

SECTION 6.51 CULVERTS

6.51.01--Description: This item shall consist of furnishing and installing new pipe culverts, new pipe-arch culverts and relaying existing pipe and pipe-arch culverts of the type, size and length called for on the plans or as ordered, at the locations and to the lines and grades designated on the plans, or as directed by the Engineer, and in conformity with these specifications. This item shall also consist of furnishing and installing slotted drain pipes to the dimensions, details and of the size, length and location shown on the plans or ordered by the Engineer.

This item shall also include furnishing and installing culverts, either circular or arched, composed of structural plates, fabricated in the field in accordance with the details shown on the plans, or as ordered. Substructures and incidental construction shall comply with the requirements of the specifications for the various items which constitute the completed structure.

This item shall further include the furnishing and installing of corrugated metal pipe elbows of the type and size shown on the plans, at the location, to the lines and grade designated, or as ordered by the Engineer and in conformance with these specifications.

6.51.02--Materials: The materials for this work shall conform to the following:

Pipes of the type indicated on the plans, joint sealant and bedding material shall conform to the requirements of Article M.08.01. Gravel fill shall conform to the requirements of Article M.02.01.

6.51.03--Construction Methods: Unless otherwise directed by the Engineer, all new or relaid pipe culverts, including culverts composed of structural plates, shall be installed in pipe bedding in accordance with the details as shown on the plans and in conformance with these specifications.

Pipe with an internal diameter of less than 1200 mm and pipe-arch of an equivalent horizontal span shall be installed in a Type I installation, and pipe of 1200 mm internal diameter or more, including pipe-arch of equivalent horizontal span shall be installed in a Type II installation.

Type I installation shall consist of installing the pipe, or pipe-arch, in bedding material with a thickness directly under the pipe of 100 mm and preshaped to a height of 10 percent of the total height of the pipe. After the pipe has been installed, the trench shall be backfilled with bedding material to a height 25 percent of the total height of the pipe.

Type II installation shall consist of installing the pipe or pipe-arch in bedding material, with a thickness directly under the pipe of 100 mm and preshaped to a height of 10 percent of the total height of the pipe. After the pipe has been installed, the trench shall be backfilled with bedding material to a height of 300 mm above the top of the pipe.

Methods of backfilling shall be in conformance with the pertinent sections of Article 2.05.03.

Where pipe is to be laid below the ground line, a trench shall be excavated to the required depth, the bottom of which shall be graded to the elevation of the bottom of the bedding material or to afford a uniform firm bearing for the pipe throughout its entire length, whichever the case may be. When rock is encountered, it shall be excavated to not less than 300 mm below the bottom of the pipe; and this depth shall be refilled with bedding material which shall be thoroughly tamped.

Where pipe is to be laid in a fill area, the embankment shall be placed and compacted to an elevation 300 mm above the top of the proposed pipe, whereupon the trench excavation shall be made and the pipe installed.

Where the nature of the foundation is poor, the culvert shall be relocated in firm material if possible. Where this cannot be done, the poor material shall be removed and replaced with a layer of gravel fill of such depth as

the Engineer may direct; or special construction of the character shown on the plans, special provisions or as ordered by the Engineer, may be employed.

Normally, the placement of pipe shall start at the downstream end and progress upstream. All pipe shall be carefully laid, true to the lines and grades given, hub ends upgrade and with the spigot ends fully entered into the adjacent hubs.

Joints in concrete and vitrified clay pipe shall be sealed with either cold-applied bituminous sealer, preformed plastic gaskets or flexible, watertight, rubber-type gaskets conforming to the requirements of Article M.08.01. Portland cement mortar shall not be used for sealing pipe joints except by permission of the Engineer, and if permitted shall conform to the requirements of Article M.11.04.

When cold-applied bituminous sealer is used, the bell and spigot or tongue and groove pipe shall be wiped clean and dry before applying the bituminous sealer to the pipe joint. Before the pipes are placed in contact with each other, the spigot or tongue end shall be completely covered with an excess of bituminous sealer; then the pipe shall be laid to line and grade so the inside surface of the abutting pipes are flush. The joints shall be completely filled with bituminous sealer. All excess joint sealant shall be removed from inside of the pipe.

Metal pipe and pipe-arches shall be carefully jointed and firmly clamped together by approved connecting bands which shall be properly bolted in place before any backfill is placed.

Bituminous fiber and asbestos cement pipe shall be joined by use of coupling bands of the same material as the pipe.

Corrugated structural plate pipe, plate-arches and plate pipe-arches shall be constructed in conformity with the plans, or as ordered, shall be true to lines and grades given, and shall have a protective bituminous coating applied by an approved method on the inside and outside of the plates. The coating material shall meet the requirements of Subarticle M.08.01-5. Before applying the coating, the metal shall be cleaned to the extent possible of all dust, dirt, oil, unbonded or incompatible paint, grease, acids, alkalies or other foreign matter.

If so ordered by the Engineer, any pipe which is not in true alignment, or which shows any settlement or distortion after laying, shall be taken up and relaid or corrected, to the satisfaction of the Engineer without additional compensation.

Where indicated on the plans or directed by the Engineer, existing pipe culverts shall be taken up and relaid or extended and renewed in the same manner as specified herein for new pipe culverts.

Where shown on the plans or directed by the Engineer, the Contractor shall connect the proposed drainage system with existing drainage structures or pipes. This work shall be performed in a workmanlike manner.

Where shown on the plans or directed by the Engineer, the Contractor shall plug existing pipes with cement masonry.

For Slotted Drain Pipe: All slotted drain pipe and related fittings shall be handled and assembled in accordance with the manufacturer's instructions except as modified in the contract documents or as ordered by the Engineer.

Placement of concrete shall conform to Article 6.01.03. The Contractor shall ensure all voids are filled with the concrete.

Care shall be taken in placing concrete backfill immediately adjacent to the interceptor drain pipes to avoid damage to the pipe and to prevent pipe misalignment. The concrete shall be thoroughly consolidated using internal vibrators. Sufficient hold downs shall be provided by the Contractor to prevent the interceptor drain from floating during concrete placement.

The Contractor shall make sure the surface of the concrete shall be sloped towards the slotted drain pipe detailed in the contract documents. The Contractor shall provide a suitable cover for the wall openings to prevent the concrete backfill or any other foreign debris from entering the pipe or sealing the opening during the installation and subsequent curing periods.

Transverse contraction joints shall be either formed or sawed in the concrete backfill at 6 m intervals unless the concrete abuts concrete curbs. In this case, the transverse joints shall be 9 mm wide and 65 mm deep. Sawing shall be done within 24 hours after placement. Care shall be taken not to saw into the interceptor drain pipe.

One expansion joint shall be provided in the concrete backfill for every 150 m of continuous interceptor drain pipe installed or at every location where the concrete backfill abuts a drop inlet, manhole, or other similar structure. This joint shall be formed for the full depth of the backfill concrete and shall be a minimum of 19 mm in width.

A longitudinal joint shall be provided if the concrete backfill is placed adjacent to a concrete pavement. This joint shall be either formed or sawed 6 mm wide and 65 mm deep. Finish of concrete will be similar to burlap drag finish.

After curing, the transverse, expansion, and longitudinal joints shall be thoroughly cleaned to remove any contaminants or laitance remaining from forming or saw cutting. Before sealing, a backer rod bond breaking material such as closed cell polyurethane rod shall be placed so that a sealer width to depth ratio of 1:1 will be achieved. The joints shall then be sealed with an elastomeric polymer sealer. The methods and materials used to construct the various joints shall be chosen by the Contractor subject to the approval by the Engineer.

Movement of construction equipment and all other vehicles and loads over and adjacent to any slotted drain pipe shall be done at the Contractor's risk. Any pipe or backfill which becomes damaged or disturbed through any cause shall be replaced or repaired as directed by the Engineer at the expense of the Contractor and at no cost to the State. Suitable temporary crossovers consisting of steel plate or other materials approved by the Engineer shall be employed for a minimum of 7 days following concrete backfill operations in all areas where vehicular traffic must be maintained or until such time as the pipe installation will withstand loading without damage. All concrete surfaces shall receive a protective coating.

End cap installation shall be as recommended by the manufacturer.

6.51.04--Methods of Measurement: This work will be measured for payments as follows:

1--New and Re-laid Pipe Culverts and Pipe-Arch Culverts will be measured for payment by the actual number of meters of pipe or pipe-arch of the various sizes and types, completed and accepted and measured in place along the invert. Coupling bands and fittings for culvert pipe and pipe-arches will not be measured for payment.

Corrugated Metal Pipe Elbows (of the type and size specified) will be measured for payment by the actual number of meters of pipe elbows completed and accepted, based on 2 m per elbow, as shown on the plans. Coupling bands for elbows will not be measured for payment.

2--Corrugated Structural Plate Pipe will be measured for payment by the actual number of meters of pipe of the diameter specified, completed and accepted and measured in place along the invert.

3--Corrugated Structural Plate Arches and Pipe-Arches, being paid for on a lump sum basis, will not be measured for payment.

4--Excavation for Trench will be measured for payment in accordance with Article 2.05.04.

5--Gravel Fill will be measured for payment in accordance with Article 2.13.04.

6--Bedding Material will be measured for payment by the actual number of cubic meters completed and accepted, measured within the payment lines as shown on the plans or as ordered by the Engineer. The volume of the pipe will not be included in the measurement.

7--There will be no measurement for payment for the cost of connecting proposed drainage systems with existing systems, but the cost thereof shall be included in the contract unit price per meter for the size and type of pipe being installed. Excavations necessary for such work will be considered as trench excavation and will be measured for as such.

8--There will be no measurement for payment for the cost of plugging existing pipes.

9--Slotted Drain Pipe or Temporary Slotted Drain Pipe shall be measured in meters along the top centerline, including elbow, as designated on the plans or as directed by the Engineer.

6.51.05--Basis of Payment: This work will be paid for as follows:

1--New Pipe Culverts and Pipe-Arch Culverts will be paid for at the contract unit price per meter for pipe or pipe-arch of the type and size specified, complete in place, including all materials, equipment, tools and labor incidental thereto.

Corrugated Metal Pipe Elbows will be paid for at the contract unit price per meter for "Corrugated Metal Pipe Elbow" of the type and size specified, complete in place, including all materials, equipment, tools and labor incidental thereto.

2--Re-laid Pipe Culverts and Pipe-Arch Culverts will be paid for at the contract unit price per meter for re-laid pipe or pipe-arch of the type and size actually re-laid, complete in place, including all materials, equipment, tools, labor and work incidental thereto.

3--Corrugated Structural Plate Pipe will be paid for at the contract unit price per meter for pipe of the size specified, complete in place, including all material, protective coating, equipment, tools, labor and work incidental thereto.

4--Corrugated Structural Plate Arches and Pipe-Arches will be paid for at the contract lump sum price for "Corrugated Structural Plate Arch" or "Corrugated Structural Plate Pipe-Arch" of the dimension specified, complete in place, including all materials, protective coating, supporting channels, equipment, tools, labor and work incidental thereto. Excluded therefrom shall be work and materials entering into the construction of masonry foundations.

5--Trench Excavation will be paid for in accordance with Article 2.05.05 at the contract unit price per cubic meter for "Trench Excavation" of the applying depth.

6--Gravel Fill will be paid for in accordance with Article 2.13.05.

7--Bedding Material will be paid for at the contract unit price per cubic meter for "Bedding Material," complete in place, which price shall include all materials, tools, equipment and labor incidental thereto.

8--There will be no direct payment for the plugging of existing pipes, but the cost thereof shall be included in the contract unit prices of the drainage and excavation items.

9--Slotted Drain Pipe or Temporary Slotted Drain Pipe will be paid for at the contract unit price per meter for "Slotted Drain Pipe" or "Temporary Slotted Drain Pipe" of the size specified, complete in place, which price shall include all excavation, pipe, saw cutting, end caps, elbows, concrete, protective coating, grate, and all materials, tools, equipment, and labor incidental thereto.

In addition, if **Temporary Slotted Drain Pipe** is required, as shown on the plans, the contract unit price shall include the removal and disposal of the pipe and concrete backfill, including excavation and all materials, tools,

equipment and labor incidental thereto to permit the construction of the permanent structures and/or pavement. The price shall also include any repair of receiving drainage structures subsequent to the removal of the slotted drain pipe outlet.

Pay Item	Pay Unit
(Size and Type) Pipe (Thickness)	m
(Size) C.C.M. Pipe-Arch (Thickness)	m
(Size and Type) Corrugated Metal Pipe Elbow	m
(Size) Corrugated Structural Plate Pipe (Thickness)	m
(Size) Corrugated Structural Plate Arch	L.S.
(Size) Corrugated Structural Pipe-Arch	L.S.
Re-laid Pipe (Type and Size)	m
Re-laid Pipe-Arch (Type and Size)	m
Bedding Material	m ³
(Size) Slotted Drain Pipe	m
(Size) Temporary Slotted Drain Pipe	m