

SECTION 05100

METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section includes specifications for metal fabrications, including minimum requirements for fabricator, and galvanizing.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM):
 - 1. A27 Specification for Steel Castings, Carbon, for General Application
 - 2. A36 Specification for Carbon Structural Steel
 - 3. A48 Specification for Gray Iron Castings
 - 4. A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 5. A109 Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
 - 6. A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 7. A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 8. A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
 - 9. A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 10. A488 Standard Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel
 - 11. A536 Specifications for Ductile Iron Castings
 - 12. A563 Specification for Carbon and Alloy Steel Nuts
 - 13. A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 14. A780 Practice for Repair of Damaged Hot-Dip Galvanized Coatings

15. D6386 Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
 16. F436 Specification for Hardened Steel Washers
- B. American Welding Society (AWS):
1. D1.1 Structural Welding Code Steel
- C. Department of Defense (DOD):
1. DOD-P-15328 Primer (Wash), Pretreatment (Formula No. 117 For Metals) (Metric)
- D. Federal Specifications (FS):
1. QQ-F-461 Floor Plate, Steel, Rolled
- E. Steel Structures Painting Council (SSPC):
1. SSPC-SP 1 Solvent Cleaning
 2. SSPC-SP 3 Power Tool Cleaning
 3. SSPC-PA 1 Shop, Field & Maintenance Painting
 4. SSPC-Paint 20 Zinc-Rich Primers (Type I – Inorganic & Type II – Organic)
 5. SSPC-Paint 22 Epoxy-Polyamide Paints (Primers, Intermediate & Topcoats)

1.03 SUBMITTALS

- A. Submit shop drawings showing the following:
1. Sizes, details of fabrication and construction, methods of assembly, locations of hardware, anchors, and accessories, and installation details.
 2. Details for manufacturer's items or fabricated metalwork.
 3. Field erection details showing cuts, copes, connections, holes, threaded fasteners and welds, both shop and field, by symbols conforming to AWS standards. Indicate net weld lengths.
- B. Submit manufacturers' product data. Include application instructions for galvanizing repair product.
- C. Metal Fabricator: Submit a list of projects demonstrating a minimum of 5 years of experience in the custom fabrication and construction of metal fabrications and miscellaneous metalwork.

- D. Written verification from the manufacturer that the primer is compatible with the finish coats specified in Section 09900, Paints and Coatings.

1.04 DELIVERABLES

- A. Welders' Certificates: Submit certification of personnel employed on the work to satisfy the requirements of Part 4 of AWS D1.1.

1.05 QUALITY ASSURANCE

- A. All metal fabrications shall be done by a licensed fabrication shop with a minimum of 5 years of experience in this type of work.
- B. Welding including shielded arc process shall conform to the requirements in AWS D1.1 Structural Welding Code

PART 2 - PRODUCTS

2.01 STEEL

- A. Plates, Shapes and Bars: ASTM A36, unless otherwise noted
- B. Sheet, Commercial Quality, Galvanized: ASTM A653, G90
- C. Strip: ASTM A109
- D. Pipe: ASTM A53, Grade B, Schedule 40, black or galvanized, as indicated
- E. Castings: ASTM A27 or A48, as indicated
- F. Ductile Iron: ASTM A536

2.02 FASTENERS

- A. Steel Bolts, Anchor Bolts, Nuts, Shear Studs and Threaded Rods: ASTM A 307, ASTM A 563, and ASTM F 436, unless otherwise noted. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A 153.
- B. High Strength Steel Bolts and Nuts: ASTM A 325, unless otherwise noted.
- C. Threaded Inserts: ASTM A 488, unless otherwise noted.

2.03 MISCELLANEOUS MATERIALS

- A. Use E7018 low hydrogen electrodes for A36 steel.
- B. Primer Pretreatment: DOD-P-15328.
- C. Corrosion-Inhibitive Metal Primer: SSPC-Paint 20 or SSPC-Paint 22. Verify compatibility of shop primer and finish coats specified in Section 09900, Paints and Coatings.

2.04 CHECKERED SAFETY PLATE

- A. FS QQ-F-461, Class 1, flat black, standard 4-way raised pattern.

2.05 IRON CASTINGS

- A. Gray: ASTM A48, Class 35B, unless otherwise noted.

2.06 FABRICATION - GENERAL

- A. Fabricate miscellaneous metal items with light structural angles, tees, bars, channels, plates, rods, pipes and other rolled steel shapes, as indicated in the Contract Documents and specified herein.
- B. Fabricate work true to shape, size and tolerances as indicated on the Contract Drawings and approved shop drawings; with straight lines, square corners or smooth bends; free from twists, kinks, warps, dents, and other imperfections. Straighten work bent by shearing or punching. There shall be no exposed screws, bolts, and fasteners in the finished work, except as indicated or required.
- C. Utilize metal of sufficient thickness and detail assembly and support to provide strength and stiffness sufficient to resist distortion during shipment, handling, installation, and severe service conditions. Exposed edges and ends of metal shall be ground smooth with no sharp edges and with corners slightly rounded. Connections and joints exposed to weather shall be watertight.
- D. Form curved work to radii indicated. Furnish bolts, nuts, washers, and other fastening devices required for securing work.
- E. For pipe sleeves in concrete construction, provide standard weight, black steel pipe with anchors welded to exterior. Provide sizes as required to accommodate passage of conduits, pipes, ducts and similar items with proper clearance.
- F. Fabricate flanges for posts from 3/8-inch minimum thickness plate, and for standoffs from not less than 3/16-inch thickness plate.
- G. Metal fabrications shall be prefabricated and preassembled in the factory or shop as far as practicable.
- H. Grind off excess metal and make smooth surface welds which will be exposed to view.

2.07 GALVANIZING

- A. Steel and ferrous metal items in contact with concrete, on the exterior of buildings, exposed to the weather and moist conditions, and items specifically indicated, shall be galvanized after fabrication. Fabricate items complete or in largest practical sections before galvanizing. Do not field weld fabricated items except where indicated or permitted by the Engineer. Thoroughly clean welded

areas prior to galvanizing. Remove weld spatter, burrs, oil, grease and any other deleterious matter that would interfere with the adherence of the zinc.

- B. Hot dip galvanize products after fabrication (including shearing, punching, bending, forming, or welding) in accordance with ASTM A 123.
- C. The weight of zinc coating shall conform to the requirements specified under "Weight of Coating" in ASTM A 123, but not be less than 2.0 ounces per square foot of surface area.
- D. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by field galvanizing repair in accordance with ASTM A 780.
- E. Hardware items, and bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A 153.

2.08 SHOP FINISHING

- A. Nongalvanized Metalwork: Shop paint ferrous metal which is not indicated to be galvanized.
 - 1. After fabrication and immediately before shop painting, power-tool clean ferrous metalwork in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter. Wire brush welds thoroughly.
 - 2. After power-tool cleaning and just before shop painting, wash ferrous metalwork with solvent to remove dust and residue in accordance with SSPC-SP 1.
 - 3. After cleaning and solvent washing, shop paint ferrous metalwork with one coat of corrosion-inhibitive metal primer in accordance with SSPC-PA 1. Material and application shall conform to SSPC-Paint 20 or SSPC-Paint 22.
- B. Galvanized Metalwork:
 - 1. Galvanized metal surfaces indicated to be painted shall be prepared for painting in accordance with ASTM D 6386.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install metal fabrications with installation accessories furnished by fabricator as required for complete installation.
- B. Install in accordance with approved shop drawings, true and horizontal, perpendicular, or at required angle, as the case may be, level and square with angles and edges parallel with related lines of structure.

- C. Install threaded rods used as dowels as specified in Section 03200, Concrete Reinforcing.
- D. Field welding, where indicated or allowed, shall conform to the requirements for welding as specified in Section 05200, Structural Steel.
- E. Keep field joints to a minimum and concealed. Make field joints strong, rigid, watertight and flush with hairline fit. Grind sharp corners smooth.
- F. Grind off excess metal and make smooth surface welds which will be exposed to view.
- G. Securely grout posts set in sleeves in conformance to grout manufacturer's instructions. Attach posts not set in sleeves with appropriate fasteners.
- H. After installation, damaged prime surfaces shall be prepared as required and touched up with the same primer used for shop primer; leave ready for field painting.

3.02 GALVANIZING REPAIR

- A. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired immediately after installation with galvanizing repair material in accordance with ASTM A 780.

END OF SECTION

SECTION 05200 STRUCTURAL STEEL

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Section includes specifications for structural steel, including steel designated as structural steel on the Contract Drawings.

1.02 REFERENCE STANDARDS

- A. American Institute of Steel Construction (AISC):
 - 1. Quality Certification Program for Fabricators.
- B. American Railway Engineering and Maintenance-of Way Association (AREMA):
 - 1. Manual for Railway Engineering
- C. American Society of Nondestructive Testing (ASNT):
 - 1. SNT-TC-1A Recommended Practice
- D. American Society for Testing and Materials (ASTM):
 - 1. A588 Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi Minimum Yield Point to 4 inches Thick
 - 2. A709 Standard Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
 - 3. E94 Guide for Radiographic Testing
 - 4. E142 Method for Controlling Quality of Radiographic Testing
 - 5. E164 Practice for Ultrasonic Contact Examination of Weldments
 - 6. E165 Test Method for Liquid Penetrant Inspection Method
 - 7. E709 Guide for Magnetic Particle Examination
 - 8. E1032 Method for Radiographic Examination of Weldments
- E. American Welding Society (AWS):
 - 1. B1.10 Guide for the Nondestructive Inspection of Welds
 - 2. D1.1 Structural Welding Code Steel
 - 3. D1.5 Bridge Welding Code

4. D10.9 Specification for Qualification of Welding Procedure and Welders for Piping and Tubing
5. QC1 Specification for AWS Certification of Welding Inspectors
- F. State of California, Department of Transportation (Caltrans), Standard Specifications (hereafter Standard Specifications)
 1. Section 55 Steel Structures
- G. Steel Structures Painting Council (SSPC):
 1. SP 1 Solvent Cleaning
 2. SP 3 Power Tool Cleaning
 2. SP 10 Near-White Blast Cleaning
 3. SP 11 Power Tool Cleaning to Bare Metal
 4. PA 1 Shop, Field & Maintenance Painting
 5. Paint 20 Zinc-Rich Primers (Type I – Inorganic & Type II – Organic)
 6. Paint 22 Epoxy-Polyamide Paints (Primers, Intermediate & Topcoats)

1.03 SUBMITTALS

- A. Submit shop drawings conforming to Caltrans Standard Specifications, Section 55-1.02 Drawings, second paragraph, and AREMA Manual, Section 1.1 of Chapter 15. Shop drawings shall also show the following:
 1. Profiles, sizes, spacing, locations, member identity, methods of assembly, locations of hardware, anchors, and accessories, and erection sequence and details of structural members.
 2. Cuts, copes, gussets, holes, openings, fasteners, camber, fabrication and erection tolerances, type of finish, weights of members, and critical clearances. Profiles, sizes, spacing, locations, member identity, methods of assembly, locations of hardware, anchors, and accessories, and erection sequence and details of structural members.
 3. Details of connections: bolted and welded. Indicate all shop and field bolts and welds.
 4. Details of welded connections with symbols conforming to AWS standards. Indicate size, type, and net lengths of each weld.
 5. Investigate stresses caused by the proposed erection procedure. Submit drawings showing details of required temporary supports, staying, and bracing. Include descriptive data and design calculations to illustrate the erection, transportation, and handling procedures, including sequence of erecting and transfer of loads if applicable.

- B. Product data for primer including written verification from the manufacturer that the primer is compatible with the finish coats specified in Section 09900, Paints and Coatings.
- C. Steel Fabricator: Submit a list of projects demonstrating a minimum of 10 years of experience in the fabrication of structural steel, and verification that the fabricator meets the specified AISC Certification program requirements.
- D. Steel Erector: Submit a list of projects demonstrating a minimum of 10 years of experience in the erection of structural steel.
- E. Welder Qualifications: Submit copies of qualification test records for each welder, welding operator, and tack welder to be employed in the work. Comply with requirements of AWS D1.1. For pipe and tube, comply with requirements of AWS D10.9.
 - 1. Submit welders' identification marks (I.D.) for each welder along with qualifications.
- F. Welding Procedure Specifications (WPS): Prior to commencement of welding, submit the procedure specifications that will be used for welding. The WPS shall contain all data indicated in AWS D1.1 Annex IV, and any other information necessary to produce welded joints in compliance with this specification. For procedures other than those prequalified in accordance with AWS D1.1, D1.2, and D1.5, submit a copy of procedure qualification test records in accordance with the qualification requirements of AWS D1.1, AWS D1.2, and AWS D1.5, as applicable. The WPS shall also include the mitigation of corrosion of welds, including heat treatment and chemical compatibility, as applicable.
- G. Welding Records and Data:
 - 1. Submit all radiographs upon completion of fabrication.
 - 2. Submit certifications that magnetic particle and dye-penetrant inspections have been satisfactorily completed.
 - 3. Submit records of ultrasonic testing upon completion.
 - 4. If field welding is permitted, submit descriptive data for field welding equipment.
- H. Mill Certificates: Submit mill certificates and certified copy of reports for analyses and tests required by referenced ASTM and AWS specifications.

1.04 DELIVERABLES

- A. Quality Control Deliverables:
 - 1. Certified Mill Test Reports: Submit certified mill test reports indicating structural strength, and destructive and non-destructive test analyses.
 - 2. Certificates of Compliance: Submit Certificates of Compliance to certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Calculations substantiating camber, which are submitted with shop drawings in accordance with Caltrans Standard Specifications, Section 55-1.02, and erection procedures shall be prepared, sealed, and signed by a Professional Engineer hired by the Contractor who is currently registered in the State of California.

- B. Steel Fabricator:
 - 1. Minimum of 10 years experience in the fabrication of structural steel, and who participates in the AISC Certification program and is designated an AISC Certified Plant, Category STD.
 - 2. Additionally, a fabricator involved in the fabrication of structural steel for bridges shall be designated an AISC Certified Plant, Category CBR.

- C. Steel Erector:
 - 1. Minimum of 10 years experience in the erection of structural steel.

- D. Qualifications of Welders and Welding Procedures: Welders, welding operators, tack welders, and welding procedures shall be prequalified or qualified in accordance with the following AWS Welding Codes and Standards:
 - 1. Structural Steel: AWS D1.1, Section 4, Qualification
 - 2. Steel for Bridges: AWS D1.5, Section 5, Qualification
 - 3. Stud Welding: AWS D1.1, Section 7.6, Stud Application Qualification Requirements
 - 4. Pipe and Tube: AWS D10.9

- E. Qualifications of Welding Inspector: Welds to be inspected by the Contractor shall be inspected and certified by a Contractor-employed AWS Certified Welding Inspector (CWI), certified in accordance with AWS QC 1.

- F. Qualification of Personnel Performing Nondestructive Testing: Personnel performing nondestructive testing, who are Contractor-employed, shall be qualified and certified in accordance with SNT-TC-1A. Only persons certified for NDT Level I and working under a NDT Level II person or persons certified for NDT Level II may perform nondestructive testing.

- G. Weldability of Steel: For structural steel requiring impact test qualification, the weldability of the steel and the procedures for welding it shall be established by qualification in accordance with AWS D1.1, Section 4.

- H. Qualification of Stud-Connector Manufacturer: Stud shear connector manufacturer shall be qualified in accordance with AWS D1.1, Annex IX, Manufacturers' Stud Base Qualification Requirements.

- I. Stud Welding Standards: For stud welding, comply with applicable requirements of AWS C5.4.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Unless otherwise noted in the Contract Documents, the following shall be used for structural steel members:
 - 1. Structural Steel Members: Members shall conform to Caltrans Standard Specifications, Section 55-2, Materials, and AREMA Manual, Chapter 15.
 - 2. Bolts, Nuts, and Washers: Bolts, nuts, and washers shall conform to Caltrans Standard Specifications, Section 55-2, Materials, and AREMA Manual, Chapter 15.
 - 3. Stud connectors shall conform to AREMA Manual, Chapter 15.
 - 4. Welding Materials: Welds shall conform to Caltrans Standard Specifications, Section 55-3.17, Welding, and AREMA Manual, Chapter 15.
 - 5. Shop Primers: SSPC Paint 20 or 22. Verify compatibility of shop primer and finish coats specified in Section 09900, Paints and Coatings.
- B. Section 05500, Metal Fabrications: Steel items required in construction of Shelters, except for shelter steel items designated as structural steel on the Contract Drawings.

2.02 FABRICATION

- A. Fabricate structural steel in accordance with Caltrans Standard Specifications, Section 55-3, Fabrication, and as specified herein.
- B. Fabricate structural steel for railroad bridges in accordance with AREMA Manual, Chapter 15.
- C. Shop Assembly: Steel members shall be prefabricated and preassembled in the shop as far as practicable. Continuously seal joined members by continuous welds. Grind all exposed welds smooth.
- D. Field Connections: Provide bolts for all field connections except where indicated or permitted by the Engineer.
 - 1. Use high-strength bolts unless indicated or specified otherwise.
 - 2. If structural steel details shown on the Contract Drawings are not compatible with selected erection procedures, submit proposed modifications for review.
- E. Field welding, where indicated or permitted by the Engineer, shall be performed as herein specified for shop welding.

2.03 SHOP FINISHING

- A. Interior, Non-Corrosive Applications:
 - 1. After fabrication and immediately before shop painting, wash structural steel materials with solvent to remove dust and residue in accordance with SSPC-SP 1.
 - a. Structural Steel Materials not Exposed to the Public: Power-tool cleaned in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter.
 - b. Structural Steel Materials Exposed to Public View: Blast cleaned in accordance with SSPC-SP 10 or power-tool cleaned in accordance with SSPC-SP 11 to remove all visible mill scale, rust, grease, oil, and any other foreign matter.
 - 2. If materials are not painted immediately after cleaning then those materials shall be washed with solvent to remove dust and residue in accordance with SSPC SP 1.
 - 3. After preparation, shop paint steel materials with one coat of corrosion-inhibitive metal primer in accordance with SSPC PA 1. Materials and application shall conform to SSPC-Paint 20 or SSPC-Paint 22.
- B. Exterior Applications:
 - 1. Steelwork to be Exposed to Weather: Blast cleaned in accordance with SSPC-SP 10, Near White Blast Cleaning, or power-tool cleaned in accordance with SSPC-SP 11, Power Tool Cleaning to Bare Metal. For new steel bridges, cleaning shall be in accordance with SSPC-SP 10.
 - 2. After cleaning, solvent wash in accordance with SSPC-SP 1, and shop paint steelwork in accordance with SSPC-PA 1. Materials and application shall conform to SSPC-Paint 20. For new steel bridges, only shop-applied Type I – Inorganic Zinc Rich Primers shall be used.

2.04 SHOP WELDING

- A. Perform shop welding as indicated in accordance with the AWS D1.1 and AWS D1.5, as applicable to the work.
- B. Welders shall mark adjacent to completed welds their welder I.D., using metal stamp, metal engraving, keel, paint stick, or other appropriate marking material.
- C. Welding of stud shear connectors shall conform with AWS D1.1, Section 7, Stud Welding, AWS C5.4, and the stud manufacturer's instructions.

2.05 INSPECTIONS AND TESTS BY THE CONTRACTOR

- A. Visual Inspection: All welds for structural steel and structural steel for bridges shall be visually examined in accordance with AWS D1.1, Sections 6 and 7.8, as applicable. Quality of welds and standards of acceptance shall be in accordance with AWS D1.1, Section 6.9.
- B. Nondestructive Testing: Nondestructive testing shall conform with AWS B1.10.

- C. Radiographic Testing: Radiographic testing of welds shall conform with AWS D1.1, Section 6.12 and ASTM E94, ASTM E142, and ASTM E1032, as applicable. Complete joint penetration groove welds shall be tested as follows:
 - 1. 20 percent with thickness equal to or less than 3/4 inch
 - 2. 50 percent with thickness greater than 3/4 inch and equal to or less than 1-1/2 inches
 - 3. 100 percent for thickness greater than 1-1/2 inches
- D. Ultrasonic Testing: Ultrasonic testing of welds shall conform with AWS D1.1, Section 6.13, and ASTM E164, as applicable. Complete joint penetration groove welds not accessible for radiographic testing shall, with Engineer's approval, be subjected to ultrasonic testing. The extent shall be the same as specified for radiographic testing.
- E. Magnetic Particle Inspection: Magnetic particle inspection of welds shall conform with ASTM E709. Complete and partial joint penetration groove welds and fillet welds shall be inspected as follows:
 - 1. 25 percent of complete joint penetration groove welds of tee and corner joints.
 - 2. 20 percent of partial joint penetration groove welds and fillet welds.
- F. Liquid Penetrant Inspection: Liquid dye penetrant inspection of welds shall conform to ASTM E165. Liquid penetrant inspection shall be used for detecting discontinuities that are open to the surface.
- G. Inspections for Bridge Structural Steel Welding: In addition to the inspection requirements specified herein, inspect welding in accordance with AREMA Section 15.3.5.5 including the following non-destructive testing:
 - 1. All full-penetration welds in girder webs and flanges shall be inspected by the radiographic method.
 - 2. All flange to web welds shall be inspected by the ultrasound method.
 - 3. All fillet welds on bearing stiffeners shall be inspected by the ultrasound method.
 - 4. At least 25 percent of all other welds shall be inspected by the ultrasonic or magnetic particle method.
 - a. If any defects are found, 100 percent inspection by the ultrasonic or magnetic particle shall be required.
 - 5. Inspection of welded work for Fracture Critical Members shall be in accordance with AREMA Chapter 15.
 - 6. Time delay prior to NDT of weld repairs to groove welds of ASTM A588 or ASTM A709 material over 2 inches in thickness subject to tensile stress, shall be 16 hours minimum.

- H. Test Results: Test result information shall be forwarded to the Engineer immediately after test results are available, stating the acceptance or rejection of fabricated components, so that repairs and reinspection or testing may be performed as soon as possible.
- I. Repairs: Unacceptable welds shall be repaired in accordance with AWS D1.1, Section 5.26. Repaired or corrected welds shall be reinspected or retested as specified for the original weld.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Erection:
 - 1. Allow for erection loads, and for sufficient temporary bracing to maintain the structure safely plumb and in true alignment until completion of erection and installation of permanent bracing.
 - 2. Do not field cut or alter structural members without prior approval of the Engineer.
 - 3. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
 - 4. Coordinate the installation of structural steel with the installation of miscellaneous metals to minimize the requirement for field cutting, alteration, temporary bracing, and redundant operations during erection.
- B. Erection Tolerances: Maximum offset from true alignment shall be 1/4 inch.

3.02 FIELD FINISH

- A. Refer to Section 09900, Paints and Coatings, for field finish for work of this Section.
 - 1. After installation or erection of structural steelwork, abraded areas, field bolts, and welds shall be touched up and spot painted with corrosion-inhibitive primer. Field welds shall be thoroughly wire-brushed or disc-sanded prior to touch-up painting.

END OF SECTION

SECTION 05500

PEDESTRIAN EXIT GATES AND GUARDRAIL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section includes specifications for pedestrian exit gates and guardrailing for installation at at-grade crossings. The locations of this installation include vehicular grade crossings, and pedestrians only at passenger stations crossings and at rail crossings.
- B. The proper functioning of the exit gates requires high level of workmanship in fabrication and installation of hinges and gates.

1.02 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM International):
 - 1. A36 Specification for Carbon Structural Steel
 - 2. A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. A780 Practice for Repair of Damaged Hot-Dip Galvanized Coatings
- B. American Welding Society (AWS):
 - 1. D1.1 Structural Welding Code Steel

1.03 SUBMITTALS

- A. Submit shop drawings showing member sizes, details of fabrication and construction, methods of assembly, and installation details. Guardrailing shall allow for slope variation on sidewalk.
- B. Submit shop drawings for the fabricator's hinges and gates.
- C. Submit manufacturers product data. Include application instructions for galvanizing repair product.

1.04 DELIVERABLES

- A. Welders Certificates: Submit certification of personnel employed on the work to satisfy the requirements of Part 4 of AWS D1.1.

1.05 QUALITY ASSURANCE

- A. Welding including shielded arc process shall conform to the requirements in AWS D1.1 Structural Welding Code.
- B. All components (hinges, posts, gates, guardrailing) in this Section shall be fabricated in shop for desired quality. Use only well experienced welders and fitters.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Hinges: DOM (Drawn Over Mandrel) steel with minimum yield strength of 60 ksi.
- B. Steel Plate and Miscellaneous Items: ASTM A36, except as otherwise indicated on the Contract Drawings.
- C. Steel Pipe for posts, gates and guardrailing: Seamless steel pipe, conforming to ASTM A53, Type S, Grade A, standard weight, nominal size as shown on the Contract Drawings.
- D. Brackets, Bolts, Threaded Studs, Nuts, Washers and Other Fittings: Galvanized, commercial quality structural steel, except that standard steel pipe fittings may be used where shown on the Contract Drawings. For mounting of signage to the gates: use only SS 316 hardware as shown on the Caltrain Standard Drawing.
- E. Mechanical expansion anchors for attaching the railing to supporting concrete members: Concrete anchorage devices as specified in Section 75-1.03, "Miscellaneous Bridge Metal."
- F. Non-Shrink Grout: Master Builders "Embeco," Sonneborn Bldg Products, Inc "Ferrolith G," Halemite Manufacturing Company "Por Rok," or Engineer approved equal.
- G. Hot Process Field Galvanizing (for repairs): Galv, Galvalloy, Galvweldalloy, or Engineer approved equal.

2.02 FABRICATION

- A. Workmanship: Accurately fabricate hinges, gates and posts neat and rigid in shop for desired quality. Set components accurately in position, leveled, squared and aligned. The dimensions and other details are in the Caltrain Standard Drawing or Contract Documents.
- B. Mock-up Set: Fabricate in shop a complete mock-up set for Engineer's approval. Approved set serves as the standard of quality for other sets.
- D. Guardrailing: Weld railings, continuous as detailed. Fabricate welded pipe items with flush welded construction throughout, except where sleeve joints or other mechanical joints for field connection or job requirements are necessary.

- E. Heat railing and make radius bends to produce uniform curvature without distortion. Shape curved sections on true radius without buckle, dent, kinks or flattened sections. Cope intersections; continuously weld and grind welds smooth. Return rail ends to 1/4 inch clearance and weld plug over open end.
- F. Sleeves for Anchoring Railing Posts in Concrete: Galvanized standard pipe sleeves with welded-on bottom plates or 24 gage galvanized sheet metal sleeves with bottoms. Sleeve diameter shall be at least 3 times the outside diameter of the rail posts.
- G. Grind off excess metal and make smooth surface welds which will be exposed to view.

2.03 WELDING

- A. Use electric shielded arc process conforming to the requirements of AWS D1.1.
 - 1. Use E7018 low hydrogen electrodes for A36 steel.

2.04 GALVANIZING

- A. Fabricate units complete or in largest practical sections before galvanizing. Thoroughly clean welded areas prior to galvanizing. Remove weld spatter, burrs, oil, grease and any other deleterious matter that would interfere with the adherence of the zinc.
- B. Hot dip galvanize exterior railing, gates, and attached metal components after fabrication (including shearing, punching, bending, forming, or welding) in accordance with ASTM A123.
- C. The weight of zinc coating shall be not less than 2.0 ounces per square foot of surface area.
- D. After galvanizing, all elements of the railing shall be free of fins, abrasions, rough or sharp edges and other surface defects and shall not be kinked, twisted or bent. If straightening is necessary, straighten using methods approved by the Engineer. Kinks, twists, or bends in railing elements may be cause for rejection of the railing elements.

2.05 FINISHES

- A. Gates, gate posts and hinges and all attached metal components shall be painted in accordance with Section 09900, Paints and Coatings. Color shall be Federal Safety yellow FS 33538.
- B. Guardrailing shall be painted in color as specified in the Contract Documents.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install work straight and plumb with members anchored, secure and fasten together in accurate position, neat, rigid, level, square, straight and plumb.
- B. Keep field joints to a minimum and concealed to greatest practical extent. Make field joints strong, rigid, watertight and flush with hairline fit. Ease sharp corners.
- C. Securely posts set in sleeves with non-shrink grout in accordance with grout manufacturer's instructions.
- D. Where posts are not set in sleeves, mechanically secure posts to wood or steel surfaces with fasteners as shown on the Contract Drawings or in accordance with approved shop drawings.
- E. Repair abraded or damaged galvanized surfaces with hot process field galvanizing in accordance with ASTM A780 and manufacturer's published instructions.

3.02 SITE TOLERANCES

- A. Gates shall swing open freely and close return such that the gate stops meet tightly.
- B. Install guardrailing posts vertical within a tolerance not to exceed 0.02-foot in 10 feet.

END OF SECTION