### NOTES

**RAILS, PICKETS & POSTS:** Pipe Rails and Pickets shall be in accordance with ASTM A500 Grade B, C or D, or ASTM A53 Grade B for standard weight pipe (Schedule 40) or ASTM A36 for bars. Structural Tube Posts shall be in accordance with ASTM A500 Grade A, B, C or D. Pipe Rails and Pickets shall be fabricated from solid pipe and included plum, +1" tolerance when measured at 3'-6" above the foundation. Pickets shall be fabricated parallel to the posts. Corrosion and changes in tangential/longitudinal alignment shall not exceed 1/2" bend radius or terminals at adjoining sections with mitered ends when handrails are not required. For changes in tangential/longitudinal alignment greater than 45°, posts shall be positioned at a maximum distance of 4'-6" on center. For changes in alignment, the top and bottom rails and handrails shall be bent to match the alignment radius.

### 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; x 4&quot; Rectangular Tube</td>
<td>2.00&quot; x 4.00&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Rolls</td>
<td>2&quot; NPS (Sch. 40)</td>
<td></td>
<td>0.154&quot;</td>
</tr>
<tr>
<td>Roll Joint/Splice Sleeves</td>
<td>1/2&quot; NPS (Sch. 40)</td>
<td>1.000&quot; NPS</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1&quot; Round Bar</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Pickets</td>
<td>1/4&quot; NPS (Sch. 40)</td>
<td>0.840&quot; NPS</td>
<td>0.109&quot;</td>
</tr>
<tr>
<td></td>
<td>5/8&quot; Round Bar</td>
<td>1.750&quot; NPS</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**BASE PLATES & POST CAPS:**

- Base Plates and Post Cap plates shall be in accordance with ASTM A36 or ASTM A709 Grade 36.
- Show Plates shall be aluminum in accordance with ASTM B209, Alloy 5056 or 6063.
- Show plates shall be used for foundation height adjustments greater than 1/2" and localized irregularities greater than 1/4".
- Field trim: shim plates when necessary to match the contours of the foundation. Beveled shim plates may be used instead to light on triangular (flattened) shim plates must be positioned together with an 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 Field trimmed precisely. Timing ofهم لـ" للأسلاك المثبتة في الأرض. Expansion Anchors are not permitted. All anchor bolts shall have single self-locking hex nuts. Tack welding of the nut to the anchor bolt is not permitted. All anchor bolts shall be self-locking hex nuts. Anchor bolts shall be positioned at a maximum distance of 4'-6" on center. Oriented with the nut facing the foundation and tack welds shall be galvanized with a galing compound in accordance with the Specifications.

**RESEDENT AND NEOPRENE PADS:** Resilient and Neoprene pads shall be in accordance with Specification Section 932 except that testing for finished pads shall not be required. Neoprene pads shall be PRESTRESSED hardness 60 or 70.

**JOINTS:** All fixed joints are to be welded around and ground smooth. Expansion joints shall be spaced at a maximum of 4'-6" on center. Expansion joint details as approved by the Engineer to facilitate hot-dip galvanizing and handling, but rolling must be continuous across a minimum of two posts. Only the Continuity Field Splice (Global) shall be used to make the continuous connection for tangential/longitudinal field adjustments. Metallic rails with a galing compound when field adjustments are required.

**WELDING:** All metal shall be in accordance with the American Welding Society Structural Welding Code (Steel) AWS/D1.1 (current edition). Weld metal shall be E601XX or E607XX. Nondestructive testing of welds is not required.

**SHEET DRAWINGS:** Complete details addressing project specific geometry (lines & grades) show point and expansion joint locations; anchor bolt installation "Case" or lengths, and ventilation holes for galing, must be submitted for the Contractor's approval prior to fabrication of the railing. Shop drawings shall be in accordance with the Specifications.

### DESIGN SPECIFICATIONS:

- Florida Department of Transportation (FDOT) "Structural Design Guidelines for Load and Resistance Factor Design", January, 2006

### DESIGN LIVE LOADS:

- Post and Base Plate: Equivalent load shall = 200 lb. load + 150 lb./ft. * Post Spacing (ft.) applied transversely at top rail connection. Top & Bottom Rails: 50 lb./ft. uniform load applied simultaneously vertically and transversely + 200 lb. concentrated point load applied at midspan in the directions for both maximum stress and deflection. Handrails: Maximum of either 50 lb./ft uniform load applied in any direction or 250 lb concentrated load applied in any direction at any point along the top. Pickets: Concentrated 200 lb. load applied transversely over an area of 1.0 square foot.

### GEOMETRY:

- Clear Opening between Pickets: Shatter reject the passage of a 4" diameter sphere below 42" height, and a 8" diameter sphere above 42" height.
- ADA Handrail Height: 34". Standard Height Bicycle Railing Height: 42" minimum. Special Height Bicycle Railing Height: 54" minimum.

### DEFLECTION:

- Total combined deflection of the railing system including the resilient or neoprene pads, due to the top rail design live loads, shall not exceed 1/32", when measured at midspan of the top rail.

### APPLICATION NOTE TO DESIGNER:

This railing is not applicable for shielding drop-off hazards for vehicular traffic. This railing is applicable in areas, such as a pedestrian or bicyclist drop-off hazard exceeds 2'-6" or when a drop-off hazard is less than 2'-6" and is required by design. Index No. 851 for special requirements and modifications for use on bridges. Adequate fence non-contact shall provide anchorage and stability against overturning. For unsuitable conditions a site specific railing is to be designed by the responsible engineer. The railing shown on these drawings requires a handrail for ramp steeper than a 5% grade to conform with the requirements of the Americans with Disabilities Act (ADA). Refer to FDOT Plans Preparation Manual (Volume I) Chapters 4 & 8, for the definition of pedestrian, bicyclist and "drop-off hazards".

### ALTERNATE DESIGN:

Manufacturers seeking approval of proprietary railing systems for inclusion on the Qualified Products List (QPL) must provide alternate designs. Manufacturers must submit application along with design documentation showing the proprietary railing system is designed to meet the design life, live loads, geometry, and other requirements specified herein. All fixed joints are to be either welded or commercially designed fixed joint systems. Each field section of railing must be fabricated with a permanently affixed label with the manufacturer's name and the FDOT QPL approver number. Labels must be a minimum of 1/2" x 1" and located at the base of a post within the grips of the hands of an average sized person. All specific shop drawings are required for QPL approved railings, see Shop Drawings note.

### SHIPMENTS:

- All fixed joints are to be either welded or commercially designed fixed joint systems. Each field section of railing must be fabricated with a permanently affixed label with the manufacturer's name and the FDOT QPL approver number. Labels must be a minimum of 1/2" x 1" and located at the base of a post within the grips of the hands of an average sized person.
- Shop drawings shall be submitted with certified test reports from an approved independent testing agency. Test railings systems in accordance with ASTM E935 (Test Method A & C) using test loads of 1/2% of the design load. Test proprietary or nonstandard anchorage systems in accordance with ASTM E894 (Flexural test). Anchorage systems must resist a minimum of 1/2% of the design load for failure of the anchor bolts or 20% of the design load for failure in the concrete foundation. Payments shall be for per linear foot (Item No. 515=2-web). Payment will be prorated quantity measured as the length along the center line of the top rail, and includes rails, posts, pickets, 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.
**TOP RAIL CONNECTION**

*Base Plate Not Shown for Clarity*

- **Post & Anchor Bolts**
  - 1" Offset to Face of Post
  - 1/2" Max gap (Typ.)
- **Post Cap**
  - 1/2" Venting Hole (Typ.)
- **Base Plate**
  - 1/2" x 1/4" Long Slotted Holes for Anchor Bolts with Flat Washers (Typ.)
- **Anchor Bolts**
  - 1/4" Pan Head Stainless Steel (Type 316 or 18-8 Alloy)
  - Flat Washers (Typ.)
  - Screws at 2" spacing may be substituted for the 1/4" pan head set screws. Set screws must penetrate the full wall thickness of the inner sleeve and be set flush against the outside face of rail and underside of handrail.

**BASE PLATE & BOTTOM RAIL CONNECTION**

- **Base Plate**
  - 1" x 1/4" Plate
- **Post**
  - 1/2" Venting Hole
  - Holes for Anchor Bolts with Plate Washers (Typ.)
- **Post & Anchor Bolts**
  - 1/2" Max gap (Typ.)
  - 1/2" Venting Hole (Typ.)
  - 1/2" Base Plate
- **Base Plate Washers**
  - 2" Pan Head Stainless Steel (Type 316 or 18-8 Alloy)

**ALTERNATE BASE PLATE DETAIL**

*Recommended for Top of Step Cheekwalls*

- **Post & Anchor Bolts**
  - 1" Offset to Face of Post
  - 1/2" Max gap (Typ.)
  - 1/2" Venting Hole (Typ.)
  - 1/2" Base Plate
  - 1/2" x 1/4" Long Slotted Holes for Anchor Bolts with Flat Washers (Typ.)
  - 1/4" Pan Head Stainless Steel (Type 316 or 18-8 Alloy)
  - Flat Washers (Typ.)

**SHIM PLATE DETAIL**

*Centred*

- **SHIM PLATE**
  - 3/8" x 1/4" Plate
  - 3/8" x 1/4" Hole

**DETAIL "C" - RAIL CONNECTIONS**

*Showing Outside Face of Structure and Railing, Pickets and Handrail Not Shown for Clarity*

- **Top Rail**
  - 3/8" Venting Hole
  - 3 Sp. @ 2" Long Slotted Holes for Anchor Bolts with Flat Washers (Typ.)
  - 1 1/2" NPS (Sch. 40)
  - Match Grade of Ramp or Stairs
- **Handrail**
  - 3/8" Venting Hole
  - 3 Sp. @ 2" Long Slotted Holes for Anchor Bolts with Flat Washers (Typ.)
  - Steel Sleeve: 1 1/2" NPS (Sch. 40) for rails 1" NPS (Sch. 40) for handrails

**DETAIL "D" - EXPANSION JOINT**

*FIELD SPlice SLIP JOINT SIMILAR*

- **Steel Sleeve**
  - 1 1/2" NPS (Sch. 40)
  - Round over both ends of rails 1/2" (Typ.)
  - Round over both ends of rails 1/2" (Typ.)
  - Bevel bottom of post as required to maintain plumb posts (Typ.)

**DETAIL "E" - CONTINUITY FIELD SPICE**

*Showing Slanted Condition for Stairs or Ramp*

- **Top Rail**
  - 3/8" Venting Hole
  - 3 Sp. @ 255°
  - 1 1/2" NPS, Sch. 40
  - Match Grade of Ramp or Stairs
- **Handrail**
  - 3/8" Venting Hole
  - 3 Sp. @ 255°
  - 1 1/2" NPS, Sch. 40

**DETAIL "B" - RAIL AND HANDRAIL**

*Showing Sloped Condition for Stairs or Ramp*

- **Top Rail**
  - 3/8" Venting Hole
  - 3 Sp. @ 255°
  - 1 1/2" NPS, Sch. 40
- **Handrail**
  - 3/8" Venting Hole
  - 3 Sp. @ 255°
  - 1 1/2" NPS, Sch. 40

**CROSS REFERENCE**

For locations of Details "C", "D" and "E", see Sheet 2 of 5.