Section 65 Concrete Pipe

Bracketed section numbers refer to the 2006 *Standard Specifications*.

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4-6501 General

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General

Concrete pipe is used for culverts, siphons, drains, and conduits. Section 65-2 [65], "Concrete Pipe," of the *Standard Specifications*, includes specifications for circular reinforced concrete pipe, oval-shaped reinforced concrete pipe, and reinforced concrete pipe arch. Section 65-3, "Nonreinforced Concrete Pipe," of the *Standard Specifications*, is reserved for specifications for fabricating and constructing nonreinforced concrete pipe. The resident engineer and assistant resident engineers responsible for inspecting reinforced concrete pipe need to be familiar with the specifications and Standard Plans that provide for determining the physical characteristics of the pipe. The specifications provide options to the contractor for selecting the class of pipe and earthwork required for installing the pipe. The Office of Materials Engineering and Testing Services (METS) personnel will test and inspect the pipe during manufacturing, but the resident engineer and assistant resident engineers must ensure that the correct combination of class of pipe and earthwork methods are used in each location.

4-6502 Before Work Begins

4-6502
Before Work
Begins

Well before work begins, review the plans and specifications and inspect the sites of all planned installations. Reviewing these items sufficiently in advance helps prevent scheduling conflicts and errors in ordering materials. During the preliminary review and inspections, the resident engineers and assistant resident engineers should also do the following:

- Review the "Materials Information" from METS and ensure that the special provisions cover any special requirements.
- Note any unsolved drainage problems, and make any necessary changes by change order.
- As soon as final locations and lengths are determined, give the contractor a revised pipe list, including those pipes added or altered by change order.
- Verify that Form CEM-3101, "Notice of Materials to Be Used," includes concrete pipe of the type and class specified. Refer to Section 6-202, "Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products," of this manual for additional information. Note that use of direct design method circular reinforced concrete pipe or nonreinforced pipe is permitted under those conditions enumerated in the specifications.

4-6503 During the Course of Work

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During work operations, the resident engineer and assistant resident engineers should do the following:

- Once the pipe arrives at the job site, check the identification tags or marks to ensure a METS inspector has inspected the pipe at the source of origin.
- Determine the final acceptability of the pipe using the guidelines in Section 6-2, "Acceptance of Manufactured or Fabricated Materials and Products," of this manual. Sections of pipe that have met the requirements of the three-edge bearing test may be used in the work. Cracks resulting from the three-edge bearing test are not a reason for rejecting the pipe. Small numbers of hairline cracks and minor chips are not so serious as to require rejecting pipe, either. However, the following problems are not acceptable: pipe with cracks through the wall; exposed reinforcing steel; or damaged bells, spigots, or joint grooves.
- For culverts that have been installed and backfilled, cracks should not exceed 1/100 inch in width in severely corrosive environments (that is, environments consisting of a pH of 5.5 or less, seawater, or water containing vegetal or animal wastes or chloride concentration greater than 500 ppm). Conversely, for culverts installed in a noncorrosive environment (that is, environments consisting of a pH greater than 5.5, water containing animal or vegetal wastes or chlorides concentration less than 500 ppm), cracks of up to 1/8 inch in width in the installed pipe are acceptable if they are not excessive in number. Note the requirements in the specifications for marking pipe. Ensure that pipe of the specified size, type, and class is installed at the proper locations.
- Before structure excavation, require that embankments be constructed as specified. Before installing pipe, determine the acceptability of excavations and any required bedding, as described in the specifications and as shown in the *Standard Plans*. Excavation must occur for each bell to avoid shear cracking.
- Require methods of handling that will not damage the pipe.
- At the contractor's option and expense, the contractor can use extra strong pipe to withstand the pressures of jacking. Ensure any voids resulting from jacking are filled.
- Elliptically reinforced pipe must be placed so the minor axis is vertical. Note the locations of indicators, painted stripes, or lift holes to ensure proper placement. Before the contractor places the backfill, ensure lift holes are plugged.
- Ensure pipes are placed with belled ends upstream. Where possible, pipes should be laid on the upgrade. Progress on the upgrade facilitates tight joints, particularly for pipes on steep grades. However, extending existing pipes downstream will require laying pipe on the downgrade or will require a special connecting structure.
- Joints must have smooth, uniform interior surfaces. Unless otherwise required, joints must be sealed completely with cement mortar, rubber gaskets, or resilient materials. Reject gaskets that have cracks or splits.
- Check the aggregate and the proportioning of cement mortar. The mortar must be used within 30 minutes after the addition of water. Permit the use of admixtures to improve workability, and determine the amounts to be added.
- Ensure rubber gaskets are stored in a cool place away from sunlight. If lubrication is required before installation, require the contractor to follow the manufacturer's instructions.

- Ensure resilient materials are tested before use. During sealing with liquid materials, ensure molds or runners retain the liquid materials. Liquid sealers must be placed continuously and agitated until the joint is completely filled.
- Review backfill details on the contract plans, *Standard Plans*, or both. Determine that the class of reinforced concrete pipe and method of backfill selected by the contractor meet these details. Refer to Section 4-19, "Earthwork," of this manual for additional instructions on excavation and backfill.
- Backfill may be done while the mortar in joints is plastic. However, after the mortar sets, do not permit backfill until 16 hours after sealing. Further, because free water may not contact the pipeline until seals containing portland cement have aged 24 hours, no backfill may be placed during this period if it must be watered in place. Require backfilling in a manner that will not damage seals, whether by direct impact or through displacement of joints. Imported structure backfill should be checked for pH and resistivity levels to verify that the service life of the pipe will not decrease. The limits of concrete backfill, when required, will be shown on the plans. Concrete backfill is paid for as a separate item. The contractor may use slurry cement backfill for backfilling culverts. When either concrete backfill or slurry cement backfill is used, observe carefully and ensure the pipe is not displaced or floated by uneven or too rapid placement. For rapid strength concrete or rapid strength slurry cement backfill, allow only nonchloride admixtures to accelerate the setting time.
- After the backfill of pressure pipes or siphons to 2 feet over the crown, witness the specified hydrostatic tests. Require the repair of all obvious leaks and leak reductions to the maximum permitted. Refer to Section 65-2.01D(2), "Field Testing of Siphon and Pressure Pipe," of the *Standard Specifications*.
- Require that minimum cover for construction loads, as shown in the *Standard Plans*, be placed over reinforced concrete pipe culverts.
- Insist that pipes be protected from damage during continuing operations. Periodically inspect pipes as work progresses. A particularly critical time to inspect comes after the completion of the grading plane and before the start of base and surfacing. During the final phases of the project, make another inspection, primarily to find any pipes that need cleaning.

4-6504 Measurement and Payment

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The length of pipe to be paid for is the slope length designated by the engineer. This slope length is the length shown on the plans, plus or minus any changes the engineer makes, or the length as determined from the surveyors' staking notes. If pipe is cut to fit a structure or a slope, the pay length is the length necessary to be placed before cutting, rounded up to the nearest 2-foot increment. If the contractor forms the pipe out from a structure, the formed distance is also part of the length of the pipe necessary before cutting. If the pipe joins a structure at a skew, the length of pipe necessary to be placed before cutting is the longer side of the pipe. Pipe bends, wyes, tees, and other branches must be field measured in accordance with the specifications. The following are examples for measuring culvert pipe when the length to be paid for is the slope length designated by the engineer.

4-6504A Case I

PIPE PLACEMENT	CUT OR UNCUT PIPE	PAYMENT METHOD
Pipe between two structures (inside face to inside face of two drop inlets)	Cut	Pay to the nearest 2-foot increment equal to or longer than the pipe necessary before cutting

Example 1:

The length along centerline between the two faces and additional length required due to skew = 62.33 ft

Individual lengths of pipe placed total 60.08 ft, plus additional length made up in joints and by forming out from one structure.

Pipe is cut due to skew at the other structure.

Therefore:

Pay for 64 ft

Example 2:

Centerline length between inside faces not on a skew = 60.75 ft

Lengths of pipe placed total 64.25 ft

Therefore:

Pay for 62 ft

4-6504B Case II

PIPE PLACEMENT	CUT OR UNCUT PIPE	PAYMENT METHOD
Pipe between two structures.	Uncut	Pay the designated length.

Example:

- Slope length along centerline of the pipe between the two inside faces = 145.5 ft
- Individual lengths of pipe placed total 144 ft, plus additional length made up in joints or forming out from one structure, or both.

Therefore:

Pay for 145.5 ft

4-6504C Case III

PIPE PLACEMENT	CUT OR UNCUT PIPE	PAYMENT METHOD
Pipe placed from toe of fill to toe of fill.	Uncut	Pay the slope length the engineer designates.

Example:

- Designated length = 145 ft
- Laid pipe = 146 ft, with the additional length due to the gain in joints.

One end is allowed to extend the additional distance beyond the toe of fill.

Therefore:

Pay for 145 ft

Under the following circumstances, you may use field measurements in lieu of calculations or you may supplement calculations:

1. A pipe runs between two structures. After verifying that the structures are constructed as shown on the plans, you can determine designated length from a field measurement along the centerline of the pipe between the two inside faces. If the pipe is cut, make appropriate adjustments to the field measurement.
2. After verifying that a pipe is properly staked, you may use field measurements between stakes referenced to the ends of the pipe to determine the length designated by the engineer. If you use a field measurement to determine pay lengths, include on the quantity sheet an explanation of how the field measurement relates to the length designated by the engineer.