

## SECTION 63: CAST-IN-PLACE CONCRETE PIPE

### 63-1.01 DESCRIPTION

- Cast-in-place concrete pipe shall consist of portland cement concrete placed monolithically in a prepared trench at the locations shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

### 63-1.02 MATERIALS

- The pipe shall be constructed of Class 2 portland cement concrete conforming to the provisions in Section 90, "Portland Cement Concrete."
- The combined aggregates for concrete shall conform to the grading limits for the one inch, maximum size specified in Section 90-3.04, "Combined Aggregate Gradings."
- Penetration shall not exceed 1½ inches when determined by California Test 533.
- The minimum wall thickness for the various sizes of pipe shall conform to the following table:

Minimum Internal Diameter (inches)	Minimum Wall Thickness (inches)
36	3½
42	4
48	5
54	5½
60	6
66	6½
72	7
78	7½
84	8

### 63-1.03 PIPE MAKING EQUIPMENT

- The pipe shall be constructed with equipment specially designed for constructing cast-in-place monolithic concrete pipe in one operation. The equipment shall be acceptable to the Engineer and the Contractor may be required to furnish evidence of successful operation on other work of the equipment the Contractor proposes to use. Equipment not suitable to produce the quality of work required for the pipeline will not be permitted to operate on the work.

### 63-1.04 EARTHWORK

- Excavation, backfill and shaped bedding shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," except that slurry cement backfill shall not be used.
- The trench shall be excavated to the lines and grades established by the Engineer. The trench width shall not exceed the outside diameter of the pipe plus 2 inches to a height of one foot above the top of the pipe. The bottom of the trench shall be shaped to the external diameter of the pipe and shall be graded and

prepared to provide a firm and uniform bearing throughout the entire length of the pipe.

- The grade of the bottom of the trench shall not vary from the grade established by the Engineer by more than 0.10-foot, nor shall the rate of any variance from grade exceed 0.10-foot per 10 feet. The horizontal alignment of the trench shall not vary from the lines established by the Engineer by more than 0.40-foot, nor shall the rate of any variance from line exceed 0.20-foot per 10 feet.
- The trench shall be free of rocks, mud, sloughed material, debris and standing or running water. Voids shall be backfilled or filled with concrete as part of the pipe placement, as approved by the Engineer.

### 63-1.05 CONSTRUCTION

- Surfaces against which concrete is to be placed shall be thoroughly moistened with water, if necessary, so that moisture will not be drawn from the freshly placed concrete.
- Concrete shall not be placed when the temperature of the soil of the trench walls is at or below 32° F.
- The concrete shall be placed around the full circumference of the pipe in one operation by means of fixed forms and traveling forms. Traveling forms shall be of sufficient strength to withstand vibrating or tamping the concrete. Fixed forms shall be of sufficient strength to withstand consolidation of the concrete. Inflatable internal forms will not be allowed.
- The traveling forms shall be equipped with internal vibrators and tampers. Portable vibrators will be allowed in addition to the internal vibrators, but shall not be the primary means used to consolidate and distribute the concrete.
- The concrete shall be vibrated, tamped or worked until the concrete has been consolidated to the maximum practicable density, free of rock pockets. The concrete shall bond to the bottom and walls of the trench and close snugly against all surfaces of forms.
- When placing operations cease for more than 30 minutes, or in any case prior to initial set of the concrete, a construction joint shall be formed. The ends of the pipeline shall be covered with suitable material, to maintain a humid condition within the pipe.
- Construction joints shall consist of embedding reinforcing bars into the ends of the pipe wall, a maximum of 12 inches on center around the circumference for pipes 42 inches in diameter and smaller, and 18 inches on center for pipes larger than 42 inches in diameter. The reinforcing bars shall conform to the provisions in Section 52, "Reinforcement," and to the requirements in ASTM Designation: A 615/A 615M, Grade 40 or 60. The bars shall be No. 4, a minimum of 24 inches long, and shall be embedded a minimum of 12 inches into the ends of the pipe wall. The concrete at the ends of the pipe wall shall be left rough.
- Construction joints shall be cleaned immediately prior to completing the construction joint and continuing pipe construction. Cleaning construction joints shall consist of removing laitance, loose or defective concrete, coatings and any other deleterious materials.
- The flow line grade of the finished pipe shall not vary more than 0.10-foot from the grade line established by the Engineer.

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- Fixed forms shall be removed not less than 6 hours and not more than 24 hours after placement of the concrete.
- After the removal of forms, any required repairs shall be made. Offsets and indentations, greater than  $\frac{1}{4}$  inch for pipes with internal diameters of 42 inches or less,  $\frac{3}{8}$  inch for pipes with internal diameters larger than 42 inches and less than 72 inches, and  $\frac{1}{2}$  inch for pipes with internal diameters 72 inches and larger, shall be repaired as directed by the Engineer. Rock pockets, blisters, voids, fractures, porous concrete or similar defects not extending through the pipe wall and less than 2 square feet in area shall be removed and repaired with concrete or other materials, as directed by the Engineer. Holes cut in the pipe for inspection or to facilitate removing the forms shall be repaired by filling with concrete or dry patching mortar, as directed by the Engineer.
- After completion of backfill and compaction, cracks shall be repaired as directed by the Engineer. Cracks less than 0.01-inch in width, and cracks exceeding 0.01-inch in width and less than 12 inches in length, shall be repaired with mortar or other materials approved by the Engineer. Longitudinal cracks exceeding 0.01-inch in width and 12 inches in length shall be repaired with pressurized epoxy grout as directed by the Engineer, provided the total length of such cracks is less than 25 percent of the length of the reach. A reach is any length between 2 structures. Circumferential cracks exceeding 0.01-inch in width shall be repaired as directed by the Engineer.
- Any of the following conditions may be cause for rejection of pipe:
  - A. Rock pockets, blisters, voids, fractures, porous concrete or similar defects extend through the pipe wall or exceed 2 square feet in area. Pipe may be rejected for one foot on each side beyond the limits of the defect.
  - B. The total length of longitudinal cracks exceeding 0.01-inch in width and 12 inches in length exceeds 25 percent of the length of any reach. The entire reach of pipe may be rejected.
  - C. The pipe is damaged during construction.
  - D. Failure to repair other cracks and defects as directed by the Engineer.
  - E. The pipe is not in conformance with the provisions for thickness, grade or alignment, or was not constructed in conformance with the provisions in this Section 63.
- Rejected pipe shall be removed and replaced as directed by the Engineer.
- The finished surface of the concrete pipe shall be the equivalent of wood float surface, substantially free of fractures, cracks and roughness.

### 63-1.06 CURING AND PROTECTING CONCRETE

- Immediately after casting, the pipe shall be cured either by covering with polyethylene film or by application of a waterproof membrane or pigmented curing compound. Polyethylene film shall be a minimum of 0.0015-inch thick and shall be placed to cover the exposed surface of the pipe. After initial set of the concrete, moist, loose backfill material shall be placed over the film to a depth of between 3 inches and 6 inches. Waterproof membrane and curing compound shall conform

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to the provisions in Section 90-7, "Curing Compound." Hand spraying of the compound will be permitted. During the period following the placement of the concrete, the ends of the pipeline shall be covered with suitable material to maintain a humid condition within the pipe for a minimum of 7 days.

- The concrete pipe shall be protected as provided in Section 90-8, "Protecting Concrete."
- Except as otherwise provided, backfill shall not be placed or compacted until the concrete has developed a compressive strength of not less than 2,500 psi.

### 63-1.07 (BLANK)

### 63-1.08 MEASUREMENT

- The length of cast-in-place concrete pipe to be paid for will be the slope length designated by the Engineer. Pipe placed in excess of the length designated will not be paid for.

### 63-1.09 PAYMENT

- The contract price paid per linear foot for cast-in-place concrete pipe shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the pipeline, complete in place, including structure excavation, backfill, and reinforcement bars for construction joints, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.