NOTES:
1. Shop Drawings are required.
2. Work with Specification 515.
3. Materials:
   A. Pan Head Set Screws: Aluminum Alloy 2024-T4 or 7075-T13 or Stainless Steel (SS) Type 316 or 18-8 Alloy.
   C. Structural Pipe Tube and Bars: ASTM B221 or ASTM B429, Alloy 6061-T6.
   D. End Rails: 90° bends and corner bends with a maximum 4 foot spacing; Alloy 5083-T5 is permitted.

<table>
<thead>
<tr>
<th>RAILING MEMBER DIMENSIONS TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEMBER</td>
</tr>
<tr>
<td>Posts</td>
</tr>
<tr>
<td>Rails</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
</tr>
<tr>
<td>Handrail</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
</tr>
</tbody>
</table>

E. Galvanized Steel Fasteners:
   a. Hex Head Bolts: ASTM A 307 Type 1 or ASTM F1554 Grade 36
   b. Adhesive Anchors: ASTM F1554 Grade 36 Fully Threaded Rods
   c. Hex Nuts: ASTM A 563
   d. Flat Washers: ASTM F436
   e. Aluminum Shims: ASTM B209, Alloy 6061

4. Fabrication:
   A. Place expansion joints at a maximum of 30'-0" spacing.
   B. Field joints 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 to be made with 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 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.
   G. Handrails are required and must be continuous at landings for:
      a. Grades Steeper than 5%.
      b. Three or more steps.

5. Cutting of reinforcing steel is permitted for post installed anchor bolts.
PIPE GUIDERAIL (ALUMINUM)

REVISION

DESCRIPTION:

REVISED STANDARD PLANS

FY 2019-20

STANDARD PLANS

INDEX

515-070

2 of 5

Sheet 4

See Detail "C" Sheet 4

Top of Sidewalk

or Bikeway

Ground Line

Minimum from free end of concrete

and expansion joints (Typ.)

1'-6" Max.) (Typ.)

Varies (4" Min.,

1'-6" Max.) (Typ.)

Continuity Field Splice

(as required) see Detail "E"

Sheet 4 (Typ.)

(Continued)

Showing Inside Face of Railing

RAMP REQUIREMENTS

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

LANDING REQUIREMENTS

Max. landing cross-slope = 2%
Max. landing slope = 2%

NPS = Nominal Pipe Size

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

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

NOTES:

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

CROSS REFERENCE:

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

1'-6" (Typ.)

6'-0" (Max.) - Equal Panels

Post Spacing (Typ.)

1'-6" (Typ.)

See Plans for continuation or termination limits of railing

See Plans for continuation or termination limits of railing

Top of Sidewalk

or Bikeway

Ground Line

Minimum from free end of concrete

and expansion joints (Typ.)

1'-6" Max.) (Typ.)

Varies (4" Min.,

1'-6" Max.) (Typ.)

Continuity Field Splice

(as required) see Detail "E"

Sheet 4 (Typ.)

(Continued)

Showing Inside Face of Railing

RAMP REQUIREMENTS

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

LANDING REQUIREMENTS

Max. landing cross-slope = 2%
Max. landing slope = 2%

NPS = Nominal Pipe Size

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

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

NOTES:

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

CROSS REFERENCE:

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

1'-6" (Typ.)

6'-0" (Max.) - Equal Panels

Post Spacing (Typ.)

1'-6" (Typ.)

See Plans for continuation or termination limits of railing

See Plans for continuation or termination limits of railing

Top of Sidewalk

or Bikeway

Ground Line

Minimum from free end of concrete

and expansion joints (Typ.)

1'-6" Max.) (Typ.)

Varies (4" Min.,

1'-6" Max.) (Typ.)

Continuity Field Splice

(as required) see Detail "E"

Sheet 4 (Typ.)

(Continued)

Showing Inside Face of Railing

RAMP REQUIREMENTS

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

LANDING REQUIREMENTS

Max. landing cross-slope = 2%
Max. landing slope = 2%

NPS = Nominal Pipe Size

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

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

NOTES:

For Details "C", "D" and "E", see Sheet 4.
Railing Continuation Beyond Steps
(Bottom shown, Top similar)

Concrete sidewalk to extend 6" min. behind Post

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

See Index 400-021 or Contract Plans for Step Details

Handrail Continuation

At Landing

Handrail

9" Min. Wide cheekwall both sides

Equal to one tread length

5'-0" Max. on Steps

Varies = Equal spacing

6'-0" Max. on Steps

6'-0" (Max.) - Equal Panels

Varies = Equal spacing

6'-0" Max. on Steps

Equal to one tread length

Post

Handrail

Handrail Termination

See Detail "A" (Typ.)

Handrail Termination

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

See Index 400-021 or Contract Plans for Step Details

ELEVATION
(At-Grade Steps)

Length of Landing 5' Min.

Bottom Landing

Top Landing

Handrail Continuation

See Detail "A" (Typ.)

ALTERNATE END TREATMENT
PIPE GUIDERAIL (ALUMINUM)

SECTION B-B
(Handrail Connection)

SECTION C-C
BASE PLATE DETAIL
(2-Bolt Anchorage)

SECTION C-C
BASE PLATE DETAIL
(4-Bolt Anchorage)

PLATE WASHER DETAIL

ALTERNATE BASE
PLATE DETAIL
(Recommended for Steep Slopes)

SHIM PLATE DETAIL
(2-Bolt Anchorage)

SHIM PLATE DETAIL
(4-Bolt Anchorage)

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

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

DETAIL "B" - RAIL AND HANDRAIL
(Showing Sloped Condition for Ramps with 2-Bolt Anchorage)

DETAIL "E" - CONTINUITY
FIELD SPLICE

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
(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)

SIDEWALK ANCHORAGE DETAIL
OPTION 1

SIDEWALK ANCHORAGE DETAIL
OPTION 2 & 3

NOTES:

2 ~ 3/8" Ø x 8" or 4 ~ 3/8" Ø x 6" Steel Anchors:
Galvanized Steel Bolts (As Shown) (C-I-P); Galvanized U-Bolts
Permitted (C-I-P); Galvanized Adhesive Anchors Permitted

*** The minimum embedment for Adhesive Anchors is 6" for
2-Bolt Anchorage or 8" for 4-Bolt Anchorage.