NOTES:
1. Shop Drawings are required, refer to Specification Section 515.
2. Materials:
   A. Hex Head Set Screws: Stainless Steel (SS) Type 316 or 18-8 Alloy.
   B. Base Plates and Cap Plates: ASTM A36 or ASTM A709 Grade 36.
   C. Pipe Rails and Posts: ASTM A53 Grade B for standard weight pipe and ASTM A500 Grade B, C or D or ASTM A501 for Structural Tube.

Handrail Support Bars: ASTM A36

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSION</th>
<th>WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>2” NPS (Sch. 40)</td>
<td>2.375”</td>
<td>0.154”</td>
</tr>
<tr>
<td>Rails</td>
<td>2” NPS (Sch. 40)</td>
<td>2.375”</td>
<td>0.154”</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1½” NPS (Sch. 40)</td>
<td>1.900”</td>
<td>0.145”</td>
</tr>
<tr>
<td>Handrails Joint/Splice Sleeves</td>
<td>3” NPS (Sch. 40)</td>
<td>1.313”</td>
<td>0.133”</td>
</tr>
<tr>
<td>Handrails</td>
<td>3½” NPS (Sch. 40)</td>
<td>1.900”</td>
<td>0.145”</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1” Ø Round Bar</td>
<td>1.000”</td>
<td>N/A</td>
</tr>
</tbody>
</table>

D. Galvanized Steel Fasteners:
   a. Hex Head Bolts: ASTM A307 Type 1 or ASTM F1554 Grade 36
   b. Adhesive Anchors: ASTM F1554 Grade 36 fully threaded rods
   c. Hex Nuts: ASTM A307
   d. Flat Washers: ASTM F1554
   e. Aluminum Shims: ASTM B209, Alloy 6061

3. 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 "F") 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” radius for changes in alignment radius.
   E. For curved longitudinal alignments, shop bend the top and bottom rails and handrails to match the alignment radius.
   F. For changes in tangential longitudinal alignment greater than 45°, positioned posts a maximum of 2'-0" each side of the corner, not at the corner apex.

4. Handrails are required and must be continuous at landings for:
   A. Grades Steeper than 3%.
   B. Three or more steps.

5. Cutting of reinforcing steel is permitted for adhesive anchor bolt installations.
TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%

See Plans for continuation or termination limits of railing

See "Typical Railing Details" for post & rail details

ELEVATION

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

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

CROSS REFERENCE:

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

NOTE:

NPS = Nominal Pipe Size

STRAIGHT JOINTS (as required) see Detail "E" Sheet 4 (Typ.)

NOTE:

Steel pipe guidewalls are not considered to be expansion joints.

CROSS REFERENCE:

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

ELEVATION

RAILINGS ON GRADES SLOPED THAN 5% TO 8.33%

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%

RAMP REQUIREMENTS
30'-0" Max. for slopes > 6.25%
40'-0" Max. for slopes ≤ 6.25%

Intermediate Landing
5'-0" Min.

Top Landing
6'-0" Min.

Bottom Landing
6'-0" Min.

RAILINGS ON GRADES SLOPER THAN 5% TO 8.33%

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%

RAMP REQUIREMENTS
30'-0" Max. for slopes > 6.25%
40'-0" Max. for slopes ≤ 6.25%

Intermediate Landing
5'-0" Min.

Top Landing
6'-0" Min.

Bottom Landing
6'-0" Min.
**GUIDERAIL ON STEPS & STAIRS**

**DESCRIPTION:**

- **Steel Pipe Guardrail**

**FY 2017-18**

**DESIGN STANDARDS**

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**Railing Continuation Beyond Steps**

(Bottom shown, Top similar)

- Steel Handrail required for three or more steps (handrail and cheekwalls continuous at landings)
- Concrete sidewalk to extend 6" min. behind handrail
- See 'Typical Railing Details' Sheet 2 for post & rail details
- See Index S21 or Contract Plans for Step Details

**Handrail Termination**

See Detail "A" (Typ.)

**Handrail Termination**

See 'Typical Railing Details', Sheet 2 for post & rail details

**Elevation**

(At-Grade Steps)

- 5'-0" Min.
- 2" Min. (Typ.)
- 2" Min.
- 2'-10" ±
- 2'-10" Min.
- 9" Min.
- 3'-6"

**Guiderail on Steps & Stairs**

- **Handrail**
- **Post**
- **Cheekwall**

**Handrail Continuation**

See Detail "A" (Typ.)

**Handrail Continuation**

See 'Typical Railing Details', Sheet 2 for post & rail details

**Length of Landing**

1'-6" Min.

**Top Landing**

9" Min.

**Bottom Landing**

6'-0" Max. for one run of steps

- 6'-0" Max. on Steps
- Varies = Equal spacing
- 6'-0" Max. on Steps
- Varies = Equal spacing

**Handrail**

See 'Typical Railing Details', Sheet 2 for post & rail details

**Cheekwall**

9" Min. Wide, cheekwall both sides

**Length of Landing**

5'-0" Min.

**Bottom of Cheekwall**

9" Min. Wide, cheekwall both sides

**Length of Landing**

6' Min.

**Elevation**

(At-Grade Steps)

- 5'-0" Min.
- 2" Min. (Typ.)
- 2" Min.
- 2'-10" ±
- 2'-10" Min.
- 9" Min.
- 3'-6"

**Guiderail on Steps & Stairs**

- **Handrail**
- **Post**
- **Cheekwall**

**Handrail Continuation**

See Detail "A" (Typ.)

**Handrail Continuation**

See 'Typical Railing Details', Sheet 2 for post & rail details

**Length of Landing**

1'-6" Min.

**Top Landing**

9" Min.

**Bottom Landing**

6'-0" Max. for one run of steps

- 6'-0" Max. on Steps
- Varies = Equal spacing
- 6'-0" Max. on Steps
- Varies = Equal spacing

**Handrail**

See 'Typical Railing Details', Sheet 2 for post & rail details

**Cheekwall**

9" Min. Wide, cheekwall both sides

**Length of Landing**

5'-0" Min.

**Bottom of Cheekwall**

9" Min. Wide, cheekwall both sides

**Length of Landing**

6' Min.

**Elevation**

(At-Grade Steps)

- 5'-0" Min.
- 2" Min. (Typ.)
- 2" Min.
- 2'-10" ±
- 2'-10" Min.
- 9" Min.
- 3'-6"
**DESCRIPTION:**

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STEELE PIPE GUIDERAIL

**FY 2017-18 DESIGN STANDARDS**

**CROSS REFERENCE:**

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

**DETAIL "C" - RAIL CONNECTIONS**

(Handrail and 4-Bolt Anchorage Not Shown)

**DETAIL "D" - EXPANSION JOINT**

(FIELD SPLICE SLIP JOINT SIMILAR)

**DETAIL "E" - CONTINUITY FIELD SPLICE**

**SECTION B-B**

(Handrail Connection)

**SECTION C-C**

BASE PLATE DETAIL

(2-Bolt Anchorage)

BASE PLATE DETAIL

(4-Bolt Anchorage)

PLATE WASHER DETAIL

(RECOMMENDED FOR STEEP SLOPES)

**SHIM PLATE DETAIL**

(2-Bolt Anchorage)

(4-Bolt Anchorage)

**BASE PLATE DETAIL**

(2-Bolt Anchorage)

(4-Bolt Anchorage)

**PLATE WASHER DETAIL**

**ALTERNATE BASE PLATE DETAIL**

**SHIM PLATE DETAIL**

**BASE PLATE DETAIL**

**SECTION C-C**

**PLATE WASHER DETAIL**

(Recommended for Steep Slopes)
10 /19 /2016

DESCRIPTION:

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TYPICAL SECTION ON CONCRETE SIDEWALK

TYPICAL SECTION ON GRAVITY WALL

(Other Retaining Walls Similar)

TYPICAL SECTION ON STEPS & STAIRS

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

OPTIONAL SIDEWALK ANCHORAGE DETAIL

SIDEWALK ANCHORAGE DETAIL OPTION 2 & 3

NOTES:

**2 ~ 1/2" Ø x 8" or 4 ~ 3/4" Ø x 6" Steel Anchors:
Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Permitted (C-I-P). Galvanized Adhesive Anchors Permitted (***): Expansion Anchors Not Permitted.

*** The minimum embedment for adhesive anchors is 6" for 2-Bolt Anchorage or 4" for 4-Bolt Anchorage.