

Section 02643

STRUCTURAL PLATE CULVERT STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural plate culverts and special structural plate shapes.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.

1. Payment for structural plate pipes, pipe arches, arches, underpasses or box culverts is on linear foot basis for each structure, measured along flow lines between ends of structures. Separate payment will be made for each different required size, gage, or minimum thickness of required material.
2. For multiple structures, measured length will be sum of lengths of barrels as prescribed above.
3. Include cost of aluminum alloy inverts, toe walls, footings, closure plates, and stiffeners in unit price for structure.
4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. AASHTO M 167 - Standard Specification for Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe, Pipe Arches, and Arches.
- B. AASHTO M 190 - Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
- C. AASHTO M 219 - Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field Bolted Pipe, Pipe Arches, and Arches.
- D. AASHTO M 243 - Standard Specification for Field Supplied Coating of Corrugated Metal Structural Plate for Pipe, Pipe Arches, and Arches.

- E. ASTM A 153 - Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.
- F. ASTM B 221 - Standard Specification for Aluminum and Aluminum - Alloy Extruded Bars, Rods, Wires, Profile, and Tubes.
- G. ASTM B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
- 8. Tex-728-I-Measurement of Dry Film Coating Thickness on Steel.

1.04 ACCEPTANCE

- A. Furnish itemized list of number and size of plates in each shipment to be used for visual inspection by City Engineer. Inspection will be made of plates for deficiency in size, radius of curvature and evidence of poor workmanship. Inspection may include sampling for chemical analysis and determination of weight of splutter coating. Plates failing to meet requirements of this Specification Section will be rejected.
- B. City Engineer may elect to inspect materials in rolling mill or in fabrication shop. City Engineer will have free access to mill or shop for inspection.
- C. Repair damaged areas of splutter coating. Repair may be accomplished by painting with dust-zinc oxide paint conforming to Federal Specification TT-P-641G when approved in advance by City Engineer.
- D. The following defects are causes for rejection:
 - 1. Uneven laps.
 - 2. Elliptical shaping (unless specified).
 - 3. Variation from straight centerline.
 - 4. Ragged edges.
 - 5. Loose, unevenly lined or spaced bolts.
 - 6. Illegible brand.
 - 7. Bruised, scaled, or broken splutter coating.
 - 8. Dents or bends in metal.

PART 2 P R O D U C T S

2.01 METAL PIPE AND ARCH MATERIALS

- A. Conform plates and fasteners used for construction of structural plate pipes, pipe arches, arches, underpasses, box culverts and special shapes to AASHTO M 167 for galvanized corrugated steel structures, and to AASHTO M 219 for aluminum alloy structures.
- B. Steel fasteners shall be mechanically galvanized or hot-dip galvanized and shall conform to ASTM A 153, Class C or D, or ASTM B 695, Class 40. Determine weight of galvanized coating according to Test Method Tex-728-I.
- C. Steel plates shall consist of structural units of corrugated galvanized metal. Furnish single plates in standard sizes to permit structure length increments of 2 feet. Plates shall have approximately 2-inch lip beyond each end and crest. Length of given structure shall be approximately 4 inches longer than nominal length, except when skewed or beveled.
- D. Aluminum plate shall consist of structural units of corrugated aluminum alloy. For aluminum alloy structures, furnish cut plates on structure ends to permit structure length increments of one foot. Conform aluminum alloy inverts, toe walls, footings and closure plates to material requirements for aluminum structural plate. Extruded aluminum transverse stiffeners shall conform to ASTM B 221, Alloy 6061-T6.
- E. Comply headwalls with material requirements shown on Drawings.

2.02 STRUCTURE AND MATERIAL DESIGNATION

- A. The types of structures are described on Drawings as follows:
 - 1. Structural Plate Pipe (Galvanized Steel)
 - 2. Structural Plate Pipe (Aluminum)
 - 3. Structural Plate Pipe Arch (Galvanized Steel)
 - 4. Structural Plate Pipe Arch (Aluminum)
 - 5. Structural Plate Arch (Galvanized Steel)
 - 6. Structural Plate Arch (Aluminum)
 - 7. Structural Plate Underpass (Galvanized Steel)
 - 8. Structural Plate Underpass (Aluminum)
 - 9. Structural Plate Box Culvert (Galvanized Steel)

10. Structural Plate Box Culvert (Aluminum)

- B. Either galvanized steel or aluminum may be used when no material is designated on Drawings.

2.03 PLATE JOINTS

- A. Form plates to provide bolted lap joints. Punch bolt holes so plates having like dimensions, curvature, and same number of bolts per foot of seam are interchangeable.
- B. Curve each plate to proper radius so cross-sectional dimensions of finished structure will be as indicated on Drawings.
- C. Stagger joints so not more than three plates are jointed at any one point. Unless otherwise specified, place bolt holes along edges of plates forming longitudinal seams in finished structure as follows:
 - 1. Stagger in rows 2 inches apart, with one row in valley and one in crest of corrugations with not less than 4 bolts per foot for galvanized steel structures.
 - 2. Stagger in rows 1:inches apart, with 2 bolts in each valley and on each crest and not less than 16 bolts per 3 feet for aluminum alloy structures.
- D. Provide for bolt spacing of not more than 12 inches for bolt holes along edges of plates that will form circumferential seams in finished structure.
- E. Keep minimum distance from center of hole to edge of plate to not less than 1: times diameter of bolt.
- F. Diameter of bolt holes in longitudinal seams not to exceed diameter of bolt by more than c inch.
- G. Cut plates for forming skewed or sloped ends to give angle of skew or slope specified.
- H. Repair burned edges to eliminate oxide and burrs. Maintain legible identification numerals on each plate to designate proper position in finished structure.

2.04 CONCRETE

- A. Conform to Section 03315 - Concrete for Utility Construction. Unless otherwise shown on Drawings, use Class A concrete for footings and headwalls. Use Class B concrete for slope protection and for invert paving. Place reinforcement as shown on Drawings.

2.05 REINFORCING STEEL

- A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

PART 3 EXECUTION

3.01 PROTECTIVE COATINGS, LININGS AND PAVINGS

- A. When required, protect structural plate structures with bituminous coating, bituminous lining or have invert paved with bituminous material. Remove moisture, dirt, oil, unbonded or incompatible paint, grease, alkalies, or other foreign matter from surface to be coated before applying coating material.
- B. Apply bituminous coatings to inside and outside of structures to minimum thickness of 0.05-inch as provided in AASHTO M 190, Type A.
- C. Apply protective coating to coupling bands for coated structures. Use coatings in accordance with AASHTO M 190. Coupling bands may be single-dipped with coating thickness requirement waived.
- D. Apply bituminous linings, when required, over bituminous coatings, to inside bottom portion of structure as provided in AASHTO M 190, Type C.
- E. When linings and pavings are not required, asphalt mastic coating may be substituted for bituminous coating on corrugated steel or aluminum structures on outside surface of structure. Inside surface need not be coated.
- F. Use asphalt mastic coating conforming to requirements of AASHTO M 243, except asbestos fibers will not be used. Perform this process at fabrication plant. Apply asphalt mastic material uniformly to outside surface with minimum thickness of 0.05 inch. Pinholes, blisters, cracks or lack of bond are cause for rejection.
- G. When protective coatings are applied to structures, clearly identify thickness of metal on inner surface of each section with paint or other approved means. Repair damaged protective coatings, linings, and invert paving. Use bituminous material conforming to AASHTO M 190 or other approved materials to repair damaged asphalt mastic coatings.
- H. Coat portion of nuts and bolts projecting outside pipe after installation. Portion of nuts and bolts projecting inside structure need not be coated.
- I. When asphalt mastic is used for protective coating, surface at joints of structure need not be coated prior to assembly. Thoroughly seal joints after assembly with asphalt mastic on outside of structure.

3.02 CONSTRUCTION METHODS

- A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities. Make trenches for pipes, pipe arches, underpasses or box culverts of sufficient width to provide free working space for erection and thorough tamping of backfill and bedding material under and around structure. When quality of native soil is less than proposed backfill material, extend excavation to each side of barrel, minimum horizontal distance of half span or two-thirds of total rise, whichever is greater.
- B. Bed foundations for structural plate structures with metal inverts in foundation of sandy earth material as specified in Section 02320 - Utility Backfill Materials, accurately shaped to fit lower part of pipe for at least ten percent of its overall height. Length of bedding arch need not exceed width of bottom plate. Uniformly seat corrugations on minimum 3-inch thick bed of sandy material. For culverts, place bedding to full width of invert.
 - 1. Where rock, in ledge or boulder formation, exists below pipe, remove rock below grade and replace with compacted earth cushion having minimum thickness of 12 inches.
 - 2. Where soil encountered at established grade is quicksand, muck, or similar unstable material, remove and replace material in accordance with Section 02317 - Excavation and Backfill for Utilities. When required, use special bedding as shown on Drawings.
- C. Form foundations for structural plate structures with reinforced concrete footings to lines and grades shown on Drawings or as established by City Engineer.
 - 1. Set anchors or slots for box culverts to line and grade when placing concrete for each substructure unit. Conform to Section 03315 - Concrete for Utility Construction for placing substructure units.
 - 2. Place footings entirely in rock, shale or similarly hard material, or on firm soil or compacted soil cushion. When part of founding area is rock, undercut it and replace with minimum 12-inch thick compacted soil cushion. When thin layer of soil is partially covering rock within bearing area and when practical to do so, soil may be removed and footings placed directly on rock in accordance with details shown on Drawings.
- D. Erection: Install structural plate structures in accordance with Drawings.
 - 1. Coat steel in joints not protected by galvanizing with suitable bituminous coating.
 - 2. Handle pipes and plates carefully to avoid damage to protective coating. Repair damaged coatings.
 - 3. Use anchor bolts with: inch diameter by 6 inch minimum length on not more than 19 inch centers for anchoring plates to headwalls or other concrete end treatment.
 - 4. Do not place plates for arch structures until substructure has cured for minimum of 3 days.

5. When plates are in position, tighten nuts and bolts progressively and uniformly, beginning at one end of structure. Tighten nuts second time to torque of not less than 150 ft-lbs nor more than 300 ft-lbs for steel bolts and not less than 100 ft-lbs nor more than 150 ft-lbs for aluminum bolts. When impact wrench is used, check with long-handled, structural, socket, or torque wrench to ensure that they are properly tightened. Replace service bolts used in drawing plates together with standard high strength bolts.
- E. Use acceptable shape control devices for monitoring horizontal and vertical shape of structures. Maintain shape within two percent of design span or rise during erection and backfilling.
- F. Backfilling: Perform backfilling and embankment construction around pipe in accordance with Section 02317 - Excavation and Backfill for Utilities. Conduct backfill operations to insure inside dimensions remain within tolerances specified in shape control.

END OF SECTION