NOTES:

1. Shop Drawings are required, refer to Specification Section 515.

2. Materials:
   A. Pan 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

   RAILING MEMBER DIMENSIONS TABLE

<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&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Rails</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrails Joint/Splice Sleeves</td>
<td>3&quot; NPS (Sch. 40)</td>
<td>1.313&quot;</td>
<td>0.133&quot;</td>
</tr>
<tr>
<td>Handrails</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1&quot; Ø Round Bar</td>
<td>1.000&quot;</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 A363
      d. Flat Washers: ASTM F436
      e. Aluminum Shims: ASTM B209, Alloy 6061
      f. Bearing Pads: Plain, Fabric Reinforced, or Fabric Laminated meeting requirements of Specifications 515 and 932.

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 "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 the 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.

4. Handrails are required and must be continuous at landings for:
   A. Grades Steeper than 5%.
   B. Three or more steps.
   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 the 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. Cutting of reinforcing steel is permitted for adhesive anchor bolt installations.
PIPE GUIDERAIL (STEEL)

**ELEVATION**

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

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

**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%

**NOTES:**

NPS = Nominal Pipe Size

STRUCTURES EXPANSION JOINTS NOTE:

* Keyed construction joints in Index 400-011 Gravity Structures Expansion Joints

Walls are not considered to be expansion joints.

**CROSS REFERENCE:**

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

**REFERENCES:**

See Plans for continuation or termination limits of railing

See "Typical Railing Details" for post & rail details

See Detail "C" Sheet 4

See Detail "D" Sheet 4

See Detail "E" Sheet 4 (Typ.)

Rail expansion joints (Typ.)

Rail expansion joints to be located in panels above structure expansion joints * (30'-0" maximum spacing).

Continuity Field splice (as required) see Detail "E" Sheet 4 (Typ.)

See Plans for continuation or termination limits of railing

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

NOTES:

NPS = Nominal Pipe Size

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See Detail "D" Sheet 4

See Detail "E" Sheet 4 (Typ.)

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Continuity Field splice (as required) see Detail "E" Sheet 4 (Typ.)

See Plans for continuation or termination limits of railing

For Details "C", "D" and "E", see Sheet 4.
GUIDERAIL ON STEPS & STAIRS

- **PIPE GUIDERAIL (STEEL)**

**DESCRIPTION:**

- **FY 2018-19**
- **STANDARD PLANS**
- **INDEX** 515-080
- **SHEET** 3 of 5

**REVISION**

- **R1 01/17**

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**GUIDERAIL ON STEPS & STAIRS**

- **Railing Continuation Beyond Steps**
  - (Bottom shown, Top similar)
  - See 'Typical Railing Details', Sheet 2 for post & rail details
  - Concrete sidewalk to extend 6" min. behind railing

**Handrail Termination**

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

**Steel Handrail**

- Required for three or more steps
- See Index 400-021 or Contract Plans for Step Details

**Handrail Continuation**

- See Detail 'A' (Typ.)
- Handrail and cheekwalls continuous at landings

**Handrail Details**

- Varies - Equal spacing
- 6'-0" Max. on Steps
- Equal to one tread length

**Handrail Termination**

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

**Handrail Details**

- Varies - Equal spacing
- 6'-0" Max. on Steps
- Equal to one tread length

**Elevation**

- (At-Grade Steps)
- See Index 400-021 or Contract Plans for Step Details

**Alternate End Treatment**

- See Detail 'A' (Typ.)
PIPE GUIDERAIL (STEEL)

**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**

(Recommended for Steep Slopes)

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

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

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

**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.
TYPICAL SECTION ON CONCRETE SIDEWALK

TYPICAL SECTION ON GRAVITY WALL

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

NOTE S:
**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.