NOTES:

1. Shop Drawings are required, refer to Specification 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 A500 Grade B.
   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>
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<tr>
<th>MEMBER</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSION</th>
<th>WALL THICKNESS</th>
</tr>
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<tr>
<td>Posts</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.275&quot;</td>
<td>0.125&quot;</td>
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<tr>
<td>Rails</td>
<td>2&quot; NPS (Sch. 40)</td>
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<td>0.125&quot;</td>
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<tr>
<td>Rail Joint/Splice Sleeves</td>
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<td>1.375&quot;</td>
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<tr>
<td>Handrails Joint/Splice Sleeves</td>
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<tr>
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<td>0.125&quot;</td>
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<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 A36
   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.
   C. Continuity field splice (Detail "F") is only used to make the railing continuous for unforeseen field adjustments.
   D. Corners and changes in tangential longitudinal alignment may be made continuous with a 90° 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 used to make the railing continuous for unforeseen field adjustments.

5. Cutting of reinforcing steel is permitted for adhesive anchor bolt installations.
Sheet 4 (Typ.)
(see required) see Detail "E" Sheet 4

See Plans for continuity or termination limits of railing

See Plans for continuation or termination limits of railing

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

NOTES:
NPS = Nominal Pipe Size

STRUCTURES EXPANSION JOINTS NOTE:
* Keyed construction joints in Index 400-011 Gravity
Wall are not considered to be expansion joints.

ELEVATION

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

RAMP REQUIREMENTS
For slopes greater than 5%:
Max. ramp slope = 8.25%
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%
RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

Steel Handrail required for three or more steps
(Handrail and cheekwalls continuous at landings)

Handrail

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

Concrete sidewalk to extend 6" min. behind Handrail

Handrail Termination
See Detail “A” (Typ.)

Handrail

6'-0" Max. on Steps

See Index 400-021 or Contract Plans for Step Details

Length of Landing 5' Min.
Top Landing

ELEVATION
(At-Grade Steps)

GUIDERAIL ON STEPS & STAIRS

ALTERNATE END TREATMENT
PIPE GUIDERAIL (STEEL)

**DESCRIPTION:**

- **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
- **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)

**Notes:**
- Stainless Steel Set Screw. Set Screws must be set flush against outside face of rail (Typ.).
- Round over both ends of rails to remove sharp edges (Typ.).
- Steel Sleeve: 1½" NPS (Sch. 40) for Rails 1" NPS (Sch. 40) for Handrails
- Bevel bottom of post as required to maintain plumb posts (Typ.).
- At the Contractor's option, embedded length may be 4" when ½" Ø plug weld is substituted for the ½" Ø set screw.

**CROSS REFERENCE:**

For locations of Details "C", "D" and "F", see Sheet 2.
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 ~ 2~ Ø x 6" or 4 ~ 2~ 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.