

## SECTION 36 - CAST-IN-PLACE CONCRETE PIPE (CIPCP)

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## **SECTION 36 - CAST-IN-PLACE CONCRETE PIPE (CIPCP)**

### **36-1 GENERAL**

All sewer facilities constructed within the Sacramento Area Sewer District service area (<http://www.sacsewer.com/pdf/map-servicearea.pdf>) must be constructed in accordance with the Sacramento Area Sewer District Standards and Specifications available at <http://www.sacsewer.com/pdf/ord/2011-SASD-Standards-and-Specifications-v1.pdf>

Construction of cast-in-place concrete pipe will be permitted when shown or specified in the Contract. Cast-in-place concrete pipe must consist of portland cement concrete placed in a prepared trench at the locations shown and specified in the Contract. The Agency may deny the use of cast-in-place concrete pipe if, in the Agency's judgment, local conditions make the use of such pipe undesirable.

Unless otherwise specified herein, the placement of cast-in-place concrete pipe must conform to the requirements of Section 38, "Storm Drain Construction", of these Specifications.

It is the Contractor's responsibility to determine the suitability of the excavated trench for the placement of cast-in-place concrete pipe. The Contractor must determine whether the trench walls will provide sufficient lateral support to prevent deflection and cracking of the pipe due to backfill and live loads, and that the trench width at the top of the pipe will be sufficiently narrow to preclude additional loading on the pipe.

If, after examining the sides of the trench, the Contractor elects to place cast-in-place concrete pipe, and the pipe subsequently develops longitudinal cracks exceeding 5 feet in length, the Contractor, at the Contractor's expense, must repair or replace the pipe as directed by the Agency.

Should the Contractor decide not to place cast-in-place concrete pipe after examination of the trench sidewalls, alternative pipe conforming to the requirements in Section 38, "Storm Drain Construction", of these Specifications must be furnished and placed, and no additional payment will be made.

### **36-2 PIPEMAKING EQUIPMENT**

The pipe must be constructed with equipment specially designed for constructing cast-in-place concrete pipe, as approved by the Agency. The Contractor must furnish evidence of successful operation of the proposed equipment on other work. Equipment not suitable to produce the quality of work required for the pipeline will not be permitted to operate on the Work.

### **36-3 TRENCH EXCAVATION**

Trench excavation must conform to Section 19, "Trench Excavation, Bedding and Backfill", of these Specifications. The trench must be excavated to the lines and grades of the completed pipe as shown on the Plans and within the tolerance specified in these Specifications. The trench must be of the proper width and the bottom of the trench must be shaped to the external diameter of the pipe to be constructed. The bottom of the trench must be prepared to provide full, firm, uniform support by undisturbed earth or compacted fill over a minimum of the bottom 180 degrees of the outside of the pipe. Trench width at the top of pipe must not exceed the outside diameter of the pipe at the spring line.

Unless otherwise directed by Agency or specified in the Special Provisions, the trench in which pipe was placed during the previous 24 hours, plus the trench required for the next day's work, plus additional trench 1/2 the length of the trench required for the next day's work, is the total maximum allowable length of trench on any portion of the Work that may remain open at the end of each Working Day. The remainder of the trench must be backfilled and compacted, and when in streets or highways, opened to traffic as soon as practicable.

**36-4 SPECIAL FOUNDATION TREATMENT**

Whenever the bottom of the trench is soft, rocky or in the opinion of the Agency otherwise unsuitable as a foundation for the pipe, the unsuitable material must be removed to a depth such that when replaced with a suitable material, it will provide a stable and satisfactory foundation. Suitable materials for backfilling the trench below the pipe must consist of select material approved by the Agency compacted to a relative compaction of not less than 90 percent as determined by Test Methods ASTM D6938 and ASTM D1557. Alternate backfill materials and methods may be used with the approval of the Agency.

**36-5 CONCRETE**

Concrete must be Class “A-1” portland cement concrete conforming to Section 50-5, “Portland Cement Concrete”, and these Specifications.

The maximum aggregate size is determined by the size of cast-in-place concrete pipe constructed, and must be as follows:

Pipe Size	Maximum Aggregate
48" or less	1"
Over 48"	1-1/2"

Gradation for combined aggregates must conform to the State Specifications.

Slump must not exceed 2 inches as determined by the slump cone method of ASTM C143 or an equivalent slump as determined by California Test 533, unless otherwise permitted or directed by the Agency.

The minimum wall thicknesses for the various sizes of pipe must conform to the following table:

Internal Diameter	Minimum Wall Thickness
24" through 30"	3"
33" and 36"	3-1/2"
42"	4"
48"	5"
54"	5-1/2"
60"	6"
66"	6-1/2"
72"	7"
78"	7-1/2"
84"	8"
90"	8-1/2"
96"	9"
108"	10"
120"	12"
132"	14"
144"	15"

The compressive strength of the concrete must be at least 700 psi at 1 Calendar Day, at least 1400 psi at 3 Calendar Days, at least 2100 psi at 7 Calendar Days, and at least 3500 psi at 28 Calendar Days, as determined by moist-cured test cylinders.

### **36-6 PLACING CONCRETE**

Prior to placing any pipe, the Contractor must secure the Agency's written approval of the excavated trench. Concrete placement must conform to the provisions of the State Specifications. Surfaces against which concrete is to be placed must be free from standing water, mud, and debris, and must be firm enough to prevent contamination of the concrete by earth or other foreign material. Absorptive surfaces against which concrete is to be placed must be moistened thoroughly so that the moisture will not be drawn from the freshly placed concrete. An approved method or device must be used when placing invert concrete to insure that thickness is maintained at not less than minimum wall thickness at any point. Written approval of the method or device must be obtained from the Agency prior to beginning concrete placement.

The cast-in-place concrete pipe must be constructed in one placement around the complete periphery.

The temperature of the concrete when it is being placed must be between 40 and 90 degrees F in moderate weather, or between 50 and 90 degrees F if the mean daily temperature in the vicinity of the work site falls below 40 degrees F. Whenever the mean daily temperature in the vicinity of the work falls below 40 degrees F for more than 1 day, the concrete must be maintained at a temperature of at least 50 degrees F for at least 72 hours after it is placed. Concrete must be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F. Where artificial heat is employed, the concrete must be prevented from drying. If concrete is placed when the weather could cause the temperature of the concrete to exceed 90 degrees F, the Contractor must employ effective means, such as precooling of aggregates and mixing water and placing at night, to maintain the temperature of the concrete, as it is placed, below 90 degrees F.

### **36-7 START AND CLOSE SECTIONS**

A starter section may be used at the beginning of each run of cast-in-place concrete pipe, such as beginning from an existing structure, or from a manhole, at a change in size or from a manhole at an angle point. Starter sections must be approximately 6 feet in length and of the same inside diameter as the cast-in-place concrete pipe, unless otherwise approved by the Agency. The strength of the reinforced concrete starter section must be as shown on the Plans and must be placed in accordance with the requirements of these Specifications.

A closing section must be used when directed by the Agency or where it is not possible to complete a run of cast-in-place concrete pipe because of lack of clearance ahead in the trench.

Starting and closing sections may be either concrete pipe or corrugated steel pipe meeting the strength requirements indicated in the Contract. However, if the combined length of the starting and closing sections exceeds 12 feet in 1 reach between manholes, concrete pipe must be used.

### **36-8 CONSTRUCTION JOINTS**

If construction of the pipe stops short of a manhole or for more than 20 minutes, the resulting construction joint must be reinforced with a concrete collar. This collar must extend 1 foot either side of the joint and must be a minimum thickness equal to that of the pipe. The resulting end of pipe must be securely closed by a heavy canvas or equal to prevent excessive dehydration of the concrete already placed.

Joints must be clean and damp when covered with fresh concrete or mortar. Cleaning of construction joints must consist of removing all laitance, loose or defective concrete, coating, and

foreign material.

### **36-9 FINISH**

Flowline elevations of the completed pipe must not vary more than 0.05 feet from the design grade shown on the Plans. Variations in the internal diameter must not exceed 1/32 inch per diameter inch. (For example, for 24-inch pipe, 1/32 inch x 24 inches = 3/4 inch variation). Offsets at form laps must not exceed the limits specified in the following table:

<b>Pipe Diameter</b>	<b>Maximum Offset</b>
24" through 30"	3/8"
33" through 42"	1/2"
48" through 66"	5/8"
72" through 90"	7/8"
96" through 108"	1"
120" and larger	1-1/8"

The finished surface of the concrete pipe must be substantially free of fractures, cracks and interior surface roughness.

The Contractor must hand trowel the bottom 90 degrees of the inside of the pipe unless alternate provisions are made to provide a smooth interior surface satisfactory to the Agency. The remaining interior surface of the pipe not covered by forms must be equivalent to a steel screeded finish. All extraneous concrete must be removed from the interior surface as soon as possible after placing. Any additional finish work or repair work required to be done on the pipe must be completed within 5 days after the pipe is placed.

If obvious segregation or honeycombing or inadequate wall thickness is found by the Agency, the pipe may be rejected.

### **36-10 FORMS**

Forms must be strong enough to permit the placement and vibrating of the concrete without causing distortion at any point. Form support systems must be constructed so that previously placed concrete will not be damaged. Form structure bearing plate indentations must not exceed one-eighth inch (1/8") and care must be taken when removing the forms to prevent damage to the pipe. After removal of the forms, the inside of the pipe will be inspected by the Agency and any repairs made promptly by the Contractor, at the Contractor's expense.

The surfaces of the forms against which concrete is to be placed must be cleaned of all dirt, mortar, and foreign material. Forms must be thoroughly coated with form oil prior to use. The form oil must be a commercial quality form oil or other equivalent coating that will permit the ready release of the forms.

### **36-11 CURING**

Curing must take place immediately after finishing exposed exterior surfaces by one or a combination of the following methods:

- Pigmented curing compound, blanketing, cotton mat, polyethylene film or spraying methods as specified in the State Specifications.
- A 6-inch layer of moist earth backfilled over the pipe. Avoid damage to the fresh concrete while placing the backfill. The backfill must be kept moist for at least 7 days.

During the curing period, the ends of the pipeline must be securely closed with heavy canvas,

or by other methods approved by the Agency, to maintain a humid condition within the pipe for a minimum of 7 days, except during periods when repair work is actually in progress on the inside of the pipe.

### **36-12 FIELD QUALITY CONTROL**

#### **36-12.01 Placement Tests**

The Agency will be present for testing and inspection at all times during construction of a cast-in-place concrete pipe. Cast-in-place concrete pipe may not be constructed without the presence of the Agency.

A slump test of each truckload of concrete will be made by the Agency before the concrete will be permitted to be placed in the pipe casting machine.

Any concrete having a slump that exceeds the specified slump by more than 1/2 inch will be rejected. At least 3 compressive test cylinders will be cast from representative portions of each load of concrete. Each cylinder must have recorded the line, station number, date and batch ticket number. Compression tests will be made at the Agency's expense. Concrete compressive strength will be determined from 6 by 12 inch cylinders conforming to ASTM C31, tested in conformance with ASTM C39.

One cylinder of each set will be tested after curing for 2 days and 7 days, at the option of the Agency. The other cylinder of the set will be held for testing in the event that the Agency wishes to retest any batch.

If more than 2 cylinders tested in any day's concrete placement fall more than 10 percent below the minimum specified compressive strength, cores will be taken from the pipe and tested for compressive strength at the expense of the Contractor. If cores indicate concrete strength more than 20 percent below the minimum specified compressive strength, that portion of pipe must be removed and replaced with precast concrete pipe, at the expense of the Contractor.

#### **36-12.02 Crack Repair**

After completion of entire backfill and compaction, all cracks must be repaired as follows: Crack width must be determined by penetration to more than 0.25 inch (6.4mm) of a standard machinist gage leaf defined in AASHTO T 280.

Where the pipe function requires repair, circumferential cracks greater than 0.01 inch (0.3mm) and less than 0.06 inch (1.5mm) in width must be cleaned and filled with mortar. Circumferential cracks 0.06 inch or more in width must be cleaned and filled to a depth of 0.38 inch (9.5mm) with an elastomeric sealant.

Longitudinal cracks with a width of more than 0.01 inch (0.3mm) and a length less than that determined by the formula 0.0005 times the outside pipe diameter must be cleaned and filled to a depth of 0.38 inch (9.5mm) with an elastomeric sealant.

Longitudinal cracks having displacement greater than 0.08 inch (2.0mm) or width greater than that determined by the formula 0.0005 times the outside pipe diameter must be repaired by full depth epoxy pressure grouting.

### **36-13 REIMBURSEMENT FOR FIELD QUALITY CONTROL**

The Agency has determined that there is an additional cost to the Agency for field quality control of cast-in-place concrete pipe over and above that required for other types of underground construction. This additional cost is fixed at the amount specified in the Special Provisions and must be reimbursed to the Agency in order that bids received for various pipe materials and methods of construction will be comparable in total cost. Reimbursement will be deducted from the prices paid per linear foot for each size of cast-in-place concrete pipe.

### **36-14 BACKFILL**

Initial backfill is the material placed between the top of the pipe shoulder in contact with the trench and a point 12 inches above the top of the pipe. Initial backfill selected from job excavated material must be finely divided and free from debris, organic matter and pieces larger than 1 inch. The material must be placed immediately after the pipe has been completed, inspected and accepted by the Agency and permission to backfill has been obtained in writing from the Agency. The material must not disturb or damage the pipe and must be brought up evenly on both sides.

The material must be compacted to a relative compaction of at least 90 percent as determined by Test Methods ASTM D6938 and ASTM D1557. Jetting will not be permitted during placement of initial backfill.

Jetting might be permitted for backfill above 12 inches over the pipe, if approved by the Agency.

As an alternative to job excavated material, initial backfill may consist of imported 3/4-inch clean crushed rock conforming to ASTM D448 sieve size number 6 or 7 and to Section 50-16, "Clean Crushed Rock", of these Specifications.

Intermediate and final trench backfill must conform to Section 19, "Trench Excavation, Bedding and Backfill", of these Specifications.

### **36-15 LOADING DURING CURING**

No backfill other than a 6-inch layer permitted for curing purposes can be placed until designated tests have been made and permission to backfill has been obtained from the Agency. Depth of backfill over the top of the pipe must not exceed 12 inches until the concrete compressive strength reaches 700 psi or the pipe has been in place 24 hours, whichever is longer. Light traffic (axle load less than 6000 pounds) may be routed over the pipe when loosely backfilled and prior to jetting. Unrestricted traffic will be permitted over the pipe when the concrete strength reaches 1400 psi or the pipe has been in place for 72 hours, whichever is longer. In all cases, the Contractor is responsible for correcting any damage to cast-in-place concrete pipe caused by premature or excessive loading prior to the end of a 7 day curing period.

### **36-16 MEASUREMENT AND PAYMENT**

The length of cast-in-place concrete pipe to be paid for will be the slope length designated by the Agency. Pipe placed in excess of the length designated will not be paid for. The price paid per linear foot for cast-in-place concrete pipe includes 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 excavation, bedding material, special foundation treatment, backfill, and construction joints, as shown or specified in the Contract, specified in these Specifications, and directed by the Agency.