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 A503 for Structural Tube.

   Handrail Support Bars: ASTM A36

   Handrail Support Bars: ASTM A38

   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 A563
      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;
      but top rail must be continuous across a minimum of two posts.
   C. Continuity field splice (Detail "E") only use to make 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 the top and bottom rails and handrails to match
      the alignment radius.
   F. For changes in tangential longitudinal alignment greater than 45°, positioned 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 use to make 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 the top and bottom rails and handrails to match
      the alignment radius.
   F. For changes in tangential longitudinal alignment greater than 45°, positioned posts a maximum
      of 2'-0" each side of the corner, not at the corner apex.

5. Cutting of reinforcing steel is permitted for adhesive anchor bolt installations.
PIPE GUARDERAIL (STEEL)

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

- See Plans for continuation or termination limits of railing
- See "Typical Railing Details" for post & rail details

RAILINGS ON GRADES STEEPER THAN 5% TO 8.33%

- 1'-6" Min.
- 6'-0" Min.
- 3'-0" Min.

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

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

NOTES:
- NPS = Nominal Pipe Size
- Keyed construction joints in Index 400-011 Gravity Structures Expansion Joints
- Wall are not considered to be expansion joints.
- Cross Reference: For Details "C", "D" and "E", see Sheet 4.
RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

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

Handrail Continuation
See Detail "A" (Typ.)

Handrail
Varies = Equal spacing
6'-0" Max. on Steps

At Landing
Handrail Continuous

Handrail Terminations
See Detail "A" (Typ.)

6'-0" Min. for one run of steps

6'-0"

Concrete sidewalk to extend 6" min. behind Handrail

GUIDERAIL ON STEPS & STAIRS

PIPE GUARDERAIL (STEEL)
PIPE GUIDERAIL (STEEL)

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

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

SHIM PLATE DETAIL
(2-Bolt Anchorage)

PLATE WASHER DETAIL
(Recommended for Steep Slopes)

ALTERNATE BASE PLATE DETAIL

FIELD SPlice SLIP JOINT SIMILAR

DETAIL "D" - EXPANSION JOINT

SECTION B-B
(Handrail Connection)

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

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

DETAIL "E" - CONTINUITY FIELD SPlice

SECTION B-B
(Handrail Connection)

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

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

ALTERNATE BASE PLATE DETAIL
(Recommended for Steep Slopes)

FIELD SPlice SLIP JOINT SIMILAR

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)

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)

OPTIONAL SIDEWALK ANCHORAGE DETAIL

SIDEWALK ANCHORAGE DETAIL
OPTION 2 & 3

NOTES:
- **2 ~ 2" Ø x 6" or 4 ~ 1/2" Ø x 8" 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.

**2 ~ 2" Ø x 6" or 4 ~ 1/2" Ø x 8" 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.