

## SECTION 54

### PIPE CULVERTS

#### 54.1 DESCRIPTION

##### A. General

This work consists of furnishing and installing concrete and metal culverts and storm drains ([storm sewers](#)), excluding structural metal plate culverts. [Pipe culverts shall be in accordance with Section 11 – Utility Excavation and Backfill except as modified by the provisions contained here within.](#)

##### B. Related Work Items

Section 11	Utility Excavation and Backfill
Section 12	Roadway and Drainage Excavation
Section 15	Disposal of Surplus Excavation and Waste
Section 52	Box, Pipe, and Plate Culvert Undercutting
<a href="#">Section 62</a>	<a href="#">Drop Inlets</a>
<a href="#">Section 63</a>	<a href="#">Storm Sewer Manholes</a>
Section 65	Riprap
Section 66	Slope Protection
Section 68	Bank and Channel Protection <a href="#">Rock Filled Wire Baskets</a>
Section 109	Riprap and Slope Materials
Section 112	Select Granular Backfill
Section 120	Reinforced Concrete Pipe
Section 121	Corrugated Metal Pipes
Section 125	Gabions

#### 54.2 MATERIALS

- A. Reinforced concrete pipe shall conform to the requirements of Section 120, REINFORCED CONCRETE PIPE.
- B. Corrugated metal pipe shall conform to the requirements of Section 121, CORRUGATED METAL PIPE.

#### 54.3 CONSTRUCTION REQUIREMENTS

##### A. Concrete Pipe

Concrete pipe culverts shall be laid with the groove or bell end of the pipe upstream and the tongue end shall be inserted into the groove. Except where watertight

rubber gaskets are used, each joint shall be covered over the top three-fourths (3/4) of the outside circumference of the pipe, with at least a six (6) inch wide strip of composition roofing paper or drainage fabric. This strip shall be centered over the joint and cemented with a plastic asphalt cement to hold it in place during embankment construction.

Lift holes shall be covered or plugged to prevent backfill from entering the pipe.

When the plans require the use of rubber gaskets at joints, they shall be installed according to the manufacturer's instructions.

#### B. Corrugated Metal Culverts

Corrugated metal culverts are approved for use as driveway cross pipe only. Corrugated metal pipe shall not be used [within the public right of way or](#) under the street paving section with the exception of corrugated metal pipe used in strip drain applications and only with the written approval of the Engineer. Such strip drains shall be bedded and backfilled with concrete or flowable fill only. Corrugated metal culverts shall be laid with outside laps of circumferential joints pointing upstream and with the longitudinal laps on the sides. The ends of the pipe sections shall be approximately one (1) inch apart to enable corrugations of the bands to mesh with the corrugations of the pipe.

Multiple lines of pipe culverts shall be laid in truly parallel lines in all planes.

The amount of camber shall be varied to suit the height of fill and nature of supporting soil.

Proper equipment shall be provided by the Contractor, for lowering the sections of pipe into place. Dropping the pipe into place will not be permitted.

#### C. Excavation

Trenches shall be excavated to a width sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe. Where soil type allows, trench walls shall be vertical to an elevation atop the pipe.

The completed trench bottom shall be firm for its full length and width.

The foundation for each type of bedding shall be adequate to furnish a uniform stable support. Removal of unstable material or rock below bedding grade shall be performed as set forth in Section 12.

#### D. Bedding

The pipe bedding shall conform to one of the classes described below as specified. When no bedding class is specified, the requirement for Class C bedding shall apply.

1. Class A Bedding

This bedding shall consist of a continuous concrete cradle conforming to the plan details.

2. Class B Bedding (Ring Compression Design)

Material shall be excavated from below the bottom of the pipe grade for a depth of twelve (12) inches and for a width equal to the external diameter of the pipe plus one (1) foot. The excavated area shall be backfilled with select fill material to at least fifteen percent (15%) of the pipe's overall height above the lower face of the pipe. The material shall be thoroughly compacted to provide a firm uniform foundation. The foundation shall then be shaped to fit the lower part of the pipe, and the pipe shall be bedded on a three (3) inch layer of suitable granular material. Select fill material shall then be placed in six (6) inch layers and compacted with mechanical tampers, to at least thirty percent (30%) of the overall pipe height.

When the pipe foundation is entirely in new embankment, the twelve (12) inch undercut will be waived, provided select fill material was used for the embankment.

3. Class C Bedding

This bedding shall consist of an earth or gravel cradle of uniform density shaped to fit the lower part of the pipe with reasonable closeness for at least ten percent (10%) of the pipe's overall height.

- E. Backfill Above Bedding Grade

Pipe shall be backfilled to the elevation shown on the plans or as directed by the Engineer. Backfilling shall conform to the requirements for Normal Type Backfill or Imperfect Trench Backfill as specified. When backfilling requirements are not specified, the requirements for Normal Type Backfill will apply. Moisture and density requirements for backfill shall be as specified for project embankment or as directed by the Engineer. Backfill material shall be pre-moistened if necessary to obtain uniform moisture.

1. Normal Type Backfill

Selected embankment material shall be placed along the pipe in layers not exceeding six (6) inches loose depth and thoroughly compacted by mechanical compactors to the required density before successive layers are placed.

The width of the berms on each side of the pipe shall be twice as wide as the external diameter of the pipe, or twelve (12) feet, whichever is least. This

method of backfilling shall be continued until the embankment is at least two (2) feet over the top of the pipe.

In trench installations, backfill width shall be equal to trench width. The backfill shall be brought up evenly on both sides of the pipe for its full length. This method of backfilling shall be continued until the embankment is at least two (2) feet over the top of the pipe.

## 2. Imperfect Trench Backfill (Concrete Pipe Only)

Imperfect Trench Backfill shall be designed and specified as required for a specific project. ~~A portion of the embankment directly over the pipe, one external diameter in height and one external diameter in width shall be placed in as loose a condition as possible. One of the following methods may be used to produce this result.~~

~~a. The backfill shall be completed as specified under Normal Type Backfill to a height above the pipe equal to the outside diameter of the pipe plus one (1) foot. A trench equal in width to the outside diameter of the pipe shall then be excavated to within one (1) foot of the top of the pipe, with walls as nearly vertical as possible. The trench shall be loosely filled with highly compressible soil. Straw, hay, corn stalks, leaves, brush, or sawdust may be used to fill the lower one-fourth (1/4) to one-third (1/3) of the trench. Construction of the embankment above the trench shall then proceed in a normal manner.~~

~~b. The backfill shall be completed as specified under Normal Type Backfill to a height one (1) foot over the top of the pipe. Lath shall then be set on each side of the pipe marking the external diameter of the pipe. The embankment on each side of the pipe shall then be placed and compacted to a height above the top of the pipe equal to one external diameter of the pipe plus one (1) foot. Earth moving equipment or compaction equipment will not be permitted to travel over the area enclosed by the lath until the required height is reached. Fill between the laths shall then be completed by pushing loose material into this area to a height of one external diameter of the pipe. Construction of the embankment above the trench shall then proceed in a normal manner.~~

## F. Replacing Disturbed Surfacing Material

In the event that pipe culvert installation requires the removal or disturbing of surfacing material, and no items or quantities of replacement surfacing are provided in the contract, the Contractor shall replace the disturbed surfacing to the satisfaction of the Engineer.

## G. Pipe Culvert and Storm Drain (Storm Sewer) Tests:

1. General: A visual inspection and a TV inspection test shall be performed as specified herein for all pipe culverts and storm drains (storm sewers) as a condition of acceptance by the City. All tests shall be performed after backfill is complete but prior to any surface restoration. In addition the designer or Engineer may supplement this specification by also specifying a leakage test.
2. Pre-Cleaning: Prior to testing newly installed pipe culverts and storm drains (storm sewers), the Contractor shall remove all accumulated construction debris, rock, gravel, sand, silt, and other foreign matter from the pipe.

The Contractor shall be responsible for all work necessary to make the pipe culverts and storm drains (storm sewers) acceptable for usage including removal of all mud, silt, rocks, or blockages that make said pipes unacceptable for final acceptance and usage. Also included is all work necessary in the Drop inlets, Storm Sewer Manholes and all cleanup work required prior to final acceptance.

The City will not be responsible for cleaning lines prior to televising the pipe culverts and storm drains (storm sewers). In the event that the line is not acceptable for televising, due to the Contractor's operations, the Contractor will be notified. It will be the Contractor's responsibility to arrange to clean the pipe culverts and storm drains (storm sewers) and make them acceptable for the television work. If not cleaned in a timely manner, the City may cause to take any actions necessary and charge the Contractor one and a half (1½) times the cost incurred.

3. Visual Tests: All newly installed pipe culverts and storm drains (storm sewers) pipe shall pass a visual, or "lamping", inspection by the Engineer, and a television inspection by the City Utility Maintenance Division. Straight alignment shall be checked either with lamping or with the laser beam. Lamping shall be conducted by viewing the pipe from inside a drop inlet or storm sewer manhole to determine proper alignment. The television inspection shall consist of viewing the inside of all pipe culverts and storm drains (storm sewers) installed to determine proper alignment, grade, joining, etc. The Contractor shall correct, at his own expense, any defects discovered because of lamping and/or televising the pipe.

Both a visual and television inspection shall be completed unless specified otherwise in the Detailed Specifications or on the Drawings. Waiving the visual or television inspections shall only be done in writing by the Engineer and will only be considered if requested by the design engineer.

The expense of the initial television inspection and one additional reinspection will be borne entirely by the City. If defective workmanship of material or construction is noted, the Contractor at no expense to the City, shall correct the deficiency. The City will perform additional television inspections to review if the repairs were made properly and in accordance with the specifications. The expense of any additional television inspections beyond the initial inspection and one additional reinspection will be borne entirely by the Contractor. The

Contractor shall be responsible for all related costs, including concrete or asphalt resurfacing if the street has been surfaced. The Contractor shall be required to repair all deficiencies. The City may cause to take any actions necessary for any items not completed or repaired in a timely manner and may charge the contractor one and a half (1½) times the costs incurred.

It is the Contractors responsibilities to notify both the Engineer/City Inspector and Utility Maintenance that the pipe culverts and storm drains (storm sewers) are ready for inspection. From the time initial notification that the pipe culverts and storm drains (storm sewers) are ready to be inspected the Contractor shall allow the City at least four (4) weeks to perform the television inspection. Any surfacing started prior to televising the pipe culverts and storm drains (storm sewers) and said pipe culverts and storm drains (storm sewers) being accepted is at the Contractors own risk.

4. Leakage Tests: If required by detailed specifications or by notes on the drawings, the Contractor shall conduct leakage testing of all newly constructed or reconstructed pipe culverts and storm drains (storm sewers). The Contractor shall furnish all necessary equipment and be responsible for conducting the leakage test in the presence of the Engineer and/or project Inspector.

Refer to the detailed specifications or notes on the drawings for specific testing methods and requirements. Pipeline segments between drop inlets or storm sewer manholes shall be tested separately. Mechanical or pneumatic plugs shall be placed in the line at opposing drop inlets or storm sewer manholes and each plug braced as a safety precaution.

#### 54.4 METHOD OF MEASUREMENT

##### A. Furnishing and Installing Pipe Culverts

Furnishing and installing pipe culverts will be measured by the linear foot of the respective type, classes, and sizes of acceptable pipe culverts furnished, installed, and accepted. The footage will be obtained by multiplying the nominal length of the sections by the number of sections installed.

When an installation requires that a section of pipe be cut, such as storm sewer installations, the footage will be the actual length required, rounded up to the nearest even two (2) feet.

##### B. Furnishing and Installing Flared End Sections

Furnishing and installing flared end sections for the respective type and sizes of pipe culverts will be measured by the number of complete flared end sections installed and accepted, including tie bolts or bands.

##### C. Replacing Disturbed Surfacing Material

Measurement will not be made for this item unless otherwise specified.

#### 54.5 BASIS OF PAYMENT

##### A. Furnishing and Installing Pipe Culverts

Furnishing and installing pipe culverts will be paid for at the contract unit price per linear foot for the respective designated types, classes, and sizes installed.

Payment for this item will be full compensation for furnishing and installing the pipe culverts, special sections, gaskets, connecting devices, and coupling bands. It will also be full compensation for necessary bedding operations, cost of selecting and placing backfill, furnishing and installing required granular or other bedding materials, testing, and necessary excavation required, with the exception of authorized excavation of material below pipe foundation.

##### B. Furnishing and Installing Flared End Sections

Furnishing and installing flared end sections will be paid for at the contract unit price per each for the respective type and size installed, including tie bolts or bands.

C. Replacing Disturbed Surfacing Material

Unless otherwise specified, separate payment will not be made. The cost of replacement shall be absorbed in the bid item for pipe culverts.

**END OF SECTION**