

Amend **Section 603 - Culverts and Storm Drains** to read as follows:

"SECTION 603 - CULVERTS AND STORM DRAINS

603.01 Description. This section is for constructing culverts and storm drains referred as "culvert", according to the contract.

603.02 Materials. Materials shall conform to the following:

Bed Course Material for Pipe	703.16(B)
Structure Backfill Material	703.20
Trench Backfill Material	703.21
Joint Mortar	705.02
Flexible Watertight Gaskets	705.03
Reinforced Concrete Pipe	706.02
High Density Polyethylene Pipe	706.10
Cullet Materials for Utility Structures	717.03
Cullet Materials for Drainage Systems	717.04

When the location of manufacturing plants allows, the Engineer may inspect the plants periodically for compliance with specified manufacturing methods. The Engineer may get samples of materials for laboratory testing for compliance with material quality requirements. This may be the basis for acceptance of manufacturing lots as to quality.

The condition of materials will be subject to inspection for acceptance before or during incorporation of materials into the work.

If specified in the contract, the Contractor shall have the option of furnishing and installing reinforced concrete pipe, or high density polyethylene pipe for culvert. Do not mix the type of pipe within the inlet and outlet points of installation.

603.03 Construction Requirements. The Contractor shall provide, as may be necessary, for the temporary diversion of water to install the culvert on a dry bed.

(A) Excavation. Excavate the trenches according to Section 206 - Excavation and Backfill for Conduits and Structures and as set forth herein.

Trench widths shall be sufficient to allow:

- (1) proper jointing of the culverts,
- (2) thorough compaction of the bed course, and
- (3) backfill material under and around the culvert.

If feasible, trench walls shall be vertical.

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

Remove solid rock met in excavation below invert grade. Backfill and compact the trench up to the culvert invert. Backfill and compact the trench to a relative compaction of not less than 95% in maximum 6 inch lifts with bed course material. The test method to establish maximum densities and relative compaction shall be according to Subsection 106.09(A) - Relative Compaction Test.

For culverts, the bed course material under the culvert shall have a thickness of 12 inches. The width of the bed course shall be equal to the diameter of the culvert plus 18 inches on each side.

When meeting soft, spongy, or unsuitable material, remove such material from a width equal to the diameter of the culvert plus one foot on each side and to a depth specified.

When the contract shows bed course material without thickness specified, resolve the thickness as specified above for solid rock excavation.

When shown in the contract, excavate the trench below grade. Backfill the resulting space with compacted bed course material.

(B) Laying Culvert. Remove and replace the culverts that the Contractor breaks, bends, or damages by its operations at no cost to the State.

The culvert laying shall begin at the downstream end of the culvert line. The lower end of the culvert shall be in contact with the shaped bedding throughout its full length. Place the bell or groove ends of rigid culverts and outside circumferential laps of flexible culverts facing upstream. Place the flexible culverts with longitudinal laps or seams at the sides.

(C) Joining Culverts. Rigid culverts may be of bell and spigot or tongue and groove design. The method of joining culvert sections shall be such that the Contractor enters the ends fully and the inner surfaces are flush and even.

Make joints with joint mortar or flexible watertight gaskets.

When using mortar to join culvert sections 30 inch or less in diameter, apply mortar to the ends of each section of culvert before joining. Make mortar joints with an excess of mortar to form a bead around the outside of the culvert and finish smooth on the inside.

When using mortar to joint culvert sections greater than 30 inch in diameter, apply the mortar to the joint's inside only. Mortar the joints only after installing the culvert sections and after placing sufficient backfill to assure that the culvert does not move. Finish the joint's inside smooth with the inside culvert surface.

When using collared joints, center the collar carefully over the joint. Pack the entire space between the collar and culvert tightly with mortar.

When using portland cement mixtures, protect the completed joints against rapid drying by suitable covering material.

When using preformed plastic sealing compounds, clean and dry the joint surfaces. Apply an accepted primer coat to surface. Allow the primer coat to dry completely. Apply the flat side of the preformed plastic sealing adhesive strips to the dry primed surface. The outside wrapper remains for protection.

In the ditch before jointing, remove the outside wrapper. Install the jointing by a pushing or pulling force applied in a straight line to bring the opposing joint surface tightly closed. The jointing pressure shall result in squeezing the plastic gasket to a solid pack. The Engineer will allow only whole pieces and one cut pieces. Do not use the short, fragmented pieces to complete the circumference.

Table 603-I and Table 603-II lists the gasket sizes for dry and wet trench (double head application) conditions.

Pipe Size Inch	Rope Diameter Inch	Cross Sectional Area Square Inch	Minimum Delivery Length Foot-Inch
18 and below	1	0.80	2 - 5
24 - 42	1-1/2	1.75	3 - 5
48 - 66	1-3/4	2.50	3 - 5
72 - 96	2	3.25	3 - 5

Pipe Size Inch	Rope Diameter Inch	Cross Sectional Area Square Inch	Minimum Delivery Length Foot-Inch
30 and below	1	0.80	2 - 5
36 - 48	1-1/2	1.75	3 - 5
54 - 72	1-3/4	2.50	3 - 5
78 - 96	2	3.25	3 - 5

Install rubber ring gaskets to form a flexible watertight seal. Clean and dry the surfaces to receive lubricants, cements, or adhesives. Affix the gaskets and jointing materials to the culvert not more than 24 hours before the installation. Protect the gaskets and jointing materials from the sun, dust, and other deleterious substances. Inspect the gaskets and jointing materials before installation of the culvert. Remove and replace loose or improperly affixed gaskets and jointing materials. If, the Contractor can see through the exterior joint recess when pulling the joint up to one inch of closure, remove the culvert and remake the joint.

Join the flexible culverts firmly to coupling bands. Submit a joint detail and joining method to the Engineer for acceptance before installing flexible culvert.

The Engineer will inspect the culvert before the Contractor places backfill. Take up and re-lay or replace culverts out of alignment and unduly settled at no cost to the State.

(D) Backfilling. After installing the culvert, backfilling shall be according to Section 206 - Excavation and Backfill for Conduits and Structures. The Contractor may use Section 313 - Controlled Low Strength Material (CLSM) instead of Subsection 206.02(C) - Trench Backfill Material as backfill material subject to the Engineer's acceptance. Do not use CLSM as trench backfill when installing aluminum and aluminum coated pipe culverts. When using CLSM, the Engineer will consider CLSM as the required backfill.

Trench backfill material placed below a horizontal plane 12 inches above the top of the pipe or culvert shall conform to Subsection 703.21(A) - Trench Backfill Material A or Section 313 - Controlled Low Strength Material (CLSM).

When using CLSM for trench backfill, the Contractor may reduce the width of the excavation shown on the plans so that the clear distance between the outside of the pipe and the side of the excavation on each side of the pipe is a minimum of 6 inches.

Backfill the remainder of the trench with structural backfill material according to Section 703.20(B) - Structure Backfill Material B or with trench backfill material according to Section 703.21(B) - Trench Backfill Material B or with CLSM according to Section 313 - Controlled Low Strength Material (CLSM).

Place CLSM only for that portion of the trench backfill below the original ground, the grading plane, or top of embankment placed before excavating for the culvert pipe. Where necessary, compact the earth plugs at each end of the pipe before placing backfill so that the CLSM is completely contained in the pipe trench.

When using CLSM, the Engineer will not require compaction of the backfill.

When operating earth moving equipment over culverts, the Engineer will require a compacted cushion of earth at least:

- (1) four feet above the top of the culvert and
- (2) extending five diameters on each side of the culvert.

Remove and replace broken culverts or damaged by its operation, with acceptable culverts at no cost to the State.

603.04 Method of Measurement. The Engineer will measure the bed course material per cubic yard.

The Engineer will measure culverts per linear foot complete in place. The Engineer will measure culvert with sloped or skewed ends along its invert. The Engineer will include branch connections and elbows in the length measurement for the culvert.

603.05 Basis of Payment. The Engineer will pay for the accepted bed course material at the contract unit price per cubic yard. The price includes full compensation for furnishing, placing, and compacting the bed course material; and furnishing labor, material, tools, equipment, and incidental necessary to complete the work.

The Engineer will pay for the accepted culvert at the contract unit price per linear foot complete in place. The price includes full compensation for diverting the water temporarily; plugging existing culvert with brick and mortar; furnishing, laying, and joining the reinforce concrete pipe; furnishing labor, material, tools, equipment, and incidental necessary to complete the work.

The Engineer will make payment under:

Pay Item	Pay Unit
Bed Course Material for Culvert	Cubic Yard
_____ - Inch Reinforced Concrete Pipe, Class _____, or	
_____ - Inch High Density Polyethylene Pipe, Type _____	Linear Foot

The Engineer will pay for the accepted excavation including excavation below flow line grade, and backfill for culverts and storm drains under Section 206 - Excavation and Backfill for Conduits and Structures.