

ITEM 481

MONOLITHIC REINFORCED CONCRETE BOX SEWERS

481.1 Description. This specification shall govern for the construction of monolithic, reinforced concrete box sewers of the size, type and configuration and constructed to the lines and grades established by the plans, including all excavation, sheeting, bracing, dewatering, bedding, backfill and disposal of surplus excavation.

481.2 Materials. Concrete for monolithic box sewers shall be Class B concrete as described in the Item, "Structural Concrete". The mixing and placing of concrete shall be in accordance with that item.

The Contractor shall provide reinforcing steel in accordance with the Item, "Reinforcing Steel". The steel shall be placed and tied in accordance with the details shown on the plans.

481.3 Construction Methods. Trenches shall be excavated with suitable type equipment, such as ladder type trenching machines or trenching hoes as approved by the Engineer. Trenches for monolithic box sewers shall have a width adjacent to the sewer section equal to the outside diameter of the sewer, plus the thickness of any steel or wood sheeting extending below the top of the concrete. Above the top of the monolithic box sewer, the trench width may be greater than specified above by an amount sufficient only to place sheeting and bracing and permit installation of well point headers or manifolds and pumps where the depth of the trench is such that it would be uneconomical to pump from a surface installation. For monolithic box sewers constructed within existing channels, ditches and bayous, the trench width shall only be wide enough at the flowline grade of the box sewer to permit placement of forms. Side slopes may be laid back on the sufficient grade to permit placement of outside forms without causing slope failures or as directed by the Engineer, or as shown on the plans. "Step cutting or benching", will not be permitted without the written approval of the Engineer.

After the trench has been excavated to the bottom, the trench shall be fine graded to the established subgrade. 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 construction operations. The Contractor shall, at his own expense, furnish and place in position as directed by the Engineer, all necessary

stakes, grade and batter boards for locating the work. The Contractor may, at his own expense, use a laser beam to maintain line and grade.

No box sewer shall be constructed in a trench in the presence of water. All water shall be removed from the trench sufficiently ahead of the construction 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 constructed and backfilled as directed by the Engineer. Removal of water may be accomplished by pumping or pumping in connection with well point installation as the particular situation may warrant. The Contractor shall satisfy himself as to the soil conditions to be encountered. Where available, the Engineer will provide the Contractor with soil data; however, the Engineer does not guarantee the adequacy or accuracy of the information as compared to actual field conditions to be encountered at the time of construction. The Contractor may elect to do soil borings on his own, if he so desires.

Where necessary to comply with the requirements of 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. For vertical trenches, where board sheeting utilized floor shall be installed as bracing to support the bottom of the vertical sheeting. Flooring shall be set solidly against undisturbed earth sheeting. Flooring shall be set solidly against undisturbed earth in the bottom of the trench. Where voids are left below the flooring, the board shall be spaced apart adequately to allow concrete to flow between the boards and fill the voids. Bracing and sheeting shall be installed in accordance with the Item, "Timber Ordered Left in Trench".

The Contractor shall construct a concrete seal slab in the trench bottom when excavation cannot be dewatered to the point where the construction of a monolithic reinforced concrete box sewer subgrade is free of mud, excessive wet soil, sandy silt or clay with water. Excavation shall be made below the bottom of the monolithic box sewer to a depth equal to the thickness of the seal slab. Concrete for seal slab shall be in accordance with Item 421, Structural Concrete. The seal slab shall be Class "D", 5 sacks of cement per cubic yard with a minimum compressive strength of 1,750 P.S.I. at 7 days and 2,500 P.S.I. at 28 days. A precast seal slab may be used, provided that the joints of the seal slab do not occur at the joint of the monolithic box sewer. Contractor shall have an option of a three day cylinder break test at no expense to Harris County. The Contractor may, at his option and expense, place seal slabs other than as shown on the drawings or as ordered by the Engineer. The seal slab cannot be substituted for the floor or "bottom slab" of the monolithic concrete box.

The Contractor shall provide forms having smooth surfaces and ample strength that shall be rigidly braced. The bracing shall be adequate to prevent deviations from the correct lines. All steel forms shall be neatly and accurately made with all similar parts in each longitudinal section being interchangeable with other sections. All wooden forms shall be built of clean sound lumber, reasonably free from knots, dressed on all sides and neatly fitted. The form surface shall be watertight and shall be securely fastened to the ribs or supports. No form shall be used that is not of proper shape and strength, and in every way suitable to the Engineer.

Before placing reinforcing steel and concrete, the forms shall be coated with lubricants to prevent adherence of the concrete.

Where construction of the box sewer permits construction of the bottom slab with a starter wall and construction joints, the Contractor shall not erect wall forms or wall and top forms on the slab prior to twenty four (24) hours following placement of the concrete. Wall forms must remain in place until the concrete has attained a compressive strength of one thousand pounds per square inch (1,000 psi), but in no event shall they be removed prior to twenty four (24) hours following placement of the concrete.

Forms and center supports shall not be disturbed until the concrete has attained a compressive strength of two thousand pounds per square inch (2,000 psi), but in no event shall they be removed prior to seventy-two (72) hours following placement of concrete, without the prior written authorization of the Engineer. In certain instances, a "stiffback" system may be utilized to remove top forms prior to this time, provided they adequately support the top slab at its midpoint while being supported themselves by only the side walls.

In cases of vertical trench excavations, the trench sheeting may be used as the outside form for box sewers. During the trench excavation, rangers and struts shall be placed as necessary to adequately brace the sheeting and permit placement of forms. Rangers and struts placed immediately above the permissible construction joint in the walls shall not be removed until the concrete in the bottom slab has attained a compressive strength of two thousand pounds per square inch (2,000 psi). Rangers and struts placed immediately above the top slab shall not be removed until the concrete has attained a compressive strength of two thousand five hundred pounds per square inch (2,500 psi). Strength of the concrete shall be determined by test cylinder breaks. Cylinders for these tests shall be kept at job temperature and under job conditions and shall be made and broken by the laboratory designated by the Engineer at the Engineer's expense.

Backfill over monolithic box sewers shall not be started until the concrete has attained a compressive strength of three thousand six hundred pounds per square inch (3,600 psi). 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 on 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 material 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 D698), except under the roadway. Moisture content shall be controlled so that the required density is achieved from optimum moisture content to 3% above optimum moisture content.

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 95% standard proctor density (D698).

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 County.

All surplus excavated material shall be disposed of by the Contractor. If the material is suitable, it can be used in the construction of the roadway.

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.

Where junctions with 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" brick bulkhead.

The cost of providing these openings and the brick bulkheads shall be included in the unit price of the box sewer.

481.4 Quality Assurance. The concrete for the pipe and seal slab will be tested in accordance with the Item "Structural Concrete".

The Testing Laboratory's representative will determine the moisture density relationship in accordance with ASTM D698, on material secured from the trench excavation or from the supplier of cement stabilized sand. Samples secured from the cement stabilized sand supplier shall be blended with Portland cement in accordance with the Item "Cement Stabilized Sand Bedding and Backfill Material", and in accordance with ASTM D558 on material from the supplier of cement stabilized sand.

The Testing Laboratory's representative will determine the in-place density in accordance with ASTM D2922 or D1556. The minimum level of testing will consist of at least one test for each 200 linear feet of trench per lift of backfill.

- 481.5 Method of Measurement. All box sewers installed in accordance with the above specification and accepted by the Engineer, shall be measured by the linear foot of the size installed. Longitudinal measurements shall be made along the centerline of the box sewer from face of headwall or outfall structure and shall continue through manholes to a point of change in size or termination of the line.

Seal slabs shall be measured by the square yard installed, along the centerline of the structure.

- 481.6 Basis of Payment. All box sewers installed in accordance with this specification and accepted by the Engineer shall be paid for at the unit price bid by the Contractor, 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, reinforcing, concrete, dewatering, sheeting, bracing, forming, backfilling and special necessary to install the box sewers in accordance with this specification and of the size, type, and depth as shown on the plans.

Payment for seal slab shall be made at the unit price bid per square yard for Class "D" Concrete Seal Slab and shall include all costs for labor, materials and equipment necessary to install this item complete in place. When timber is ordered left in place, it shall be paid for in accordance with the Item, "Timber Ordered Left In Trench".

There are line code(s), description(s), and unit(s) for this item.

SUMMARY SHEET

ITEM 481 - MONOLITHIC REINFORCED CONCRETE BOX SEWERS

Other Specifications Required

Item 420, Concrete Structures
Item 421, Structural Concrete
Item 429, Trench Safety Systems
Item 433, Cement Stabilized Sand Bedding and Backfill
Item 435, Timber Ordered Left In Trench
Item 440, Reinforcing Steel

Reference Standards

1. ASTM D698
2. ASTM D558

Description:

Discusses the construction of monolithic, reinforced concrete box sewers.

Payment:

Monolithic concrete box sewers are paid for by the linear foot.
Seal slab, if required, is paid for by the square yard.

DO NOT INCLUDE THIS SHEET IN THE CONTRACT SPECIFICATIONS.