

Section 65 Concrete Pipe

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Section 65 Concrete Pipe

4-6501 General

This section provides guidelines for inspecting concrete pipe for work specified under Section 65, “Concrete Pipe,” of the *Standard Specifications*. Concrete pipe includes circular reinforced concrete pipe, oval-shaped reinforced concrete pipe, reinforced concrete pipe arch, and nonreinforced concrete pipe. The contractor selects the class of pipe and method of backfill shown in Sheet A62D, “Excavation and Backfill—Concrete Pipe Culverts,” of the *Standard Plans*, unless the bid item list specifies the class or method. Materials Engineering and Testing Services (METS) personnel will test and inspect the pipe during manufacturing, but the resident engineer and assistant resident engineers must verify that the correct combination of class of pipe and earthwork methods are used in each location.

4-6502 Before Work Begins

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 make sure 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.
- Obtain from the contractor the selected class of reinforced concrete pipe and method of backfill to be used for each length of culvert. Also obtain from the contractor culverts that are to be manufactured using the direct design method or nonreinforced pipe where allowed by the specifications and *Standard Plans*.
- 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.

4-6503 During the Course of Work

During the course of work, do the following:

- Once the pipe arrives at the job site, check the identification tags or marks to verify that 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; such as environments consisting of a pH of 5.5 or less, seawater, or water containing vegetal or animal wastes or chloride concentration greater than 500 parts per million (ppm). Conversely, for culverts installed in a noncorrosive environment; such as 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. Make sure 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 may use extra strong pipe to withstand the pressures of jacking. Assure 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 assure proper placement. Before the contractor places the backfill, check that lift holes are plugged.
- Verify that 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.

- Make sure 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.
- Make sure resilient materials are tested before use. During sealing with liquid materials, verify that 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 contact 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 verify that 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.
- 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 Level of Inspection

Suggested levels of inspection for typical work activities are:

- Intermittent inspection of trench excavation
- Benchmark inspection of bedding and pipe installation
- Intermittent inspection of backfill
- Intermittent inspection of sampling and testing of materials, compaction, and applying curing seal

4-6505 Quality Control

Witness the specified hydrostatic tests for siphons and low-head conduits. Verify hydrostatic test results and leakage calculations. Refer to Section 65-2.01D(2), "Field Testing of Siphon and Pressure Pipe," of the *Standard Specifications*.

4-6506 Payment

The length of pipe to be paid for is the slope length designated by the resident engineer. This slope length is the length shown on the plans, plus or minus any changes the resident 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 resident engineer.

4-6506A Case 1

PIPE PLACEMENT	CUT OR UNCUT PIPE	PAYMENT METHOD
Pipe between 2 structures, inside face to inside face of 2 drop inlets.	Cut	Pay to the nearest 2-foot increment equal to or longer than the pipe necessary before cutting.
<p>Example 1:</p> <p>The length along centerline between the 2 faces and additional length required because of skew = 62.33 ft</p> <p>Individual lengths of pipe placed total 60.08 ft, plus additional length made up in joints and by forming out from 1 structure.</p> <p>Pipe is cut due to skew at the other structure.</p> <p>Therefore:</p> <p>Pay for 64 ft</p> <p>Example 2:</p> <p>Centerline length between inside faces not on a skew = 60.75 ft</p> <p>Lengths of pipe placed total 64.25 ft</p> <p>Therefore:</p>		

Pay for 62 ft

4-6506B Case 2

PIPE PLACEMENT	CUT OR UNCUT PIPE	PAYMENT METHOD
Pipe between 2 structures.	Uncut	Pay the designated length.
<p>Example:</p> <ul style="list-style-type: none"> Slope length along centerline of the pipe between the 2 inside faces = 145.5 ft Individual lengths of pipe placed total 144 ft, plus additional length made up in joints or forming out from 1 structure, or both. <p>Therefore:</p> <p>Pay for 145.5 ft</p>		

4-6506C Case 3

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.
<p>Example:</p> <ul style="list-style-type: none"> Designated length = 145 ft Laid pipe = 146 ft, with the additional length from the gain in joints. <p>One end is allowed to extend the additional distance beyond the toe of fill.</p> <p>Therefore:</p> <p>Pay for 145 ft</p>		

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

1. A pipe runs between 2 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 2 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.