

SECTION 33 42 16.13

PRECAST REINFORCED CONCRETE BOX CULVERTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for the furnishing and placing of precast reinforced concrete box culverts of the size, type and configuration installed to the lines and grades established by the plans.

1.2 MEASUREMENT AND PAYMENT

- A. All box culverts installed in accordance with the above specifications and accepted by the Engineer shall be considered as a complete installation, in place and paid for by the linear foot as noted in the Bid Proposal complete in place, of the type, size and depth constructed. The unit price bid shall be full compensation for furnishing all material, equipment and labor for all excavation, shaping of trench bottom, jointing, laying, dewatering, sheeting, bracing, bedding, backfilling, and specials necessary to install the box sewers in accordance with this specification and of the size, type and depth as shown on the plans.

1.3 SUBMITTALS

- A. Manufacturer's certification that the Precast Reinforced Concrete Box Sections meets the required ASTM Standards.

PART 2 – PRODUCTS

2.1 MATERIAL

Precast reinforced concrete box culverts shall be manufactured in accordance with the latest revisions published by the American Society for Testing Materials of the following specifications:

- A. ASTM C789 - Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers.
- B. ASTM C850 - Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers with less than Two Feet of Cover and Subjected to Highway Loadings.

Unless otherwise specified, all boxes furnished under this specification shall be fabricated with tongue and groove joint.

PART 3 – EXECUTION

3.1 GENERAL

- A. Joints in concrete boxes shall be made watertight by the methods described herein. The Contractor shall be fully responsible for choosing methods, using workmanship and materials and such other precautions as may be necessary to secure the required water tightness.

- B. Joints shall be made with a plastic joint sealing compound supplied in preformed strips of uniform size manufactured by K.T. Snyder Company, such as "Ramnek" or approved as being equal to "Ramnek".
- C. Construction fabric shall be a woven fabric consisting only of long-chain polymeric filaments or yarns such as polypropylene, polyethylene, polyester, polyamide or polyvinylidene-chloride formed into a stable network such that the filaments or yarns retain their relative position to each other. High modulus is the essential characteristic for this application, hence non-woven fabrics have been excluded. The fabric shall be inert to commonly encountered chemicals and conform to the properties in the following table:

RESISTANCE TO INSTALLATION STRESSES

FABRIC PROPERTY	TEST METHOD	FABRIC REQUIREMENT MIN. SHIPMENT AVG.
Grab Tensile Strength, lbs.	ASTM D 1682	200
Grab Tensile Elongation, %	ASTM D 1682	20
Burst Strength, psi	ASTM D 751 (Diaphragm Method)	375
Trapezoid Tear Strength, lbs.	ASTM D 2263	100

PERFORMANCE CRITERIA DURING SERVICE LIFE

FABRIC PROPERTY	TEST METHOD	FABRIC REQUIREMENT MIN. SHIPMENT AVG.
Equivalent Opening Size, U.S. Standard Sieve	CW 002215	70 - 100
Water Flow Rate gal/min/ft ²	H, 20cm to 10cm	20
Water Permeability, K, cm/sec	CFMC-FFET-2	0.005
Modulus (Load at 10% Elongation), lbs.	ASTM D 1682	110

RESISTANCE TO ENVIRONMENTAL FACTORS

FABRIC PROPERTY	TEST METHOD	FABRIC REQUIREMENT MIN. SHIPMENT AVG.
Mildew, Rot Resistance, % Strength Retention	AATCC-30	100
Insect, Rodent Resistance, % Strength Retention	AATCC-24	100

3.2 INSTALLATION

- A. Trenches shall be excavated with suitable type equipment such as ladder type trenching machines or trench hoes or other equipment that may be approved by the Engineer. Trenches for precast box sewers shall have a width below the top of the box of not less than the outside width of the box plus 16 inches and shall be wide enough to permit making up the joints.
- B. After the trench has been excavated to the bottom, the trench shall be fine graded to the established subgrade and recompacted to a density of at least 90% of maximum as determined using ASTM D 698. Any over excavation of the subgrade shall be filled with 3 sack per cubic yard of cement stabilized sand. Cement stabilized sand shall be in accordance with SECTION 31 23 23.53 – CEMENT STABILIZED SAND BACKFILL. The Contractor shall establish the grade line in the trench from grade stakes. The Contractor shall maintain this grade control a minimum of 100 feet behind and ahead of the box laying operation. The Contractor shall, at his expense, furnish and place in position all necessary stakes, grade and batter boards for locating the work.
- C. The precast box sections shall be so laid in the trench that after the sewer is completely installed, the interior surface shall conform accurately to the grade and alignment as shown on the plans or as established and given by the Engineer. All box sections must be laid in a straight line with the tongue end of the box section pointed downstream entering the grooved end of the previously laid box section, to full depth. Caution shall be taken to not drag cement stabilized sand or earth into the annular space. Box sections shall be fitted together and matched to achieve a finished storm sewer with a smooth and uniform invert.
- D. In preparing the joints and laying the box sections, the following procedures shall be adhered to. A suitable primer of the type recommended by the manufacturer of the gasket joint sealer shall be brush applied to the tongue and groove joint surfaces and the end surfaces and allowed to dry and harden. No primer shall be applied over mud, sand or dirt or sharp cement protrusions. The surface to be primed must be clean and dry when the primer is applied.
- E. Before laying the box section in the trench, the plastic gasket sealer shall be attached around the tapered tongue or tapered groove near the shoulder or hub of each box section joint. The paper wrapper shall be removed from one side only of the two-piece wrapper on the gasket and pressed firmly to the clean, dry box section joint surface.
- F. The outside wrapper shall not be removed until immediately before pushing each box section into its final position.

- G. When the tongue is correctly aligned with the flare of the groove, the outside wrapper on the gasket shall be removed and the box section shall be pulled or pushed home with sufficient force and power (backhoe, shovel, chain hoist, ratchet hoist or winch) to cause evidence of squeeze-out of the gasket material on the inside or outside around the complete box section joint circumference. Any joint material pushed out into the interior of the box section that would tend to obstruct the flow shall be removed. Each box section shall be pulled home in a straight line with all parts of the box section on line and grade at all times.
- H. When the atmospheric temperature is below 60° F, plastic joint seal gaskets shall either be stored in an area warmed to above 70° F, or artificially warmed to this temperature in a manner satisfactory to the Engineer. Gaskets shall then be applied to box section joints immediately prior to placing each box section in the trench, followed by connection to previously laid box section.
- I. No box sewer shall be laid in a trench in the presence of water. All water shall be removed from the trench sufficiently ahead of the sewer placing operation to insure a dry, firm bed on which to place the sewer, and if necessary, the trench will continue to be dewatered until after the sewer is bedded and backfilled as directed by the Engineer. Removal of water may be accomplished by pumping, or pumping in connection with the well point installation as the particular situation may warrant. The Contractor shall satisfy himself as to the soil conditions to be encountered.
- J. Where necessary, to comply with OSHA Regulation 1926.650, the side of the trench or other excavation shall be braced and rendered secure to the satisfaction of the Engineer. Board sheeting and/or steel sheeting may be utilized as directed by the Engineer. The bracing shall be in accordance with OSHA requirements.
- K. Following compaction of the trench bottom at the established grade, the Contractor shall place a minimum of a 6 inch thickness cement stabilized sand bedding in such a manner that once the box sections are laid, the invert elevation in the box section shall conform to the plan elevations. No voids in the bedding material shall be permitted. Cement stabilized sand shall be composed of a minimum of 3 sacks of cement per cubic yard of sand.
- L. When installing concrete box culverts in an existing channel, ditch or gully, cement stabilized sand shall be placed up to the spring line of the box culvert. A six ounce per square yard non-woven filter fabric, twenty four inches wide shall be draped over the top of the concrete box at each joint and extend one foot below the spring line of the box on each side. This fabric shall be in accordance with Section 2.1 "Materials".
- M. When installing concrete boxes in a trench condition, backfill shall consist of material excavated on the site, and deemed adequate by the Engineer, or materials obtained from a suitable borrow site. Suitable materials shall be CL/CH materials as determined by the Uniform Soil Classification System that are cohesive in nature, free of debris and organic materials and acceptable to the Engineer. Backfill shall be placed in maximum eight (8) inch lifts, sprinkled as required and compacted to a density of 90% standard proctor density (ASTM D 698). Moisture content shall be controlled so that the required density is achieved at a moisture content ranging from optimum moisture to 3 percent above optimum density. A six (6) ounce per square yard non-woven filter fabric, twenty four (24) inches wide shall be draped over the top of the concrete box culverts at each joint and extend one foot below the level of stabilized sand on each side.
- N. Backfill over box sections will be permitted as installation proceeds. Prior to backfilling, the Contractor shall remove all steel sheeting and/or cut off all timber sheeting a minimum of three (3) feet below finished grade as shown by the plans. Backfill shall consist of

material excavated on the site and deemed adequate by the Engineer or materials obtained from a suitable borrow site. Suitable materials shall be CL/CH materials as determined by the Uniform Soil Classification System (ASTM D 2487) and are cohesive in nature, free of debris and organic materials and acceptable to the Engineer. Backfill shall be placed in maximum eight (8) inch lifts, sprinkled as required and compacted to a density of 90% standard proctor density (ASTM D 698). Moisture content shall be controlled so that the required density is achieved at a moisture content ranging from optimum moisture to 3 percent above optimum density.

- O. Where backfill occurs beneath a road surface the material from two (2) feet below subgrade to the established base material shall be compacted to a density of 98% standard proctor density (ASTM D 698).
- P. A seal slab shall be installed, when shown by the drawings. If precast seal slabs are used, the joint of the seal slab shall not coincide with the joint of the box.
- Q. Laboratory tests will be performed as the backfill proceeds. All backfill not meeting this specification shall be removed and recompacted to the satisfaction of the Engineer at no cost to the Owner.
- R. All surplus excavated material shall become the property of the Contractor and shall be disposed of by the Contractor.
- S. The angles in box type sewers shall be built in accordance with the plans and specifications. The cost of making these angles and all cost incidental to them shall be included in the unit price bid for box sewer.
- T. Where junction with other storm sewers are to be made, openings may be left in the walls the size of which shall be the outside dimensions of the connecting sewer. A bond length of each reinforcing bar shall be left in the opening for connecting with the concrete collar or future sewer. Where a stub sewer is to be built, the end of the concrete of the stub sewer at the box sewer shall be at the inside face of the sewer box wall. All openings shall be closed with a 12-inch thick brick bulkhead. The cost of providing bulkheads shall be included in the unit price for the box sewer.

END OF SECTION