

TECHNICAL SPECIFICATIONS
FOR
STORM SEWERS AND PIPE CULVERTS

1. Description

This work shall consist of the placing of precast concrete pipe, corrugated metal pipe, structural plate pipe and pipe arches, and all fittings as called for in the Plans and in accordance with the Specification including trench excavation, bedding, and backfill.

2. Materials

(a) Pipe Materials

- 1) Reinforced concrete pipe shall conform to AASHTO M 170 for the specified diameters and strength classes. Horizontal and vertical elliptical pipe shall conform to AASHTO M 207. Precast end sections shall conform to the above specifications to the extent to which they apply. The pipe shall have tongue and groove joints for mortar joints, or bell and spigot joints suitable for the use of a rubber gasket to be provided as a part of this item.
- 2) Corrugated metal pipe, pipe arches, and their coupling bands shall conform to AASHTO M 36 for the specified sectional dimensions and gauges. Special sections such as elbows and end sections shall be the same gauge as the pipe and conform to the applicable requirements of AASHTO M 36. All pipes and pipe arches shall be bituminous coated as specified on the Plans and conforming to AASHTO M 190 Specifications.
- 3) Structural Plate for pipe, pipe arches, arches and their accessories shall conform to the requirements of AASHTO M 167.
- 4) Each pipe shall be clearly marked to show its class or gauge, date of manufacture, name of manufacturer, and mark of approval by an approved commercial testing laboratory prior to delivery. All costs of inspection are to be included in the cost of furnishing and installing the pipe.
- 5) All pipe and special fittings shall be new materials which have not been previously used and free of any defects or damage.
- 6) Pipe sizes, class or gauge, and type of bituminous coating will be shown on the Plans. Size of the pipe is nominal inside diameter.

(b) Joint Material

- 1) Pipe joint mortar shall consist of one part Portland Cement and 1 parts sand with water necessary to obtain the required consistency. The materials used shall meet the requirements for these items as specified in the Standard Specifications for Concrete Structures.

- 2) Rubber Gaskets for concrete pipe shall be O-ring rubber gasket joints conforming to the requirements of AASHTO M 198 or an approved equal.
- 3) Joints for corrugated metal pipe, pipe arches, and fittings shall be coupling bands that have galvanized steel angles riveted near the ends and bolts through the angles to draw the bands tight.

(c) Bedding Material

Bedding Material shall consist of well-graded crushed stone or crushed gravel meeting the requirements of TDOTSS, January 1, 2015, Section 903, Grading Size No. 57 or No. 67.

(d) Backfill Material

Backfill Material for pipe in the roadway or less than 5 feet from the outside edge of the roadway shall be of quality and gradation as specified in Section 5, Subsection 2-a of these Specifications. Also, this backfill shall be compacted to 100% of the standard Proctor Density at 2% less than the optimum moisture content as determined by AASHTO T99, Method D. In addition, all backfill material for pipe more than 5 feet from the outside edge of the roadway shall be fine compactable soil free of sod, brush, roots, and other perishable material and stones having a maximum dimension of more than six (6) inches. Also, this material shall be compacted in layers of not more than six inches to 95% of the Standard Proctor Density at the optimum moisture content as determined by AASHTO T99, Method D.

3. Equipment

- (a) The Contractor shall provide all equipment necessary and required for the construction of storm sewers and culverts, and have all equipment on the project in proper working condition before construction will be permitted to begin.
- (b) The Contractor shall provide hoisting equipment to handle the pipe in unloading and placing in its final position, without damage to the pipe.
- (c) The Contractor shall provide mechanical tampers of a design or designs approved by the Engineer.

4. Construction Requirements

(a) Excavation (unclassified)

- 1) Excavation (unclassified) shall consist of the removal of all materials necessary for the construction of storm sewers, culvert pipes, other pipe lines and all drainage structures such as manholes, catch basins, junction boxes, head walls, wing walls and concrete collars.
- 2) Excavation shall be made in open cuts unless shown otherwise on the Plans. Excavation shall be made to the lines and grades shown on the Plans or established by the Engineer. The width of trenches shall be sufficient to permit satisfactory jointing of the pipe, but shall not exceed the width where specified for Class "A" Bedding and permit thorough tamping around the pipe. The bottom of the trenches shall be carefully cut to the required grade of the pipe except where bedding material or cradles are shown; in which case the excavation shall extend to the bottom of the

bedding or cradles as shown on the plans. Excavation around manholes, catch basins, junction boxes, and end walls shall be such as to allow proper compaction around the structure.

- 3) Any unsatisfactory material shall be excavated below the grades shown on the Plans as directed by the Engineer, and backfilled with bedding material or other approved material and compacted.
- 4) Any excavation below the elevations shown on the Plans other than unsuitable material as designated by the Engineer shall be filled at the Contractor's expense with properly compacted bedding material or concrete.
- 5) Pipe trenches shall not be excavated more than 400 feet in advance of pipe laying and all work shall be performed to cause the least possible inconvenience to the public. Adequate temporary bridges or crossings shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
- 6) In all cases where materials are deposited along open trenches they shall be placed so that no damage will result to the work and/or adjacent property in case of rain or other surface wash.
- 7) Rocks and/or boulders not classified as rock excavation shall be removed to the limits of excavation and grades shown on the plans. The spaces created outside the excavation limits by such removal shall be backfilled with suitable material and compacted to the proper lines and grades.

(b) Rock Excavation

Rock excavation when specifically provided for in the Contract Documents and Plans shall be performed and paid for as set forth in Section 4 of the Standard Specifications for Sewer and Pipe Excavation.

(c) Laying and Bedding Pipe

- 1) Pipe shall be laid true to line and grade on a bed which is uniformly firm throughout its entire length. If material in the bottom of the excavation is of such character as to cause unequal settlement along the length of the storm sewer or culvert, the material shall be removed below the grade given, to such depth as ordered and shall be backfilled with bedding material and thoroughly tamped or otherwise compacted to insure an unyielding foundation.
- 2) Pipes shall be laid only on a foundation which is practically free of water.
- 3) Pipes shall be laid beginning at the downstream end of the pipe line. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length.
- 4) Concrete pipe shall be laid with the hubs or receiving ends upgrade. The spigot or tongue end shall be inserted into the receiving end as far as the pipe will permit. Circumferential laps of corrugated metal pipe shall be placed facing upstream and any longitudinal seams at the sides.

- 5) Concrete pipe joints shall be made with portland cement mortar, rubber gaskets, or other joints recommended by the pipe manufacturer and approved by the Engineer.

When mortar joints are used the pipe ends shall be thoroughly cleaned and wetted before the joint is made. Stiff mortar shall then be placed so as to completely fill and seal the joint. The inner surface shall be finished smooth and any surplus material removed. The completed joint shall be protected against rapid drying by suitable covering material.

Rubber ring gaskets shall be installed so as to form a flexible watertight seal.

Other type joints that are permitted shall be installed according to manufacturer's specifications.

- 6) Each section or joint of corrugated metal pipe shall be securely attached to the adjoining section or joint of pipe with connecting bands or other approved type of joint and drawn or connected as to form a rigid joint.
- 7) Any breaks in the bitumen or treatment of bituminous coated pipe shall be refilled with the type and kind of bitumen used in coating the pipe originally.
- 8) The ends of pipe shall be rigidly supported to prevent any movement pending and during the construction of end supports.
- 9) Any pipe which is not in true alignment or which shows any settlement after laying or is damaged shall be taken up and relaid at the Contractor's expense.

(d) Bedding and Backfilling

- 1) The bed for the pipe shall be shaped as specified for Class B in the City of Knoxville Standard Drawing for Storm Pipe Bedding and Backfilling. If bell and spigot pipe is used, the area under the bell shall be excavated so that the barrel supports the entire weight of the pipe.
- 2) Bedding material shall be Mineral Aggregate Base, Section 5, No. 57 or No. 67 stone and the cost of furnishing and placing the bedding material shall be included in the bid price per linear foot.
- 3) After the pipe has been laid to line and grade and properly bedded, the backfill material shall be placed and where required compacted by means of a vibrator or mechanical tamper. Tamping by hand will not be permitted. The trench shall be filled in 6-inch lifts and each lift shall be compacted with mechanical tampers. Compaction shall be 100% of the Standard Proctor Density at 2% less than the optimum moisture content as determined by AASHTO T99, Method D.
- 4) Backfill of pipes, sewers and culverts under streets (or less than 5 feet from the outside edge of the roadway), curbs, gutters and sidewalks shall be accomplished with Mineral Aggregate Base Material meeting the requirements of Section 5 of these Specifications and compacted as herein above specified. The cost of the backfill is not a separate pay item and shall be included in the bid price per linear foot.

5) The bedding for pipe must be laid in a dry trench. Removal of water encountered in ditches, springs, etc. shall be considered a necessary part of construction and shall be handled by pumping, ditching or any other method satisfactory to the Engineer.

(e) Existing Utilities

1) All existing sewers, water lines, gas lines, underground conduits, telephone lines, electric lines, or other utilities or structures in the vicinity of the work shall be carefully protected by the Contractor from damage at all times.

5. Method of Measurement

(a) The quantities of concrete pipe, corrugated metal pipe, corrugated metal pipe arches, and structural plate pipe arches shall be measured by the linear foot for each size and type of pipe and pipe arch shown on the Bid Schedule and shall be the horizontal length of pipe or pipe arch installed complete in place as measured along the centerline of the conduit from end to end with no deduction for fittings or bends.

(b) No separate payment will be made for unclassified or common excavation, bedding, or backfill. The cost of these items is to be included in the bid price per linear foot for pipe and pipe arch.

(c) Concrete for collars, cradles, piers, pipe protection and/or encasement shall be measured in cubic yards of concrete furnished and placed in accordance with Plan dimensions and these Specifications and payment for this item of work shall be made at the applicable unit price per cubic yard of the class of concrete placed as set forth under Standard Specifications for Concrete Structures.

6. Basis of Payment

The accepted quantities of pipe culverts and storm sewers, measured as provided for above, will be paid for at the Contract unit price per linear foot for each type, class, shape and size constructed, complete in place, which price shall be full compensation for labor and materials used in bedding, making joints and connections to other structures, for strutting, when required for backfilling, and for completing all incidentals necessary to complete the item in accordance with the Plans and Specifications.