

# Special Specification 4191

## Cast-in-Place Concrete Pipe (Non-reinforced)



### 1. DESCRIPTION

Furnish and install cover machine cast-in-place monolithic non-reinforced concrete pipe for culverts, storm drain mains, laterals, stubs, and inlet leads. Cast-in-place pipe will not be allowed under the pavement structure.

### 2. MATERIALS

Provide Class C concrete meeting the requirements of Item 421, "Hydraulic Cement Concrete," except as otherwise noted herein or on the plans. Use Type II Portland cement.

Provide coarse aggregate grading for pipe diameters 48 in. or less of Aggregate Grade No. 3 for 1 in. maximum size aggregate under Item 421, "Hydraulic Cement Concrete." For pipe diameters over 48 in., provide coarse Aggregate No. 2 for 1-1/2 in. maximum size aggregate.

No concrete with a slump in excess of 2 in. will be permitted for use in pipes with diameters of 48 in. and over. For pipes with diameters less than 48 in., no concrete with a slump in excess of 3 in. will be permitted for use.

### 3. EQUIPMENT

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

### 4. CONSTRUCTION

4.1. **Dimensions and Tolerances.** Furnish the design shell thickness in accordance with Table 1.

<b>Internal Diameter (in.)</b>	<b>Min. Shell Thickness (in.)</b>
18	2
24	2-1/2
30	3
36	3-1/2
42	4
48	5
54	5-1/2
60	6

Variation in the internal diameter must not exceed plus or minus 3%. The maximum allowable deviation from the true grade of the design invert of the pipe must not exceed 1/2 in. either side of true grade. Where deviation from true grade occurs, true grade must be re-established at a maximum departure of 1/8 in. per foot.

4.2.

**Excavation and Backfill.** Excavate, shape, bed, and backfill in accordance with Item 400, "Excavation and Backfill for Structures," except as modified herein. Excavate the trench to the lines and grades shown on the plans, or as directed. The width of the trench must only be enough to accommodate travel of the pipe machine. Shape the bottom of the trench to the nominal outside circumference of pipe. Excavate from the outlet to the inlet. If the trench is over-excavated for the bottom 210° of the pipe, fill the excess area with concrete. No additional payment will be made for this additional concrete or over-excavated material. If rock is encountered, removed the rock at least 6 in. below the bottom of the pipe and refill the trench with material sufficiently compacted to allow operation of the machine and provide a smooth firm surface.

Provide backfill material in accordance with Article 400.5., "Payment." No backfill other than permitted for curing purposes may be placed until the line has been inspected and approved by the Engineer. The trench may be completely backfilled after the pipe has been in place at least 24 hr. and the concrete has acquired a flexural strength of not less than 300 psi.

Mechanically compact all backfill material to the extent shown on the plans.

4.3.

**Placement.** All surfaces against which concrete is to be placed must be free from standing water, mud, and debris.

Thoroughly moisten absorptive surfaces against which concrete is to be placed so that moisture will not be drawn from the freshly placed concrete.

Place the concrete in one operation around the full circumference of the pipe by means of a traveling form. The forms must be of enough strength to withstand vibrating or tamping the concrete and to permit workmen to walk on the forms without causing springing or bulging at any point.

As the traveling form moves forward, place forms inside the newly formed pipe to support a minimum of 230° of the upper portion of the pipe.

Vibrate, ram, tamp or work the concrete with suitable appliances until the concrete has been consolidated to the maximum practicable density, free of rock pockets, and closes snugly against all surfaces of forms and provides a bond between the pipe shell and supporting earth.

When placing operations cease for any reason, leave the end of the pipe rough with a slope of approximately 45°. Cover the ends of the pipeline with canvas or other suitable cover material to prevent excessive loss of moisture from the interior of the pipe already placed.

When starting pipe laying operation from a previously laid cast-in-place pipe or section of precast pipe, make a construction joint by excavating a "bell" completely around the end of the existing pipe and constructing a concrete collar to extend at least 1 ft. either side of the joint with a minimum thickness equal to that of the wall of the pipe. Clean and dampen the end of the existing pipe before continuing pipe making operations. Clean construction joints by removing all laitance, loose, or defective concrete, coatings and any other deleterious materials.

Clean and place all forms at the trench side at the location of their proposed use for inspection by the Engineer. Do not use forms which are defective in any way and, if found unacceptable for use, remove them from the site of the work. Provide forms that do not vary more than 1/2 in. from the lower edge of a straightedge laid parallel to the centerline of the form and are free of any holes larger than 5/8 in. in greatest dimension. Thoroughly clean and service the pipe machine before the placing of the concrete.

Particular attention must be given to all parts of the machine with which concrete comes into contact.

Provide concrete chutes or trunks that reach within 1 ft. of the pipe machine hopper. Discharge the end of the chute or truck at the center of the hopper. Arrange and use chutes and trunks so the concrete ingredients will not be separated.

Handle delays in placing as follows or as otherwise directed. Keep the concrete hopper on the pipe laying machine 1/2 full at all times, provided, however, that when placing operations cease or are delayed for any

reason for more than 20 min., pull the pipe machine forward until all the concrete is exhausted and until the top troweling skirt is clear of the concrete.

If the pipe laying operation proceeds within 1 hr. of the time of the last placement, no further steps need to be taken. However, if longer than 1 hr. has elapsed, then make a construction joint as previously described. Leave the end of the pipe rough and at the natural slope when the machine is moved forward.

Provide all junctions of pipe at the time the cast-in-place pipe is placed. Effort should be made to minimize cold joints between junctions. Use a concrete collar appropriate for the pipe diameter at all cold joints and is considered subsidiary to the pay item for non-reinforced cast-in-place concrete pipe. For the collar, provide Class C concrete meeting the requirements set forth in this Special Specification.

Remove inside forms from the pipe not sooner than 4 hr. and longer than 24 hr. after placement of the concrete. Take care when removing forms to prevent damage to the pipe. Carefully inspect the inside of the pipe for imperfections in placement and make any required repairs or smoothing immediately to provide a uniform interior surface. Do not apply wash, mortar or concrete to a surface not properly moistened or cleaned. Repair visible cracks by brushing with cement paste or chipping out and pointing up with cement mortar. Repair any cracks that appear to go through the shell, by epoxy injection per the Department Concrete Repair Manual. Use construction operations and methods necessary to provide a watertight pipeline. Provide mortar consisting of one-part cement and two parts well graded sand passing the 1/8 in. sieve. Provide wash consisting of four parts cement and one part fireclay. The finished surface of the concrete pipe must be substantially free of fractures, cracks and surface roughness.

4.4. **Curing.** Immediately after the concrete is placed, cure the exposed surface of the concrete by any one, or a combination of the following methods:

- as outlined in Section 420.4.10., "Curing Concrete,"
- placing a 6 in. layer of backfill material consisting of damp, fine earth over the pipe immediately after the concrete has hardened enough to prevent injury to the pipe from backfill operations. Keep the initial backfill moist until covered with final backfill, and
- cover the top with a sheet of polyethylene film sealed with dirt along the edges.

During the curing period following the placement of the concrete, cover the ends of the pipeline and all other openings into the pipeline with canvas or other suitable material, except at locations where work is actually in progress. Do not cure the inside surface of the pipeline.

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## 5. MEASUREMENT

This Item will be measured by the foot. Measurement will be made between the ends of the pipe barrel along the flow line, not including safety end treatments. Safety end treatments will 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 the 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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## 6. 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 "Cast-in-Place Concrete Pipe," of the size specified. This price is full compensation for constructing, furnishing, transporting, placing, and joining pipes; shaping

the bed; cutting pipes on skew or slope; connecting to new or existing structures; breaking back, removing, and disposing of portions of the existing structure; replacing portions of the existing structure; cutting pipe ends on skew or slope; and equipment, labor, tools, and incidentals.

Protection methods for excavations greater than 5 ft. deep will be measured and paid for as required under Item 402, "Trench Excavation Protection," or Item 403, "Temporary Special Shoring." Excavation, shaping, bedding, and backfill will be paid for in accordance with Item 400, "Excavation and Backfill for Structures."