FENCING TERMINALS AT BRIDGE ENDS

(ROADWAY)

- Top Of Fence Approx. Equals Tops Of Headwall:
- Terminate Fence Where Culvert Tops Of Headwall Approx. Equals Fence Height
- Fence Locations At Cross Drains With Excavated Outfall Ditches Or As Shown In Plans.
- Fence Locations At Gutter Transition With Excavated Outfall Ditches Or As Shown In Plans.

FENCING TERMNALS AT BOX CULVERTS

(For Heights Of Headwall Greater Than 4')

FENCING DETAIL AT CULVERT

(For Heights Of Headwalls 4' Or Less.)

Note: When height of headwall is 4' or less (drainage pipe 36" or less) the fence shall not be tied to the headwall, but shall span the lateral ditch.
End LA R/W Line & Fence

NOTE: LA R/W along the crossroad will extend a minimum of 300' beyond the end of the acceleration or deceleration section on ramps. For interchange quadrants having a ramp, the LA R/W will extend along the crossroad to a point opposite the limit of LA R/W established by the ramp taper or radius point as noted above.

For interchange quadrants having no ramp the LA R/W will extend along the crossroad to a point opposite the limit of LA R/W established by the ramp taper or radius point as noted above.

APPLIES TO BRIDGE OVER CROSSROAD AND CROSSROAD OVER FREEWAY (BRIDGE OVER CROSSROAD SHOWN)

FENCING TERMINALS AT RURAL INTERCHANGES

Retaining Wall

6" Where Footing Permits

Fence

End LA R/W Line & Fence

See Note Above

PLAN

Ground Line

Terminate Fence Where Wall Height
Approximately Equals Fence Height.

FENCING TERMINALS AT RETAINING WALLS

ELEVATION

FENCING TERMINALS AT URBAN INTERCHANGES

Note A - The indicated distance shall be sufficient to provide satisfactory sight distance for the traffic from the ramp.

Note B - The indicated distance shall be identical to the above noted dimension, if practical.

INSET A

50' Min. Overlap

30' Min.

See Inset A

Sidewalk

See Note B

Radius Point

LA R/W Line

Local Street

E Cross Street

LA R/W Line

Ramp

LA R/W Line

Ramp

Fence Type "B"

Fence Type "B"

50' Min. Overlap

30' Min.

50' Min. Overlap

Fence Type "B"
GENERAL NOTES

1. This fence to be provided generally in rural areas. For supplemental information see Section 550 of the FDOT Specifications.

2. Fabric to be woven wire, either galvanized steel, meeting the requirements of ASTM A120, No. 9 Grade 60, Design Number 1047-6-9, with Class 3 zinc coating, No. 12 ½ grade 757, Design Number 1047-6-12 ½, with a 10 ½ gage top and bottom wire and with Class 3 zinc coating, or aluminum coated steel, meeting the requirements of ASTM A528, No. 9 Farm, Design Number 1047-6-9, with a minimum coating weight of 0.60 oz./ft.². For additional information see payment note below.

3. Fence shall be installed with wire side to private property except on horizontal curves greater than 3° the fence shall be installed as to pull against all posts.

4. Posts may be either timber, steel, recycled plastic or concrete. Unless a specific post material is called for in the plans, the Contractor may elect to use either a single material or a combination of timber, steel, recycled plastic or concrete materials. Line posts of one material may be used with corner, pull and end post assemblies of a different material. Line posts of only one optional material and pull post only of only one optional material will be permitted between corner and post assemblies. Within individual corner and end post assemblies only one optional material will be permitted.

5. Timber posts shall meet the material requirements of Specification Section 954. Timber line posts are to be minimum 6” diameter. Timber corner post assemblies shall consist of: one corner post, two approach posts, four braces, eight diagonal tension wires and all necessary fittings and hardware. Corner post assemblies are to be installed at all horizontal and vertical breaks in fence of 15° or more.

6. Steel posts and braces shall be standard steel posts, galvanized at the rate of 2 oz./ft.², together with necessary hardware and wire clamps and meeting the following requirements.

   (A) Approach posts: 2"x2"x 1 1/2" angles with necessary hardware and fabricated for attaching brace; with necessary hardware, clamps, etc.
   (B) Pull, end and corner posts: 2 1/2"x1/2"x 1 1/2" angles, 8 ft. long; fabricated for attaching brace; with necessary hardware, clamps, etc.
   (C) Braces: 2 1/2"x 1 1/2"x 1 1/2" angles with necessary hardware and fabricated for attaching to post.
   (D) Pull posts where the wire is not spliced and pulled through the assembly, see General Note 18.

7. Recycled plastic posts shall meet the following material requirements: line posts shall have a minimum section of 2” round or 2” square. Plastic posts shall not be used as corner, pull, end or approach posts unless such use is specifically detailed in the plans. The straightness of the post shall comply with 954-5 for timber post.

8. The Contractor, at his option, may use any suitable precast or prestressed concrete posts; however, approval by the Engineer, of posts not shown in this index, will be required prior to construction of the Fence. Precast posts shall be Class 1 concrete. Prestressed posts shall be Class II (concrete). Lengths of concrete post to be as indicated for timber posts.

9. Aluminum post, braces and accessory framing hardware shall not be used unless the plans specifically detail their application or the Engineer specifically approves their incorporation in fence construction or repair. Aluminum framed gates are permitted as described in General Note 19.

10. The woven wire shall be attached to steel and concrete posts by a minimum of four tie wires. The single wire ties shall be applied to the top, bottom and three intermediate line wires. The ends of each tie wire shall have a minimum of two tight turns around the line wire. Tie wires shall be steel wire not less than 0.120" diameter, zinc coating Class 3, soft temper, in accordance with ASTM A461.

11. Steel Barbed Wire can be either of the following types:

   Type IIA: This type shall conform to the requirements of ASTM A121, with two strands of 12 gauge wire; four-point bars, wire size 14 gauge, twisted around both line wires; and, Class 3 coating. Design No. 12-4-0-16B.
   Type IIA: This type same as Type I except the two strand wires are twisted in alternating directions between consecutive posts.
   Type IIB: This type shall conform to the requirements of ASTM A122 with two strands of 15 gauge, high tensile wire; four-point bars; wire size 16 gauge twisted around both line wires; and, Class 3 coatings. Design No. 15-4-0-16R.

Aluminum Barbed Wire shall be fabricated of two strands of 0.110-inch wire with 0.08-inch diameter four-point bars spaced at approximately 1/3", and at a maximum spacing of 6". The wire for the strands and for the bars shall be of ASTM A307 Alloy 3006-158 or equivalent.

12. The woven wire shall be stretched only until one-half the tension curl has been pulled out of the line wires.

13. Posts to be set by driving or digging. If by digging, the posts shall be set at the center of the hole and the soft tamped securely on all sides.

14. Longer posts than those indicated above may be required by the plans or for deeper installations.

15. Concrete bases for angular steel posts (pull, corner, end and approach) shall be Class NS as specified in Section 437. Materials for Class NS concrete may be proportioned by volume and/or weight.

16. Pulled post assemblies shall be installed at approximately 330' centers except that this maximum interval may be reduced by the Engineer on curves where the radius is less than 300'.

17. Corner post assemblies are to be installed at all horizontal and vertical breaks in fence of 15° or more.

18. A maximum length of 1320' of wire may be installed as a unit. For pulls through a pull post assembly the fabric shall be spliced by crimping sleeves only. Pulls through a corner post assembly will not be permitted.

19. Unless otherwise called for in the plans gates shall be commercially available metal swing gates assembled and installed in accordance with the manufacturer's specifications as approved by the Engineer. Chain link swing gates in accordance with Index No. 803 may be substituted for metal swing gates as approved by the Engineer. For construction purposes, assemblies are defined as follows: End post assemblies shall consist of: one end post, one approach post, two braces, four diagonal tension wires and all necessary fittings and hardware. Corner post assemblies shall consist of: one corner post, two approach posts, four braces, eight diagonal tension wires and all necessary fittings and hardware.

21. All posts, braces, tension wires, fabric, tie wires, Class NS concrete, and all miscellaneous fittings and hardware to be included in the cost for Fencing, 16. Fencing shall be inclusive of the lengths of pull, end and corner post assemblies, but exclusive of gate widths.
This index details fencing that is constructed with farm fabric 46" (47" nominal) in height and with specific ground clearance and specific barbed wire spacings. For fencing of different height or installation details, the fence shall be fully detailed in the Contract Plans.

Designation: TIMBER POST ILLUSTRATED.

Note: See General Note No. 2.

CONCRETE BASE FOR ANGULAR STEEL POST

FENCE POSITION AT LOCATIONS WITHOUT FRONTAGE ROADS

(REFER TO DETAIL PLANS FOR FENCE POSITION AT LOCATIONS WITH FRONTAGE ROADS)

DESIGN NOTE

Two No. 6 Gage Wires
Twisted To Singing Tightness, Steel Wire, Soft Temper, Galvanized At The Rate Of 0.8 oz./ft²; ASTM A641 (Typical)
ALTERNATE CONCRETE POSTS AND BRACES

FASTENER FOR CONCRETE POST AND BRACES

FASTENER FOR TIMBER POST AND BRACE

CORNER POSTS

END AND PULL POSTS

Each horizontal wire to be wrapped around corner, end and pull post and tied to same wire. See General Notes 5 and 17. Timber post illustrated. These methods also apply to steel and concrete post illustrations.

SPLICES
GENERAL NOTES

1. This fence to be used generally in urban areas.

2. For supplemental information refer to Section 550 of FDOT Standard Specifications.

3. Chain link fabric, post, truss rods, tension wires, tie wires, stretcher bars, gates and all miscellaneous fittings and hardware shall meet the requirements of AASHO and AASHTO as of current publication.

4. Fence component options:

   A. Post options:
      (1) Galvanized steel pipe, Schedule 40-10' nominal dia., zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B.
      (2) Aluminum coated steel pipe, ASTM A53, 1-2 galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B.
      (3) Steel C or D and external coating Types A, B, C or D; the chromate conversion coating of external Type B shall have a thickness of 0.0003" min. and the polymer film topcoat shall have a thickness of 0.0003" min.; internal and external coatings are not restricted to the combinations of Table 2, ASTM F1043.

   B. Rail options:
      (1) Galvanized steel pipe, Schedule 40, 1/2" nominal dia., zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B.
      (2) Aluminum coated steel pipe, ASTM A53, 1-2 galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B.

   C. Tie wire options:
      (1) Tension wire: 1/8" dia., 0.040 oz./ft²: AASHTO M181.

   D. Chain link fabric options (2" mesh with twisted and barbed selvage top and bottom for all options except as described in Note No. 10):
      (1) Galvanized steel pipe, Schedule 40, 2' nominal dia., zinc galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B.
      (2) Aluminum coated steel pipe, ASTM A53, 1-2 galvanized at the rate of 1.8 oz./ft²: ASTM A53 Table 2, Grade A or B.

F. Tie wire and hog ring options:
   (1) Steel wire: 0.020" dia., 0.040 oz./ft²: AASHTO M181.
   (2) Aluminum wire: 0.020" dia., 0.040 oz./ft²: AASHTO M181.

5. Design standards:

   A. Design standards for highway fences:
      (1) Fence type A: 10' Max.
      (2) Fence type B: 802-813

6. Notes:

   A. Tubular post illustrated.
   B. Concrete base:
      (1) Concrete base cemented 1" above grade at all posts (Typical).
   C. Chain link Fabric No. 8 gage, 2' Mesh, Twisted And Barbed Top And Bottom Selvage.
   D. Ties @ 2' Centers.
   E. Ties @ 12" Centers.
   F. Ties @ 6" Centers.
   G. 14 Ga, 1/2" Tension bands per bar equally spaced (±15%).
   H. Ground Line:
      (1) Ground line post cap:
      (2) Corner:
      (3) End:
   I. Design:
      (1) Design:
      (2) Design:

7. For supplemental information refer to Section 550 of FDOT Standard Specifications.


9. 0.0003" min.; internal and external coatings are not restricted to the combinations of Table 2, ASTM F1043.

10. Casting alloy 5056 temper H38, or, Alclad alloy 5056 temper H192.

11. 0.9 oz./ft². zinc-5% aluminum ( Alternative Design: AASHTO M181.

12. Coated at the rate of 0.40 oz./ft². AASHTO M111.

13. Coated at the rate of 0.40 oz./ft². AASHTO M111.

14. Coated at the rate of 0.40 oz./ft². AASHTO M111.

15. Coated at the rate of 0.40 oz./ft². AASHTO M111.

16. Coated at the rate of 0.40 oz./ft². AASHTO M111.

17. Coated at the rate of 0.40 oz./ft². AASHTO M111.

18. Coated at the rate of 0.40 oz./ft². AASHTO M111.

19. Coated at the rate of 0.40 oz./ft². AASHTO M111.

20. Coated at the rate of 0.40 oz./ft². AASHTO M111.
GENERAL NOTES CONTINUED

5. Unless a specific material is called for in the plans the Contractor may elect to use either a single type of material or a combination of material types from the component options listed in note 4. Combinations of optional materials are restricted as follows:
(a) Only one fabric optional material will be permitted between corner and/or end post assemblies.
(b) Only one post optional material will be permitted between corner and/or end post assemblies.
(c) Pull post assemblies shall be optional materials identical to the line post optional material or the corner and end post assembly optional material; but, pull post assemblies shall be the same optional material between any set of corner and/or end post assemblies.

6. Concrete base plates shall be Class NS concrete as specified in Section 347 of the Standard Specifications or a proportioned, dry material meeting the requirements of a concrete under ASTM C-387. Materials for Class NS concrete may be proportioned by volume and/or by weight.

7. Line post shall be 8'-6" long (Standard). Line post are to be set in concrete as described above or by the following method:
(a) In accordance with special details and/or as specifically described in the contract plans and specifications.
(b) In accordance with ASTM F567 Section 5.4 as approved by the Engineer.
(c) Line post installed in accordance with Section 5.8 shall be 9'-6" long.

8. Pull post shall be used at breaks in vertical grades of 15° or more, or at approximately 350' centers except that the maximum interval may be reduced by the Engineer on curves where the curve is greater than 3°.

9. Corner post are to be installed at all horizontal breaks in fence at 15° or more and as required at vertical breaks over 15° as determined by the Engineer.

10. When fence has an installed top of fabric height less than 6' knuckled top and bottom selvages shall be used unless the plans specifically identify locations for twisted selvage fabrics.

11. Unless sliding gates or special gates are called for in the plans, all gates shall be chain link swing gates meeting the material requirements described and as approved by the Engineer. Payment shall include all hardware for installation and any additional length and/or size for posts at the opening. Gates shall be paid for under the contract unit price for Fence Gates, EA.

12. For construction purposes corner post assemblies shall consist of one corner post; two braces, two truss rods, and all necessary fittings and hardware as detailed. End post assemblies shall consist of one end post, one brace, one truss rod and all necessary fittings and hardware as detailed.

13. In areas where there are physical constraints outside the right-of-way which restricts the fence construction, the fabric may be installed on the inside of the posts.

<table>
<thead>
<tr>
<th>TYPE IV VINYL COATED FABRIC</th>
<th>ASHTO M181 Table 4 Redefined As Follows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specified Diameter Of Metallic Coated Core Wire</td>
<td>Minimum Weight Of Zinc Coating (Extruded Or Extruded And Bonded Coating)</td>
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<tr>
<td>in.</td>
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DESIGN NOTE
This index details fencing that is constructed with chain link fabric 6' (nominal) in height and with specific ground clearance. For fencing of different height or installation details, the fence shall be fully detailed in the Contract plans.
FENCE POSITION AT LOCATIONS WITHOUT FRONTAGE ROADS (REFER TO DETAIL PLAN FOR FENCE POSITION AT LOCATIONS WITH FRONTAGE ROADS)

NOTES

Attachments to be used only when called for in plans.
Attachments to extend in direction of restraint, unless otherwise called for in plans, direction of restraint will be as follows:
(a) Outward on limited access right of way lines.
(b) Outward on controlled access right of way lines.
(c) Outward from utilities and hazardous facilities located within highway right of way.
(d) Outward from lateral ditches, culverts, retention basins, canals, borrow areas and similar support facilities.
(e) Toward on pedestrian ways.

The cap-arm shall be designed to provide a drive fit over the top of posts and to exclude moisture in posts with tubular sections.

BARB WIRE ATTACHMENT

BASE PLATE AND ANCHOR NOTES:

1. Base plate identical for line, pull, end and corner posts and shall be considered an integral part of the respective posts for basis of payment.
2. Post to be plumbed by grout shim under base plate.
3. Anchors (Galvanized Steel):
   12" Cast In Place, 100% Embedment
   (a) Heeded Bolts, U-Bolts or Cluster Plates
   (b) Adhesive Anchors, 6" Min. Embedment
   8" Dia. Galvanized or Aluminum Anchor Bolts set in drilled holes with an adhesive material system in accordance with Specification Sections 416 and 937; drilled holes shall be 8" larger in diameter than the anchor bolt.
   Expansion Bolts Not Permitted.

FENCE MOUNTING ON CONCRETE ENDWALL AND RETAINING WALLS

STEEL

<table>
<thead>
<tr>
<th>Area (in²)</th>
<th>Tensile Strength (ksi)</th>
<th>Yielding Point (psi Min.)</th>
<th>Yielding Point (ksi)</th>
<th>Moment Of Inertia (in⁴)</th>
<th>Section Modulus (in³)</th>
<th>Rad. Of Gyration (in)</th>
<th>Surface Area (in²)</th>
<th>Weight (lb.)</th>
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<td>0.428</td>
<td>30,000</td>
<td>0.456</td>
<td>0.124</td>
<td>0.428</td>
<td>0.107</td>
<td>0.776</td>
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ALUMINUM

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<th>Area (in²)</th>
<th>Tensile Strength (ksi)</th>
<th>Yielding Point (psi Min.)</th>
<th>Yielding Point (ksi)</th>
<th>Moment Of Inertia (in⁴)</th>
<th>Section Modulus (in³)</th>
<th>Rad. Of Gyration (in)</th>
<th>Surface Area (in²)</th>
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<tr>
<td>724</td>
<td>0.428</td>
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<td>0.107</td>
<td>0.776</td>
<td>23,000</td>
</tr>
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</table>

**OPTIONAL 3/4" x 1/8" H-BEAM LINE POST**

Dimensions Same As Adjacent Side
CANTILEVER SLIDE GATE TYPE B FENCE

GENERAL NOTES

1. Extruded, rolled or formed components that provide equal strength and stability may be used in lieu of the pipe components shown; and, internal rollers may be used in lieu of the external roller units shown.

Gate components shall meet or exceed the protective coatings specified on Index No. 802.

2. Steel gate frame shall be fabricated prior to galvanizing, except that truss rods may be fabricated following frame galvanizing provided surfaces damaged during welding are galvanized in accordance with Section 24 of AASHTO M39, or, fabricated from pipe components with protective coating meeting the requirements of Index No. 802 that are tolerant of welding (low burn back), and a protective coating applied to the weld and damaged pipe surfaces that is equivalent to the protective coating of the fabricated pipe stock.

Steel gate frame shall be fabricated prior to galvanizing, except that truss rods may be fabricated following frame galvanizing provided surfaces damaged during welding are galvanized in accordance with Section 24 of AASHTO M39, or, fabricated from pipe components with protective coating meeting the requirements of Index No. 802 that are tolerant of welding (low burn back), and a protective coating applied to the weld and damaged pipe surfaces that is equivalent to the protective coating of the fabricated pipe stock.

3. All fabric shall be knuckled top and bottom selvages.

Concrete for bases shall be either Class RS concrete as specified in Section 347 of the Standard Specifications or a packaged, dry material meeting the requirements of a concrete under ASTM C-391. Materials for Class RS concrete may be proportioned by volume or by weight.

4. Concrete for bases shall be either Class RS concrete as specified in Section 347 of the Standard Specifications or a packaged, dry material meeting the requirements of a concrete under ASTM C-391. Materials for Class RS concrete may be proportioned by volume or by weight.

5. Cost of all gate components shall be included in the contract unit price for Sliding Fence Gate (Cantilever), EA.

- TYPICAL FRAME - 24' Opening
- TYPICAL FRAME - 12', 16' & 20' Opening

REV 01/12 DESCRIPTION:

FY 2017-18 DESIGN STANDARDS

INDEX NO.

803

SHEET NO.

1 of 1
**FENCING NOTES**

**FENCE INSTALLATION:**
Install posts plumb (within a tolerance of ± 1/2") Use shim plates as required to achieve plumb. The required quantity and thickness of shim plates will be determined in the field. Install chain link fence in accordance with ASTM F567 as applicable.

**TRAFFIC RAILING DETAILS:**
See Superstructure Sheets for Traffic Railing Barrier details.

**CONCRETE PARAPET DETAILS:**
See Index 820 – Pedestrian/Bicycle Railing for Concrete Parapet details. Provide fencing in lieu of aluminum bullet railing as shown on Index 820.

**LIMITS OF FENCING:**
Limits of fencing are from begin of approach slab at Begin Bridge to end of approach slab at End Bridge, unless otherwise shown in the plans.

**PAYMENT:**
Payment will be made under Fencing, Type R. Payment includes posts, horizontal and expansion rails, brace rails and bands, rail ends, combination rail ends, boulevard clamps, chain link fabric, tension wire, ties, hog rings, tension bars and bands, post and loop caps, pipe clamps, base plates, anchor rods, bolts, nuts, washers, shim plates, spacers, neoprene pads, miscellaneous fence fittings and hardware and all incidental materials and labor required to complete installation of the fence.

**CROSS REFERENCE:**
For Table of Fence Components, Table of Post Attachment Components, View A-A and Detail "A" see Sheet 2.
For Pull Post Assembly Detail for Traffic Railing Barriers see Sheet 3.
For Pull Post Assembly Detail for Concrete Parapets and Detail "B" see Sheet 4.
### TABLE OF CHAIN LINK FENCE COMPONENTS

<table>
<thead>
<tr>
<th>COMPONENT INFORMATION</th>
<th>ASTM DESIGNATION</th>
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<tbody>
<tr>
<td>Posts</td>
<td>F1083 Galvanized Steel Pipe - 3&quot; NPS, Schedule 40 Regular Grade</td>
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<tr>
<td>Chain Link Fabric</td>
<td>A392 Zinc Coated Steel - 9 gage (coated wire diameter), Class 2 Coating</td>
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<td></td>
<td>A491 Aluminum Coated Steel - 9 gage (coated wire diameter)</td>
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<tr>
<td>Tie Wires</td>
<td>F626 Polyvinyl Chloride (PVC) Coated Steel - 9 gage Class 2b</td>
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<tr>
<td>Brace Bands</td>
<td>F626 12 Gage (Min. thickness) x 1/2&quot; (Min. width) Steel Bands (Bleveled or Heavy)</td>
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<tr>
<td>Tension Bars</td>
<td>F626 1/4&quot; (Min. thickness) x 1/2&quot; (Min. width) x 5-10&quot; (Min. height) Steel Bands</td>
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<tr>
<td>Tension Bands</td>
<td>F626 14 Gage (Min. thickness) x 1/2&quot; (Min. width) Steel Bands</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
<td>F626 Zinc Coated Steel - (includes post or loop caps, horizontal and brace rail ends, combination rail ends, bowlder clamps and all other miscellaneous fittings &amp; hardware)</td>
</tr>
<tr>
<td>Horizontal Rails</td>
<td>F1083 Galvanized Steel Pipe - 2½&quot; NPS, Schedule 40 Regular Grade</td>
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<tr>
<td>Expansion Rails</td>
<td>F1083 Galvanized Steel Pipe - 2&quot; NPS, Schedule 40 Regular Grade</td>
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<tr>
<td>Bolts</td>
<td>A307 9/16&quot; x 4½&quot; Hex Head Bolts for Expansion Rail Connections</td>
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<tr>
<td>Nuts</td>
<td>A563 Hex Nuts for Expansion Rail Connections</td>
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<tr>
<td>Washers</td>
<td>F436 Flat Washers for Expansion Rail Connections</td>
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<tr>
<td>Tension Wire</td>
<td>A824 &amp; A817 Type II (Zinc Coated Steel Wire) - 7 gage, Class 4 Coating</td>
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<tr>
<td>Hog Rings</td>
<td>F626 Zinc Coated Steel Wire - 12 gage</td>
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<td>Pipe Clamp</td>
<td>F1083 Galvanized Steel Pipe - 1½&quot; NPS, Schedule 40 Regular Grade</td>
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### TABLE OF POST ATTACHMENT COMPONENTS

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<th>COMPONENT INFORMATION</th>
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<tr>
<td>Base Plates</td>
<td>A36 or A709 Grade 36</td>
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<tr>
<td>Shim Plates</td>
<td>A36 or A709 Grade 36 or B209 Matt 6061-T6 or B221 Matt 6063-T5</td>
</tr>
<tr>
<td>Spacers</td>
<td>- 1½&quot; for all materials</td>
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<tr>
<td>Adhesive Anchor Rods</td>
<td>F1554 Grade 36 Fully threaded Headless Anchor Rods - 9/16&quot; Ø x 6&quot; (no spacer) or 1/2&quot; Ø x 1½&quot; (with spacer)</td>
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<tr>
<td>C-1-P Anchor Rods</td>
<td>F1554 Grade 36 Hex Head Anchor Rods - 9/16&quot; Ø x 6&quot; (no spacer) or 1/2&quot; Ø x 1½&quot; (with spacer)</td>
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<tr>
<td>Adhesive Anchor Rods</td>
<td>F1554 Grade 36 Fully threaded Headless Anchor Rods - 1/2&quot; Ø x 1½&quot;</td>
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<tr>
<td>Bolts</td>
<td>A307 9/16&quot; Ø x 4½&quot; Hex Head Bolts for Pipe Clamp Connections to Posts</td>
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<tr>
<td>Nuts</td>
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<tr>
<td>Washers</td>
<td>F436 Flat Washers for Pipe Clamp and Base Plate Connections</td>
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<tr>
<td>Neoprene Pads</td>
<td>- In accordance with Specification Section 932 for Ancillary Structures</td>
</tr>
</tbody>
</table>

### POST ATTACHMENT NOTES

ANCHOR RODS, NUTS AND WASHERS:
- After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.
- Hot-dip galvanize all Nuts, Washers, Bolts, C-1-P Anchor Rods, Adhesive Anchors and Fence Framework (Posts, Internal Sleeves, Shim Plates, Base Plates, Pipe Clamps and Spacers) in accordance with Specification Section 962.

COATINGS:
- Hot-dip galvanize all Nuts, Washers, Bolts, C-1-P Anchor Rods, Adhesive Anchors and Fence Framework after fabrication.

ADHESIVE-BONDED ANCHORS AND DOWELS:
- Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 416. Cutting of reinforcing steel is permitted for drilled hole installation.

WFELDING:
- All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal will be L60XX or E70XX. Nondestructive testing of welds is not required.

CROSS REFERENCE:
- For location of View A-A and Detail "A" see Sheet 1.
REVISION NO. SHEET NO. INDEX

DESCRIPTION:

REVISION LAST of DESIGN STANDARDS FY 2017-18

(Must be manufactured from an incompressible material (i.e., steel or aluminum))

3" Spacer " Ø Holes for Ø Anchors (Typ.)
1½" Ø Pipe Clamp

5/8" Ø Holes for 5/8" Ø Anchors (Typ.)

3" x 3" x 1½" Thick Neoprene Pad

R = 1½"

5/8" Ø Holes for 5/8" Ø Bolt with Hex Nut and Washer

NOTES:

1. For treatment at bridge ends, see Sheet 1.
2. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".

BRIDGE FENCING (VERTICAL)
Bulge Chain Link Fabric to allow for joint movement (See Note 2)

3'-0" + Expansion Joint Opening

Expansion Rails

Pull Post Assembly (required at maximum intervals of 500'-0"

Post Cap (shown) or Loop Cap (Typ.)

Ties @ 2'-0" Centers

Tension Bar (one each side of pull post) (Typ.)

Horizontal Rail

Pull Post

Concrete Parapet

Bridge Deck (shown) or Raised Sidewalk

NOTES:
1. For treatment at bridge ends, see Sheet 1.
2. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".
3. This Dimension is the expansion joint opening plus ½". Expansion rails are required at expansion joint locations where the total movement exceeds 1", but is less than or equal to 6". Expansion rails are part of expansion assemblies when the total movement exceeds 6". Install expansion rails midway between the fence posts spanning the expansion joint.
4. Install nuts for expansion rails finger-tight. Nuts will fully engage bolts with a minimum of one bolt thread extending beyond the nuts. Distort the first thread on the outside of the nut to prevent loosening.

CROSS REFERENCE:
For location of Detail "B" see Sheet 1.
**FENCING NOTES**

**FENCE APPLICATION:**
This bridge fence can only be used on sidewalk installations separated from traffic by a traffic railing.

**FENCE INSTALLATION:**
Install posts plumb (within a tolerance of ± 1/2") and shim plates as required to achieve plumb. The required quantity and thickness of shim plates will be determined in the field. Install chain link fence in accordance with ASTM F567 as applicable.

**CONCRETE PARAPET DETAILS:**
See Index 820 - Pedestrian/Bicycle Bullet Railing for Concrete Parapet details. Provide fencing in lieu of aluminum bullet railing as shown on Index 820.

**LIMITS OF FENCING:**
Limits of fencing are from begin of approach slab at Begin Bridge to end of approach slab at End Bridge, unless otherwise shown in the plans.

**PAYMENT:**
Payment will be made under Fencing, Type R. Payment includes posts, horizontal and expansion rails, brace bands, rail ends, combination rail ends, boulevard clamps, chain link fabric, ties, tension bars and bands, post and loop caps, base plates, anchor rods, bolts, nuts, washers, shim plates, neoprene pads, miscellaneous fence fittings and hardware and all incidental materials and labor required to complete installation of the fence.

---

**NOTES:**
1. A Pull Post Assembly is required at maximum intervals of 500'-0". See Sheet 2.
PULL POST ASSEMBLY DETAIL

Table of Chain Link Fence Components

<table>
<thead>
<tr>
<th>COMPONENT INFORMATION</th>
<th>ASTM DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts</td>
<td>F1083</td>
</tr>
<tr>
<td>Horizontal Rails</td>
<td>F1083</td>
</tr>
<tr>
<td>Expansion Rails</td>
<td>F1083</td>
</tr>
<tr>
<td>Bolts</td>
<td>A307</td>
</tr>
<tr>
<td>Nuts</td>
<td>A563</td>
</tr>
<tr>
<td>Washers</td>
<td>F436</td>
</tr>
<tr>
<td>Chain Link Fabric</td>
<td>A932</td>
</tr>
<tr>
<td>Tie Wires</td>
<td>F626</td>
</tr>
<tr>
<td>Brace Bands</td>
<td>F626</td>
</tr>
<tr>
<td>Tension Bars</td>
<td>F626</td>
</tr>
<tr>
<td>Miscellaneous Fence</td>
<td>F626</td>
</tr>
</tbody>
</table>

Pull Post Assembly (required at maximum intervals of 500'-0")

2'-0" + Expansion Joint Opening

NOTES:
1. This Dimension is the expansion joint opening plus \( \frac{1}{16} \)". Expansion rails are required at expansion joint locations where the total movement exceeds 1", but is less than or equal to 6". Expansion rails are part of expansion assemblies when the total movement exceeds 6". Install expansion rails midway between the fence posts spanning the expansion joint.
2. Install nuts for expansion rails finger-tight. Nuts will fully engage bolts with a minimum of one bolt thread extending beyond the nuts. Distort the first thread on the outside of the nut to prevent loosening.
3. For treatment at bridge ends, see Sheet 1.
4. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".

Bridge Deck (shown) or Raised Sidewalk

NOTES:
1. This Dimension is the expansion joint opening plus \( \frac{1}{16} \)". Expansion rails are required at expansion joint locations where the total movement exceeds 1", but is less than or equal to 6". Expansion rails are part of expansion assemblies when the total movement exceeds 6". Install expansion rails midway between the fence posts spanning the expansion joint.
2. Install nuts for expansion rails finger-tight. Nuts will fully engage bolts with a minimum of one bolt thread extending beyond the nuts. Distort the first thread on the outside of the nut to prevent loosening.
3. For treatment at bridge ends, see Sheet 1.
4. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".

Tension Bands (5 required per Tension Bar - Space Equally @ 1'-3" Maximum Centers) (Typ.)

Expansion Assembly Detail (Required only at expansion joint locations where total movement exceeds 6")

Legend: NPS = Nominal Pipe Size

Bridge Fencing (Curved Top)
**TABLE OF POST ATTACHMENT COMPONENTS**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASTM DESIGNATION</th>
<th>COMPONENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Plates</td>
<td>A36 or</td>
<td>3/8&quot; Steel Ø</td>
</tr>
<tr>
<td>Shim Plates</td>
<td>A709 Grade 36 or</td>
<td>Plate thicknesses as required. Holes in shim plates will be 3/8&quot; Ø</td>
</tr>
<tr>
<td>Adhesive Anchor Rods</td>
<td>F1554 Grade 36</td>
<td>Fully threaded Headless Anchor Rods – 3/8&quot; Ø x 14½&quot;</td>
</tr>
<tr>
<td>C-I-P Anchor Rods</td>
<td>F1554 Grade 36</td>
<td>Hex Head Anchor Rods – 3/8&quot; Ø x 14½&quot;</td>
</tr>
<tr>
<td>Nuts</td>
<td>A563</td>
<td>Hex Nuts for Base Plate Connections</td>
</tr>
<tr>
<td>Washers</td>
<td>F436</td>
<td>Flat Washers for Base Plate Connections</td>
</tr>
<tr>
<td>Neoprene Pads</td>
<td></td>
<td>In accordance with Specification Section 932</td>
</tr>
</tbody>
</table>

**POST ATTACHMENT NOTES**

ANCHOR RODS, NUTS AND WASHERS:
After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.

COATINGS:

ADHESIVE- BONDED ANCHORS AND DOWELS:
Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 416. Cutting of reinforcing steel is permitted for drilled hole installation.

WELDING:
All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal will be E60XX or E70XX. Nondestructive testing of welds is not required.

**COMPONENT INFORMATION**

**ANCHOR RODS, NUTS AND WASHERS:**
After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.

**COATINGS:**

**ADHESIVE- BONDED ANCHORS AND DOWELS:**
Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 416. Cutting of reinforcing steel is permitted for drilled hole installation.

**WELDING:**
All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). Weld metal will be E60XX or E70XX. Nondestructive testing of welds is not required.

**CROSS REFERENCE:**
For location of Detail "A" see Sheet 1.
FENCING NOTES:

1. A Pull Post Assembly is required at maximum intervals of 500'-0". See Sheet 3.
2. Dimension is measured along Inside Face of Concrete Parapet.
3. Dimension shown is for 32" F-Shape Traffic Railing Barriers as shown in Index 420. Adjust as required for other Traffic Railing Barriers and sidewalk widths.
4. For sidewalk clear widths greater than 5'-0", increase the radius and height of the curved portion of the Hoop Post at the rate of 6" for every one foot increase in sidewalk width.

TYPICAL SECTION

ELEVATION AT INSIDE FACE OF CONCRETE PARAPET

NOTES:

FENCE INSTALLATION:
Install posts plumb (within a tolerance of ± 1/2°). Use shim plates as required to achieve plumb. The required quantity and thickness of shim plates will be determined in the field. Install chain link fence in accordance with ASTM F567 as applicable.

TRAFFIC RAILING BARRIER DETAILS:
See Superstructure Sheets for Traffic Railing Barrier details.

CONCRETE PARAPET DETAILS:
See Index 820 – Pedestrian/Bicycle Railing for Concrete Parapet details. Provide fencing in lieu of aluminum bullet railing as shown on Index 820.

LIMITS OF FENCING:
Limits of fencing are from begin of approach slab at Begin Bridge to end of approach slab at End Bridge, unless otherwise shown in the plans.

PAYMENT:
Payment will be made under Fencing, Type R. Payment includes posts, horizontal and expansion rails, brace bands, rail ends, combination rail ends, boulevard clamps, chain link fabric, tension wire, ties, hog rings, tension bars and pipe clamps, base plates, anchor rods, bolts, nuts, washers, shim plates, spacers, neoprene pads, miscellaneous fence fittings and hardware and all incidental materials and labor required to complete installation of the fence.

CROSS REFERENCE:
For Table of Fence Components and Table of Post Attachment Components see Sheet 2.
For Pull Post Assembly Detail, View A-A and Detail "A" see Sheet 3.
For Detail "B" and "E" see Sheet 4.

REV ISIO N
NO.
SHEET
INDEX
DESCRIPTION:
FY 2017-18 DESIGN STANDARDS
BRIDGE FENCING (ENCLOSED)
COMPONENT INFORMATION

ANCHOR RODS, NUTS AND WASHERS:

After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562.

Adhesive Anchor Rods will comply with American Concrete Institute (ACI) 380.1R or A706M-11 (current edition). Nondestructive testing of welds is not required.

ADHESIVE-BONDED ANCHORS AND DOWELS:

Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 936. Cutting of reinforcing steel is permitted for drilled hole installation.

WELDING:

All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) AWS D1.1 (current edition). Weld metal will be E60XX or E70XX. Nondestructive testing of welds is not required.

TENSION WIRE

A824 & A817

Type II (Zinc Coated Steel Wire) - 7 gage, Class 4 Coating

Type I (Aluminum Coated Steel Wire) - 7 gage

TIE WIRES

F626

Zinc Coated Steel Wire - 9 gage

MOP RINGS

F626

Zinc Coated Steel Wire - 12 gage

BRACE BANDS

F626

12 gage (Min. thickness) x 3/8" (Min. width) Steel Bands

TENSION BARS

F626

5/8" (Min. thickness) x 3/8" (Min. width) Variable Height Steel Bars - Height = Tangent or Hoop Length - Barrier or Parapet Height - 2" max.

TENSION BANDS

F626

14 gage (Min. thickness) x 3/8" (Min. width) Steel Bands

MISC. FENCE COMPONENTS

F626

Zinc Coated Steel - (includes horizontal rail ends, combination rail ends, boulevard clamps and all other miscellaneous fittings and hardware)

BOLTS

A307

5/8" Ø x 4" Hex Head Bolts for Internal Sleeve connections

1/2" Ø x 4½" Hex Head Bolts for Expansion Rail connections

NUTS

A563

Hex Nuts for Internal Sleeve and Expansion Rail connections

WASHERS

F436

Flat Washers for Internal Sleeve and Expansion Rail connections

Post Attachment Notes

ANCHOR RODS, NUTS AND WASHERS:

After the nuts have been tightened, distort the Anchor Rod threads to prevent removal of the nuts. Coat distorted threads and exposed trimmed ends of anchors with a galvanizing compound in accordance with Specification Section 562. Nondestructive testing of welds is not required.

ADHESIVE-BONDED ANCHORS AND DOWELS:

Adhesive Bonding Material Systems for Anchors and Dowels will comply with Specification Section 937 and be installed in accordance with Specification Section 936. Cutting of reinforcing steel is permitted for drilled hole installation.

WELDING:

All welding will be in accordance with the American Welding Society Structural Welding Code (Steel) AWS D1.1 (current edition). Weld metal will be E60XX or E70XX. Nondestructive testing of welds is not required.
**DESCRIPTION:**

Pipe Clamp Connection (see Detail) (Typ.)

Traffic Railing Barrier (Type varies, 32" F-Shape shown)

Tension Wire

Hog Rings @ 2'-0" Centers (Typ.)

Traffic Railing Barrier (Type shown, Concrete Parapet Similar)

**PULL POST ASSEMBLY DETAIL**

(Traffic Railing Barrier Shown, Concrete Parapet Similar)

**EXPANSION ASSEMBLY DETAIL**

(Required only at expansion joint locations where total movement exceeds 6")

2 - ½" C-1-P Anchor Rods or Adhesive-Bonded Anchors (shown) set in drilled holes with Heavy Hex Nuts and Washers

9½" x 3" x ½" Thick Neoprene Pad

**PIPE CLAMP CONNECTION DETAIL**

(Connection without spacer shown, Connection with spacer similar)

**NOTES:**

1. For treatment at bridge ends, see Sheet 1.

2. The 3'-0" dimension shown is for expansion joint openings 9" or less. If the expansion joint opening exceeds 9", increase this dimension by the difference between the expansion joint opening and 9".

**CROSS REFERENCE:**

For location of View A-A and Detail "A" see Sheet 1.
PIPE CLAMP DETAIL

SPACER DETAIL
(Must be manufactured from an incompressible material (i.e., steel or aluminum))

BASE PLATE DETAIL

DETAILED "B"

DETAILED "C"

DETAILED "D"

DETAILED "E"
(INTERNAL SLEEVE DETAIL)

CROSS REFERENCE:
For location of Details "B" and "E" see Sheet 1.

NOTE:
1. Values shown for Dim. H are for a 5'-0" clear sidewalk width. Adjust as required for clear sidewalk widths greater than 5'-0".
2. For clear sidewalk widths greater than 5'-0" increase radius and height by 6" for every one foot increase in sidewalk width.
3. Spacer plate thickness shown is for the 32" F-Shape Traffic Railing shown in Index 420. Adjust thickness as required for other Traffic Railings.

BRIDGE FENCING (ENCLOSED)

DIMENSIONS

CROSS-SLOPE

SIDEWALK

BASE PLATE DETAIL

PIPE CLAMP DETAIL

SPACER DETAIL

DETAILED "B"

DETAILED "C"

DETAILED "D"

DETAILED "E"
(INTERNAL SLEEVE DETAIL)

CROSS REFERENCE:
For location of Details "B" and "E" see Sheet 1.

NOTE:
1. Values shown for Dim. H are for a 5'-0" clear sidewalk width. Adjust as required for clear sidewalk widths greater than 5'-0".
2. For clear sidewalk widths greater than 5'-0" increase radius and height by 6" for every one foot increase in sidewalk width.
3. Spacer plate thickness shown is for the 32" F-Shape Traffic Railing shown in Index 420. Adjust thickness as required for other Traffic Railings.

BRIDGE FENCING (ENCLOSED)
ELEVATION OF INSIDE FACE OF TRAFFIC RAILING WITH PEDESTRIAN/BICYCLE BULLET RAILING

NOTES:

1. A Tapered-End Transition is required for all approach ends of Bullet Railings on Traffic Railings.

2. Where Bullet Railing continues on retaining wall mounted Traffic Railings or other Traffic Railings, the Tapered End Transition shall be located at the terminus of the Bullet Railing.

CROSS REFERENCES:

Work in conjunction with Index 822.

For Traffic Railin Details, Reinforcement and Notes see Index 420.

SECTION A-A
TYPICAL SECTION THRU BRIDGE DECK
(APPROACH SLAB SIMILAR)
1. **Rail Clamp Bars**
   - **Details for Post B**:
     - 3/8" x 1" Stainless Steel Hex Cap Screw & Washer

2. **Rail Post**
   - **Details for Post C**:
     - 3/8" x 1" Stainless Steel Hex Cap Screw & Washer

3. **Base Plate**
   - **Details for Post D**:
     - 3/8" x 6" x 6" Base Plate

4. **Resilient or Neoprene Pad**
   - 1/8" Resilient or Neoprene Pad

5. **Anchor Bolts**
   - 2 - 3/8" x 10" C-I-P Hex Head Anchor Bolts with hex nuts & washers or see Detail "A".

6. **Holes**
   - 7/16" Ø Holes for Anchor Bolts (Typ.)

7. **Post**
   - 4" (Index No. 820)
   - 4 1/4" (Index No. 821)
   - 6 1/2" (Index No. 423)

8. **Thread**
   - 2 ~ 5/8" Ø x 1" Stainless Steel Hex Cap Screw & Washer

9. **Elevation**
   - Elevation of Post "B"

10. **Rail Clamp Bar**
    - Round over top corners 1/2" R

11. **Detailed Dimensions**
    - Post - WF 5 x 6.49
    - 7/8" x 6" x 6" Base Plate

12. **Ribbed Pad**
    - Ribbed Pad, 1/8" Resilient or Neoprene Pad

13. **Rivets**
    - 3/8" Ø x 1" Stainless Steel Hex Cap Screws & Washers

14. **C-Clamp**
    - 3/8" Ø x 1" Stainless Steel Hex Cap Screw & Washer

15. **Design Standards**
    - FY 2017-18 Design Standards

16. **Bridge Aluminum Pedestrian/Bicycle Bullet Railing Details**
    - Index No. 822

17. **Post C Details**
    - For Pedestrian/Bicycle Railing on Concrete Parapets (Index 820)

18. **Post B Details**
    - For Special Height Bicycle Railing on Traffic Railings (Index 423 and 821)

19. **Concrete Parapet**
    - For Pedestrian/Bicycle Railing on Concrete Parapets (Index 820)

20. **Concrete Parapet**
    - For Pedestrian/Bicycle Railing on Concrete Parapets (Index 820)

21. **Concrete Parapet**
    - For Pedestrian/Bicycle Railing on Concrete Parapets (Index 820)
RAILING NOTES:

1. Work this Index with Index 423, 820 and 822 and Specification Section 515.
2. Shop Drawings: Submit shop drawings prior to fabrication.
   a. Include post and rail splice/expansion assembly location for curved alignments with radii < 40 feet and for all end terminations.
3. Materials:
   a. Supply Aluminum materials In accordance with Specification Section 965 and the following:
      Wrought Aluminum Post: ASTM B221, Alloy 6061-T6 or 6351-T5
      Rail End Cap: ASTM B26 sand cast aluminum alloy 356.0-F
      Plate and Bars: ASTM B209 Alloy 6061-T6
      Rails: ASTM B221 Alloy 6061-T6 or 6351-T5.
4. Layout:
   a. Posts shall be uniformly spaced with reasonable consistency.
   b. Tapered End Transitions are required at the terminus of the approach ends of Bullet Railing mounted on a Traffic Railing. Bullet Railings on concrete parapets shielded by a traffic railing do not require Tapered End Transitions unless noted otherwise in the Plans.
   c. Adjust post spacing’s to avoid parapet obstacles, such as armor expansion plates, by 9 inches minimum.
   d. Rail shall be continuous over a minimum of 3 posts, except that lengths less than 12 feet need only be continuous over 2 posts.
   e. Space splices at 40 feet maximum. Splice all rails in a given railing section at about the same center line.
   f. Provide rail expansion assemblies in panels between posts on either side of a bridge expansion joint. Rail expansion assemblies are similar to the rail splice assemblies with increased space at the expansion assembly to allow for movement equal to 1.5 times the bridge joint opening or 1" greater than the expected joint movement.
5. Installation:
   a. Set rails near bridge expansion joints to allow for expected movement.
   b. Cutting of reinforcing steel is permitted for post installed anchors.
6. Payment: Includes the full cost of installed bullet railing. Cost of the Concrete Parapet or Traffic Railing is separate.
**Traffic Railing Required** (Type Varies, 32" F-Shape shown, see Structures Plans, Superstructure Sheets)

**Begin or End Bridge**

**Approach Slab**

**Edge of Approach Slab** (Coping)

**Inside Face of Railing**

*See Structures Plans, Superstructure Sheets for actual dimensions and joint orientation. Open Railing Joints at Deck Expansion Joint locations shall match the dimension of the Deck Joint. For treatment of Railings on skewed bridges see Index 420. Deck Joint at Begin Bridge or End Bridge shown. Deck Joint at Pier or Intermediate Bent similar.

**ELEVATION OF INSIDE FACE OF RAILING**

(Reinforcing Steel not shown for clarity)

**PLAN**

(Reinforcing Steel not shown for clarity)

**ALTERNATE REINFORCING (WELDED WIRE REINF.) DETAILS**

**NOTE:** Place wire panels to ensure vertical wire is within 4" of open joints.

**SPICE DETAIL** (Between WWR Sections)

**WELDED WIRE REINFORCEMENT (WWR)** (2 Pieces Req'd.)

**CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS**

**BILL OF REINFORCING STEEL**

**DETAIL "A" - SECTION AT INTERMEDIATE OPEN JOINT**

**ESTIMATED CONCRETE RAILING QUANTITIES**

The above quantities are based on a deck with a 2% cross slope.

**RAILING NOTES:**

1. Railing shall be placed vertical and top surface shall be level transversely.

**INTERMEDIATE JOINT SEAL NOTES:**

1. At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant in accordance with Specification Section 932.

2. Apply sealant prior to any Class 5 Finish Coating and remove all curing compound and loose material from the surface prior to application of bonding agent.

3. The cost of the Pre-cured Silicone Sealant shall be included in the Contract Unit Price for the Railing.

**REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.

2. The reinforcement for the railing on a retaining wall shall be the same as detailed above for an 8" deck.

3. All reinforcing steel at the open joints shall have a 2" minimum cover.

4. Bar splices for Bars 4S shall be a minimum of 1'-8".

5. At the option of the Contractor deformed WWR may be used in lieu of all Bars 3R and 4S.

**SECTION A A**

(Typical C-I-P Section Thru Bridge Deck Shown, Section Thru Approach Slab Similar)

**FREQUENCY OF OPEN JOINTS**

**Spacing Bars 4S**

**As Reqd.**

**Bars 3R** or #3 Bar may be tied.

**CONCRETE BARS**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CY/LF</td>
<td>0.079</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB/LF</td>
<td>13.12</td>
</tr>
</tbody>
</table>

**CONTRACT UNIT PRICE:**

**Details shown in the plans.**
PLAN
(Scheme 2 shown, other Schemes similar, Reinforcing Steel not shown for clarity)

ELEVATION OF INSIDE FACE OF RAILING
(Scheme 2 shown with Post "A", other Schemes similar, Reinforcing Steel not shown for clarity)

NOTES:
1. Shop Drawings are required.
2. Work this Index with Index 852 Steel Bicycle/Pedestrian Railing Details and Specification Section 515. Refer to the IDS for Design Criteria and Limits of Use.
3. Materials:
   A. Steel: Galvanized after fabrication
      b. Support Bracket (Scheme 3) L-shape and Stiffener Plate: ASTM A36
      c. Bottle-guard (Schemes 1 & 3) L-shape: ASTM A36
   B. Concrete: Same as bridge deck
   C. Pre-cured Silicone Sealant: Specification Section 932
   D. Bearing Pads: Provide 1½" Plain, Fabric Reinforced or Fabric Laminated bearing pads that meet the requirements of Specification Section 962 for Ancillary Structures.
4. See Structures Plans, Superstructure Sheets for bridge information including concrete type, deck expansion joint locations and orientations, and thermal movement.
5. Railings:
   A. For thermal movement greater than 4" (up to a maximum of 5½), clear opening between adjacent pickets, or panels at Rail Expansion Joints above Deck Joints must be reduced to 1½".
   B. For treatment of railings on skewed bridges see Index 420.
6. Curbs:
   A. Match open curb joints at Deck Expansion Joint locations to the deck joint dimension.
   B. Construct Concrete Curb (Scheme 2) vertical with the top surface finished level transversely. See Concrete Curb Details Sheet 3.
   C. Provide ½" Intermediate open joints in curbs coinciding with the ½" joints in the traffic railing.
7. Payment: Support bracket (Scheme 3) is incidental to the cost of railing. Curb concrete and reinforcing steel (Scheme 2) are included in the bridge deck quantities.
SCHEME 1 - TYPICAL SECTION THROUGH DECK MOUNTED RAILING

SCHEME 1A - DETAILS
(Adhesive Anchor Option shown)

SCHEME 1B - DETAILS
(Thru-Bolt Option)

THRU-BOLT PLATE WASHER DETAIL

SCHEME 2 - TYPICAL SECTION THROUGH CURB MOUNTED RAILING

PLAN VIEW

1 1/4" Ø Hole for Anchor Bolts

THRU-BOLT PLATE WASHER DETAIL

SCHEME 3 - SIDE MOUNTED SUPPORT BRACKET DETAILS

TYPICAL SECTION

ELEVATION VIEW

Index 852, Steel Pedestrian/Bicycle Railing

Traffic Railing required for all Schemes (Type Varies, see Plans)

Index 852 Steel Pedestrian/Bicycle Railing

Bottle-Guard (See Detail on Sheet 3)

1/2" Thick Bearing Pad (Typ.)

Bridge Deck Sidewalk

Slope 2% Max. (away from Cogging)

South Elevation View

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**Design Standards FY 2017-18**

**Square Rails - Intermediate or Bottom Rail**

* 1/2" Ø x 3/4" Pan Head Stainless Steel (Type 316 or 18-8 Alloy)
  - Set Screws along outside face of railing. Set screws must be set flush against the rail surface. A 1/2" plug weld may be substituted for the two set screws at expansion joints.
* **Increase handrail sleeve embedment to 8" for Expansion Joint openings greater than 2".
  - **Expansion joint opening shall match the clear opening in the deck joint but not greater than 3".

**Detail "B" Expansion Joint (Field Splice Similar)**

**Conventional Reinforcing Steel Bending Diagrams**

**Bill of Reinforcing Steel**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>4</td>
<td>2'-0&quot;</td>
</tr>
<tr>
<td>S</td>
<td>4</td>
<td>As Read.</td>
</tr>
</tbody>
</table>

**Alternate Reinforcing (WWR) Details**

**Cross Reference:**

- See Sheet 1 for Bridge Railing Notes.

**Curb Reinforcing Steel Notes:**

1. All bar dimensions in the bending diagrams are out to out.
2. The reinforcement for the curb on a retaining wall shall be the same as detailed for an 8" deck.
3. All reinforcing steel at the open joints shall have a 2" minimum cover.
4. Bars 4S may be continuous or spliced at the construction joints.
5. Deformed Welded Wire Reinforcement (WWR) meeting the requirements of Specification Section 931 may be used in lieu of all Bars 4P and 4S.

**IntermEDIATE joint SEAL note:**

At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.

**Estimated Concrete Curb Quantities (Scheme 2)**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CY/LF</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LB/LF</td>
</tr>
</tbody>
</table>

**Scheme 2 - Concrete Curb Details**

**Scheme 3 - Bottle Guard Detail**

**Cross Reference:**

- See Sheet 1 for Bridge Railing Notes.

**Typical Section Through Bottom Rail (Post Not Shown for Clarity)**

**Design Standards FY 2017-18**

**Bridge Pedestrian/Bicycle Railing (Steel)**

**Index No.**

**Sheet No.** 3 of 3
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 1/8&quot;</td>
<td>2.500&quot; x 1.500&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Post &quot;B&quot;</td>
<td>HSS 2 1/2 x 1 1/8&quot;</td>
<td>2.500&quot; x 1.500&quot;</td>
<td>0.188&quot;</td>
</tr>
<tr>
<td>Top Rail Joint/Splice Sleeves</td>
<td>HSS 3.000 x 0.120</td>
<td>3.000&quot;</td>
<td>0.120&quot;</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
<td>HSS 2.500 x 0.123</td>
<td>2.500&quot;</td>
<td>0.129&quot;</td>
</tr>
<tr>
<td>Int. &amp; Bottom Rail Post Connection Sleeve</td>
<td>HSS 1.500 x 0.125</td>
<td>1.500&quot;</td>
<td>0.120&quot;</td>
</tr>
<tr>
<td>Handrail Joint/Splice Sleeves</td>
<td>3&quot; NPS (Sch. 40)</td>
<td>3.133&quot;</td>
<td>0.133&quot;</td>
</tr>
<tr>
<td>HSS 1.500 x 0.125</td>
<td>1.500&quot;</td>
<td>0.125&quot;</td>
<td></td>
</tr>
<tr>
<td>Handrails</td>
<td>1 1/2&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.140&quot;</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>3/8&quot; Ø Round Bar</td>
<td>0.750&quot;</td>
<td>N/A</td>
</tr>
<tr>
<td>Pickets</td>
<td>3/8&quot; Ø Round Bar</td>
<td>0.750&quot;</td>
<td>N/A</td>
</tr>
<tr>
<td>Infill Panel Members (Types 2 - 5)</td>
<td>Varies (See Details)</td>
<td>Varies</td>
<td>Varies</td>
</tr>
</tbody>
</table>

(1) 0.125" wall thickness permitted for rails with post spacings less than 5'-8", except that Post Connection Sleeve must be 3/4" NPS (Sch. 40).

NOTES:
1. Shop Drawings are required; see Specification Section 515
2. For bridge mounted railings work this Index with Index 851 Bridge Bicycle/Pedestrian Railing
3. Materials:
   A. Pipe Rails and Pickets: ASTM A500 Grade B, C or D, or ASTM A53 Grade B for standard weight pipe (Schedule 40) and ASTM A36 for bars.
   B. Structural Tube: ASTM A500 Grade A, B, C, or D or ASTM A518
   C. Steel Plate: ASTM A36 or ASTM A203 Grade 36
   D. U-Channels and filler plates: ASTM A36 or ASTM A46 (Grade 36).
   E. Stainless steel (SS) screws: Type 316 or 18-8 Alloy
   F. Galvanized Steel Fasteners: coated in accordance with Specification Section 962.
   a. Hex Head Bolts: ASTM A 307 or ASTM F1155
      1. 3/4" diameter single bolt option, Grade 36
      2. 3/4" four bolt option, Grade 55
   b. Adhesive Anchors: ASTM F1554 fully threaded rods, Grade 55
   c. Hex Nuts: ASTM A563
   d. Flat Washers: ASTM F436
   e. Plate Washers: ASTM A36 or ASTM A706 Grade 36
   f. Shims: ASTM B209 (Grade 36)
   H. Bearing Pads: 3/4" Plain, Fabric Reinforced or Fabric Laminated pads that meet the requirements of Specification Section 962 for Ancillary Structures.
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 6 1/2" for standard installations and 3 1/2" 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 "K" when a 4" sphere requirement is indicated in the Data Tables.
8. Make corners and changes in tangential longitudinal alignment with a 9" bend radius or terminate adjoining 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.
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INDEX
NO.
DESCRIPTION:
REV. OF DESIGN STANDARDS
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Handrail required for ramps (Handrail continuous at landings between runs)

Note: Non-continuous corners are permitted when handrails are not required.

See Plans for continuation or termination limits of railing.

rail expansion joints to be located in panels above structure expansion joints * (35'-0" maximum spacing).

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 = 3%

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

EQ Post ~ 1" NPS Sch. 40 Post
30'-0" Max. for Slopes > 6.25%
40'-0" Max. for Slopes ≤ 6.25%

Intermediate Landing
5'-0" Min.

Top Landing
0'-0" Min.

Top of Sidewalk
0'-0" Min.

ELEVATION
(Showing Inside Face of Railing with Type "A" Posts)

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

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 6011 Gravity Wall are not considered to be expansion joints.
** Contraction joints (Tooled or Saw Cut) in sidewalks do not require a 6" minimum offset.

Foundation Expansion Joint *

Rail expansion joints to be located in panels above structure expansion joints * (35'-0" maximum spacing).

Rail Expansion Joint (Typ.)

See Detail 'B', Sheet 4

Post Spacing (Typ.)

5'-0" Min.

Bottom Landing

6'-0" Min.

Top Landing

7'-3" (Max.) ~ Type "A" Post

6'-5" (Max.) ~ Type "B" Post Only

5'-7" (Max.) ~ Type "A" Post or 7'-3" (Max.) ~ Type "B" Post

3'-0" Min.

Intermediate Landing

Ramp

40'-0" Max. for Slopes ≤ 6.25%

30'-0" Max. for Slopes > 6.25%
RAILINGS ON STEPS & STAIRS

HANDRAIL TERMINATION

DETAIL "L" - PLAN VIEW

Handrail termination
(Typ.) See Detail "L" 

DETAIL "J" - ELEVATION VIEW
TOP RAIL TERMINATION

Leveling Channel (Typ.) see Detail, Sheet 4

DETAIL "K" - ELEVATION VIEW
BOTTOM RAIL CONNECTION
(Intermediate Rail Similar)

Steel Handrail required for three or more steps

VIEW J-J
DETAIL "J" - ELEVATION VIEW
TOP RAIL TERMINATION

RAIL TERMINATION DETAILS

RAILING CONTINUATION BEYOND STEPS OR STAIRS
(Bottom shown, Top similar)

Concrete sidewalk to extend 6' Min. behind railing

DETAIL "L" - PLAN VIEW
HANDRAIL TERMINATION

Flatten handrail termination to 1½" Max. width.

Steel Handrail Continuous
At Landing

Length of Landing 5' Min.

ELEVATION
(At-Grade Steps shown, Elevated Stairs similar)

ALTERNATE HANDRAIL END TREATMENT OR MOUNTING LOCATION FOR SLOPED WALLS

Steel Pedestrian/Bicycle Railing

Not considered an expansion joint for railing fabrication (Typ.)
STEEL PEDESTRIAN/BICYCLE RAILING

SECTION A-A (Top Rail Connection)

SECTION B-B (Handrail Connection)

SECTION C-C (Intermediate Rail Connection)

SECTION D-D (Bottom Rail Connection - Single Anchor Bolt Shown)

SECTION G-G - BASE PLATE DETAILS

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FY 2017-18
DESIGN STANDARDS
TYPE 1 - PICKET INFILL PANEL

* Picket Spacing of 62½ centers is based on a ¾ Ø Bar for standard applications.
When shown in the Contract Plans a 6½ picket spacing may be required. See Note 4 (Sheet 1).

PICKET NOTES:

TYPE 2 - CHAIN-LINK (Continuous Infill Panel)

NOTES:
1. See Plans for Infill Panel option required.

TABLE 2 - CHAIN-LINK PANEL COMPONENT MATERIALS

<table>
<thead>
<tr>
<th>COMPONENT INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPONENT</td>
</tr>
<tr>
<td>Chain-Link Fence Fabric (2 mesh with twisted bottom and knuckled top selvage)</td>
</tr>
<tr>
<td>Chain-Link Fence Fabric (2 mesh with twisted bottom and knuckled top selvage)</td>
</tr>
<tr>
<td>Polyvinyl Chloride (PVC) Coated Steel - No. 9 gage</td>
</tr>
<tr>
<td>Zinc-Coated Steel Wire - No. 9 gage with coating to match Chain-Link Fence Fabric.</td>
</tr>
<tr>
<td>Tie Wires</td>
</tr>
<tr>
<td>Tension Bars</td>
</tr>
<tr>
<td>Miscellaneous Fence Components</td>
</tr>
</tbody>
</table>

CHAIN-LINK PANEL NOTE:
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 
0.125" steel plate pattern cut with laser or plasma CNC, welded to a 
1" x 1.5" Angle Border or the 0.125" x 1.5" Channel Border shown.

SECTION A-A

DETAIL "3A"
RAY/ARC CONNECTION

SLOT INFILL PANEL

DETAIL "3B"
INTERMEDIATE RAIL/RAY CONNECTION

SECTION B-B

PANEL END CAP

DETAIL "3C"
RAY/ARC CONNECTION

SECTION C-C

PANEL/SPICE CONNECTION

DETAIL "3D"
RAY/ARC CONNECTION

SECTION A-A

DETAIL "3E"
PANEL END CONNECTION
AT POST WITH EXPANSION JOINT

NOTES:
1. See Plans for Infill Panel Option required.
**SECTION A-A**

Seal welding mitered corners is permitted.

**SECTION C-C**

Panel Mullion

**REPEATING PATTERN DETAIL FOR PERFORATED PANEL**

- **DETAIL "5A"**
  - Panel/Rail Connection (Top Shown, Bottom Similar)
  - Perforated Panel (0.04" Min.)
  - Channel 3/8" x 1/2" x 3/16" (Typ.)
  - 1/4" x 1/2" Filler Strip (Typ.)
  - Rail Expansion Joint
  - See Detail "5A"

- **DETAIL "5B"**
  - Panel End Connection (Expansion Joint Shown, Sides Similar)
  - Perforated Panel (0.04" Min.)
  - Channel 3/8" x 1/2" x 3/16" (Typ.)
  - 1/4" x 1/2" Filler Strip (Typ.)
  - Inside Face of Post

- **NOTES:**
  1. See Plans for Infill Panel Type required.
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DESIGN STANDARDS

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STEEL PEDESTRIAN/BICYCLE RAILING

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TYPICAL SECTION ON CONCRETE SIDEWALK
(Case I)

TYPICAL SECTION ON RETAINING WALL
(Case II)

TYPICAL SECTION ON STEPS & STAIRS
(Case III)

TYPICAL SECTION FOR 4-BOLT ANCHORAGE
(Case IV)

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; 1'-2&quot; 9&quot; 10(\frac{1}{2})</td>
<td>11&quot; 5(\frac{1}{2})</td>
<td>5(\frac{1}{2}) Ø</td>
</tr>
<tr>
<td>IIa</td>
<td>Reinforced Concrete</td>
<td>4&quot; 4&quot; 9&quot;</td>
<td>10(\frac{1}{2})</td>
<td>11&quot; 5(\frac{1}{2})</td>
</tr>
<tr>
<td>IIb</td>
<td>Gravity Wall Index 6011</td>
<td>4(\frac{1}{2}) 4(\frac{1}{2}) 1'-0&quot;</td>
<td>3'-0&quot; 10(\frac{1}{2})</td>
<td>11&quot; 5(\frac{1}{2})</td>
</tr>
<tr>
<td>III</td>
<td>Step Cheekwall</td>
<td>4(\frac{1}{2}) 4(\frac{1}{2}) 9&quot;</td>
<td>10(\frac{1}{2})</td>
<td>11&quot; 5(\frac{1}{2})</td>
</tr>
<tr>
<td>IV</td>
<td>Varies</td>
<td>5&quot; 5&quot; 5&quot;</td>
<td>10(\frac{1}{2})</td>
<td>11&quot; 5(\frac{1}{2})</td>
</tr>
</tbody>
</table>

* Embedment length ≤5" for the 42" height railings for Case IIb, when the post spacing does not exceed 5'-0".

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

1. Shop Drawings are required.
2. Work this Index with Index 862 Aluminum Bicycle/Pedestrian Railing Details and Specification Section 515. Refer to the IDS for Design Criteria and Limits of Use.
3. Materials:
   A. Galvanized Steel Fasteners: Hex Head Bolt ASTM A307, Hex Nuts ASTM A363, Washers ASTM F436
   B. Aluminum:
      a. Support Bracket (Scheme 3) L-shape and Stiffener Plate: ASTM B209, Alloy 6061-T6
      b. Bottle-guard (Schemes 1 & 3) L-shape: ASTM B209, Alloy 6061-T6 or 6063-T5
   C. Concrete: Same as bridge deck
   D. Pre-cured Silicone Sealant: Specification Section 932
   E. Bearing Pads: Provide \( \frac{1}{2} \)" thick Plain, Fabric Reinforced or Fabric Laminated pads meeting the requirements of Specification Section 962 for Ancillary Structures.
4. See Structures Plans, Superstructure Sheets for bridge information including concrete type, deck expansion joint locations and orientations, and thermal movement.
5. Railings:
   A. For thermal movement greater than 4" (up to a maximum of 5"), clear opening between adjacent pickets, or panels at Rail Expansion Joints above Deck Joints must be reduced to 3½".
   B. For treatment of railings on skewed bridges see Index 420.
6. Curbs:
   A. Match open curb joints at Deck Expansion Joint locations to the deck joint dimension.
   B. Construct Concrete Curb (Scheme 2) vertical with the top surface finished level transversely. See Concrete Curb Details Sheet 3.
   C. Provide \( \frac{1}{2} \) Intermediate open joints in curbs coinciding with the \( \frac{1}{2} \)" joints in the traffic railing.
7. Payment: Support Bracket (Scheme 3) is incidental to the cost of railing. Curb concrete and reinforcing steel (Scheme 2) are included in the bridge deck quantities.
**ROUND RAILS - TOP RAIL OR HANDRAIL**

*  £ ± 2" Pan Head Aluminum (Alloy 7075-T76) or Stainless Steel (Type 316 or 18-8 Alloy) Set Screws along outside face of railing.  
  Set screws must be set flush against the rail surface.  A £ ± plug weld may be substituted for the two set screws at expansion joints.  

**Intermediate or Bottom Rail**

**INTERMEDIATE OR BOTTOM RAIL - ALUMINUM SLEEVE DETAIL (Bottom Side Shown)**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>£</td>
<td>4</td>
<td>2'-0&quot;</td>
</tr>
</tbody>
</table>

**DETAIL “B” EXPANSION JOINT (FIELD SPLICE SIMILAR)**

**CONEVENTIAL REINFORCING STEEL BENDING DIAGRAMS**

**BILL OF REINFORCING STEEL**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>£</td>
<td>4</td>
<td>2'-0&quot;</td>
</tr>
</tbody>
</table>

**ALTERNATE REINFORCING (WWR) DETAILS**

**NOTE:** Place wire panels to minimize the end overhang.  End Overhangs greater than 4£± are not permitted.

**CURB REINFORCING STEEL NOTES:**

1. All bar dimensions in the bending diagrams are out to out.  
2. The reinforcement for the curb on a retaining wall shall be the same as detailed for an 8" deck.  
3. All reinforcing steel at the open joints shall have a £ minimum cover.  
4. Bars 4S may be continuous or spliced at the construction joints.  
5. Deformed WWR meeting the requirements of Specifications Section 931 may be used in lieu of all Bars 4P and 4S.

**ALTERED CONCRETE CURB QUANTITIES (SCHEME 2)**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>CF/LF</td>
<td>0.0024</td>
</tr>
<tr>
<td>Reinforcing Steel</td>
<td>LF/LF</td>
<td>4.62</td>
</tr>
</tbody>
</table>

**SCHEME 1 - BOTTLE GUARD DETAIL**

**SCHEME 2 - CONCRETE CURB DETAILS**

**INTERMEDIATE JOINT SEAL NOTE:**

At Intermediate Open Joints, seal the lower 6" portion of the open joint with Pre-cured Silicone Sealant. Apply sealant prior to any Class V finish coating and remove all curing compound and loose material from the surface prior to application of bonding agent.
**Notes**:  
1. Shop Drawings are required, see Specification Section 315.  
2. For bridge mounted railings, work this Index with Index 861 Bridge Bicycle/Pedestrian Railing (Aluminum).  
3. Materials:  
   a. Structural Extrusions, Tube, Pipe and Bars: Table 1 and ASTM B221 or ASTM B429.  
   b. Top, bottom and intermediate rail corner bends with maximum 4'-0" post spacing may be Alloy 6063-T6.  
   d. Perforated panels (Type 3) Alloy 3003-H14.  
   e. Stainless steel (SS) screws: Type 316 or 18-8 Alloy.  
   g. Galvanized Steel Fasteners: coated in accordance with Specification Section 962.  
   j. 1" diameter single bolt option, Grade 36.  
   k. 2" diameter four bolt option, Grade 55.  
   l. Adhesive Anchors: ASTM F1554 fully threaded rods, Grade 55.  
   m. Hex Nuts: ASTM F3563.  
   n. Flat Washers: ASTM F436.  
   o. Plate Washers: ASTM A36 or ASTM A106 Grade 36.  
   p. Shims: ASTM B209 Alloy 6061, or 6063.  
   q. Bearing pads: Provide 1/2" thick plain, Fabric Reinforced or Fabric Laminated Bearing Pads meeting the requirements of Specification Section 962 for Ancillary Structures.  
4. Fabricate pickets and vertical panel elements parallel to the posts; except Type 2, 2 and 5 panel infills may be fabricated parallel to the longitudinal grade. Maintain a maximum clear opening of 5/8" for standard installations and 3/8" when a 4" sphere requirement is indicated in the Data Tables.  
5. Locate railing expansion joints between the posts on either side of the deck expansion joint. Maximum spacing between expansion joints is 35'-0".  
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 "K" for Post Type "A" & "B".  
8. Make corners and changes in tangential longitudinal alignment with a 9" bend radius or terminate adjoining sections with mitered end sections when handrails are not required.  
9. For changes in tangential longitudinal alignment greater than 45º, 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.

**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>Posts (Type &quot;A&quot; &amp; &quot;B&quot;)</td>
<td>6061-T6</td>
<td>2 x 2 x 0.250</td>
<td>0.250&quot;</td>
</tr>
<tr>
<td>Posts (Type &quot;C&quot;)</td>
<td>6061-T6</td>
<td>Extrusion (5/8&quot; x 0.125)</td>
<td>1.50&quot; x 2.50&quot;</td>
</tr>
<tr>
<td>Top Plate (Type &quot;C&quot;)</td>
<td>6061-T6</td>
<td>Extrusion (See Details)</td>
<td>2½&quot; x 7&quot;</td>
</tr>
<tr>
<td>Top Rail</td>
<td>6061-T6</td>
<td>2½&quot; OD x 0.125 Wall</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>End Hoops</td>
<td>6063-T5</td>
<td>2½&quot; OD x 0.125 Wall</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Top Cap Rail Inner Sleeve</td>
<td>6063-T5</td>
<td>1½&quot; OD x 0.125 Wall</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Intermediate &amp; Bottom Rail</td>
<td>6063-T6</td>
<td>2½&quot; OD x 0.125 Wall</td>
<td>0.125&quot;</td>
</tr>
</tbody>
</table>

**Index Notes**

1. Alloy 6061-T6 or 6063-T52 & T6 may be substituted for Alloy 6063-T52.  
2. 0.125" wall thickness permitted for rails with post spacings less than 5'-9".  
3. 1" NPS (Sch. 40) non-slit rail may be substituted when welded connection Detail "K" is utilized.

**3D View of Railing with Type 1 - Picket Infill Panel**

[Image of 3D view of railing with Type 1 - Picket Infill Panel]
Handrail required for ramps (Handrail continuous at landings between runs)

Handrail ~ 1" NPS Sch. 40 Post

30'-0" Max. for slopes > 6.25%
40'-0" Max. for slopes ≤ 6.25%

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

Max. landing slope = 2%
Max. landing cross slope = 3%

Rail expansion joints to be located in panels above structure expansion joints ~ (35'-0" maximum spacing).

Note: Non-continuous corners are permitted when handrails are not required.

Railings on Grades Steeper Than 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

Railings on Grades 0% to 5%
(Type 1 - Picket Railing Shown, Other Types Similar)

ELEVATION
(Showing Inside Face of Railing with Type "A" Posts)

Expanded Elevation at Corners
Detail for Non-Continuous Railing at Corners

NOTES:
* Keyed construction joints in Index 6011 Gravity Wall are not considered to be expansion joints.
** Contraction joints (Tooled or Saw Cut) in sidewalks do not require a 6" minimum offset.

Foundation Expansion Joint

See Typical Railing Details for post, rail & picket or infill panel details

Infill Panel Type Varies, See Data Table in Plans (Pickets Shown)

Top of Intermediate Rail

Rail Expansion Joint (Typ.)

3'-0" Min. ~ 1'-0" Max.

5" Clear Opening

Top of Sidewalk

Top of Intermediate Rail

See Plans for continuation or termination limits of railing

48" SHBR

42" PBR

42" PBR

48" SHBR

5'-0" Min.

5'-8" (Max.) ~ Type "B" or "C" Post

5'-8" (Max.) ~ Type "B" or "C" Post

5'-8" (Max.) ~ Type "B" or "C" Post

5'-8" (Max.) ~ Type "B" or "C" Post

See "Typical Railing Details" for post, rail & picket or infill panel details

Minimum from free end of concrete and expansion joints (Typ.)

Equal Clear Openings at Posts

Ramp

Intermediate Landing

Top Landing

Top of Sidewalk

See Plans for continuation or termination limits of railing

EVLATION
(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)
RAILINGS ON STEPS & STAIRS

**RAIL TERMINATION DETAILS**

**VIEW J-J**
DETAIL "J" - ELEVATION VIEW TOP RAIL TERMINATION

---

**DETAIL "K"** - ELEVATION VIEW BOTTOM RAIL CONNECTION (Intermediate Rail Similar)

---

RAIL TERMINATION DETAILS

**RAILING CONTINUATION BEYOND STEPS OR STAIRS**
(Bottom shown, Top similar)

---

**DETAIL "L"** - PLAN VIEW HANDRAIL TERMINATION

---

**DETAIL "L"**
Handrail Continuous At Landing

---

**ELEVATION**
(Al-Grade Steps shown, Elevated Stairs similar)

---

**ALTERNATE HANDRAIL END TREATMENT OR MOUNTING LOCATION FOR SLOPED WALLS**

---

**LEVELING CHANNEL**
(Typ.) See Detail, Sheet 4

---

**CONCRETE SIDEWALK**
To extend 6" min. behind railing

---

**ALUMINUM PEDESTRIAN/BICYCLE RAILING**

---

**INDEX NO.**
862

---
BASE PLATE DETAILS FOR TYPE "C" POST

(Screws Not Shown For Clarity)

COUNTERSUNK HOLES FOR SELF-TAPPING SCREWS (Min. 1/8" deep, 3/8" Max.)

Optional Intermittent weld in-lieu of Self-Tapping screws between posts.

Notes:
† See Sheet 4 for Notes.
†† See Sheet 4 for Notes.
††† Length varies for beveled posts on grades. Holes must be drilled plumb to align with screw slot.
TYPE 1 - PICKET INFILL PANEL

Picket Spacing of 6½" centers is based on a ¾" Ø Bar for standard applications. When shown in the Contract Plans a 4½" picket spacing may be required. See Note 4 (Sheet 1).

PICKET NOTES:
* Picket Spacing of 6½" centers is based on a ¾" Ø Bar for standard applications.

SECTION A-A

TYPE 2 - CHAIN-LINK (Continuous Infill Panel)

NOTES:
1. See Plans for Infill Panel option required.

CHAIN-LINK PANEL NOTE:
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 1/8" plate (ASTM B209 Alloy 6061-T6 or T651) pattern cut with laser or plasma CNC, welded to a 1x1½ Angle Border or the 3x3½ Channel Border shown.

NOTES:
1. See Plans for Infill Panel Option required.

TYPE 4 - BROADWAY INFILL PANEL

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DESIGN STANDARDS
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SHEET NO. 7 of 9
TYPE 5 - PERFORATED INFILL PANEL

SECTIONS:

AA

Panel Mullion

Perforated Panel (0.04" Min.)

Beam

Perforated Panel (0.04" Min.)

Panel Mullion

Inside Face of Post

Channel 3/8x3/8x5/32

Perforated Panel (0.04" Min.)

Inside Face of Rail

Channel 3/8x3/8x5/32

Perforated Panel (0.04" Min.)

Inside Face of Post

DETAIL "5A"

PANEL/RAIL CONNECTION
(Top Shown, Bottom Similar)

DETAIL "5B"

PANEL END CONNECTION
(Expansion Joint Shown, Sides Similar)

SECTION C-C

Panel Mullion

Perforated Panel (0.04" Min.)

#10x5/8" Pan Head Screws @ 2'-0" sp.

Perforated Panel (0.04" Min.)

#10x5/8" Pan Head Screws @ 1'-0" sp.

Perforated Panel (0.04" Min.)

Perforated Panel (0.04" Min.)

Perforated Panel (0.04" Min.)

Perforated Panel (0.04" Min.)

Seal welding mitered corners is permitted

SECTION A-A

Inside Face of Rail

Panel Mullion

Perforated Panel (0.04" Min.)

Beam

Perforated Panel (0.04" Min.)

Panel Mullion

Inside Face of Post

Channel 3/8x3/8x5/32

Perforated Panel (0.04" Min.)

Inside Face of Rail

Channel 3/8x3/8x5/32

Perforated Panel (0.04" Min.)

Inside Face of Post

DETAIL "5A"

PANEL/RAIL CONNECTION
(Top Shown, Bottom Similar)

DETAIL "5B"

PANEL END CONNECTION
(Expansion Joint Shown, Sides Similar)

REPEATING PATTERN DETAIL FOR PERFORATED PANEL

Seal welding mitered corners is permitted

ALUMINUM PEDESTRIAN/BICYCLE RAILING

FY 2017-18
DESIGN STANDARDS

INDEX NO. 862
SHEET NO. 8 of 9
**REVISION NO.**

**INDEX NO.**

**DESCRIPTION:**

**REVISION LAST OF DESIGN STANDARDS FY 2017-18**

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**TYPICAL SECTION ON CONCRETE SIDEWALK**

*Case I*

- Optional 4-Bolt Anchorages and Anchorage (shown dashed)
- Washers or Leveling Channel
- Edge Shim (8" long x ½" thick as needed)

**TYPICAL SECTION ON RETAINING WALL**

*Case II*

- Edge Dist. 4" (Case IIa)
- Embedment 6" (Min.)
- Inside Face of Concrete Structure or Sidewalk

**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>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Unreinforced Concrete</td>
<td>6&quot;</td>
<td>1&quot;-2&quot;</td>
</tr>
<tr>
<td>IIa</td>
<td>Reinforced Concrete</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>IIb</td>
<td>Gravity Wall</td>
<td>4½&quot;</td>
<td>¾&quot;</td>
</tr>
<tr>
<td>III</td>
<td>Step Cheekwall</td>
<td>4½&quot;</td>
<td>¾&quot;</td>
</tr>
<tr>
<td>IV</td>
<td>Varies</td>
<td>5&quot;</td>
<td>5&quot;</td>
</tr>
</tbody>
</table>

* Embedment length "C" may be reduced to 9" for the 42" height railings for Case IIb, when the post spacing does not exceed 5'-0".

**TYPICAL SECTION FOR 4~BOLT ANCHORAGE**

*Case IV*

- Optional 4~Bolt Anchorage (shown dashed)
- Edge Dist. 4' (Typ.)
- Embedment 9" (Min.)

---

**NOTES:**

- Minimum #4 Bars @ 1'-0" (Max) spacing for Case IIa, III & IV
- 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
- See Section A-A Sheet 4

---

**ALUMINUM PEDESTRIAN/BICYCLE RAILING**
NOTES:
1. Shop Drawings are required.
2. Work with Specification Section 515.
3. Materials:
   A. Pan Head Set Screws: Aluminum Alloy 2024-T4 or 7075-T73 or Stainless Steel (SS) Type 316 or 18-8 Alloy.
   B. Base Plates and Cap Plates: ASTM B209, Alloy 6061-T6
   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 6063-T6 is permitted.

<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; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Rails</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>2½&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrails Joint/Splice Sleeves</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.315&quot;</td>
<td>0.133&quot;</td>
</tr>
<tr>
<td>Handrails</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.500&quot;</td>
<td>0.125&quot;</td>
</tr>
<tr>
<td>Handrail Support Bar</td>
<td>1½&quot; Ø Round Bar</td>
<td>1.000&quot;</td>
<td>N/A</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 A856
   d. Flat Washers: ASTM F436
   F. Aluminum Shims: ASTM B209, Alloy 6061
   G. Bearing Pads: Plain, Fabric Reinforced, or Fabric Laminated meeting requirements of Specification Sections 515 & 962 for Ancillary Structures.

4. 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 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.

5. Handrails are required and must be continuous at landings for:
   A. Grades Steeper than 5%
   B. Three or more steps

6. Cutting of reinforcing steel is permitted for post-installed anchor bolts.
**TYPICAL RAILING DETAILS & RAILINGS ON GRADES 0% TO 5%**

- Rail expansion joints to be located in panels above structure expansion joints *(30'-0" maximum spacing)*.

**ELEVATION**

**RAILINGS ON GRADES STEEPER THAN 5% TO 8.33%**

**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%
Guided Rail on Steeps & Stairs

**Description:**

- **Rail Continuation Beyond Steps**
  - (Bottom shown, Top similar)
  - Aluminum Handrail required for three or more steps (Handrail and cheekwalls continuous at landings)
  - Handrail continuous
  - 6'-0" Max. on steps
  - 5'-0" Min.
  - 1'-6" Min.
  - 2" Min. (Typ.)
  - 9" Min. Wide cheek wall both sides
  - 2'-10" Min.

- **Elevation**
  - (At-Grade Steps)
  - Handrail termination
  - See detail "A" (Typ.)
  - Handrail continuous
  - 6'-0" Max. on steps
  - 5'-0" Min.
  - 9" Min.
  - 2" Min. (Typ.)
  - 1'-6" Min.
  - 2" Min.
  - 9" Min. Wide cheek wall both sides
  - 2'-10" Min.

- **Alternate End Treatment**
  - See detail "A" (Typ.)

**Guided Rail on Steeps & Stairs**

**Guided Rail on Steeps & Stairs**

- **Handrail Termination**
  - See typical railing details, sheet 2 for post & rail details
  - Concrete sidewalk to extend 6" min. behind rail
  - See Index 521 or contract plans for step details

**Railing Continuation Beyond Steps**

- Cones to extend 6" min. behind rail
- See typical railing details, sheet 2 for post & rail details

**FY 2017-18 Design Standards**

- **Aluminum Pipe Guardrail**
- **Index No. 870**
- **Sheet No. 3 of 5**

**Revision History:**

- **Last Revision:** 01/01/16
**TYPICAL SECTION ON CONCRETE SIDEWALK**

- **Edge Shim** (8" long x 1/2" wide x thickness as req'd)
- 2 - 5/8" Anchor Bolts (**) with Hex Nuts & Washers.
- **Steel Anchors**
- **2 or 4 Bolt Anchorage**

**DETAIL *F* (OPTIONAL SHIMMING DETAIL FOR CROSS SLOPE CORRECTION)**

(Used in lieu of Beveled Shim Plates)

**SIDEWALK ANCHORAGE DETAIL**

- 3/8" Ø Core Drilled Holes (1") in accordance with Section 416
- Seal end of post with plastic or aluminum plug
- **Steel Anchors**

**SIDEWALK ANCHORAGE DETAIL OPTION 2 & 3**

- Seal base of hole (Option 2) and end of post (Option 2) prior to epoxy filling
- **Steel Anchors**
- 6" foundation embedment permitted (Option 3)

**NOTES:**
- 2 - 5/8" Ø x 8" or 4 - 3/4" Ø x 6" Steel Anchors Permitted (C-I-P); Galvanized Adhesive Anchors Permitted
- **2 Bolt Anchorage**
- 4" for 4 Bolt Anchorage

**DESCRIPTION:**
- **REVISION NO.**
- **SHEET NO.**
- **INDEX NO.**
- **REVISION**

**DATE:**
- **10/19/2016**
- **10:01:37 AM**

**DESIGN STANDARDS:**
- **FY 2017-18**
- **ALUMINUM PIPE GUIDERAIL**
- **INDEX NO.**
- **SHEET NO.**

**INDEX NO.**
- **870**

**SHEET NO.**
- **5 of 5**
NOTES:

1. Shop Drawings are required, refer to Specification Section 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 A501 for Structural Tube.
   D. Handrail Support Bars: ASTM A36.

### Handrail Support Bars: ASTM A36

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<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
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<tr>
<td>Rails</td>
<td>2&quot; NPS (Sch. 40)</td>
<td>2.375&quot;</td>
<td>0.154&quot;</td>
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<tr>
<td>Rail Joint/Splice Sleeves</td>
<td>1½&quot; NPS (Sch. 40)</td>
<td>1.900&quot;</td>
<td>0.145&quot;</td>
</tr>
<tr>
<td>Handrails Joint/Splice Sleeves</td>
<td>3&quot; NPS (Sch. 40)</td>
<td>1.315&quot;</td>
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<tr>
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<tr>
<td>Handrail Support Bar</td>
<td>1&quot; Ø Round Bar</td>
<td>1.000&quot;</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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 "F") 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" 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 3%.
   B. Three or more steps.

5. Cutting of reinforcing steel is permitted for adhesive anchor bolt installations.
rail expansion joints to be located in panels above structure expansion joints *(30'-0" maximum spacing).

See Plans for
continuation or termination limits of railing

See "Typical Railing Details" for post & rail details

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

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

Notes:
NPS = Nominal Pipe Size

Structures Expansion Joints Note:
* Keyed construction joints in Index 6011 Gravity Wall are not considered to be expansion joints.

Railing on grades 0% to 5%

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

Rail expansion joints to be located in panels above structure expansion joints *(30'-0" maximum spacing).

See Plans for
continuation or termination limits of railing

See "Typical Railing Details" for post & rail details

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

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

Notes:
NPS = Nominal Pipe Size

Structures Expansion Joints Note:
* Keyed construction joints in Index 6011 Gravity Wall are not considered to be expansion joints.

Railing on grades steeper than 5% to 8.33%

Ramp Requirements
Max. landing slope = 2%
Max. ramp cross-slope = 2%

Landing Requirements
Max. landing slope = 2%
Max. landing cross-slope = 2%
RAILING CONTINUATION BEYOND STEPS
(Bottom shown, Top similar)

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

Handrail Termination
See Detail "A" (Typ.)

Handrail Continuation
See Index 521 or Contract Plans for Step Details

ELEVATION
(At-Grade Steps)

GUIDERAIL ON STEPS & STAIRS
**TYPICAL SECTION ON CONCRETE SIDEWALK**

- **Edge Shims**: 0" long x 1/2" wide x 1" thickness (as reqd.)
- **3 ~ 1/2" Ø Anchor Bolts (**) with Hex Nuts & Washers
- **2 ~ 1/2" Ø Anchor Bolts (**) with Hex Nuts & Washers
- **1/2" Thick Bearing Pad (Typ.)**
- **Full size Shim Plates when required for height adjustment**

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

**TYPICAL SECTION ON GRAVITY WALL (Other Retaining Walls Similar)**

- **3/4" Core Drilled Hole (Typ.)**: Clean hole in accordance with Specification Section 416
- **1/2" Thick Bearing Pad (Typ.)**
- **3/4" Ø Core Drilled Hole (Typ.)**: Clean hole in accordance with Specification Section 416
- **Seal base of hole (Option 2 & 3)**
- **Seal end of post with a plastic or galvanized steel plug**
- **6" foundation embedment permitted (Option 3)**

**OPTIONAL SIDEWALK ANCHORAGE DETAIL**

- **3" Min. Beveled Build-up (Typ.)**
- **Epoxy Mortar (Type F) in accordance with Specification Section 326**
- **3/4" Ø Core Drilled Hole (Typ.)**: Clean hole in accordance with Specification Section 416
- **Seal base of hole (Option 2 & 3) and end of post (Option 2) prior to epoxy filling to prevent leakage**
- **6" foundation embedment permitted (Option 3)**

**SIDEWALK ANCHORAGE DETAIL**

- **3" Min. Beveled Build-up (Typ.)**
- **Epoxy Mortar (Type AB or F) in accordance with Specification Section 326**
- **3/4" Ø Core Drilled Hole (Typ.)**: Clean hole in accordance with Specification Section 416
- **Seal base of hole (Option 2 & 3) and end of post (Option 2) prior to epoxy filling to prevent leakage**
- **6" foundation embedment permitted (Option 3)**

**NOTES:**

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