

### III. TECHNICAL SPECIFICATIONS

#### DIVISION 12

#### BOX CULVERT CONCRETE, HEADWALLS AND ENDWALLS

**12.01 SCOPE:** The Contractor shall furnish all materials, equipment, and labor necessary to construct concrete box culverts, headwalls, and endwalls in accordance with these Specifications, the lines and inverts on the construction plans and good construction practice.

**12.02 MATERIALS:**

- A. Fine Aggregate: Natural sand or stone sand shall consist of sound particles of Grade A stone that meet or exceed the minimum requirements for grading, soundness, organic impurities, void content and deleterious material percentage in accordance with VDOT Road and Bridge Specifications Section 202.01 through .03.
- B. Coarse Aggregate: Coarse aggregate shall consist of crushed stone, crushed slag, or crushed or uncrushed gravel that meets or exceeds the minimum requirements of VDOT Road and Bridge Specifications Section 203.01 through .03 for grading, soundness, abrasion loss, or percent deleterious material.
- C. Portland Cement: Portland Cement shall conform to AASHTO M85 with the following exception:  
  
The sulfur trioxide content as per ASTM C-150 will be permitted, provided the supporting data specified in ASTM C-150 is submitted to the City for review and acceptance prior to use.
- D. Water: Water used with cement shall be clean, clear, and free of oil, acid, salt, alkali, organic material or other deleterious substances. Water which has been approved for drinking will be accepted for use in concrete without testing.
- E. Concrete Admixtures: If admixtures are not specified in the plans or contract documents, the Contractor must request approval in writing from the Engineer prior to its use. Accelerating admixtures, water-reducing and retarding admixtures, and air entraining admixtures must conform to AASHTO Specifications M-194 Type C or E, M-194 Type D, and M-154 respectively.
- F. Portland Cement Concrete: Shall be VDOT designation Class A3, General use Concrete, air entrained, (3000 psi minimum compressive strength at 28 days).

### 12.03 EXECUTION:

- A. In the event it is necessary to temporarily relocate an existing stream or drainage facility for the installation of a pipe or box culvert, the Contractor shall design and provide temporary channels or culverts of adequate size to carry the normal flow of the stream or drainage facility. Normal flow will be determined by the Engineer prior to construction or installation of the channel or culvert.

The Contractor shall submit his temporary relocation design to the Engineer for review and acceptance in sufficient time to allow for discussion and any correction(s) prior to beginning the work which the design covers. All costs for the temporary relocation of the stream or drainage facility shall be included in the cubic yards contract price specified in the Unit Price Table.

- B. All form work shall be constructed and erected in accordance with the appropriate provisions of VDOT Road and Bridge Specifications Section 404.03 for steel or wood forms.
- C. All false work shall be designed and constructed to provide the necessary rigidity and to support the construction loads without appreciable settlement or deformation. A dead load of 150 pcf will be assumed for concrete. The Contractor will be required to employ screw jacks or wedges to compensate for any settlement of the forms prior to or during concrete placement.
- D. Placement and Consolidation: The Contractor is required to place and consolidate the concrete within the forms based on the requirements of VDOT Road and Bridge Specifications Section 404.03 (l)
- E. Construction Joints: Construction joints shall be made only as shown on the plans or as specified herein. Construction joints against which earth fill is to be placed shall be protected by a heavy coat of asphalt conforming to ASTM D312 Type II. When construction joints are exposed to view or where water seepage is possible, a waterstop acceptable to the Engineer must be installed. It must be placed a minimum of two inches into the concrete and no more than three inches away from the joint. In order to bond successive courses, keys constructed of beveled woodstrips must be inserted prior to concrete placement and subsequently removed.
- F. Concrete Exposed to Tidal Water: Concrete box culverts with construction joints located within a zone five feet above and/or below the mean tide elevation are subject to a prolonged time period of 48 hours for form removal. In addition five days of drying time and the application of one coat of primer and four coats of asphalt or one coat of Epoxy Type EP-3B followed by one coat of Epoxy Type EP-3T shall be required. The coatings for pre-cast concrete must be identical to the above guidelines.

- G. Form Removal: The time of removal for forms will be controlled by test cylinder results that meet or exceed the minimum requirements of Table IV-2 of Section 404.03 of the VDOT Road and Bridge Specifications.
- H. Curing of Concrete: Concrete curing methods shall be subject to approval by the Engineer prior to use. When the temperature is above 40° F in the shade, exposed concrete surfaces must be cured before the sheen disappears from the fresh concrete curing shall be maintained for seven days. White polyethylene sheeting shall be used between April 1 and November 1 and opaque sheeting at other times. Liquid membrane, if used, must be applied at a rate of one gallon per 150 to 200 square feet depending upon roughness of concrete. In the event the atmospheric temperature drops below 40° F after concrete placement, insulated blankets and/or heaters must be provided by the Contractor at no additional cost to the City to maintain the concrete mass at 50° F for not less than 72 hours. In no event will the City allow placement of concrete when the temperature in the shade is less than or equal to 40° F.
- I. Protection of Concrete: The Contractor is responsible for protection of the concrete following placement from weather or construction activities and will be held financially accountable for any damage incurred.
- J. Opening of Traffic: Structures shall not be opened to construction traffic until the 28 day minimum compressive strength is obtained.
- K. Finishing Concrete Surfaces: All defective areas produced by form ties, honeycomb, spalls, or broken corners and edges must be filled with mortar conforming to Sections 218 and 404.07 of VDOT Road and Bridge Specifications. After removal of forms all endwalls, headwalls and/or wingwalls must be rubbed with a carborundum stone until all form marks, projections, and irregularities have been removed.
- L. Slump Control: All box culvert concrete shall be placed at a slump of three (3) inches to four (4) inches.
- M. Precast box culverts and endwalls shall be built, measured, and paid for in accordance with these specifications with the exception that 4000 psi concrete be used. Shop drawings must be submitted to the Engineer for review or approval or certifications must be provided stating that they conform with current Chesapeake standards.
- N. Test Cylinders: Form removal and forming for and placing concrete in super imposed elements are controlled by cylinder tests, the Contractor will be permitted to perform these operations when the cylinder strengths reach the values indicated in Table IV-

2, page 425 of the VDOT Road and Bridge Specifications. The cylinders shall be cured under conditions which are not more favorable than the most unfavorable conditions for the portions of the concrete which the cylinders represent. The Contractor shall furnish the molds, labor and material for all such test specimens and shall make as many as he feels necessary and shall be responsible for transporting specimens to the testing facility. Single-use waxed paper, plastic or light gauge metal molds, conforming to AASHTO M205, may be used for making control cylinders. Control cylinders shall be made under the observation of the Engineer. Tests for compressive strength will be made by representatives of the supplier with certified documentation furnished to the Engineer of the test results, at no additional cost to the City.

**12.04 MEASUREMENT AND PAYMENT:**

- A. Concrete for box culverts will not be field measured but will be based on plan quantities. Class A3 Concrete for Box Culverts will be paid based on the contract price per cubic yard as specified in the Unit Price Table.
- B. Headwalls, endwalls, wingwalls, and aprons will not be measured but will be paid for at the contract price per each as specified in the Unit Price Table. Form work, rebar, and other materials required for its construction in accordance with these Specifications and the plans will be considered incidental to the price per each.