

## SECTION 02520

### CULVERT CONSTRUCTION

#### PART 1 - GENERAL

##### 1.1 Description

###### A. Description of Work

The work to be performed in accordance with this section includes furnishing and installing concrete pipe or concrete box culverts for the conveyance of storm drainage through roadway embankments.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all operations required to provide a complete item in accordance with the project plans and these specifications.

###### B. Related Work Specified Elsewhere

Trench Excavation and Backfill.....Section 02300  
Rock Rip-Rap Construction ..... Section 02510  
Concrete Structures .....Section 03300

##### 1.2 Quality Assurance

###### A. Reference Test Standards and Specifications

ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B316, Specification for Aluminum-Alloy Rivet and Cold Heading Wire and Rods

ASTM C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

ASTM C150, Specification for Portland Cement

ASTM C361, Specification for Low-Load Pressure Pipe.

ASTM C850, Specification for Precast Reinforced Concrete Box

Sections with less than 2-feet of Cover Subjected to Highway Loadings.

ASTM D1784, Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (PVC) Compounds.

ASTM F794, Specification for Polyvinyl Chloride (PVC) Large Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

ASTM M198, Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

**B. Bedding, Backfill and Compaction**

Test methods, frequencies and tolerances per Specification Section 2300, Trench Excavation and Backfill.

**1.3 Submittals**

**A. Certificate of Compliance**

**1. Reinforced Concrete Pipe**

- a. Compliance with ASTM C76
- b. Cement Mill Certificate
- c. Cement Content
- d. Concrete Admixture
- e. Reinforcing Steel
- f. Manufacturer Qualifications

**2. Precast Reinforced Concrete Box Culvert**

- a. Compliance with ASTM C850
- b. Cement Mill Certificate
- c. Cement Content

- d. Concrete Admixture
- e. Reinforcing Steel
- f. Manufacturer Qualifications

**3. Corrugated Aluminum Pipe**

Compliance with ASTM B209.

**4. Corrugated Steel Pipe**

Compliance with AASHTO M36.

**5. PVC Ribbed Pipe**

Compliance with ASTM F794.

**6. Concrete Pipe Gaskets**

Compliance with ASTM C361.

**7. Precast Concrete Joint Material**

Compliance with AASHTO M198.

**B. Shop Drawings**

**1. Pipe Culvert**

- a. Layout drawing including size, class, D-load of pipe and number, length and type of pipe sections.
- b. Pipe sections including joint with gasket.

**2. Precast reinforced concrete box culvert**

Box plan and sections

## **1.4 Product Delivery, Storage and Handling**

### **A. Precast Concrete Components**

Take all precautions in unloading, storing and placing precast concrete components to prevent damaging the component. All components with visible damage are subject to rejection by the **OWNER**.

### **B. Precast Concrete Box Culvert Sections**

Individual box culvert sections are subject to rejection due to any of the following imperfections;

1. Fractures or cracks passing through the wall,
2. Defects that indicate non-compliance with mixing and molding requirements of ASTM C850,
3. Honeycombed or open texture,
4. Damaged ends where such damage would prevent making a satisfactory joint.

## **1.5 Reinforced Concrete Box Culverts**

### **A. Reinforced Concrete Box Culverts**

The **CONTRACTOR** may elect to use precast reinforced concrete or cast-in-place concrete for the concrete box culvert construction. In either case, the box culvert shall meet the specifications as indicated herein and as shown on the plans. Provide certificates of compliance and shop drawings as required. Perform cast-in-place construction in accordance with Specification Section 3300, Concrete Structures; except that the walls of all cast-in-place reinforced concrete boxes shall meet the 28-day minimum compressive strength requirements within a 14-day period.

## **PART 2 - MATERIALS**

### **2.1 Reinforced Concrete Pipe**

ASTM C76, except as modified herein.

- A.** Size, class and D-load as indicated
- B.** ASTM C150, Type V cement
- C.** Pipe that has a diameter of 36 inches or less shall be supplied with an area of reinforcing steel in the bell not less than the area required for the circumferential reinforcement in the wall of the pipe.
- D.** Minimum cement content of 564 lbs. per cubic yard of concrete.
- E.** No calcium chloride or calcium chloride admixture will be allowed.
- F.** Cure pipe by steam or water techniques to produce a pipe with the specified physical properties.
  - 1.** The manufacturer shall be competent to manufacture the type, size, and quality of pipe required.

### **2.2 Precast Reinforced Concrete Box Culverts**

ASTM C850, except as modified herein and as shown on the plans.

- A.** **HS20-44 design load**
- B.** **ASTM C150, Type V cement**
- C.** **Minimum 28-day concrete compressive strength of 5000 psi.**
- D.** **Surface Repairs**

Patch surface imperfections which the **OWNER** has determined is not cause for rejection. Remove imperfections such as honeycombing or surface cracking, and patch with a grout specifically made for such repairs. Patches shall match the concrete surface appearance and integrity. Materials and patch techniques shall be in accordance with Specification Section 3300 and as approved by the **OWNER**.

## **2.3 Joint Materials**

### **A. Concrete Pipe**

O-ring rubber gasket joints conforming to ASTM C361.

### **B. Precast Reinforced Concrete Box Culverts and Precast Manhole Sections**

AASHTO M198, Type B performed joint material.

## **2.4 Corrugated Aluminum Pipe and Pipe Arches**

Corrugated aluminum pipe, pipe arches, and connectors shall be manufactured and inspected in conformance with the requirements of AASHTO M196, M197, and as specified herein. The size, type, and gage of the pipe to be furnished shall be shown on the Plans.

Corrugated aluminum sheets covered by this Section shall be fabricated from alloy Alchad 3004 with Temper H-34 and shall conform to ASTM B209.

## **2.5 Corrugated Steel Pipe and Pipe Arches**

Corrugated steel pipe, pipe arches, slotted pipe, and coupling bands shall be manufactured and inspected in conformance with AASHTO M36 and as specified herein. The size, type and metal thickness of the pipe to be furnished shall be as shown on the Plans.

Corrugated steel pipe arches shall consist of corrugated steel pipe other than spiral rib pipe which has been re-formed to multi-centered pipe, having an arch-shape top with a slightly curved integral bottom. Nominal diameter shall be the minimum inside dimensions of the round pipe.

The material for corrugated steel pipe and pipe arches shall be zinc coated (galvanized) or aluminum coated (AL-T-2) iron or steel conforming to AASHTO M36 and M218 or M274.

## **2.6 PVC Ribbed Pipe**

Pipe and fittings shall be made from PVC compounds as defined and described in ASTM D1784. The sewer pipe shall meet the performance requirements of ASTM F794 for sanitary sewers with minimum pipe stiffness of 46.

PVC sewer pipe and fittings shall be made of PVC material having a cell classification of 12454B, 12454C or 13364B as defined by ASTM D1784.

### **PART 3 - EXECUTION**

#### **3.1 Preliminary Investigation of the Work**

Verify that all preliminary work has been performed in accordance with the plans and specifications prior to performing storm drain construction.

#### **3.2 Trench Excavation and Backfill**

Accomplish excavation, bedding, backfilling, compaction, and surface replacement as specified in Section 2300 and as indicated on the Plans.

#### **3.3 Precast Concrete Pipe Culvert**

##### **A. Pipe Placement**

Carefully inspect each pipe section before and after installation. Remove those pipe sections found defective and replace with sections which comply with the specification. Place pipe with bell end in the upgrade position. Adjust spigots in bells to produce satisfactory joint. Blocking or wedging between the bell and spigot will not be permitted. Continually monitor pipe end elevations and locations to ensure proper grade and alignment.

##### **B. Jointing**

Thoroughly clean all surfaces to receive gaskets. Install gasket and stab pipe per manufacturer's recommendations. Check each joint to ensure the spigot end is home.

##### **C. Allowable Variation from Plan Line and Grade**

The final position of the pipe shall be to the plan line and grade. Variation shall not exceed "0.05 feet vertically. The horizontal alignment shall not vary from plan alignment by more than 0.1 feet.

### **3.4 Precast Concrete Box Culvert**

#### **A. Placement**

Carefully inspect each section before and after installation with reference to the ASTM specification. Remove defective sections and replace with sections that comply with the specification. Place sections with bell end in the upgrade direction. Adjust spigots in bells to produce satisfactory joint. Continually monitor box end elevations and locations to ensure proper grade and alignment.

#### **B. Jointing**

Thoroughly clean all surfaces to receive gasket material. Overlap gasket material as recommended by the manufacturer but no less than 6 inches. Check each joint to ensure the spigot end is correctly inserted. The maximum tolerable gap in the joint will be 3/4 inch. The maximum tolerable difference in invert elevation between the sections will be 1/4 inch.

Multiple precast concrete barrel box sections are to be placed with the longitudinal spacing as shown on the plans but in no case less than 3 inches. Fill the gap with grout. The grout shall have a maximum aggregate size of 3/8 inch and achieve a 28-day compressive strength of 2500 psi. Place grout by pumping or pouring and consolidate in lifts not to exceed six (6) feet.

#### **C. Allowable Variation from Plan Line and Grade**

The final position of the pipe shall be to the plan line and grade. Variation shall not exceed "0.05 feet vertically. The horizontal alignment shall not vary from plan alignment by more than 0.1 feet.

#### **D. Headwalls, Wingwalls, Cutoff Wall and End Sections**

Construct cast-in-place members in accordance with Specification Section 3300, Concrete Structures.

#### **E. Jointing of Corrugated Metal Pipe**

The pipe shall be laid so that the seams are not on the bottom. The inside circumferential seams shall be placed pointing downstream. Care shall be taken to ensure that dirt or other particles do not get



between the outside of pipe and the pipe coupling. Paved inverts shall be placed and centered on the bottom of the trench. Any damage to the protecting lining and coating shall be repaired prior to the backfilling around the pipe.

**F. Jointing of Solvent Cemented PVC Pipe**

Solvent welded jointing of PVC pipe shall be in accordance with the approved manufacturer's printed instructions which shall be furnished to the **ENGINEER**.

**PART 4 - MEASUREMENT AND PAYMENT**

**4.1 Measurement**

Precast concrete culvert pipe and concrete box culverts shall be measured by the number of linear feet of culvert laid horizontally.

Headwalls and end sections shall be paid per each.

**4.2 Payment**

**A. Culvert**

Culverts will be paid at the unit price bid per linear foot, to the nearest foot, for each size and type of culvert and shall be compensation in full for furnishing and installing the type of culvert as specified and as shown on the plans including removal of obstructions, excavation, bedding, backfilling, compacting, and joint materials.

**B. Headwalls**

Headwalls shall include the wingwalls, the attached cut-off wall and headwall. Headwalls and end sections will be paid at the contract unit price per each and shall be full compensation for furnishing and installing the item as specified and shown on the plans.

See Section 00310 Bid Schedule for Bid Items.

**\*\*END OF SECTION\*\***