at the traffic face, the back face, and the top.

For projects located in a corrosive environment, refer to the AASHTO LRFD Bridge Design Specification Section 5.12 for using epoxy coated rebar and Standard Specifications 2018 section 52-2.



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California ST-75 Bridge Rail was designed and checked as a new MASH-compliant bridge rail design including Finite Element Analysis.

Crashworthiness:

Refer to the following site for Vehicular Crash Tests of the [California ST-75 Bridge Rail Research Results](#). The Final Crash Test Report and other general information will be posted to the Division of Research and Innovation and Systems Information webpage for [Research Final Reports in the Geotechnical and Structures subsection](#) by July 2020. An FHWA Letter of Eligibility is no longer required by FHWA, but one will be requested after approval and posting as a matter of formality and to get this bridge rail added on the FHWA list of approved MASH bridge rails. More information regarding MASH Implementation by Caltrans can be found at the [Caltrans Division of Traffic Operations webpage for Implementation of the Manual for Assessing Safety Hardware \(MASH\)](#).

Utilities and Future Overlays:

No conduits are permitted in the 6-inch height concrete curb.

If an overlay is being added to the bridge deck or approach slab on the same contract that the bridge rail is being constructed, then the concrete curb should be constructed to an additional height equal to the depth of the overlay so that, after the overlay is placed, the height of the concrete curb is 6 inches above the Finish Grade of the overlay, and the height of the vehicular rail will still measure 3 feet – 0 inches above the Finish Grade which in this case is measured from the top of the overlay instead of the concrete bridge deck. It's important to note that the anchor bolts will need to be lengthened in this case by an amount equivalent to the depth of the overlay placed against the curb face of the ST-75 bridge rail.

If an overlay is planned for an existing bridge deck with an existing California ST-75 Bridge Rail, then consider the following options:

- No overlay.
- Taper the overlay down to zero or to its minimum depth and stop at least 3 feet – 0 inches away measured transversely from the traffic side toe of the concrete curb of the bridge rail.
- If need overlay to extend all the way to the curb face such as in a marine environment or in snow country where it is needed to seal the deck surface, then taper down the depth of the overlay starting at the Edge of Travelled Way down to the minimum depth that the type of overlay can be placed, then at that point



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start to remove surface of the deck shoulder down to the equivalent of the minimum possible overlay depth at the toe of the curb of the ST-75 so that that minimum depth of the overlay can be placed all the way to the toe without reducing the 3 feet – 0 inch height of the bridge rail measured from the Finish Grade of the overlay (this will minimize the area of deck shoulder that needs some surface removal). If this is not possible, then may have to replace the existing bridge rail in conjunction with an overlay placed all the way to the toe of the bridge rail. Note that if a policy or the existing bridge condition does not permit removing a portion of the top of the bridge deck surface for any specified reason, then the overlay options are limited to either no overlay, or no overlay within 3 feet – 0 inches from the toe of the bridge rail, or overlay all the way to the toe of the bridge rail in conjunction with a bridge rail replacement.

- If the shoulder is narrow which leaves little or no distance to taper down the overlay depth, then choose an overlay material that can be applied in the thinnest possible depth section and only remove the minimum area and minimum depth of deck surface close to the toe of the bridge rail in order to preserve the 3 feet – 0 inch height of the existing CA ST-75 vehicular rail and the 3 feet – 6 inch height of the bicycle railing.

Additional Drawings Needed to Complete PS&E

Connection of CA ST-75 bridge rail concrete transition end block to guardrail transitions at approach and departure ends: Standard Plans A78F1 & A78F2 for Thrie Beam Barrier guardrail or Standard Plans A77U1 & A77U2 for Midwest Guardrail System (MGS).

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 Thrie Beam Barrier guardrail or Midwest Guardrail System, then special designed detail drawings will be required.

Contract Specifications

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



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Restrictions on Use of Standard Drawings

- A special design is required if CA ST-75 is mounted on an earth retaining system.
- Sound walls cannot be mounted on the CA ST-75.
- A special design is required to mount a chain link railing to the CA ST-75.
- A special design is required for retrofitting this bridge rail onto an existing bridge deck, existing retaining wall, or existing barrier moment slab. Due to the need for the anchor bolts and anchor plates as well as the additional transverse deck bars at each post location, this bridge rail cannot be considered for placement onto an existing bridge without removal and replacement of the existing bridge deck overhang. The additional transverse bridge deck bars at the post locations cannot reach the required minimum 2 feet – 0 inches inward from the exterior girder with a deck overhang removal and replacement, so near surface deck strengthening should be considered if the CA ST-75 is desired to be added to an existing bridge. The CA ST-75 cannot be retrofitted onto the top of an existing retaining wall unless the existing retaining wall was designed for the transfer of vehicular impact loading, and -if so- the top of the existing wall will need to be removed and replaced due to the need for the anchor bolts and anchor plates. If CA ST-75 is desired as a bridge rail at the top of an existing retaining wall that was not designed for the transfer of vehicular impact loading, then either the CA ST-75 will have to be mounted on a concrete barrier moment slab that extends over the top of the existing retaining wall or be mounted on a structure approach slab that extends over the top of the existing retaining wall or wing wall.
- This bridge rail was crash tested with the bicycle railing attached (offset 9 inches from the top of the traffic-side of the vehicular rail), and it passed, so per CA Amendment to AASHTO LRFD Bridge Design Specifications Section 13.9.2 Bicycle Railings, Geometry, the bicycle railing is acceptable without being offset by 15 inches from the top of the traffic-side of the vehicular rail.



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Special Considerations

Aesthetics:

Aesthetic see-through bridge railings such as the CA ST-75 are preferred by the California Coastal Commission for use within the Coastal Zone, and may also be selected for any location where a Context Sensitive Solution is warranted.

In regards to aesthetics:

- There are no restrictions on choice of coating color for the steel elements. 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 brown) over the galvanized steel railing, or white, light blue, green, black, brown or Golden Gate orange paint over the galvanized steel railing.
- Aesthetic metal bar design can be added in between the steel tubes if a custom artistic design is desired. This could be done to match a design of a custom pedestrian or bicycle railing on the bridge or to match or complement some feature on or near the bridge. 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-75.

Fixed objects, such as lighting standards or bridge-mounted signs, must be placed on a corbel or pedestal on an outcropped portion of the deck overhang on the back side of the steel bridge rail that will require a special designed detail. For special situations, contact both the Signs and Overhead Structures Technical Specialist and the Bridge Railing Technical Specialist in the Caltrans, Division of Engineering Services, Office of Design and Technical Services by email at [DES Design and Technical Services](#).

All project-specific modifications to the CA ST-75 must be reviewed by the Bridge Railing Technical Specialist in the Caltrans, Division of Engineering Services, Office of Design and Technical Services. Contact the Bridge Railing Technical Specialist by email at [DES Design and Technical Services](#).