



3D VIEW OF RAILING WITH TYPE 1 - PICKET INFILL PANEL
(42" Height shown, 54" Height Similar)

DESIGN LOADS, GEOMETRY AND APPLICABILITY:

See the Instructions for Design Standards for the design loads, geometry and applicability requirements.

GENERAL:

Adequate foundation support shall be provided for anchorage and stability against overturning. See Index No. 861 for special requirements and modifications for use on bridges. The railing shown on these drawings requires a handrail for ramps steeper than a 5% grade to conform with the requirements of the Americans with Disabilities Act (ADA).

RAILS, PANELS AND POSTS:

Structural Extrusions, Tube, Pipe and Bar shall be in accordance with Table 1 and ASTM B221 or ASTM B429. Top, bottom and intermediate rail corner bends with maximum 4'-0" post spacing, may be Alloy 6063-T6. Perforated panels (Type 5) shall be Alloy 3003-H14. Posts shall be fabricated and installed plumb, ± 1" tolerance when measured at 3'-6" above the foundation. Pickets and vertical panel elements shall be fabricated parallel to the posts, except that Type 2, 3 & 5 panel infills may be fabricated parallel to the longitudinal grade. Corners and changes in tangential longitudinal alignment shall be made continuous with a 9" bend radius or terminate at adjoining sections with mitered end sections when handrails are not required. For changes in tangential longitudinal alignment greater than 45°, posts shall be positioned at a maximum distance of 2'-0" each side of the corner and shall not be located at the corner apex. For curved longitudinal alignments the top and bottom rails and handrails shall be shop bent to match the alignment radius.

BASE PLATES AND RAIL CAPS:

Base Plates and Post Cap plates shall be in accordance with ASTM B209, Alloy 6061-T6.

SHIM PLATES:

Shim Plates shall be aluminum in accordance with ASTM B209, Alloy 6061 or 6063. Shim plates shall be used for foundation height adjustments greater than 1/4" and localized irregularities greater than 1/8".

Field trim shim plates when necessary to match the contours of the foundation. Beveled shim plates may be used in lieu of trimmed flat shim plates shown. Stacked shim plates must be bonded together with adhesive bonding material and limited to a maximum total thickness of 1/2", unless longer anchor bolts are provided for the exposed thread length.

ANCHOR BOLTS:

Anchor bolts shall be in accordance with ASTM F1554 Grade 36. Headless anchor bolts for Adhesive Anchors shall be threaded full length. Cutting of reinforcing steel is permitted for drilled hole installation. Expansion Anchors are not permitted. All anchor bolts shall have single self-locking hex nuts. Tack welding of the nut to the anchor bolt may be used in lieu of self-locking nuts. All nuts shall be in accordance with ASTM A563 or ASTM A194. Flat Washers shall be in accordance with ASTM F436 and Plate Washers (for long slotted holes only), shall be in accordance with ASTM A36 or ASTM A709 Grade 36. After the nuts have been snug tightened, the anchor bolt threads shall be distorted to prevent removal of the nuts. Distorted threads and tack welds shall be coated with a galvanizing compound in accordance with the Specifications.

RESILIENT AND NEOPRENE PADS:

Resilient and Neoprene pads shall be in accordance with Specification Section 932 except that testing of the finished pads shall not be required. Neoprene pads shall be durometer hardness 60 to 80.

JOINTS:

All welded joints are to be ground smooth. Expansion joints shall be spaced at a maximum 35'-0". Field splices similar to the expansion joint detail may be approved by the Engineer to facilitate handling, but top rail must be continuous across a minimum of two posts. Only use the Continuity Field Splice (Detail "E") to make the top rail continuous for unforeseen field adjustments.

WELDING:

All welding shall be in accordance with the American Welding Society Structural Welding Code (Aluminum) ANSI/AWS D1.2 (current edition). Filler metal shall be either ER5183, ER5356 or ER5556. Nondestructive testing of welds is not required. Filler metal for plug welds and bend splices may be ER4043.

COATINGS:

The aluminum railing shall be mill finish unless otherwise noted in the Contract Documents. All nuts, bolts and washers shall be hot-dip galvanized in accordance with Section 962 of the Specifications.

SHOP DRAWINGS:

Complete details addressing project specific geometry (line & grade) showing post and expansion joint locations, post and panel type, anchor bolt installation "Case" or lengths, must be submitted by the Contractor for the Engineer's approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.

PAYMENT:

Railing shall be paid for per linear foot (Item No. 515-2-abb). Payment will be plan quantity measured as the length along the center line of the top rail, and includes rails, posts, pickets, panels, rail splice assembly, base plates, anchor bolts, nuts, washers, resilient or neoprene pads and all incidental materials and labor required to complete installation of the railing.

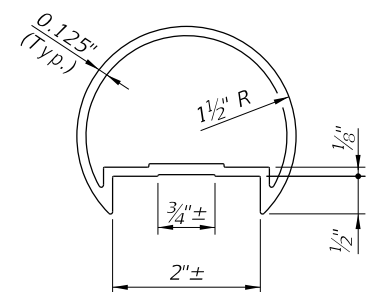
TABLE 1 - RAILING MEMBERS

MEMBER	ALLOY ⁽¹⁾	DESIGNATION	OUTSIDE DIMENSION	WALL THICKNESS
Posts	6061-T6	RT 2x2x.250	2.00" x 2.00"	0.250"
Top Rail	6061-T6	2 1/2" NPS (Sch. 10) 3" Round Top Cap Rail	2.875" 3.000"	0.120" 0.082"
End Hoops	6063-T5	2 1/2" NPS (Sch. 10) 3.00 OD x 0.125 Wall	2.875" 3.000"	0.120" 0.125"
Top Rail Joint/Splice Sleeves	6063-T5	2.50 OD x 0.125 Wall Top Cap Rail Inner Sleeve	2.500" 2.800"	0.125" 0.090"
Intermediate & Bottom Rail	6061-T6	RT 2x2x.250	2.00" x 2.00"	0.250" ⁽²⁾
Int. & Bottom Rail Post Connection Sleeve	6063-T5	1.50 OD x 0.125 Wall	1.500"	0.125"
Handrail Joint/Splice Sleeves	6063-T5	1" NPS (Sch. 40)	1.315"	0.133"
Handrails	6061-T6	1 1/2" NPS (Sch. 40)	1.900"	0.145"
Handrail Support Bar	6061-T6	3/4" Ø Round Bar	0.750"	N/A
Pickets (Type 1 Infill Panel)	6061-T6	3/4" Ø Round Bar	0.750"	N/A
Infill Panel Members (Types 2 - 5)	6063-T5	Varies (See Details)	Varies	Varies

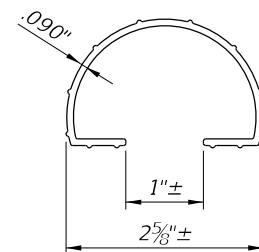
TABLE 1 NOTES:

(1) Alloy 6061-T6 or 6063-T52 & T6 may be substituted for Alloy 6063-T5.

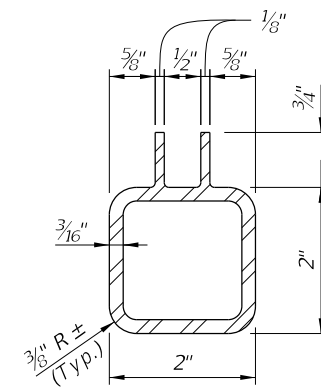
(2) 0.188" wall thickness permitted for rails with post spacings less than 5'-9".



3" ROUND TOP CAP RAIL



TOP CAP RAIL INNER SPLICE SLEEVE

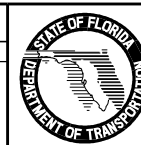


ALTERNATIVE BOTTOM & INTERMEDIATE RAIL SECTION FOR TYPE 3, 4 & 5 RAILINGS

ALTERNATE TOP RAIL SECTION

REVISIONS

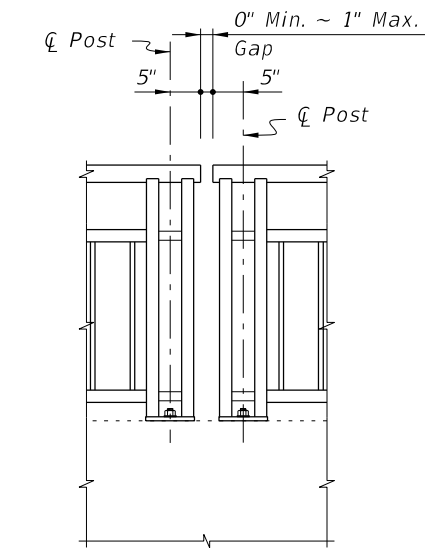
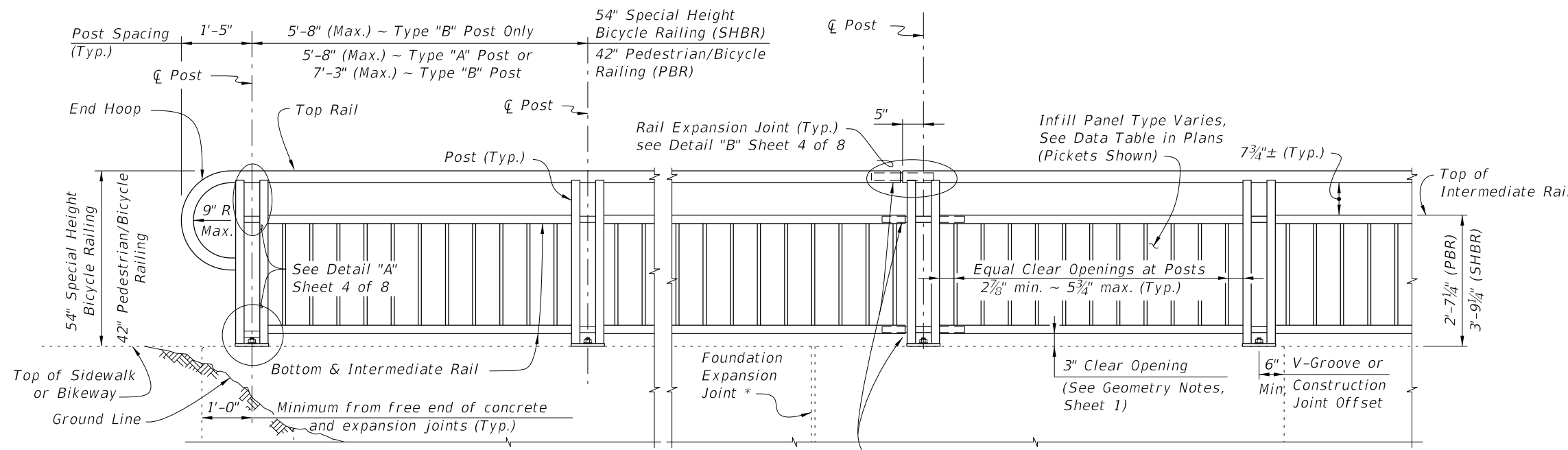
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Note: Non-continuous corners are permitted when handrails are not required.

ELEVATION
(Showing Outside Face of Railing with Type "A" Posts)

EXPANDED ELEVATION AT CORNERS

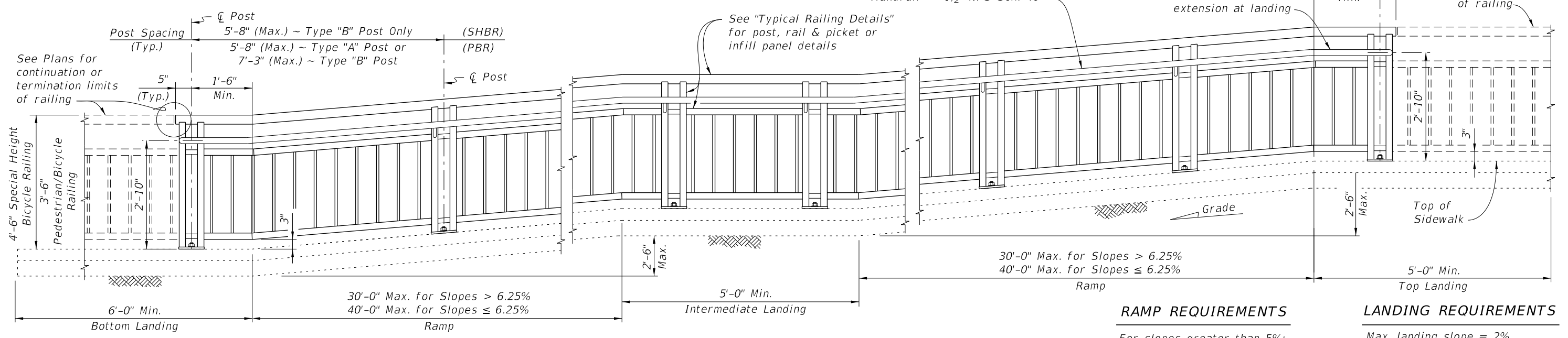
TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

DETAIL FOR NON-CONTINUOUS RAILING AT CORNERS

NOTES:
* Keyed construction joints in Index No. 6011 Gravity Wall are not considered to be expansion joints.
NPS = Nominal Pipe Size

CROSS REFERENCE:
For Details "C", "D" and "E", see Sheet 4 of 8.

Handrail required for ramps (Handrail continuous at landings between runs)
Handrail ~ 1 1/2" NPS Sch. 40



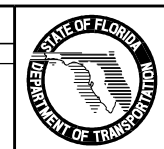
RAMP REQUIREMENTS
For slopes greater than 5%:
Max. ramp slope = 8.33%
Max. ramp cross-slope = 2.0%

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

ELEVATION
(Showing Inside Face of Railing with Type "A" Posts)

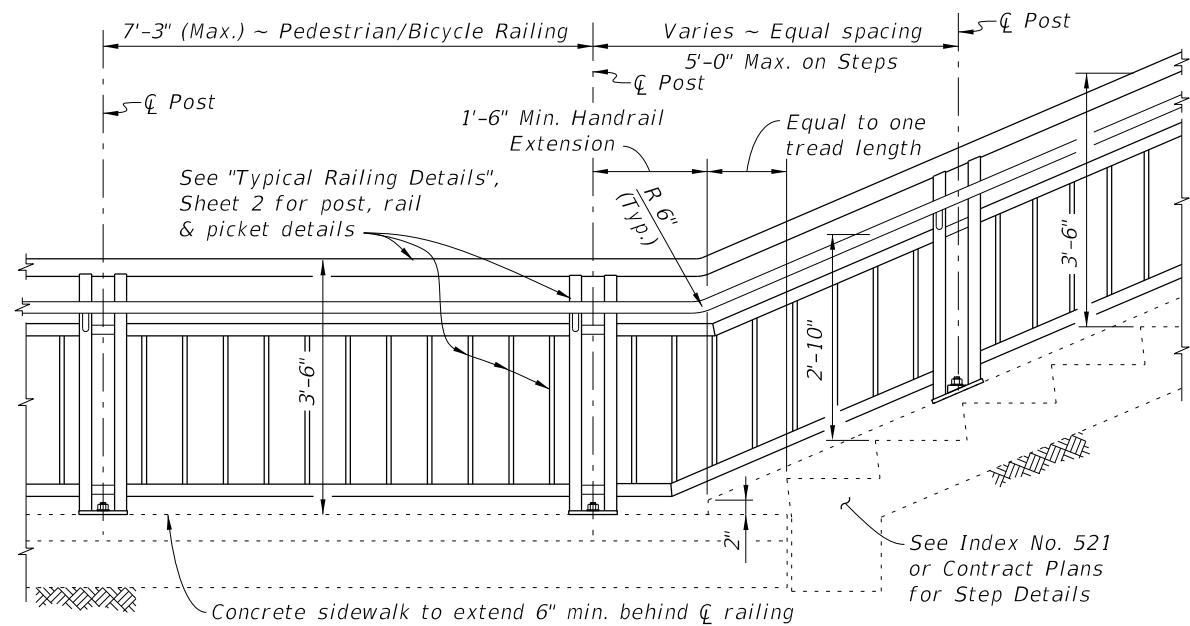
RAILINGS ON GRADES STEEPER THAN 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

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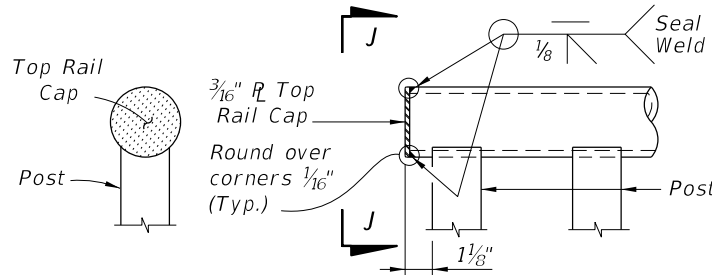


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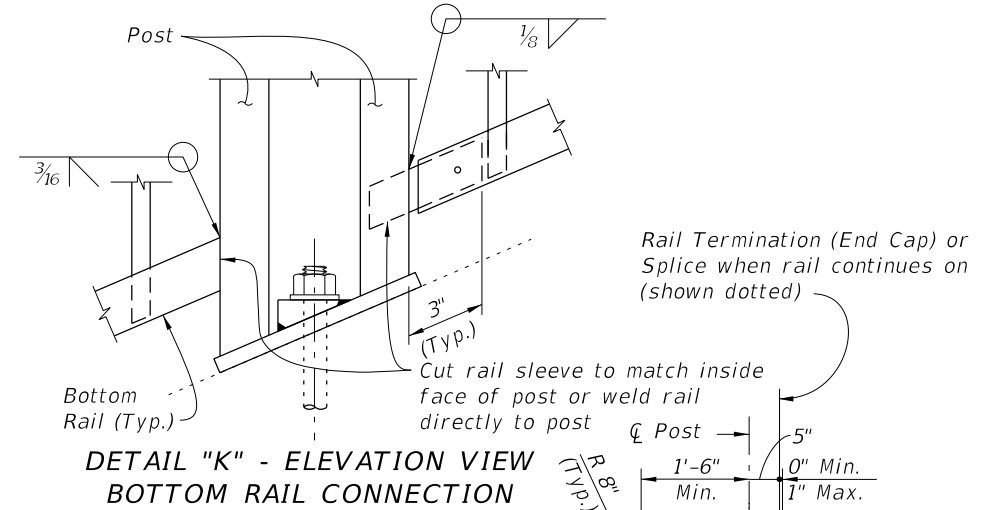
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RAILING CONTINUATION BEYOND STEPS OR STAIRS
(Bottom shown, Top similar)

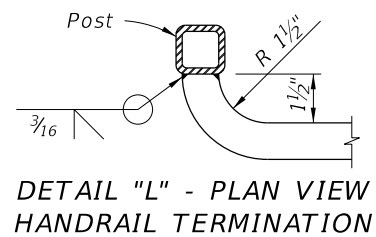


VIEW J-J DETAIL "J" - ELEVATION VIEW TOP RAIL TERMINATION



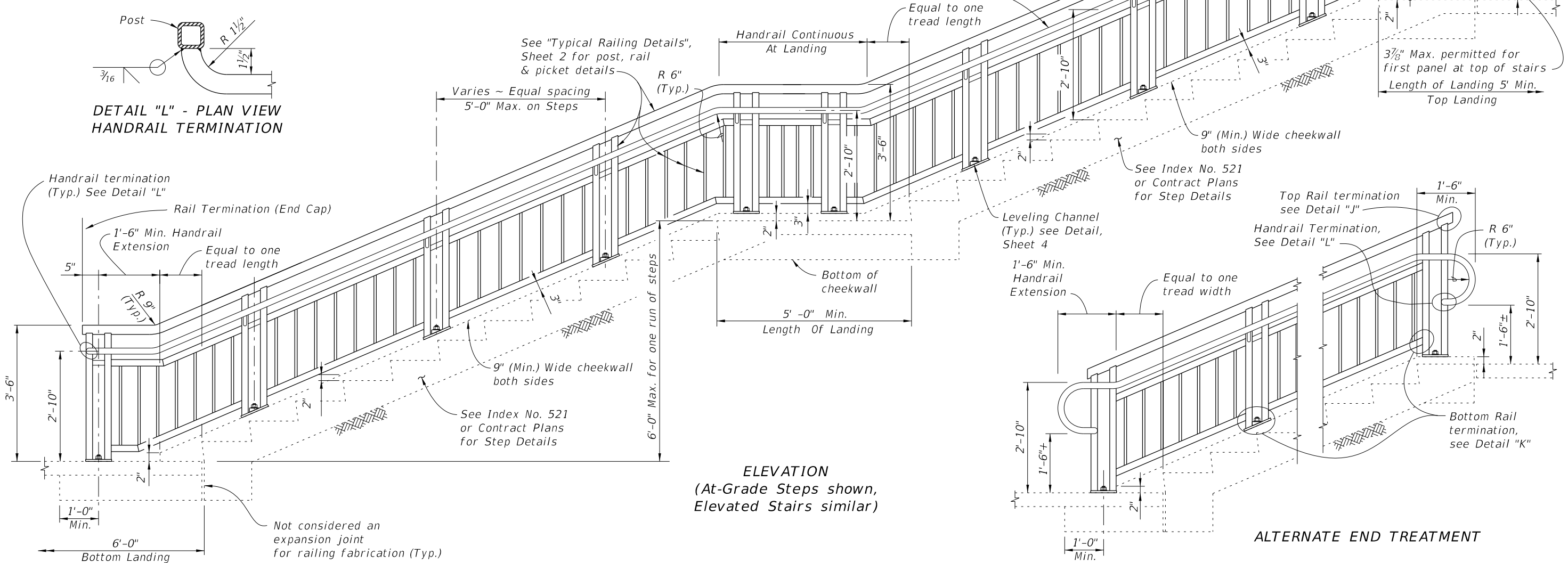
DETAIL "K" - ELEVATION VIEW BOTTOM RAIL CONNECTION

RAIL TERMINATION DETAILS



DETAIL "L" - PLAN VIEW HANDRAIL TERMINATION

Aluminum Handrail required for three or more steps (Handrail and cheekwalls continuous at landings)
Handrails ~ 1 1/2" NPS (Sch. 40) pipe



ELEVATION
(At-Grade Steps shown, Elevated Stairs similar)

ALTERNATE END TREATMENT

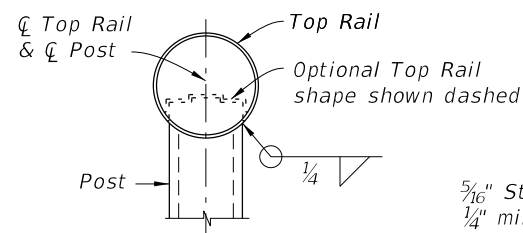
RAILINGS ON STEPS & STAIRS

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SECTION A-A
(Top Rail Connection)

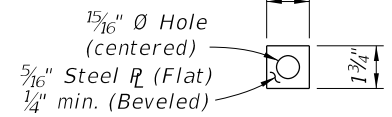
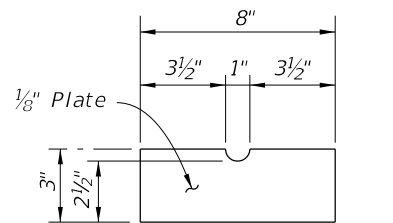
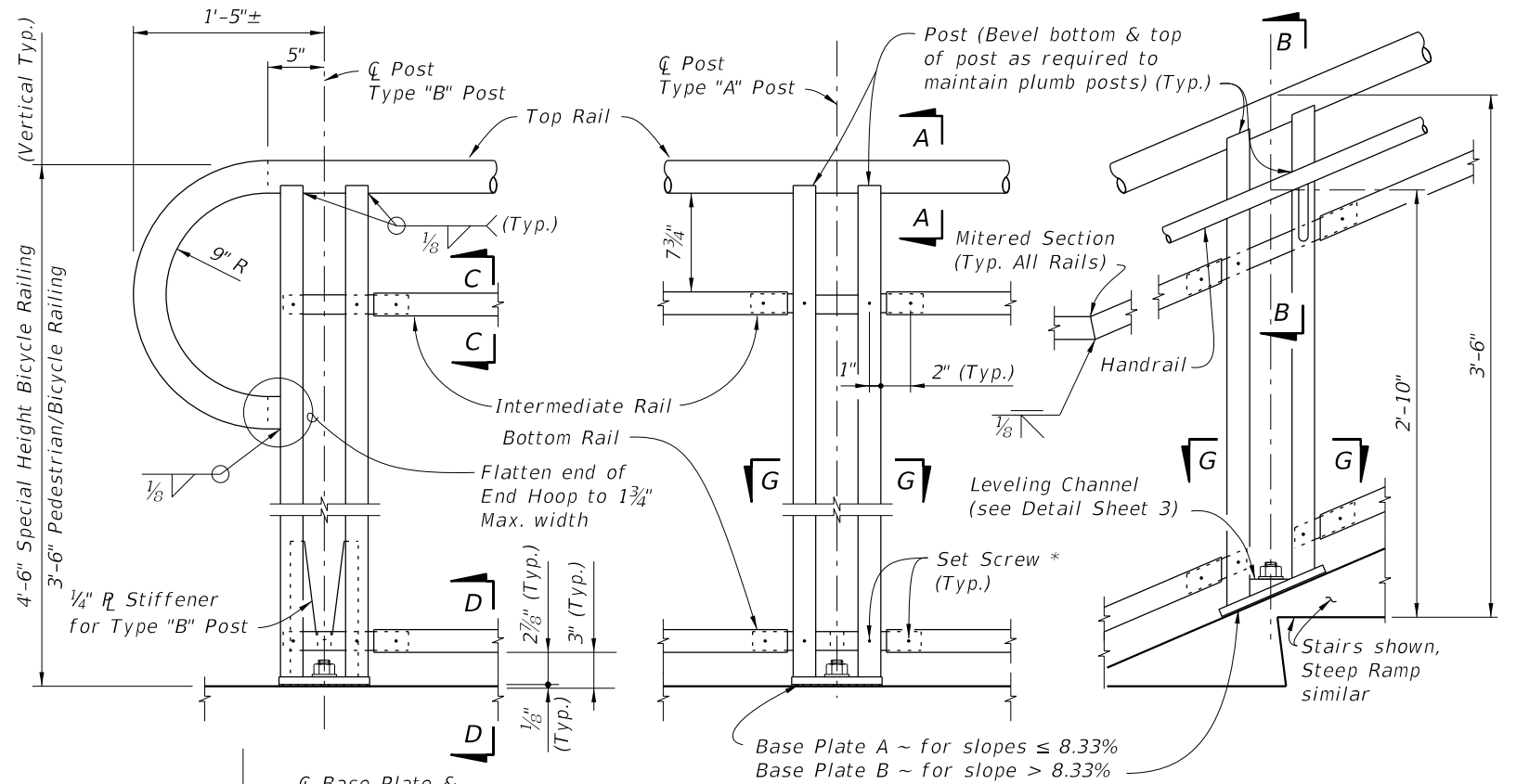


PLATE WASHER DETAIL

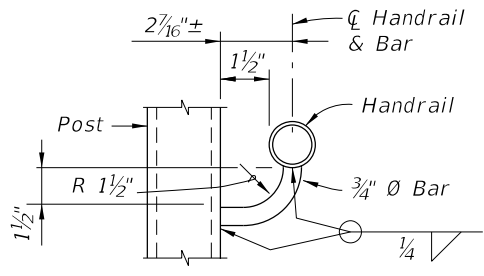


SHIM PLATE DETAIL

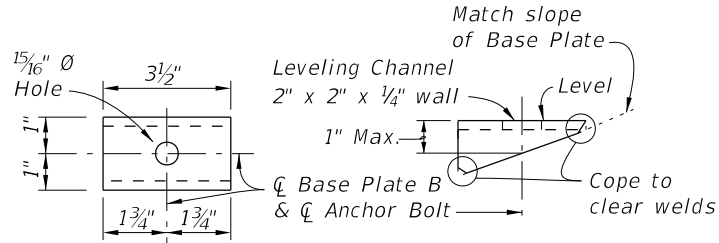


DETAIL "A" - RAIL CONNECTIONS
(Pickets/Panels Not Shown for Clarity)

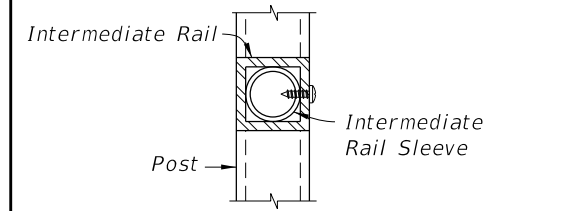
NOTES:
 # Base Plate A (Ramps - Bolts normal) use 1 1/16" Ø Holes for Anchor Bolts with Flat Washers for slopes ≤ 8.33%.
 ## Base Plate B (Stairs - Bolts plumb) use 1/4" Ø Holes for Anchor Bolts with Beveled Plate and Washers for slopes > 8.33% to ≤ 15%; use 15/16" x 1 1/2" Slotted Holes with Leveling Channel for slopes > 15%.
 * 1/4" Ø x 3/4" Pan Head Aluminum (Alloy 2024-T4 or 7075-T73) or Stainless Steel (Type 316 or 18-8 Alloy) Set Screws. Screws must be set flush against the outside face of rails & posts and underside of handrails. A single 3/4" Ø plug weld may be substituted for the Set Screws.
 ** Embedded length may be 4" for plug welded connection.



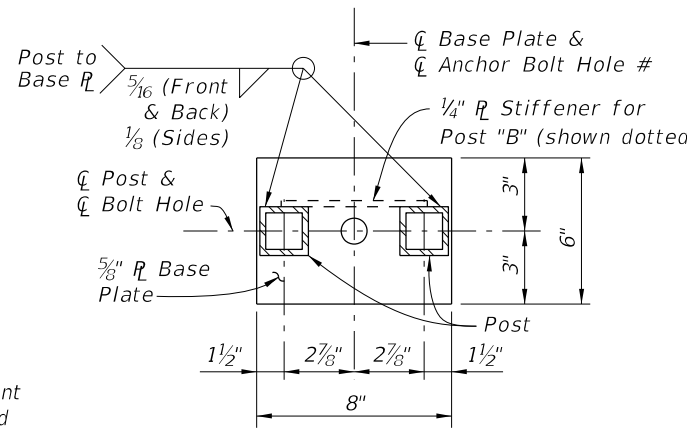
SECTION B-B
(Handrail Connection)



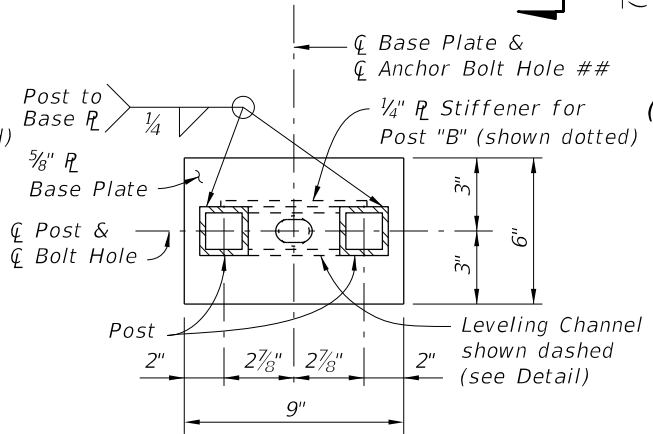
TOP VIEW
SIDE VIEW
LEVELING CHANNEL DETAIL



SECTION C-C
(Intermediate Rail Connection)

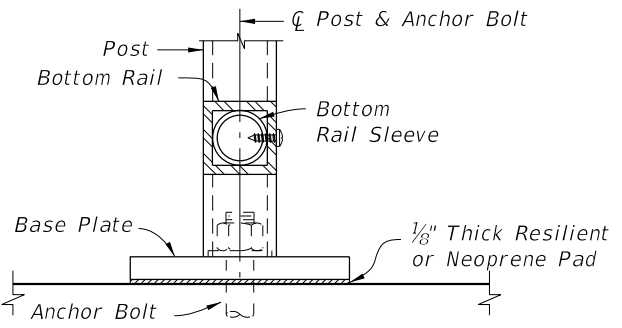


BASE PLATE A



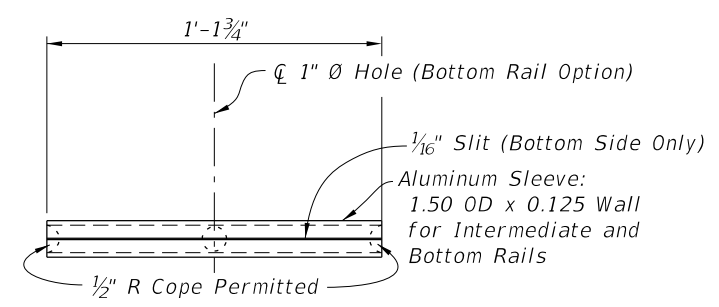
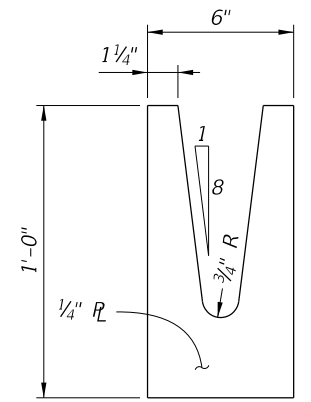
BASE PLATE B

SECTION G-G - BASE PLATE DETAILS

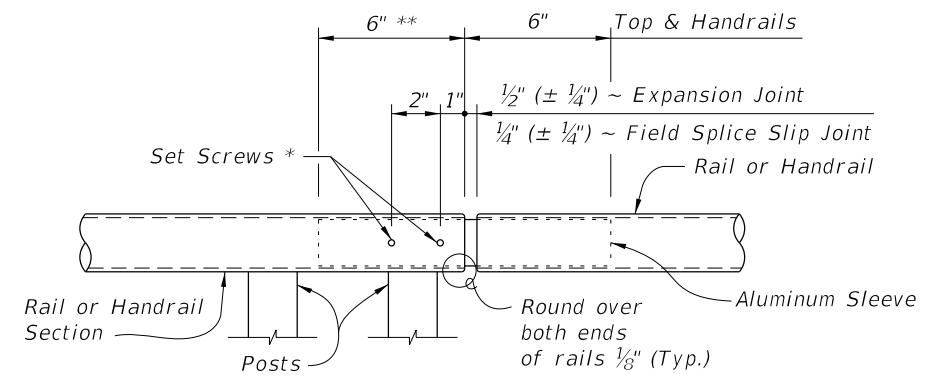


SECTION D-D
(Bottom Rail Connection)

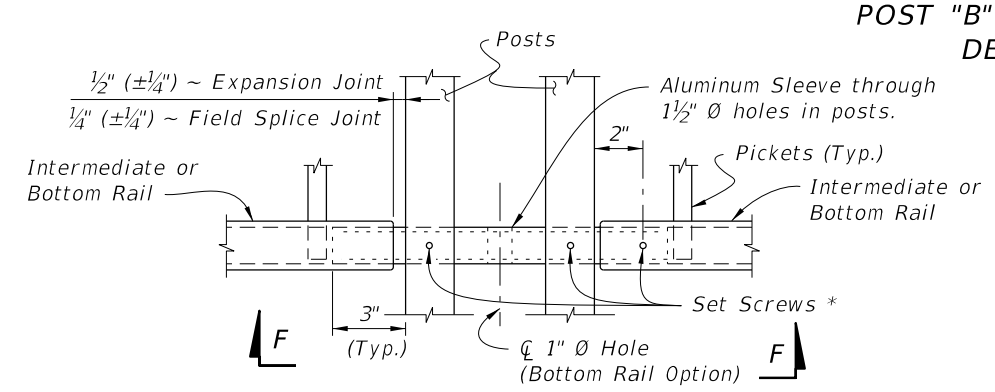
POST "B" STIFFENER DETAIL



VIEW F-F
INTERMEDIATE OR BOTTOM RAIL -
ALUMINUM SLEEVE DETAIL (Bottom Side Shown)



ROUND RAILS - TOP RAIL OR HANDRAIL
(Top Rail at Expansion Joint Shown)

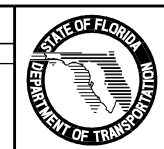


SQUARE RAILS - INTERMEDIATE OR BOTTOM RAIL
(Bottom Rail Shown at Expansion Joint Shown)

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

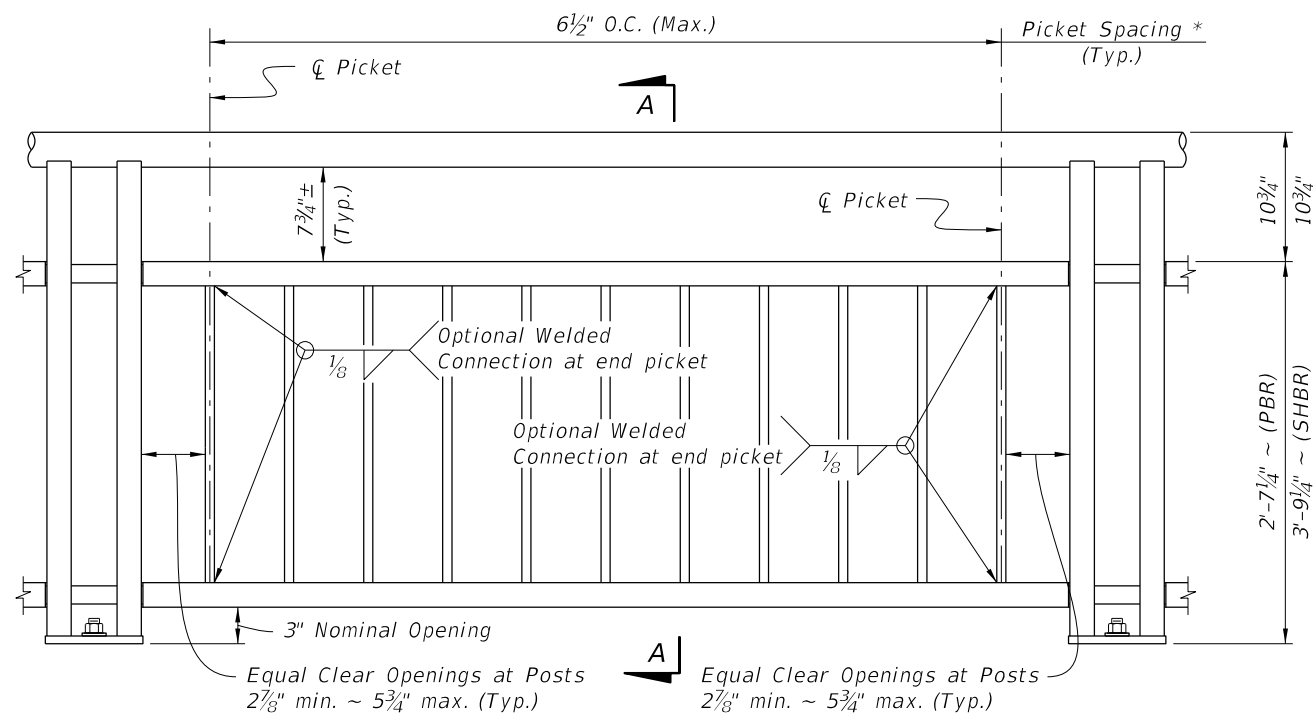
CROSS REFERENCE:
For location of Details "B", See Sheet 2.

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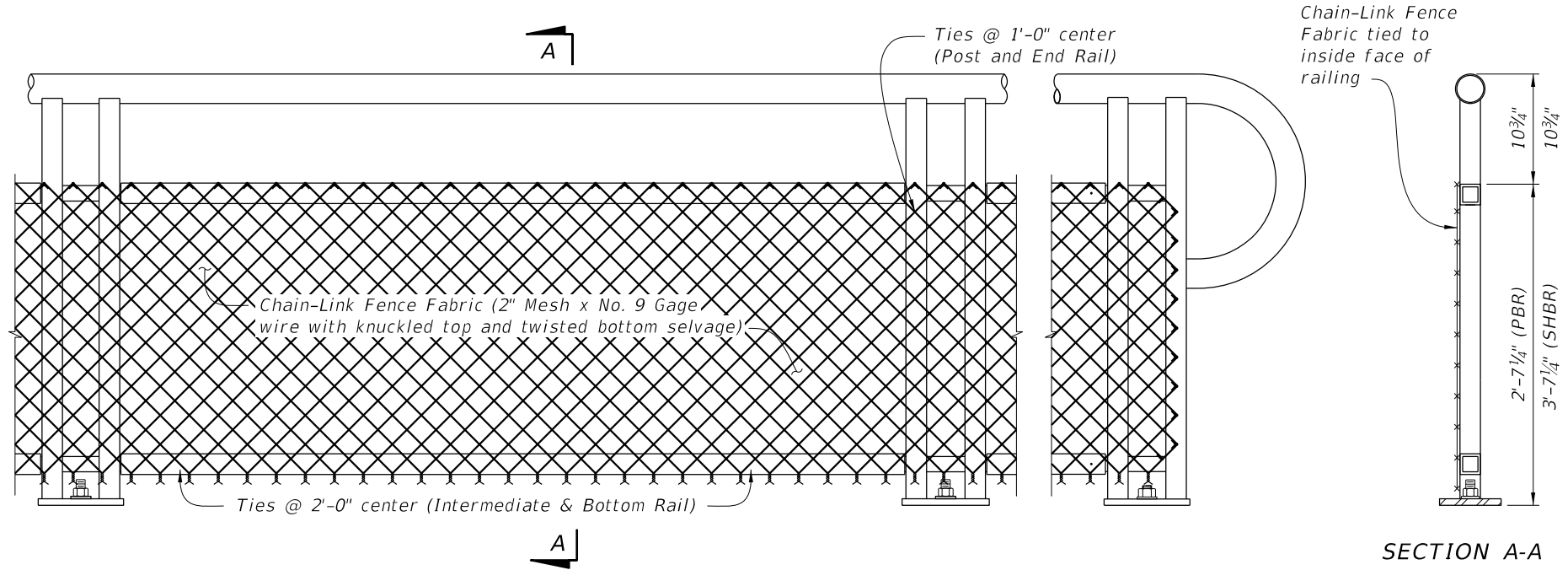
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TYPE 1 - PICKET INFILL PANEL

PICKET NOTES:

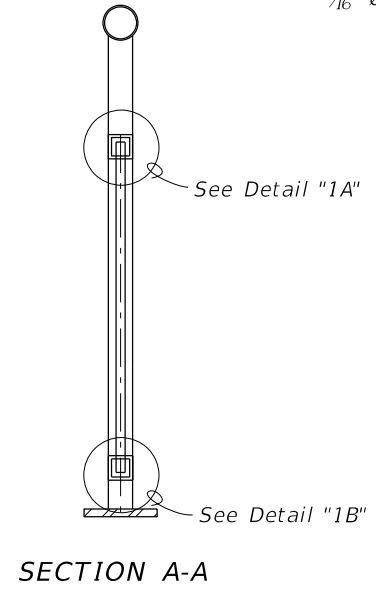
* Picket Spacing of 6 1/2" centers is based on a 3/4" NPS for standard applications. When shown in the Contract Plans a 4 1/2" picket spacing may be required. If an alternate design is used, maintain a maximum clear opening of 5 7/8" for standard installations and 3 7/8" for special conditions.



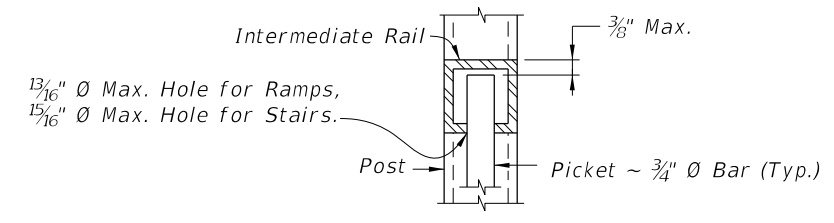
TYPE 2 - CHAIN-LINK (Continuous Infill Panel)

NOTES:

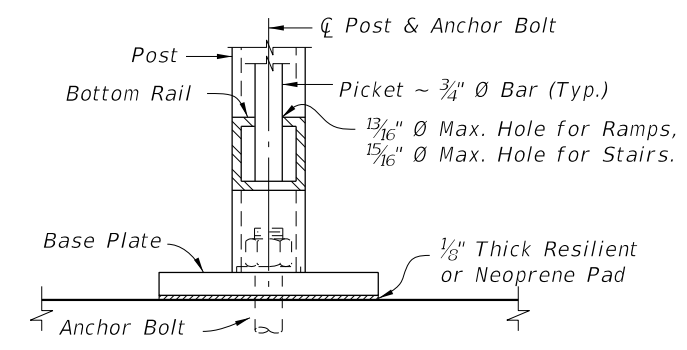
1. See Plans for Infill Panel option required.



SECTION A-A



**DETAIL "1A"
(Top of Picket Connection)**



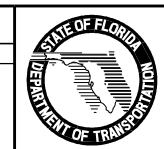
**DETAIL "1B"
(Bottom of Picket Connection)**

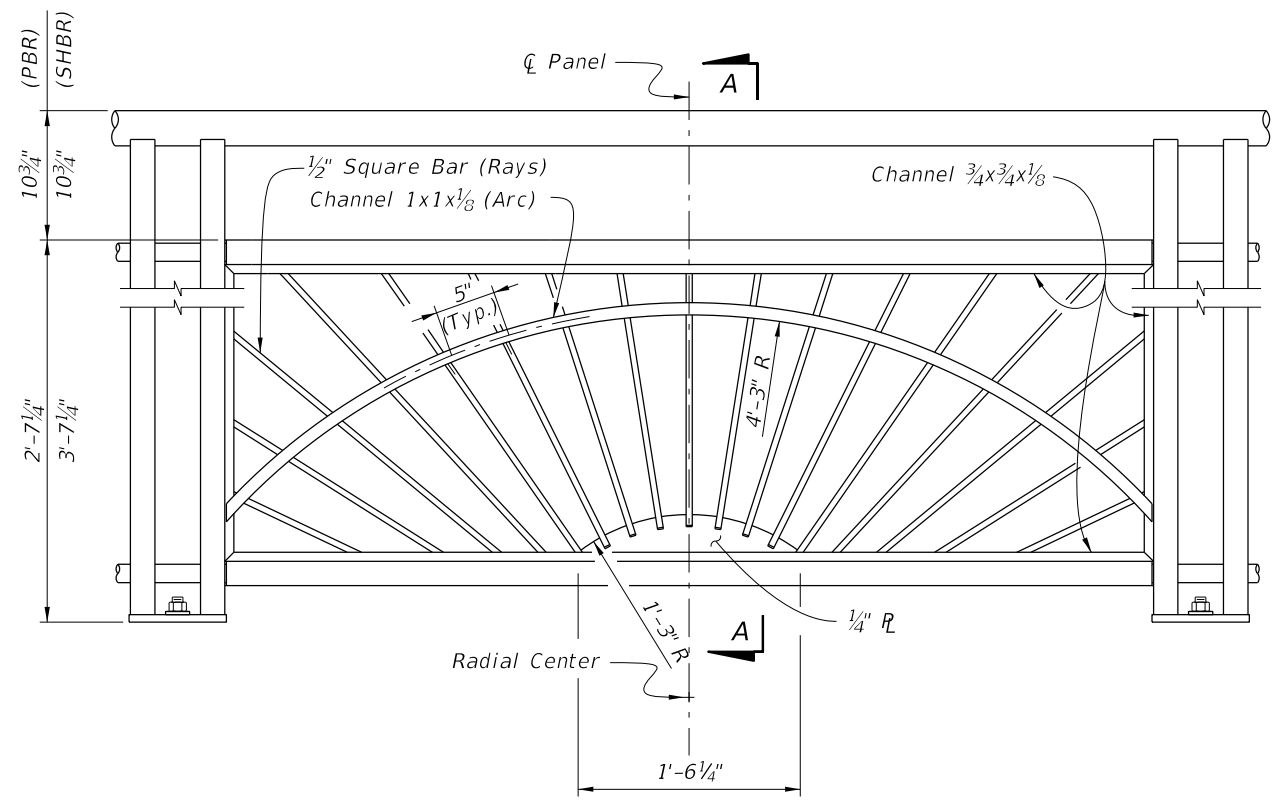
TABLE 2 - CHAIN-LINK PANEL COMPONENT MATERIALS		
COMPONENT	ASTM	COMPONENT INFORMATION
Chain-Link Fence Fabric (2" mesh with twisted bottom and knuckled top selvage)	A 392	Zinc-Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating
	A 491	Aluminum-Coated Steel - No. 9 gage (coated wire diameter)
	F 668	Polyvinyl Chloride (PVC) Coated Steel - No. 9 gage Zinc-Coated Wire (metallic-coated core wire diameter) ~ See Plans for specified color of PVC.
Tie Wires	F 626	Zinc-Coated Steel Wire - No. 9 gage with coating to match Chain-Link Fence Fabric.
Tension Bars	F 626	3/16" (min. thickness) x 3/4" (min. width) x 2'-3" (min. height) Steel Bars
Miscellaneous Fence Components	F 626	Zinc-Coated Steel

CHAIN-LINK PANEL NOTE:

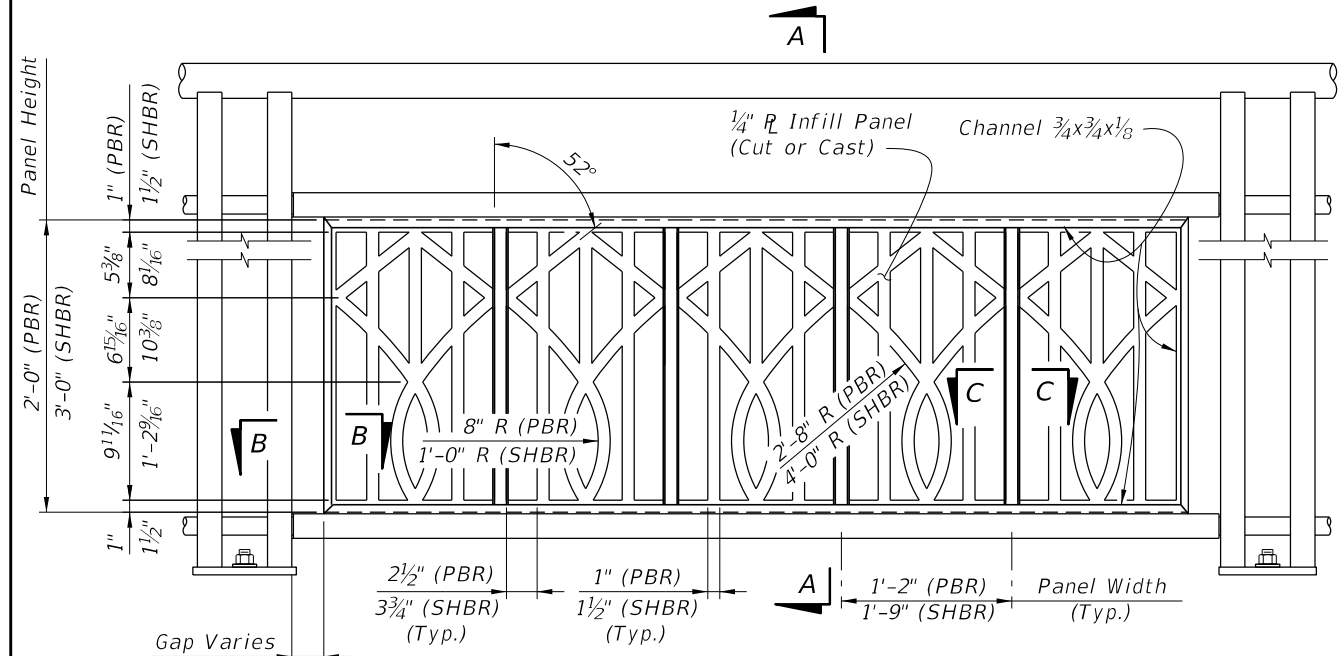
Chain-Link Fence Fabric shall be continuous along limits of railing. Splicing of Chain-Link panels using Tension Bars at 20'-0" minimum increments is permitted.

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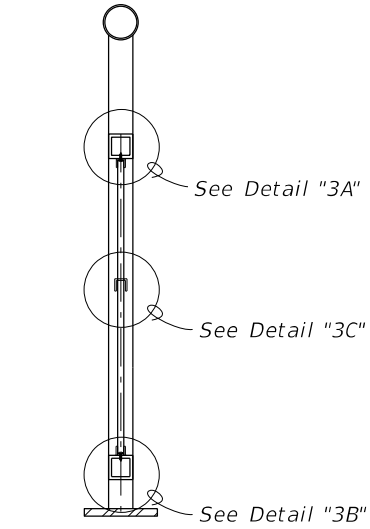
TYPE 3 - SUNSHINE INFILL PANEL



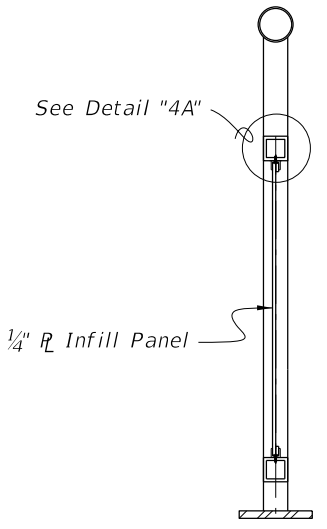
TYPE 4 - BROADWAY INFILL PANEL

NOTES:

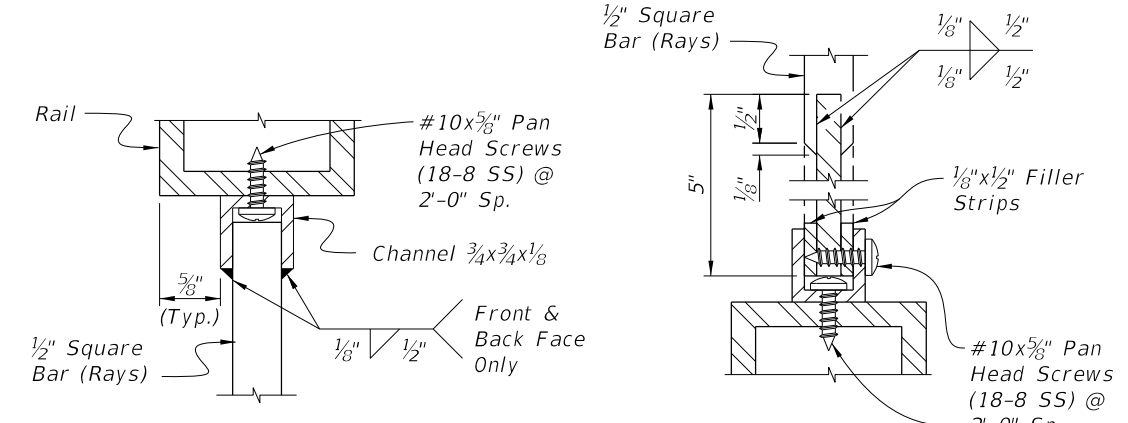
1. See Plans for Infill Panel Option required.



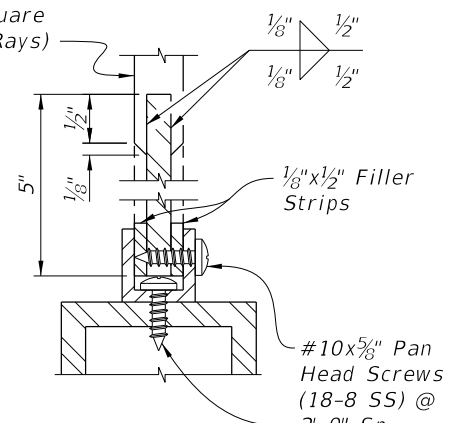
SECTION A-A



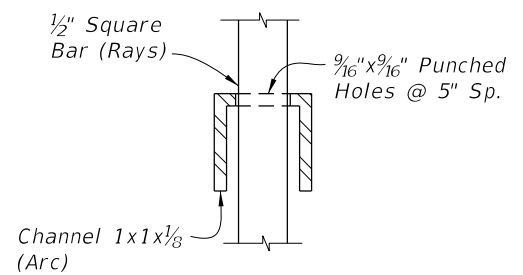
SECTION A-A



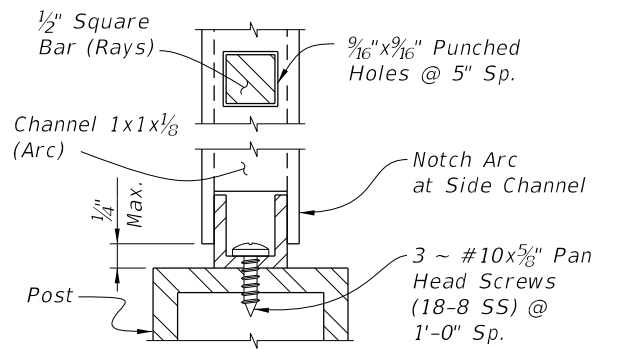
**DETAIL 3A
INTERMEDIATE RAIL/RAY
CONNECTION**



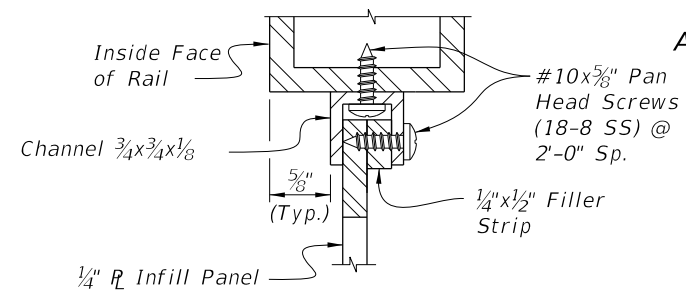
**DETAIL 3B
BOTTOM RAIL/RAY CONNECTION**



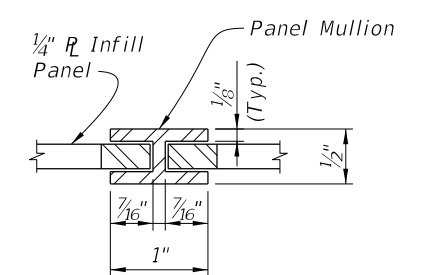
**DETAIL 3C
RAY/ARC CONNECTION**



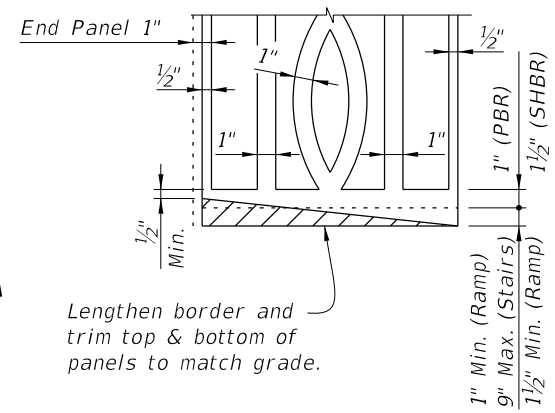
**DETAIL 3D
ARC/POST CONNECTION**



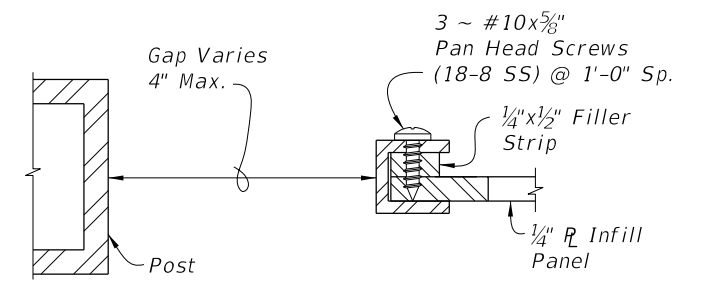
**DETAIL 4A
PANEL/RAIL CONNECTION
(Top Shown, Bottom Similar)**



**SECTION C-C
PANEL/SPLICE CONNECTION**



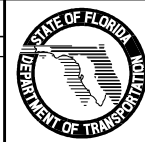
**PANEL ADJUSTMENT FOR RAILINGS
ON GRADES**



**SECTION B-B
PANEL END CAP**

REVISIONS

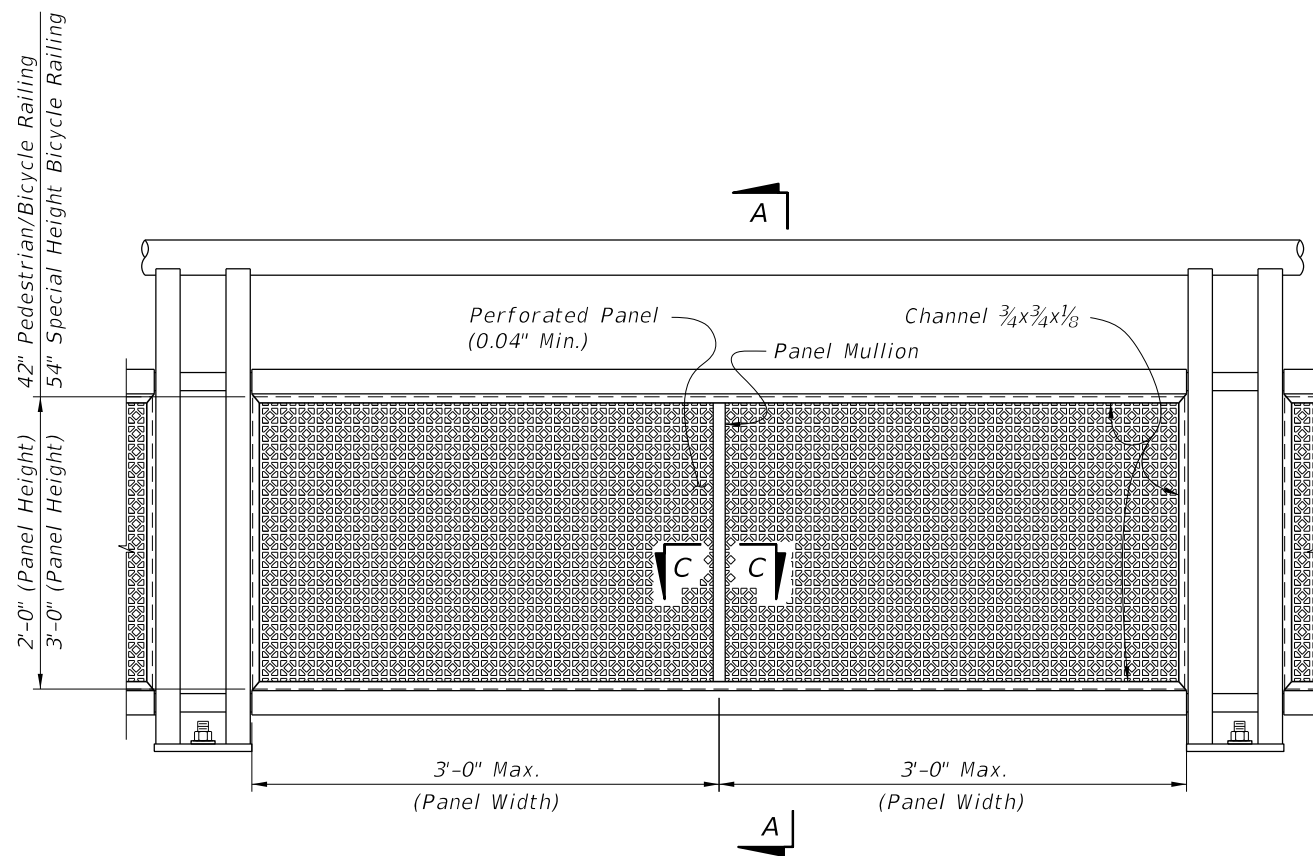
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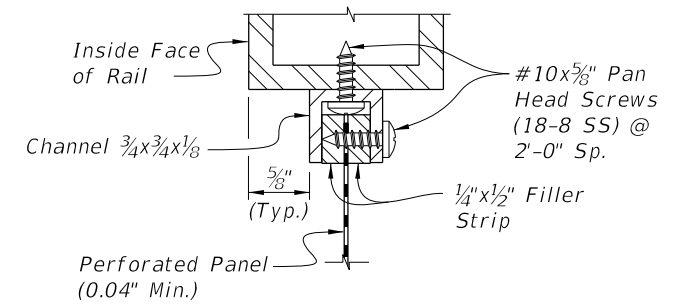
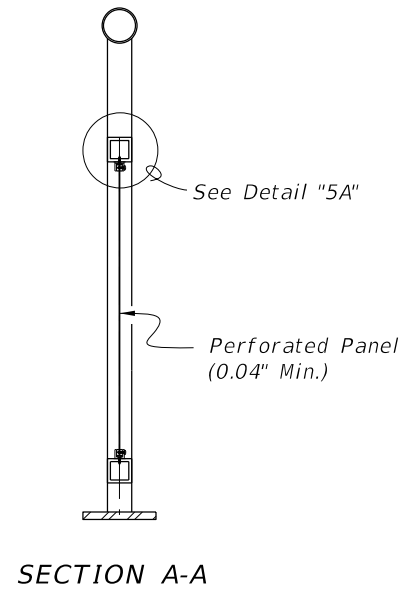
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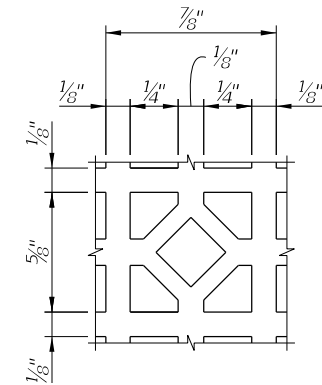
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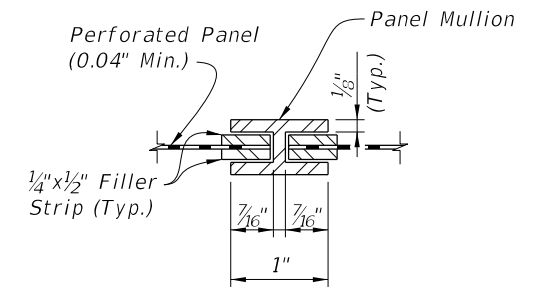
TYPE 5 - PERFORATED INFILL PANEL



DETAIL "5A"
PANEL/RAIL CONNECTION
(Top Shown, Bottom & Sides Similar)



REPEATING PATTERN DETAIL
FOR PERFORATED PANEL



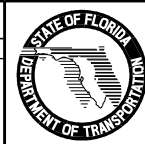
SECTION C-C
PANEL/SPLICE CONNECTION

NOTES:

1. See Plans for Infill Panel Type required.

REVISIONS

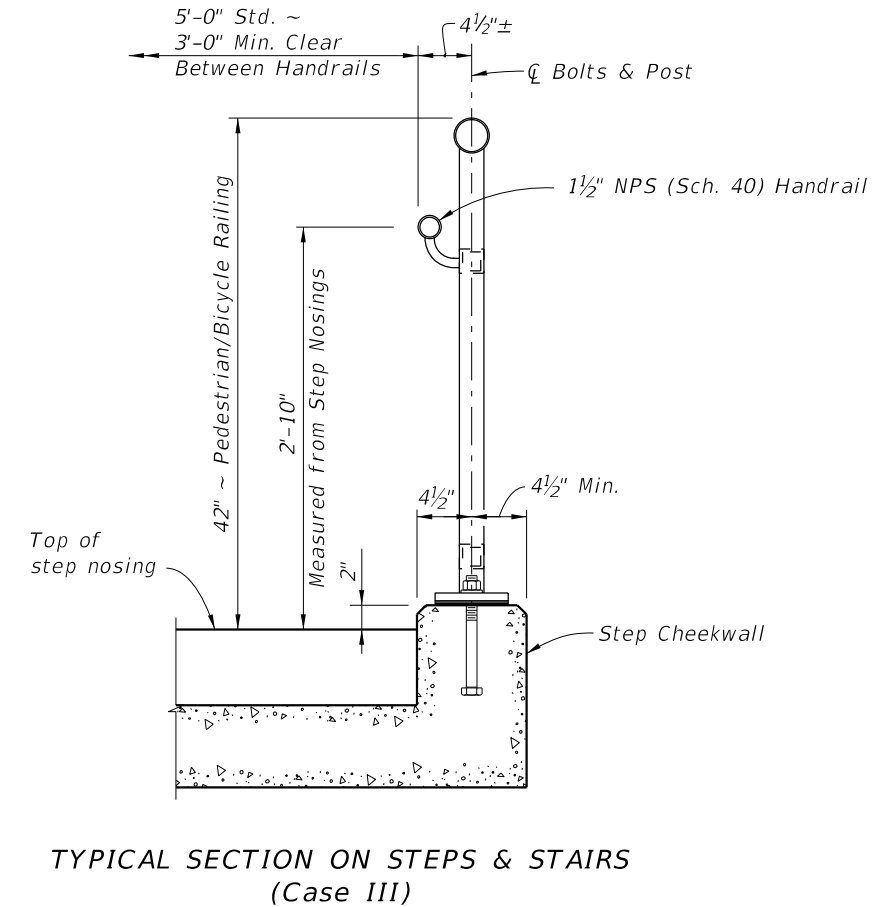
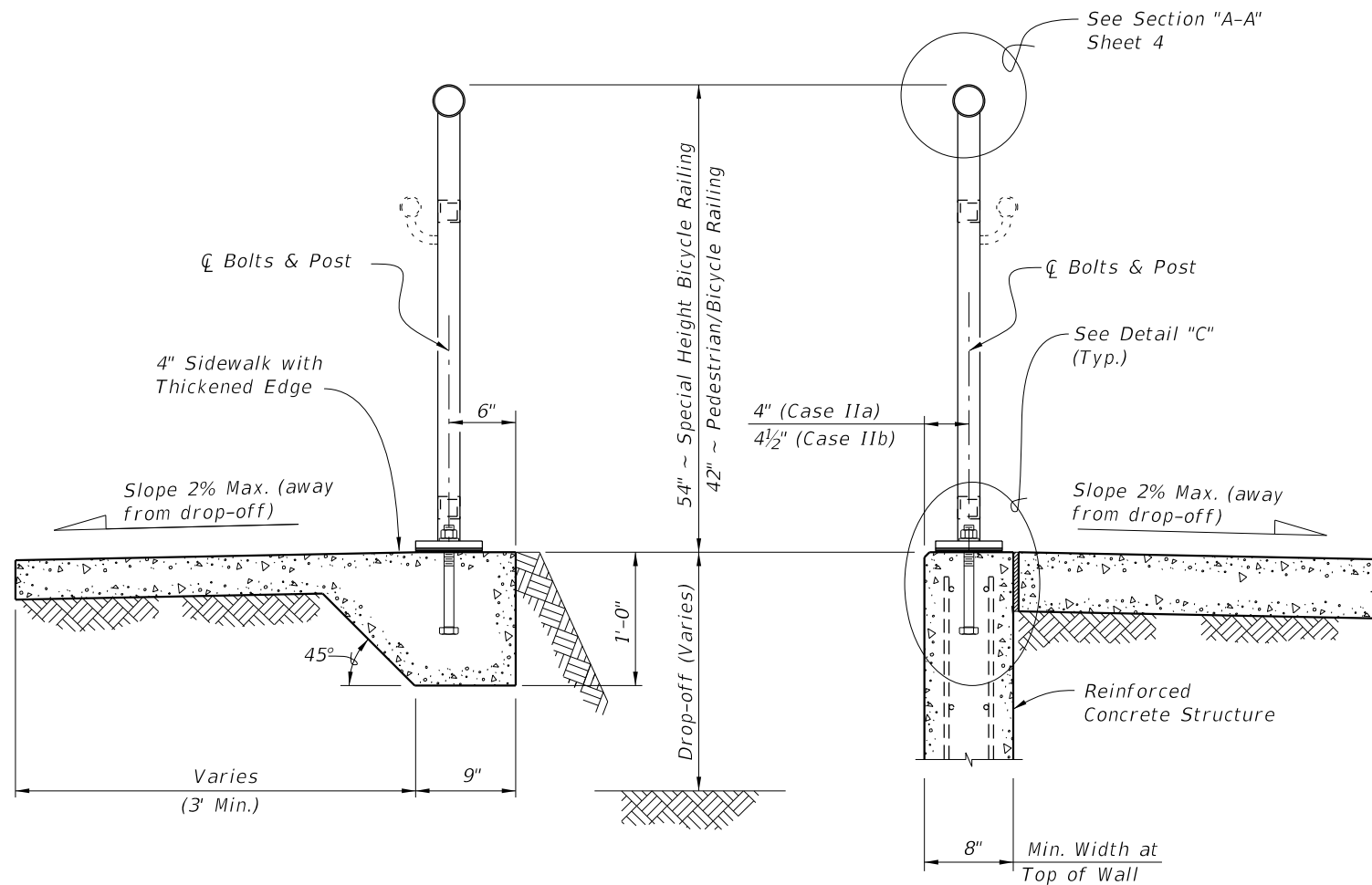
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
01/01/11	SJN	New Sheet 7 of 8			



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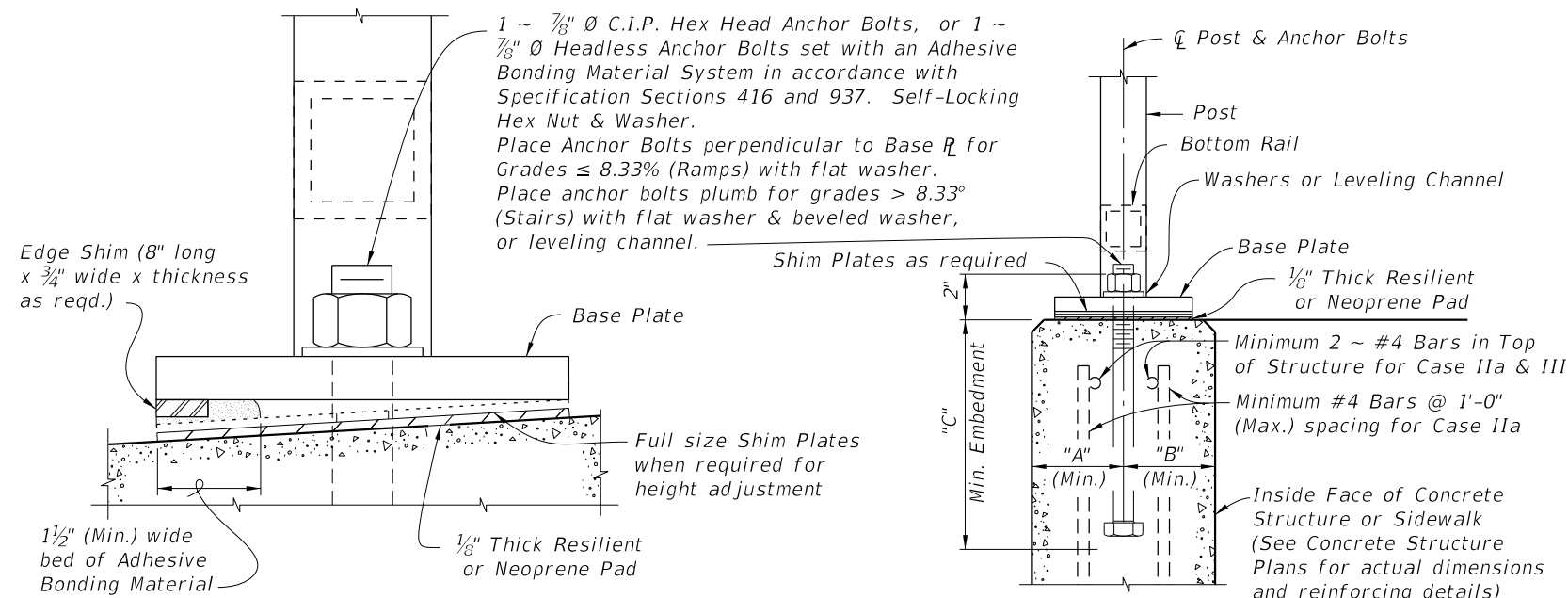
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TYPICAL SECTION ON CONCRETE SIDEWALK (Case I)

TYPICAL SECTION ON RETAINING WALL (Case II)

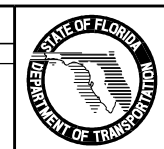
TYPICAL SECTION ON STEPS & STAIRS (Case III)



ANCHOR BOLT TABLE							
CASE	STRUCTURE TYPE	DIMENSIONS			ANCHOR LENGTH		ANCHOR SIZE
		"A" Edge Dist.	"B" Edge Dist.	"C" Embedment	C.I.P. Hex Head Bolt	Adhesive Anchor	
I	Unreinforced Concrete	6"	1'-2"	9"	10 1/2"	11"	7/8" Ø
IIa	Reinforced Concrete	4"	4"	9"	10 1/2"	11"	7/8" Ø
IIb	Gravity Wall Index No. 6011	4 1/2"	3 1/2" @ top	1'-0" *	1'-1 1/2"	1'-2"	7/8" Ø
III	Step Cheekwall	4 1/2"	4 1/2"	9"	10 1/2"	11"	7/8" Ø

* Embedment length "C" may be reduced to 9" for the 42" height railings for Case IIb, when the post spacing does not exceed 5'-0".

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
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