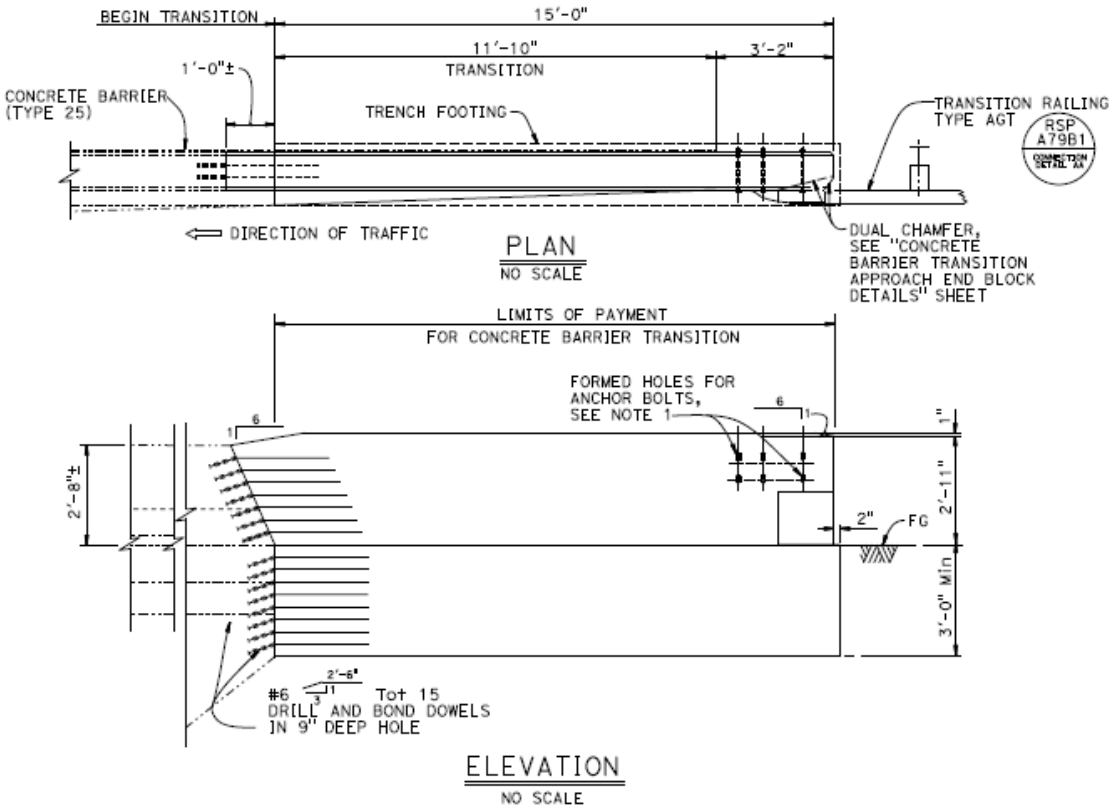
Section 16 – Barriers and Railings
Concrete Barrier Transitions

XS Sheet Numbers

xs16-010, xs16-020, xs16-025, xs16-026, xs16-027, xs16-030, and xs16-034

Description of Component



Sample Concrete Barrier Transition (Type 25 shown above)

Approach Guardrail Transitions (AGTs) are commonly used to shield the approach ends of bridge rails and/or concrete barriers as well as provide a safe transition in lateral stiffness between deformable guardrail and the rigid parapet. AGTs are sensitive systems that are designed to gradually increase the lateral stiffness along the transition length. Improper designs or abrupt changes in lateral stiffness can result in guardrail pocketing, vehicle instability, and vehicle snag.

Concrete Barrier Transitions are used to connect AGT or MGS to existing bridge rails with end blocks that were not designed to connect to these AGT or MGS systems. These Concrete Barrier Transitions meet MASH 2016 (Manual for Assessing Safety Hardware) and rated for TL-3.

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Caltrans policy is to use 20:1 taper or flatter (20 longitudinal: 1 transverse in PLAN view for any roadside safety device tapering in toward the vehicular traffic lanes), it is also per AASHTO Roadside Design Guide. Caltrans adapted 6:1 or flatter vertical transition (6 Horizontal:1 Vertical) according to approved MASH crash test reports.

Vehicular rail height is 3 feet – 0 inches above Finish Grade with the exception of a Type 2 Concrete Barrier Transition which is 3 feet – 7 inches above Finish Grade.

Standard Drawing Features

These Bridge Standard Detail Sheets are independent sheets that can be integrated into a project depending on the existing bridge barrier needing the transition to AGT. The Concrete Barrier Transition Approach End Block Detail (xs16-034) is the only one detail sheet that needs to be combined with any of the other details specific to the existing barrier type (e.g. Type 1, Type 2, Type 25, etc.).

Sheet Number: xs16-010 (Type 25)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, and concrete barrier reinforcement with typical drill and bond connections to existing bridge railing. This sheet is supplemented by xs16-034 as mentioned in Note 1.

Sheet Number: xs16-020 (Type 27)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, required concrete removal limits, and concrete barrier reinforcement with typical drill and bond connections to existing bridge railing. This sheet is supplemented by xs16-034 as mentioned in Note 1.

Sheet Number: xs16-025 (Type 1)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, and concrete barrier reinforcement with typical drill and bond connections to existing bridge railing. This sheet is supplemented by xs16-034 as mentioned in Note 1.

Sheet Number: xs16-026 (Type 2 – Alternatives 1 & 2)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, and concrete barrier reinforcement with typical

drill and bond connections to existing bridge railing. Caltrans policy is to use 20:1 taper or flatter (20 longitudinal: 1 transverse in PLAN view for any roadside safety device tapering in toward the vehicular traffic lanes), it is also per AASHTO Roadside Design Guide. This sheet is supplemented by xs16-034 as mentioned in Note 1.

Sheet Number: xs16-027 (Type 2 – Alternative 3)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, and concrete barrier reinforcement with typical drill and bond connections to existing bridge railing. Caltrans policy is to use 20:1 taper or flatter (20 longitudinal: 1 transverse in PLAN view for any roadside safety device tapering in toward the vehicular traffic lanes), it is also per AASHTO Roadside Design Guide. This sheet is supplemented by xs16-034 as mentioned in Note 1.

Sheet Number: xs16-030 (Type 9)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, and concrete barrier reinforcement with typical drill and bond connections to existing bridge railing. This sheet is supplemented by xs16-034 as mentioned in Note 1.

Sheet Number: xs16-034 (Approach End Block Details)

Includes elevation and plan views for typical railing system with approach concrete transition end blocks, typical sections, and concrete barrier reinforcement with typical drill and bond connections to existing bridge railing. This sheet provides close-up and additional details at the connection to AGT and must be used when other concrete barrier transition XS-Sheet (or XS-Sheets) are used. The end of the approach end block tapers down in height to 35” above shoulder FG.

Design/General Notes

Design Criteria:

AASHTO LRFD Bridge Design Specifications 8th edition with California Amendments:

Live Loading

- HL 93 and permit design load

Vehicular Collision Force

- MASH 2016, Test Level 3

Concrete

- f_y = 60 ksi (ASTM A706/706M, Grade 60)
- f'_c = 3.6 ksi

You may use Rapid Strength Concrete (RSC) according to Standard Specifications, Section 51-1.02D which states that "RSC must have a minimum 28-day compressive strength of 4,000 psi" for bridge rails and concrete barriers.

Concrete for Bridge rails and barriers must NEVER be minor concrete. Note that it is permissible to use either higher strength concrete mixes or rapid strength concrete mixes to reach the required concrete strength shown above in less than 28 days.

For projects located in a corrosive environment, refer to the AASHTO LRFD Bridge Design Specification Section 5.12 for using epoxy-coated rebar, Standard Specifications Section 52-2, and Structure Technical Policy 5.1 (STP 5.1) Corrosion Protection for Structural Concrete Elements. Designers may also use stainless steel reinforcement, per Standard Specifications, stainless steel reinforcement must comply with ASTM A955/A955M, Grade 60, UNS Designation S31653, S32304, S32205, or S31803.

Crashworthiness:

The AGT was approved by the Caltrans Highway Safety Features New Product Committee (HSFNPC) for MASH 2016 compliance. 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.

The report is available from the Caltrans Division of Research, Innovation and System Information (DRISI), Roadside Safety Research Group. More information regarding MASH Implementation by Caltrans can be found at the Caltrans/Division of Safety Programs Implementation of the Manual for Assessing Safety Hardware (MASH) webpage.

Utilities and Overlays:

Any drainage or utility conflict should be relocated or a special design is required.

If a deck overlay is being added to the bridge deck or approach slab or concrete barrier moment slab on the same contract that the concrete barrier transition is being constructed, then the transition height should be constructed to an additional height equal

to the depth of the overlay so that, the height of the concrete barrier transition from FG shall be equal to the height shown on the XS-Sheet, after the overlay is placed.

Additional Drawings Needed to Complete PS&E

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

To connect to Midwest Guardrail System on the departure side of bridges, modify the end block by following instructions given in “Note 2” in XS16-034 to allow for connection to MGS. “Note 2” references “BRIDGE DEPARTURE CONNECTION DETAIL BB" on Revised Standard Plan RSP A79B1 (currently Standard Plan A79B1) and "DETAIL C" on XS16-034. Concrete barrier transition length (15 feet minimum) and foundation shall be as per the Concrete Barrier Transition XS-Sheet used.

Attention is directed to HDM, Topic 309.1(2) “Clear Recovery Zone (CRZ)”, if departure end block is within the Clear Recovery Zone (CRZ, 30 feet minimum desirable for expressways and freeways and 20 feet minimum desirable for conventional highways) of opposing traffic, then use the APPROACH END BLOCK at departure end.

Contract Specifications

Caltrans Standard Specifications: Section 51 Concrete Structures, Section 52 Reinforcement, Section 55 Steel Structures, and Section 83 Railing and Barriers.

Restrictions on Use of Standard Drawings

Use of XS-Sheets are outlined in Bridge Design Details 1.6. Site conditions as specified below must be satisfied in order to use the Bridge Standard Details (as detailed).

- Require a minimum 3-feet of level ground (horizontal bench) behind the barrier transition prior there being a hinge point where the ground begins to slope down by 2:1 (2Horizontal:1Vertical) or fatter.
- Concrete Barrier Transition cannot function as a retaining wall. An upward sloping ground condition behind the transition is allowed as long as there is not soil pressure pushing on the transition. You may construct a concrete gutter behind the concrete barrier transition similar to “Detail B” in Traffic Safety System Manual (TSSM), Figure 8.

- Minimum concrete barrier transition length is 15 feet, and requires full length of trench footing at full depth as shown on the concrete barrier transition XS-Sheets. Scuppers are not allowed, any drainage or utility conflict should be relocated or a special design is required to span over an existing drainage inlet.

When all the design criteria outlined in the Design/General Notes Section are not met, or restrictions on use of these details above are encountered, a special design is needed. For special situations, contact 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.

Special Considerations

Architectural texture can be added to the surface of the concrete barrier transition, but the depth of texture must be added to the outside of the cross section of the standard details (so a textured barrier will be wider than the standard barrier and this will affect the concrete barrier transition width). If architectural texture is desired, contact the Bridge Railing Technical Specialist.

The height above Finish Grade at completion of construction contract cannot be less than the heights shown on the Bridge Standard Detail Sheets.

All project-specific modifications to the Concrete Barrier Transitions 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.

Designers must ensure that every site location meets the design criteria used in this User Guide. Ensure that no Restrictions on Use of Standard Drawings are violated.

When a Special Design is needed, contact 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. The Technical Specialist will be able to address any questions about unique site conditions and provide further instructions.

Unlike Standard Plans, use of Bridge Standard Details (XS-Sheets) require designers to stamp the plans. Be sure to understand the design limitations of these details and don't attempt to do a special design if you don't have the experience. An Engineer of Record

(EoR) is legally and professionally responsible for the design, safety, and regulatory compliance of an engineering project. This means that the responsibility extends into providing construction support if there are issues that come up. Ensure your design details are developed using this User Guide.