Table 1 - Railing Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Designation</th>
<th>Outside Dimension</th>
<th>Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post &quot;A&quot;</td>
<td>HSS 2 1/2 x 1 1/2</td>
<td>2.50&quot; x 1.50&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Post &quot;B&quot;</td>
<td>HSS 2 1/2 x 1 1/2</td>
<td>2.50&quot; x 1.50&quot;</td>
<td>0.188&quot;</td>
</tr>
<tr>
<td>Top Rail</td>
<td>HSS 3.000 x 0.120</td>
<td>3.000&quot;</td>
<td>0.120&quot;</td>
</tr>
<tr>
<td>End Hoops</td>
<td>HSS 3.000 x 0.120</td>
<td>3.000&quot;</td>
<td>0.120&quot;</td>
</tr>
<tr>
<td>Top Rail Joint/Splice Sleeves</td>
<td>HSS 2.500 x 0.125</td>
<td>2.500&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Intermediate &amp; Bottom Rail</td>
<td>HSS 2 x 2 x 1/2</td>
<td>2.00&quot; x 2.00&quot;</td>
<td>0.188&quot;</td>
</tr>
<tr>
<td>Intermediate &amp; Bottom Rail</td>
<td>HSS 2 x 2 x 1/2</td>
<td>2.00&quot; x 2.00&quot;</td>
<td>0.188&quot;</td>
</tr>
</tbody>
</table>

Notes:
1. 0.125" wall thickness permitted for rails with post spacings less than 5'-8", except that Post Connection Sleeve must be 1 1/8" NPS (Schedule 40).

Table 1 Notes:
1. Shop Drawings are required; see Specification Section 515.
2. For bridge mounted railings work this Index with Index 515-051 Bridge Bicycle/Pedestrian Railing.
3. Materials:
   A. Pipe Rails and Pickets: ASTM A500 Grade B, C or D, or ASTM A36 for standard weight pipe (Schedule 40) and ASTM A36 for bars.
   B. Structural Tube: ASTM A500 Grade A, B, C, or D or ASTM A511.
   C. Steel Plate: ASTM A36 or ASTM A500 Grade 36.
   D. U-Channels and filler plates: ASTM A36 or ASTM A511 (Grade 36).
   E. Stainless steel (SS) screws: Type 316 or 18-8 Alloy.
   F. Galvanized Steel Fasteners: coated in accordance with Specification Section 962.

4. Fabricate pickets and vertical panel elements parallel to the posts; except Type 2, 3 and 5 panel infills may be fabricated parallel to the longitudinal grade. Maintain a maximum clear opening of 3" when a 4" sphere requirement is indicated in the Data Tables.
5. Maximum spacing between expansion joints is 40'-0". Locate an Expansion Joint between the posts on either side of the Deck Expansion Joint.
6. Field splices are similar to the Expansion Joint Detail and may be approved by the Engineer to facilitate handling; but the top rail must be continuous across a minimum of two posts.
7. For intermediate and bottom horizontal rails, the screwed joints shown may be substituted with alternate joints shown in detail "X".
8. Make corners and changes in tangential longitudinal alignment with a 90° bend radius or terminate adjoining sections with mitered end sections when handrails are not required.
9. For changes in tangential longitudinal alignment greater than 45°, position posts a maximum of 2'-0" each side of the corner but not at the corner apex.
10. For curved longitudinal alignments, shop bend the top and bottom rails and handrails to match the alignment radius.
11. Handrails are required and must be continuous at landings for:
    A. Grades Steeper than 5%.
   B. Three or more steps.
12. Installation: Cutting of reinforcing steel is permitted for post installed anchors.
ELEVATION
(Showing Outside Face of Railing with Type "A" Posts)

TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

NOTES:
* Keyed construction joints in Index 400-011 Gravity Wall are not considered to be expansion joints.
** Contraction joints (Tooled or Saw Cut) in sidewalks do not require a 6" minimum offset.

EXPANDED ELEVATION AT CORNERS
DETAIL FOR NON-CONTINUOUS RAILING AT CORNERS

RAILINGS ON GRADES STEEPER THAN 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

For slopes greater than 5%:
Max. ramp slope = 8.33%
Max. ramp cross-slope = 2.0%

Max. landing slope = 2%
Max. landing cross slope = 2%
RAIL TERMINATION DETAILS

- **RAIL CONTINUATION BEYOND STEPS OR STAIRS**
  - Bottom shown, Top similar
  - See "Typical Railing Details", Sheet 2 for post, rail & picket details

- **DETAIL "L" - PLAN VIEW**
  - Handrail termination
  - See Detail "L" in bottom of handrail
  - Flatten handrail termination to 1½" Max. width
  - ½ Ø Vent/Weep hole in bottom of handrail

- **DETAIL "J" - ELEVATION VIEW**
  - Handrail Continuation At Landing
  - See "Typical Railing Details", Sheet 2 for post, rail & picket details

- **DETAIL "K" - ELEVATION VIEW**
  - Bottom Rail Connection
  - Intermediate Rail Similar
  - See "Typical Railing Details", Sheet 2 for post, rail & picket details

- **RAILINGS ON STEPS & STAIRS**
  - Steel Handrail required for three or more steps
  - Round over corners to remove sharp edges (Typ.)
  - See Index 400-021 or Contract Plans for Step Details

- **ALTERNATE HANDRAIL END TREATMENT OR MOUNTING LOCATION FOR SLOPED WALLS**
  - 9" Min. thick wall
  - Equal to one tread length
  - Not considered an expansion joint for railing fabrication (Typ.)

- **VIEW J-J**
  - Top Rail termination
  - See Detail "L" in top rail

- **VIEW K-K**
  - Bottom Rail termination
  - See Detail "K" in bottom rail
**SECTION A-A**

**Picket Notes:**
* Picket Spacing of 6" centers is based on a 5/8" Ø Bar for standard applications. When shown in the Contract Plans a 5" picket spacing may be required. See Note 4 (Sheet 1).

**Type 1 - Picket Infill Panel**

- Picket Spacing of 6" centers is based on a 5/8" Ø Bar for standard applications. When shown in the Contract Plans a 5" picket spacing may be required. See Note 4 (Sheet 1).

**Type 2 - Chain-Link (Continuous Infill Panel)**

- Chain-Link Fence Fabric shall be continuous along limits of railing. Splicing of Chain-Link panels using Tension Bars at 20'-0" minimum increments is permitted.

**Table 2 - Chain-Link Panel Component Materials**

<table>
<thead>
<tr>
<th>Component</th>
<th>ASTM</th>
<th>Component Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain-Link Fence Fabric</td>
<td>A 392</td>
<td>Zinc-Coated Steel - No. 9 gage (coated wire diameter), Class 2 Coating</td>
</tr>
<tr>
<td>(2&quot; mesh with twisted bottom and knuckled top selvage)</td>
<td>A 491</td>
<td>Aluminum-Coated Steel - No. 9 gage (coated wire diameter)</td>
</tr>
<tr>
<td>Tie Wires</td>
<td>F 626</td>
<td>Zinc-Coated Steel Wire - No. 9 gage with coating to match Chain-Link Fence Fabric.</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>F 624</td>
<td>5/8&quot; (Min. thickness) x 5/8&quot; (Min. width) Steel Bars</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
<td>F 626</td>
<td>Zinc-Coated Steel</td>
</tr>
</tbody>
</table>

**Chain-Link Panel Notes:**
Chain-Link Fence Fabric shall be continuous along limits of railing. Splicing of Chain-Link panels using Tension Bars at 20'-0" minimum increments is permitted.
**TYPE 3 - SUNSHINE INFILL PANEL**

* Arc, Rays and Sun Segment may be formed in a single panel from ½" steel plate pattern cut with laser or plasma CNC, welded to a 1x1½ Angle Border or the ½x½ Channel Border shown.

**TYPE 4 - BROADWAY INFILL PANEL**

<table>
<thead>
<tr>
<th>Note</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>See Plans for Infill Panel Option required.</td>
</tr>
</tbody>
</table>

**NOTES:**

- ½" Infill Panel (Cut or Cast)
- Channel ½x½ (Border)
NOTES:
1. See Plans for Infill Panel Type required.

TYPE 5 - PERFORATED INFILL PANEL

DETAIL "5A"

PANEL/RAIL CONNECTION
(Top Shown, Bottom Similar)

DETAIL "5B"

PANEL END CONNECTION
(Expansion Joint Shown, Sides Similar)

SECTION A-A

Rail Expansion Joint

Seal welding mitered corners is permitted

SECTION C-C

PANEL/SPICE CONNECTION

REPEATING PATTERN DETAIL
FOR PERFORATED PANEL

NOTES:
1. See Plans for Infill Panel Type required.
**Bolts & Post**

**Edge Shim (8" long x 3/4" wide x thickness as reqd.)**

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

**Full size Shim Plates when required for height adjustment**

**Shim Plates as required**

**Optional 4-Bolt Anchorage (shown dashed)**

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

**STEP-CHEEKWALL**

**Step Cheekwall**

**MIN. #4 BAR (TY.P.)** *(Continuous)*

**4'-0" Std. ~ 3'-0" Min. Clear Between Handrails**

**Optional 4-Bolt Anchorage** *(shown dashed)*

**Base Plate**

**Minimum #4 Bars @ 1'-0" (Max.) spacing for Case IIa**

**Minimum 2 ~ #4 Bars in Top of Structure** *(for Case IIa, III & IV)*

**Inside Face of Concrete Structure or Sidewalk** *(See Concrete Structure Plans for actual dimensions and reinforcing details)*

**TYPICAL SECTION FOR 4~BOLT ANCHORAGE** *(Case IV)*

**TYPICAL SECTION ON STEPS & STAIRS** *(Case III)*

**TYPICAL SECTION ON RETAINING WALL** *(Case II)*

**TYPICAL SECTION ON CONCRETE SIDEWALK** *(Case I)*

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

**DETAIL "C"** *(Cast-In-Place Anchor Bolts shown, Adhesive Anchors similar)*

**ANCHOR BOLT TABLE**

<table>
<thead>
<tr>
<th>CASE</th>
<th>STRUCTURE TYPE</th>
<th>DIMENSIONS</th>
<th>ANCHOR LENGTH</th>
<th>ANCHOR SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Unreinforced Concrete</td>
<td>6&quot; x 1'-2&quot;</td>
<td>7 1/2&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>IIa</td>
<td>Reinforced Concrete</td>
<td>4&quot; x 4'</td>
<td>7 1/2&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>IIb</td>
<td>Gravity Wall</td>
<td>4 1/2&quot; x 2 1/2&quot;</td>
<td>7 1/2&quot; @ top</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>III</td>
<td>Step Cheekwall</td>
<td>4 1/2&quot; x 5&quot;</td>
<td>7 1/2&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>IV</td>
<td>Varies</td>
<td>5&quot; x 5&quot;</td>
<td>5 1/4&quot; x 6&quot;</td>
<td>7/8&quot;</td>
</tr>
</tbody>
</table>

**When required; measured from top of sidewalk.**

**INDEX 400-011**

**PEDESTRIAN/BICYCLE RAILING (STEEL)**