

SECTION 620

CAST-IN-PLACE CONCRETE PIPE

620.1 GENERAL:

This specification covers cast-in-place non-reinforced concrete pipe intended for use as storm sewers or irrigation lines. The abbreviated title is CIPP. CIPP is conduit made of portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only:

- (A) By experienced operators. The Engineer will be the sole judge as to experience level.
- (B) In the presence of the Engineer.
- (C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.
- (D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.

620.2 MATERIALS:

620.2.1 Cement shall be ASTM C-150, Type II, low alkali as per Section 725.

620.2.2 Sand aggregate used for concrete and mortar shall conform to Section 701. Maximum size of the aggregate shall not be greater than $\frac{1}{3}$ of the minimum wall thickness up to and including a wall thickness of 4 1/2 inches. The maximum aggregate size is 1 1/2 inches.

620.2.3 Water used for concrete and for curing the pipe shall be as per Section 725.

620.2.4 Concrete shall be Class A in accordance with Section 725. Slump shall be the minimum required for satisfactory placement of the concrete by the equipment used by the Contractor. The slump shall not exceed 3 inches.

620.2.5 Bonding mortar shall consist of two (2) or more parts of cement to three (3) parts of sand by volume.

620.3 CONSTRUCTION METHODS:

620.3.1 Excavation: The trench will be neatly excavated with vertical sides and semi-circular bottom. The trench shall be shaped to form the bottom outside of the pipe on the alignment and to the grades specified in the plans. Departure from and return to established grade shall not exceed 1 inch per 10 linear feet with a maximum allowable departure of 1 1/2 inches. Departure from and return to specified alignment shall not exceed 2 inches per 10 linear feet with a maximum allowable alignment departure of 4 inches. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, firm, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe. Density of the fill shall be at least five percent (5%) greater than the natural in-place soil, but in no case less than 85 percent (85%) when tested in accordance with AASHTO T-99, Method A and T-191 or ASTM D-2922 and D-3017.

When it is necessary to install the pipe in rocky areas, the rock will be removed and replaced with suitable fill material compacted to proper density. The rock will be over-excavated to leave a 6 inches minimum compacted soil cushion between the rock and the pipe. For construction accuracy, areas left void by rock removal will be completely filled with compacted material, then trenched for the pipe as though natural ground. If the rock below the pipe subgrade is fractured or fragmented or if it consists of large cobbles or boulders, the replacement fill material will be carefully selected to insure that it is of such gradation that it will not be removed downward by fluctuation of the water table. In no case will expansive soils be used for fill. A similar procedure of over-excavation, backfill, compaction, and retrenching will be used where sloughing sand or where soft or spongy soil conditions are encountered. When expansive clays are encountered, they will be thoroughly moistened by ponding, to completely expand the soil, and the moisture maintained until the concrete is placed.

Where the pipe is to be constructed through fill materials, such fill shall have stability in the zone of the trench form equal to firm undisturbed earth, in the area adjacent to the fill.

SECTION 620

Upon direction of the Engineer, the Contractor shall substitute RCP or an acceptable alternate at locations where the conditions are unsuitable for CIPP. All cost for this substitution shall be borne by the Contractor.

620.3.2 Placement: At the time of concrete placement, all soil in the trench will be adequately moistened so that water is not drawn from the freshly placed concrete. However, the trench form will be completely free of water, mud, and debris. All forming devices, including the slipforms and hopper of the placement device, shall be thoroughly moistened.

Concrete shall not be placed when temperature of the concrete exceeds 90 degrees Fahrenheit or is less than 50 degrees Fahrenheit. The soil adjacent to the trench shall be at a temperature above freezing.

The pipe shall be constructed in one placement, the entire cross-section being placed monolithically. Inside forms shall be sufficiently rigid to withstand consolidation of the fresh concrete. Placement shall be such as to produce a thoroughly consolidated homogeneous concrete mixture conforming to the test requirements of this specification. Effective consolidation means shall be applied to the fresh concrete over the entire circumference and from within the pipe shell. Consolidation means shall be capable of effectively placing and consolidating fresh concrete at production speeds. Methods of consolidating shall be capable of building up sufficient pressure to effectively bond the concrete to the surrounding earth and to keep loose sand, mud, and water out of the pipe shell.

(A) Construction Joints:

When work is stopped at the end of a placement or for any period that would permit initial set to take place, a construction joint shall be formed. The ends of the pipe that are to be in butt contact shall be left in rough condition with a slope of approximately 45 degrees. Before resuming, if the pipe diameter is 60 inches or less, an excavation shall be made along the sides and bottom of the joint to permit casting of a concrete collar around the outside of the joint. This collar shall have a minimum thickness of 1 1/4 times the wall thickness of the pipe and shall lap the entire joint by at least two (2) times the wall thickness. Immediately before resuming concrete placement the surfaces to be bonded shall be cleaned of all laitance, coatings, foreign materials, and loose or defective concrete, thoroughly wetted and coated with a layer of bonding mortar (Subsection 620.2.5) approximately 1/4 inch thick. In lieu of the bonding mortar, neat cement paste may be thoroughly scrubbed onto the wet surface of the previously placed concrete.

For a joint that may be used for connections to another pipe or structure, a joint shall be made by squaring off the end of the pipe. An excavation shall be made along the sides and bottom of the cast-in-place pipe, for any diameter, to permit casting of a concrete collar as described above.

The outside top of all joints shall be capped for the entire width of the pipe that is exposed, that is, between the earth walls of the excavated trench. This cap shall have a minimum thickness equal to the wall thickness of the pipe and shall lap the joint, both upstream and downstream from the joint by at least twice the wall thickness of the pipe. A cap as described is required regardless of pipe size.

(B) Pipe Dimensions and Tolerances:

(1) The internal diameter of the pipe at any point shall not be less than 95 percent of the nominal diameter, and the average of any four (4) measurements of the internal diameter made at 45 degree intervals shall not be less than the nominal diameter.

(2) For pipe less than 15 inches inside diameter, the minimum wall thickness shall be 2 inches.

For pipe with an inside diameter of 15 inches to 24 inches the minimum wall thickness shall be 2 1/2 inches. For pipe exceeding 24 inches inside diameter, the minimum wall thickness shall be 1/12 of the inside diameter, plus 1/2 inch.

(3) Offsets at form laps and horizontal edges shall not exceed 1/2 inch for pipe having inside diameter not greater than 42 inches; 3/4 inch for pipe having inside diameter greater than 42 inches, but not greater than 72 inches; and 1 inch for pipe having inside diameter greater than 72 inches.

SECTION 620

620.3.3 Curing and Backfilling: The Contractor shall be responsible for proper curing of the concrete and backfilling the trench to an even grade. Final backfill and compaction shall not be started until concrete has developed a compressive strength of at least 2,000 psi. Curing shall be performed in such a manner as to prevent the premature drying of the concrete. The Contractor shall use one of the four methods described below.

(A) A 3 inch layer of moist loose soil or sand shall be carefully placed over the top of the pipe immediately after the pipe is cast. The backfill shall be material free of clods and rocks having a diameter greater than 2 inches and any other deleterious foreign materials. The backfill shall be carefully placed over the top of the pipe to prevent damage to the wet concrete. The thickness of the backfill shall be increased by 9 inches after initial set of the concrete has occurred. The backfill shall be kept moist at all times until the pipe has been covered to a depth of 12 inches or more.

(B) The exposed top portion of the pipe may be covered with wet burlap or other material of high moisture retentive properties immediately after the pipe is cast. The covering material shall be kept continuously moist until the placement of final backfill as described above. Moisture retentive material may be removed or left in place at the option of the Contractor.

(C) A pigmented membrane-curing compound conforming to ASTM C-309 may be applied to the exposed surface immediately after the pipe is cast. The compound shall be applied at the rate of not less than one (1) gallon for each 150 square of exposed concrete. The pipe shall then be covered with a minimum of 3 inches of moist loose soil when the curing compound is sufficiently hard to resist damage from the fill. Final backfill shall be placed when the pipe attains suitable strength.

(D) Polyethylene film complying with ASTM C-171, nominal thickness 0.0015 inches, may be placed on the exposed top surface of the pipe immediately after the pipe is cast. The film shall be anchored in place with loose soil to assure continuous, adequate curing. The trench shall be completely backfilled as soon as the pipe attains suitable strength.

A humid atmosphere within the pipe, as evidenced by condensation on the interior surface, shall be maintained for at least seven (7) days following placement, except for a maximum period of 48-hours allowed for removing forms and making repairs. To prevent air drafts which may dry the pipe and to maintain a humid atmosphere inside the pipe, all openings into the pipe line shall be kept closed or covered, except when and where work is actually in progress on the inside of the pipe. If necessary to promote high humidity, the pipe line will be partially filled with ponded water during the curing period.

620.3.4 Repair: Care shall be taken when removing the forms that the pipe is not damaged. Immediately after the removal of the forms, the inside of the pipe shall be inspected and all required repairs made before final backfilling begins. All spalls, cracks or indentations not satisfying Subsection 620.3.2(A) shall be filled with mortar per Subsection 620.2.5. Cracks may be repaired with epoxy materials.

Longitudinal cracks exceeding 0.01 inches in width and 12 inches in length shall be cause for rejection of the pipe. The pipe section or reach in question shall either be removed and replaced or shall be repaired in a manner approved by the Engineer.

620.3.5 Finish: Except for the form offsets the interior surface of the pipe shall be equivalent to or better than a wood float finish. All extraneous concrete shall be removed from the interior surface.

620.4 METHODS OF TESTS:

Wall thickness shall be checked at the top, sides and bottom, every 100 feet. Where thickness is not determined by probes through the fresh concrete, small holes shall be drilled a day or so after placement. The holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe, after measurements are made.

Test cylinders shall be prepared and tested as per Section 725. If the cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken from the same section of concrete represented by the faulty test cylinder under the supervision of the Engineer. The concrete should be at least 14 days old before the core specimens are taken. The diameter of the core specimens for the determination of compressive strength should be at least three (3) times the maximum nominal size of the coarse aggregate used and must be at least twice the maximum nominal size of coarse aggregate.

SECTION 620

The length of the specimen, when capped, should be twice the core diameter. A core having a maximum height of less than 95 percent of its diameter before capping or a height less than its diameter after capping shall not be tested.

If cores are taken, the Contractor shall patch all core holes in such a manner that the patch will be permanent, will not leak, and will have a smooth interior finish flush with the interior surface of the pipe.

Procedures and payment for coring shall be in accordance with applicable portions of Section 725.

The Engineer will evaluate the test results and his decision as to required corrective action will be final.

620.5 MEASUREMENT:

Measurement of cast-in-place concrete pipe will be the number of linear feet of pipe measured horizontally along the pipe axis from end to end of the pipe. At changes in diameter, the measurement shall be to center of manhole or transition.

620.6 PAYMENT:

Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing the cast-in-place concrete pipe as specified, including removal of obstructions, excavation, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal.

End of Section

