

# Special Specification 4025

## Fiber Reinforced Concrete Pipe



### 1. DESCRIPTION

Furnish and place fiber reinforced concrete pipe. Include all required joints or connections to new or existing pipe, sewer, manholes, inlets, headwalls, and other appurtenances as may be required to complete the work.

### 2. MATERIALS

Furnish materials in accordance with the following:

- Item 400, "Excavation and Backfill for Structures,"
- Item 401, "Flowable Backfill," and
- Item 467, "Safety End Treatment".

2.1. **Fabrication.** Provide fiber reinforced concrete pipe that conforms to the design shown on the plans and to the latest revision of ASTM C1450.

2.2. **Design.** Table 1 shows class and the ultimate saturated D-load equivalents.

**Table 1**  
**Minimum Crushing Load**  
**(Circular Pipe)**

Class	D-Load (lb./ft./ft.)
I	1,200
II	1,500
III	2,000
IV	3,000
V	3,750

2.3. **Physical Test Requirements.** Results of the following tests determine acceptance of the pipe:

- material tests required in ASTM C 1450,
- three-edge bearing tests to ultimate load of saturated pipe samples in accordance with ASTM C 497. Perform ultimate 3-edge bearing tests on 1 pipe for each 300 pipes or fraction thereof for each size and class produced within 30 calendar days. Test for the load to produce a 0.01-in. crack or 15% over the required D-load, whichever is less. Test the pipe to ultimate load if so directed. Tested pipe that satisfies the requirements of Section F, "Causes for Rejection," may be used for construction, and
- inspection of the finished pipe to determine its conformance with required design and freedom from defects.

2.4. **Marking.** Clearly mark the following information on each section of pipe:

- class or D-load of pipe,
- ASTM designation,
- date of manufacture, and
- name or trademark of the manufacturer.

- 2.5. **Inspection.** Provide facilities and access to allow for inspection regarding quality of materials, process of manufacture, and finished pipe at the pipe manufacturing plant. In addition, provide access for inspection of finished pipe at the project site before and during installation.
- 2.6. **Causes for Rejection.** Individual sections of pipe may be rejected for any of the following reasons:
- fractures or cracks passing through the shell, except for a single-end crack that does not exceed the depth of the joint,
  - defects that indicate imperfect proportioning, mixing, or molding,
  - surface defects, and
  - damaged ends where such damage would prevent making a satisfactory joint.
- 2.7. **Repairs.** Make repairs if necessary because of occasional imperfections in manufacture or accidental damage during handling. The Engineer may accept pipe with repairs that are sound, properly finished, and cured in conformance with pertinent specifications.
- 2.8. **Rejections.** Allow access for the marking of rejected pipe. Rejected pipe will be plainly marked by the Engineer by painting colored spots over the Department monogram on the inside wall of the pipe and on the top outside wall of the pipe. The painted spots will be no larger than 4 in. in diameter. The rejected pipe will not be defaced in any other manner. Remove the rejected pipe from the project and replace with pipe meeting the requirements of this Item.
- 2.9. **Joints.** All joints must meet requirements of ASTM C443 unless otherwise shown on the plans. Furnish the manufacturer's certificate of compliance for all jointing materials.

Provide rubber gaskets that conform to ASTM C 443. Meet the requirements of ASTM C 443 for design of the joints and permissible variations in dimensions.

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### 3. CONSTRUCTION METHODS

Only trench installation of fiber reinforced concrete pipe is permitted.

- 3.1. **Excavation.** Excavate in accordance with the requirements of Item 400, "Excavation and Backfill for Structures."

The width of the trench for pipe installation must be sufficient but no greater than necessary to ensure working room to place and compact haunching and other embedment materials properly and safely. The space between the pipe and trench wall must be wider than the compaction equipment used in the pipe zone.

When Type I backfill is used, the minimum trench width is the pipe outside diameter plus 12 in. When Type II or Type III backfill is used, the minimum trench width is specified in Table 2. The contractor can use any trench width above the pipe zone.

**Table 2**  
**Minimum Trench Width**

<b>Normal Pipe Diameter (In.)</b>	<b>Minimum Trench Width (In.)</b>
18	44
24	54
30	66
36	78

- 3.2. **Installation in Embankment.** If any portion of the pipe projects above the existing ground level, construct an embankment for a distance outside each side of the pipe location of not less than 5 times the diameter and to

a minimum elevation of 2 ft. above the top of the pipe. Then excavate the trench to a width specified under "Excavation" in Section 3.1.

- 3.3. **Shaping and Bedding.** Bed the pipe in a foundation of compacted cohesionless material such as sand, crushed stone, or pea gravel, with a maximum size not exceeding 3/8 in. Extend this material at least 6 in. below the bottom of the pipe, and shape it carefully and accurately to fit the lowest part of the pipe exterior for a least 10% of the overall height. When requested by the Engineer, furnish a template for each size and shape of pipe to be placed for use in checking the shaping of the bedding. The template must consist of a thin plate or board cut to match the lower half of the cross section of the pipe.
- 3.4. **Handling and Storage.** Handle and store fiber reinforced concrete pipe in accordance with the pipe manufacturer's instructions. Provide proper facilities for hoisting and lowering pipe into the trench without damaging the pipe or disturbing the bedding or the walls of the trench.
- 3.5. **Laying Pipe.** Unless otherwise authorized by the Engineer, start the laying of pipes on the bedding at the outlet end with the separate sections firmly joined together. Provide proper facilities for hoisting and lowering the section of pipe into the trench without damaging the pipe or disturbing the bedding and the sides of the trench. Remove and relay at the Contractor's expense any pipe not in alignment or showing any undue settlement after laying.

Lay multiple installations of fiber reinforced concrete pipe with the center lines of individual barrels parallel. Maintain clear distances between outer surfaces of adjacent pipes as shown in Table 3:

**Table 3  
Clear Distances between Outer Edges of Adjacent Pipes**

Nominal Pipe Diameter	Clear Distance between Pipes
18 in.	1 ft. 2 in.
24 in.	1 ft. 5 in.
30 in.	1 ft. 8 in.
36 in.	1 ft. 11 in.

- 3.6. **Reuse of Existing Appurtenance.** When existing appurtenances are specified for reuse, use approved methods to sever the portion to be reused from the existing culvert and move it to the new position previously prepared.  
  
Connections must conform to requirements for joining sections of pipes. Restore to their original condition at the Contractor's expense any headwalls and any aprons or pipe attached to the headwall that are damaged during moving operations. The Contractor may remove and dispose of existing headwalls and aprons and construct new headwalls at the Contractor's expense.
- 3.7. **Sewer Connections and Stub Ends.** Make connections of pipe sewer to existing sewers or sewer appurtenance as shown on the plans or as directed. Mortar the bottom of the existing structure or concrete it if necessary to eliminate any drainage pockets created by the new connection. Where the sewer is connected into existing structures that are to remain in service, restore to the satisfaction of the Engineer any damage to the existing structure resulting from making the connection. Seal stub ends, for connections to future work not shown on the plans, by installing watertight plugs into the free end of the pipe.
- 3.8. **Backfilling.** Backfill from the pipe bedding up to 1 ft. above the top of the pipe to provide necessary structural support to the pipe and to control pipe deflection. Take special care in the placement and compaction of the backfill material. Obtain uniform backfill material and uniformly compact it throughout the length of the pipe to avoid unequal pressure. Take care to ensure proper backfill under the pipe in the haunch zone.

Backfill material must meet the following specifications:

- Type I. Backfill consists of Item 401, "Flowable Backfill." Place the flowable backfill across the entire width of the trench maintaining a minimum depth of 12 in. above the pipe. Let at least 24 hr. elapse

before backfilling the remaining portion of the trench with other backfill material in accordance with Item 400, "Excavation and Backfill for Structures."

- Type II. Backfill consists of Specification 400.6, "Cement Stabilized Backfill." Place cement stabilized backfill and compact it so that all voids are filled completely.
- Type III. Backfill consists of hard, durable, clean granular material that is free of organic matter, clay lumps, and other deleterious matter. It must meet gradation requirements shown in Table 4. Place the backfill material along both sides of the completed structure(s) to a depth of 12 in. above the pipe. Place the backfill in uniform layers not exceeding 6 in. in depth (loose measurement), wetted if required, and thoroughly compacted between adjacent structures and between the structure and the sides of the trench. Until a minimum cover of 12 in. is obtained, only hand-operated tamping equipment is allowed within vertical planes 2 ft. beyond the horizontal projection of the outside surfaces of the structure.

If Type III backfill is utilized, filter fabric shall be placed between the native soil and the backfill. Filter fabric shall conform to the requirements of TxDOT Material Specification DMS - 6200, Type I.

**Table 4**  
**Gradation Requirements for Type III Backfill Material**

Sieve Number	% Retained (Cumulative)
1 in.	0 - 5
7/8 in.	0 - 35
1/2 in.	0 - 75
3/8 in.	0 - 95
No. 4	35 - 100
No. 10	50 - 100
No. 200	90 - 100

- 3.9. **Protection of the Pipe.** Unless otherwise shown on the plans or permitted in writing by the Engineer, haul no heavy earth moving equipment over the structure until a minimum of 4 ft. of compacted fill (permanent or temporary) has been placed over the top of the structure.

Before adding each new layer of loose backfill material until a minimum of 12 in. of cover is obtained, inspect the inside periphery of the structure for local or unequal deformation caused by improper construction methods. Evidence of such will be reason for such corrective measures as directed.

Remove and replace any pipe damaged by the Contractor at no additional cost to the Department.

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## 4. MEASUREMENT

This Item will be measured by the foot. Measurements will be made between the ends of the barrel along its flow line, exclusive of safety end treatments. Safety end treatments shall be measured in accordance with Item 467, "Safety End Treatment." Measurement of spurs, branches, or new connecting pipe will be made from the intersection of its flow line with the outside surface of the pipe into which it connects. Where inlets, headwalls, catch basins, manholes, junction chambers, or other structures are included in lines of pipe, the length of pipe tying into the structure wall will be included for measurement, but no other portion of the structure length or width will be included.

For multiple pipes, the measured length will be the sum of the lengths of the barrels.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

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**5. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Fiber Reinforced Concrete Pipe of the backfill type, size, and D-load specified. This price shall be full compensation for constructing, furnishing, transporting, placing, and joining of pipes; cutting pipes on skew or slope; connecting to new or existing structures; breaking back, removing, and disposing of portions of existing structures as required; for cutting of pipe ends on skew; and for all labor, tools, equipment and incidentals necessary to complete the work.