## NOTES:

1. Shop Drawings are required.

2. Work with Specification Section 515.

3. Materials:

   A. Pan Head Set Screws: Aluminum Alloy 2024-74 or 7075-T73 or Stainless Steel (SS) Type 316 or 18-8 Alloy.

   B. Base Plates and Cap Plates: ASTM B209, Alloy 6061-T6

   C. Structural Pipe Tube and Bars: ASTM B221 or ASTM B429, Alloy 6061-T6

   D. End Rails 90° bends and corner bends with a maximum 4 foot spacing: Alloy 6063-T6 is permitted.

| RAILING MEMBER DIMENSIONS TABLE | | | |
|---|---|---|---|
| MEMBER | DESIGNATION | OUTSIDE DIMENSION | WALL THICKNESS |
| Posts | 2" NPS (Sch. 40) | 2.375" | 0.154" |
| Rails | 2" NPS (Sch. 40) | 2.375" | 0.154" |
| Rail Joint/Splice Sleeves | 1½" NPS (Sch. 40) | 1.900" | 0.145" |
| Handrails Joint/Splice Sleeves | 1" NPS (Sch. 40)<br>1.50 ODx0.125 Wall | 1.315"<br>1.500" | 0.133"<br>0.125" |
| Handrails | 1½" NPS (Sch. 40) | 1.900" | 0.145" |
| Handrail Support Bar | 1" Ø Round Bar | 1.000" | N/A |

   E. Galvanized Steel Fasteners:
      a. Hex Head Bolts: ASTM A 307 Type 1 or ASTM F1554 Grade 36
      b. Adhesive Anchors: ASTM F1554 Grade 36 fully threaded rods
      c. Hex Nuts: ASTM A563
      d. Flat Washers: ASTM F436

   F. Aluminum Shims: ASTM B209, Alloy 6061

   G. Bearing Pads: Plain, Fabric Reinforced, or Fabric Laminated meeting requirements of Specification Sections 515 & 962 for Ancillary Structures.

4. Fabrication:

   A. Place expansion joints at a maximum of 30'-0"spacing
   B. Field splices are similar to the expansion joint detail and may be approved by the Engineer to facilitate handling; but top rail must be continuous across a minimum of two posts.
   C. Continuity field splice (Detail "E"); only use to make the railing continuous for unforeseen field adjustments
   D. Corners and changes in tangential longitudinal alignment may be made continuous with a 9" bend radius or terminated at adjoining sections with a standard end hoop when handrails are not required.
   E. For curved longitudinal alignments, shop bend top and bottom rails and handrails to match the alignment radius.
   F. For changes in tangential longitudinal alignment greater than 45°, position posts a maximum of 2'-0" each side of the corner, not at the corner apex.

5. Handrails are required and must be continuous at landings for:

   A. Grades Steeper than 5%
   B. Three or more steps

6. Cutting of reinforcing steel is permitted for post installed anchor bolts.

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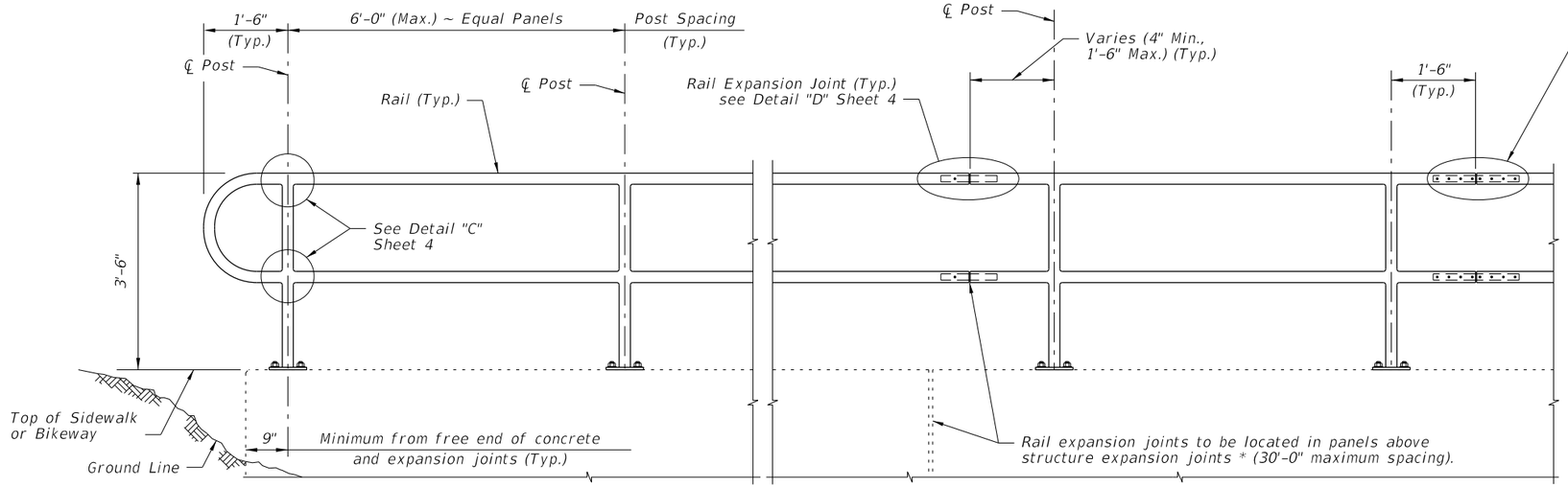


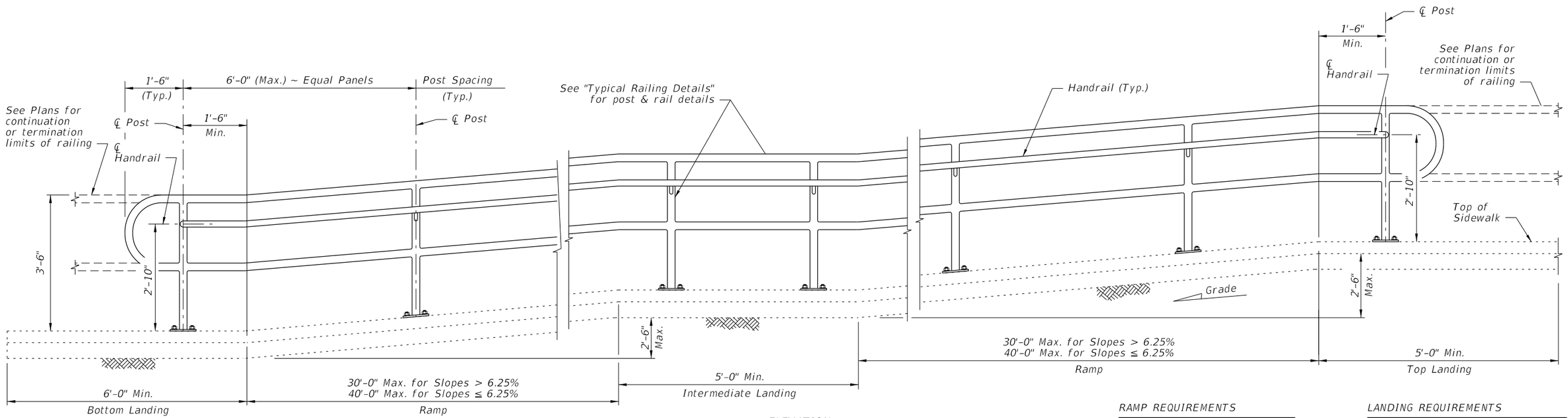

ELEVATION

NOTES:
NPS = Nominal Pipe Size

STRUCTURES EXPANSION JOINTS NOTE:
* Keyed construction joints in Index No. 6011 Gravity Wall are not considered to be expansion joints.

CROSS REFERENCE:
For Details "C", "D" and "E", see Sheet 4.

## TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%




ELEVATION
(Showing Inside Face of Railing)

RAMP REQUIREMENTS

For slopes greater than 5%:
Max. ramp slope = 8.33%
Max. ramp cross-slope = 2.0%

LANDING REQUIREMENTS

Max. landing slope = 2%
Max. landing cross-slope = 2%

## RAILINGS ON GRADES STEEPER THAN 5% TO 8.33%

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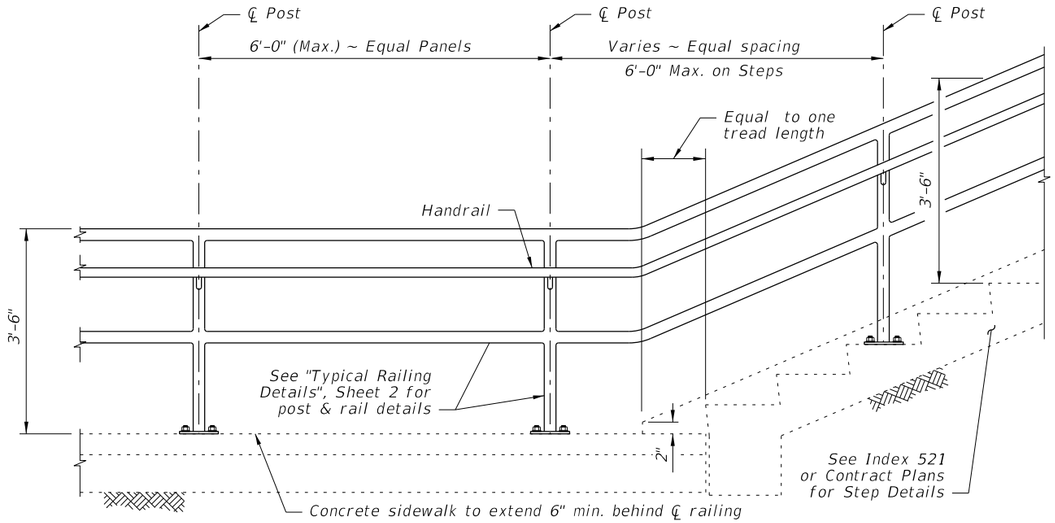
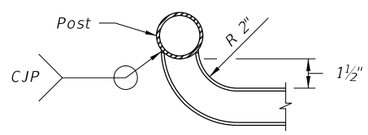
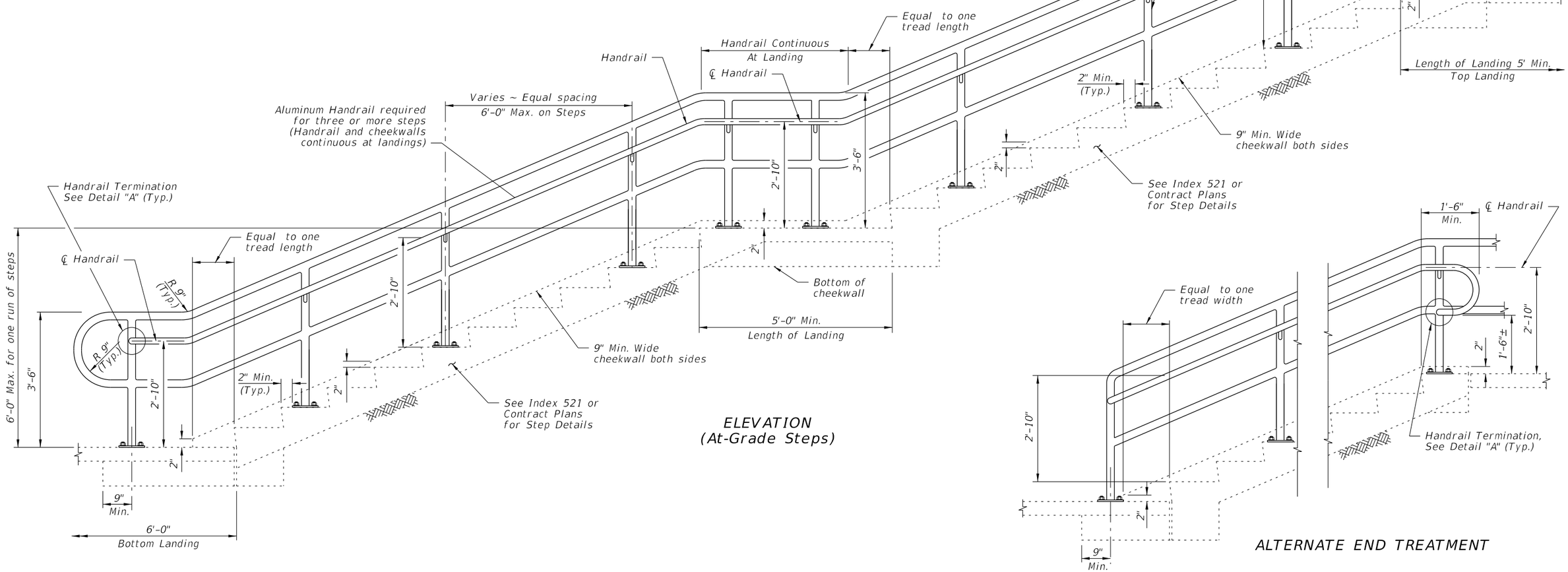
| 11/01/16 | | | | | 870 | 2 of 5 |



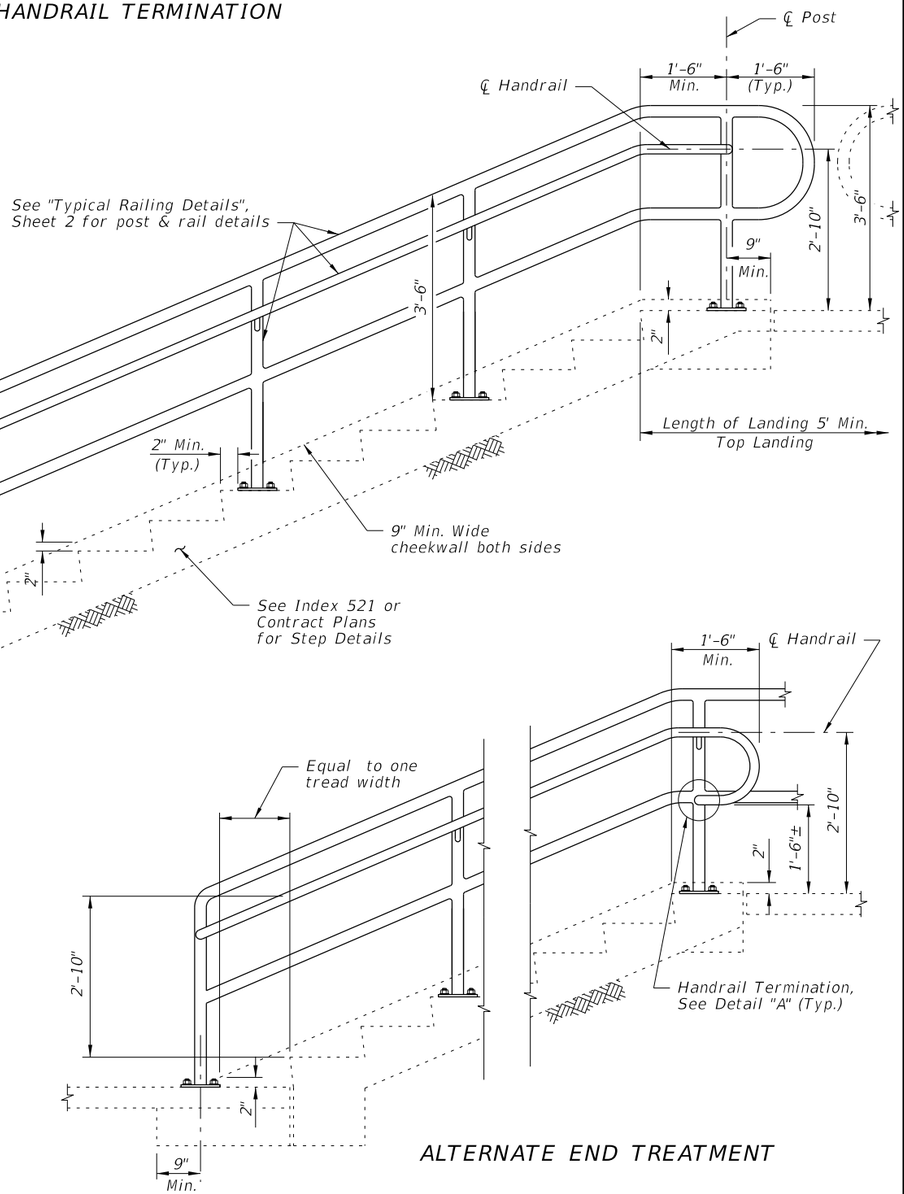

RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)




DETAIL "A" - PLAN VIEW
HANDRAIL TERMINATION




ELEVATION
(At-Grade Steps)







ALTERNATE END TREATMENT

## GUIDERAIL ON STEPS & STAIRS

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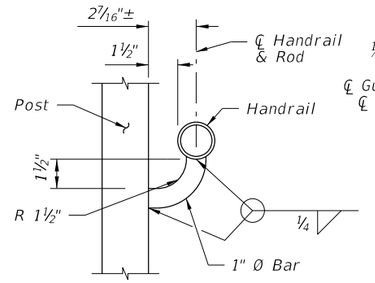
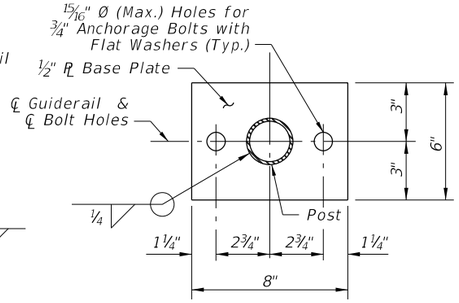
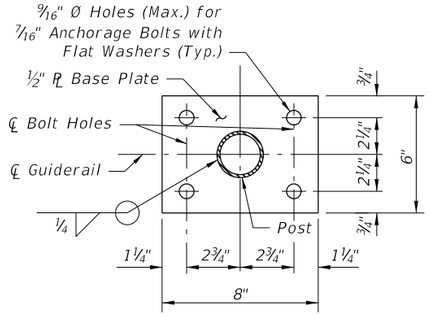


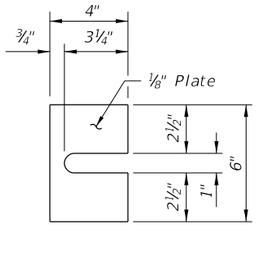

SECTION B-B
(Handrail Connection)



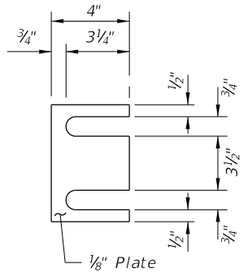

SECTION C-C
BASE PLATE DETAIL
(2~Bolt Anchorage)




SECTION C-C
BASE PLATE DETAIL
(4~Bolt Anchorage)




SHIM PLATE DETAIL
(2~Bolt Anchorage)




SHIM PLATE DETAIL
(4~Bolt Anchorage)

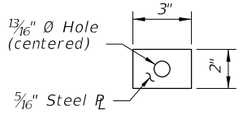
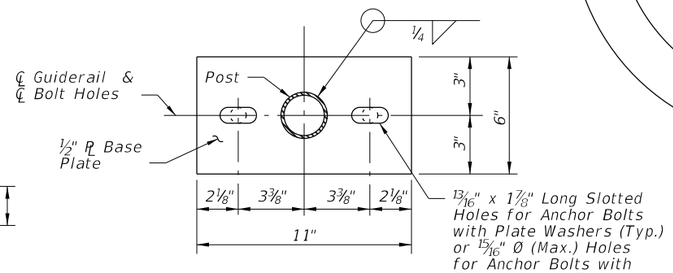
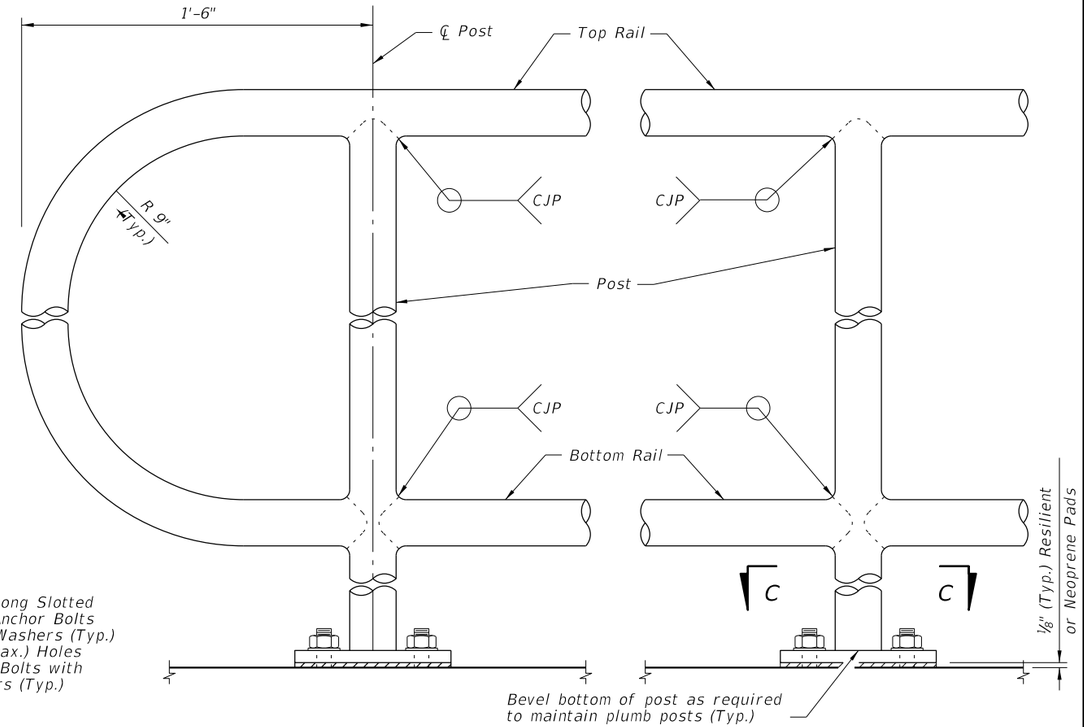


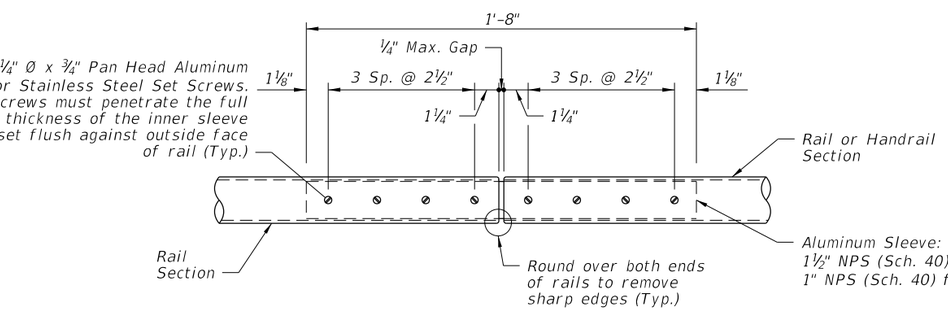

PLATE WASHER
DETAIL




ALTERNATE BASE
PLATE DETAIL
(Recommended for Steep Slopes)




DETAIL "C" - RAIL CONNECTIONS
(Handrail and 4~Bolt Anchorage Not Shown)

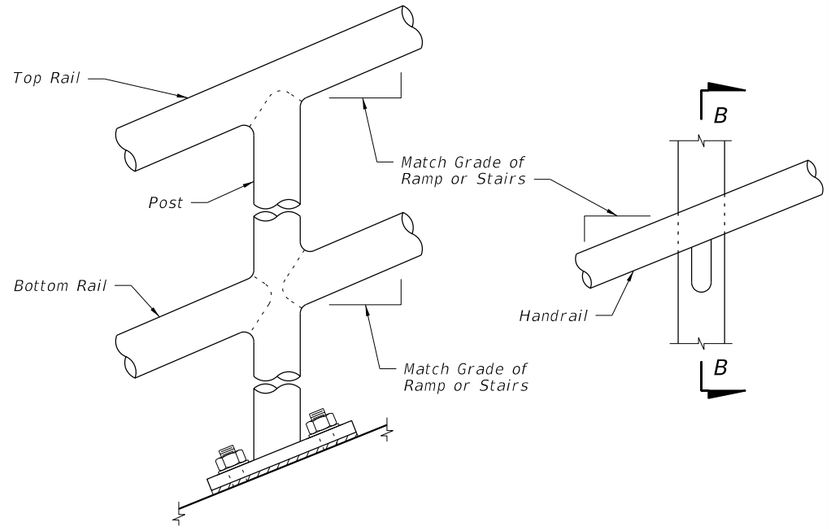



DETAIL "D" - EXPANSION JOINT
(FIELD SPLICE SLIP JOINT SIMILAR)

* At the Contractor's option, embedded length may be 4" when a 3/4" Ø plug weld is substituted for the 1/4" Ø set screw.




DETAIL "E" - CONTINUITY
FIELD SPLICE




DETAIL "B" - RAIL AND HANDRAIL
(Showing Sloped Condition for Ramps with 2~Bolt Anchorage)

CROSS REFERENCE:
For locations of Details "C", "D" and "E", see Sheet 2.

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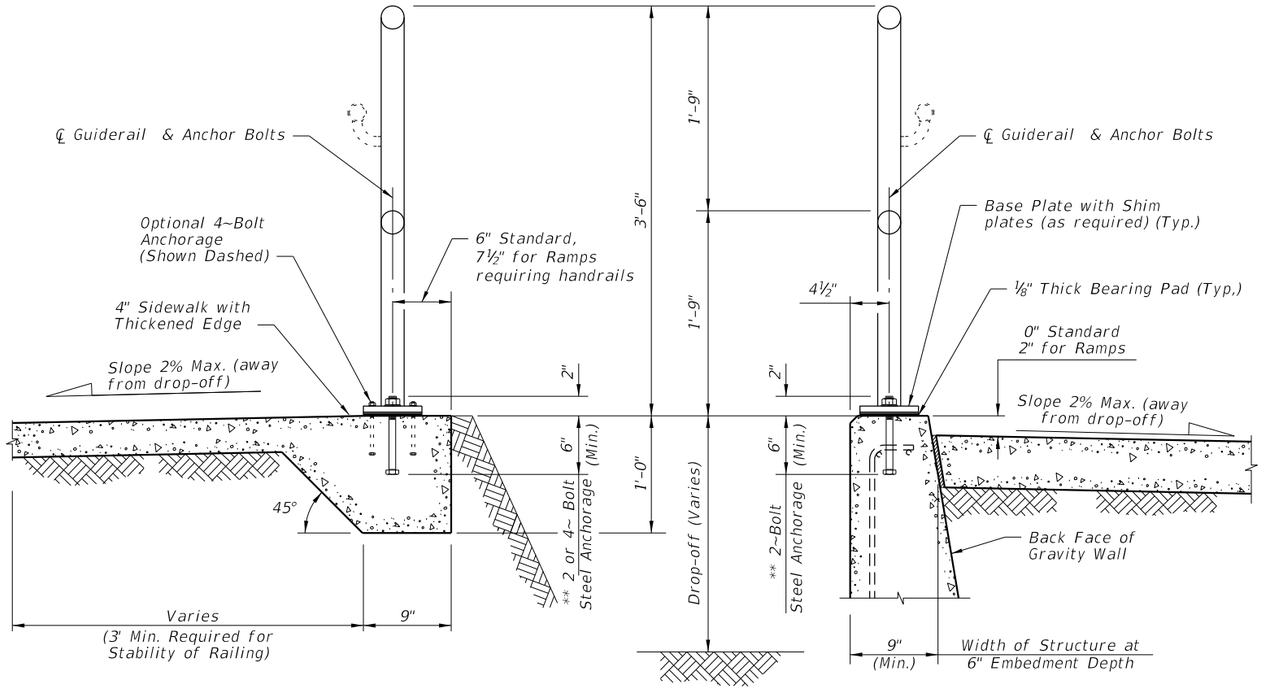
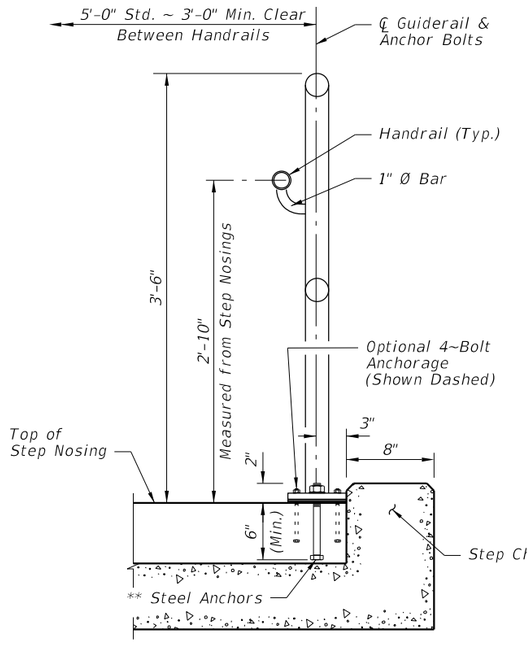
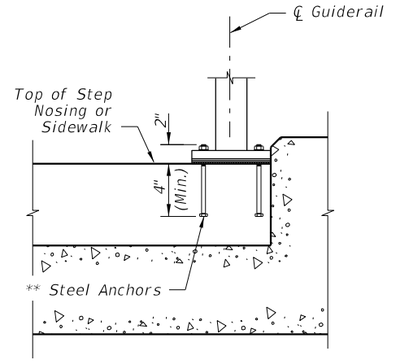



TYPICAL SECTION ON CONCRETE SIDEWALK

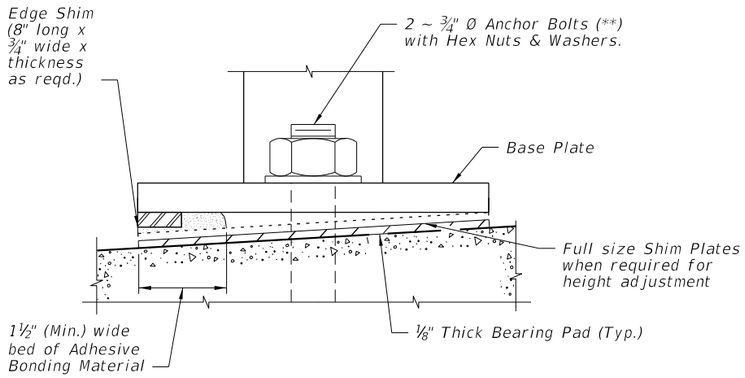
TYPICAL SECTION ON GRAVITY WALL
(Other Retaining Walls Similar)



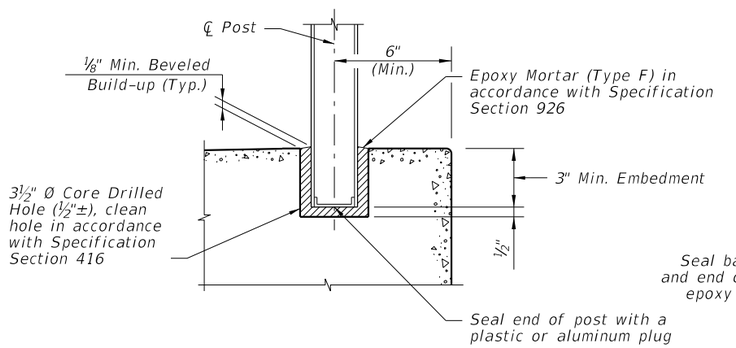

TYPICAL SECTION ON
STEPS & STAIRS



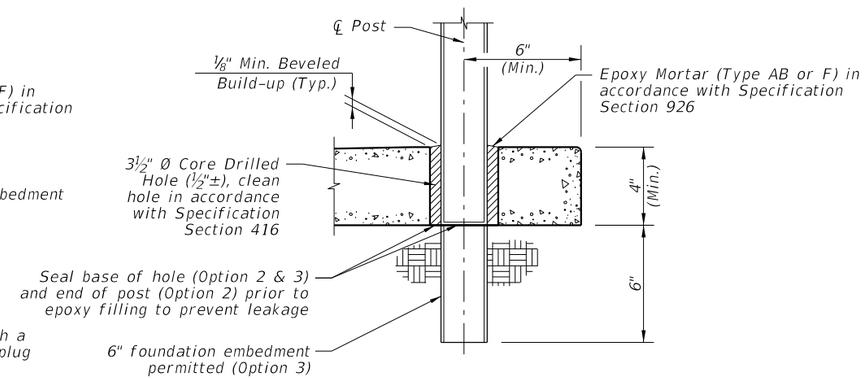

4~BOLT ANCHORAGE DETAIL




DETAIL "F" (OPTIONAL SHIMMING DETAIL
FOR CROSS SLOPE CORRECTION)
(Used in lieu of Beveled Shim Plates)




SIDEWALK ANCHORAGE DETAIL
OPTION 1




SIDEWALK ANCHORAGE DETAIL
OPTION 2 & 3

NOTES:
** 2 ~ ¾" Ø x 8" or 4 ~ 7/16" Ø x 6" Steel Anchors: Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Permitted (C-I-P); Galvanized Adhesive Anchors Permitted

*** The minimum embedment for Adhesive Anchors is 6" for 2~Bolt Anchorage or 4" for 4~Bolt Anchorage.

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