Pipe Rails and Posts shall be in accordance with ASTM A 53 Grade B for standard weight pipe and ASTM A 500 Grade B, C or D or ASTM A515 for structural tube. Bars for handrail supports shall be ASTM A36. Posts and End Rails shall be fabricated and installed plumb. ± 1/8" tolerance when measured at 3'-6" above the foundation. Corners and changes in tangential-longitudinal alignment, may be made continuous with a 9" bend radius or terminated at adjoining sections with a tee for drilled hole installation. 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. Curved longitudinal alignments the top and bottom rails and handrails shall be shop bent to match the alignment radius.

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>DESIGNATION</th>
<th>OUTSIDE DIMENSION (in)</th>
<th>WALL THICKNESS (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>2&quot; NPS (SCH. 40)</td>
<td>2.375</td>
<td>0.154</td>
</tr>
<tr>
<td>Nails</td>
<td>2&quot; NPS (SCH. 40)</td>
<td>2.375</td>
<td>0.154</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1-1/2&quot; NPS (SCH. 40)</td>
<td>1.900</td>
<td>0.145</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
<td>1&quot; NPS (SCH. 40)</td>
<td>1.150</td>
<td>0.133</td>
</tr>
<tr>
<td>Handrails</td>
<td>1&quot; NPS (SCH. 40)</td>
<td>1.900</td>
<td>0.145</td>
</tr>
</tbody>
</table>

**BASE PLATES:**
Base Plates shall be in accordance with ASTM A36 or ASTM A709 Grade 36.

**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 1/2" and localized irregularities greater than 1/2".
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 ½" unless longer anchor bolts are provided for the exposed thread length.

**COATINGS:**
The railing shall be hot-dip galvanized after fabrication in accordance with Section 962 of the Specifications.
All nuts, bolts and washers shall be hot-dip galvanized in accordance with Section 962 of the Specifications.

**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. 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 F336 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 duremeter hardness 60 or 70.

**JOINTS:**
All fixed joints are to be welded all around and ground smooth. Expansion Joints shall be spaced at a maximum of 32'-0". Field splices similar to the expansion joint detail may be approved by the Engineer to facilitate shipping and handling, but rails must be continuous across a minimum of two posts. Only use the Continuity Field Splice (Detail "E") to make the railing continuous for unforeseen field adjustments.

**WELDING:**
All welding shall be in accordance with the American Welding Society Structural Welding Code (Steel) AWS/D1.1 (current edition). Weld metal shall be E60XXXX or E70XXXX. Nondestructive testing of welds is not required.

**SHOP DRAWINGS:**
Complete details addressing project specific geometry (line & grade) showing post and expansion joint locations must be submitted by the Contractor for the Engineer's approval prior to fabrication of the railings. Shop drawings shall be in accordance with the Specifications.

**PAYMENT:**
Guiderail shall be paid for under the contract unit price for Pipe Guiderail (Steel), LF (Item No. 515-1.1). Payment for the Guiderail shall be prorated according to length along the center line of the top rail, and includes rails, posts, 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 Guiderail.
Specification Section 416. The minimum embedment is 6".

Specification Section 937 and installed in accordance with an Adhesive Bonding Material System in accordance with set in drilled holes (manufacturer recommended diameter) with *** Adhesive anchors shall be fully threaded headless anchor bolts (**); Expansion Anchors Not Permitted. Permitted (C-I-P); Galvanized Adhesive Anchors Permitted Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts Ø x 8" Steel Anchors:

NOTES:

plastic or galvanized steel plug

Seal end of post with a "2 1/4" Min. Embedment

Section 926 accordance with Specification Epoxy Mortar (Type F) in Min. 6"

Build-up (Typ.) " Min. Beveled 8 1

Step Cheekwall Measured from Step Nosing 2'-10"

3'-6"

Step nosing Top of 2'-6" Max. (away from drop-off)

Hole (Ø Core Drilled b 3"

Between Handrails

4 1/2" s

1 1/2" NPS (Sch. 40) Handrail

1" Ø Bar

Measured From Step Nosing

TYPICAL SECTION ON STEPS & STAIRS

TYPICAL SECTION ON CONCRETE SIDEWALK

TYPICAL SECTION ON GRAVITY WALL

(Other Retaining Walls Similar)

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

OPTIONAL SIDEWALK ANCHORAGE DETAIL

EDGE SHIM (8" long x ½ wide x thickness as reqd.)

2 – ½ Ø Anchor Bolts (**) with Self-Locking Hex Nuts & Washers.

6" Standard, ½Ø for Ramps requiring handrails

6" Standard, ½Ø for Ramps

Slope 2% Max. (away from drop-off)

45° Varies (3 Min.)

4" Sidewalk with Thickened Edge

6" Embedment Depth Width of Structure at (Min.)

Back Face of Gravity Wall

Base Plate

Full size Shim Plates when required for height adjustment

1/2" Thick Resilient or Neoprene Pad

1/2" (Min.) wide bed of Adhesive Bonding Material

2" curb for Ramps

1 1/2" Min. Beveled Build-up (Typ.)

1 ½" Ø Core Drilled Hole (½a). Clean hole in accordance with Specification Section 416

3" Min. Embedment

Seal end of post with a plastic or galvanized steel plug

Epoxy Mortar (Type F) in accordance with Specification Section 926

1/2" Post Ø

3/8" Min. Beveled

Full size shim plates as reqd.

Base Plate

Self-Locking Hex Nuts & Washers.

Steel Pipe Guiderrail

STEEL PIPE GUIDERRAIL

2010 Interim Design Standard

Interim Date 01/01/11
Sheet No. 5 of 5

Index No. 880

01/01/11

880