

Specification For Installing Pipe Culverts - 5000

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1 DESCRIPTION

- 1.1 The Work shall consist of various types and sizes of helical corrugated steel pipe (CSP) culverts, reinforced concrete pipe (RCP) culverts and high density polyethylene (HDPE) pipe culverts installed by open excavation at locations and in conformity with the lines and grades shown on the Plans or designated by the Engineer.
- 1.2 This specification does not cover the installation of spiral rib steel pipe culverts, structural plate corrugated steel pipe culverts, smooth wall steel pipe culverts, steel liner plate and drain pipes for subsurface drainage.

2 MATERIALS

- 2.1 The Contractor shall supply the culvert material, including but not limited to the culvert, couplers (including all mounting hardware, geotextile fabric and gaskets as required), applicable end treatments and culvert markers.
- 2.2 The following requirements shall apply:
 - 2.2.1 For geotextile fabrics:
 - 2.2.1.1 Comply with the requirements of SMM 1101 in the Specifications For Manufactured Materials Manual.
 - 2.2.2 For CSP culverts:
 - 2.2.2.1 Comply with the requirements of SMM 701 in the Specifications For Manufactured Materials Manual.
 - 2.2.2.2 Minimum thickness of 2.0 mm or as indicated in the Special Provisions.

- 2.2.2.3 68 mm x 13 mm corrugations for culverts 1 200 mm or less in diameter.
- 2.2.2.4 125 mm x 25 mm corrugations for culverts greater than 1 200 mm in diameter.
- 2.2.2.5 Unless otherwise specified in the Plans or Special Provisions, the minimum segment length shall be as specified in HM614-01 in the Hydraulic Manual.
- 2.2.2.6 Annular recorruagated ends.
- 2.2.2.7 Separate segments shall be joined with external corrugated band couplers. The couplers shall comply with the following:
 - 2.2.2.7.1 Minimum thickness of 1.6 mm.
 - 2.2.2.7.2 Corrugations same as ends of adjacent culvert segments.
 - 2.2.2.7.3 Minimum of 5 standard coupler connecting bolts per coupler segment.
 - 2.2.2.7.4 Minimum width of 600 mm.
- 2.2.2.8 All CSP culverts with a diameter of 1 500 mm and greater shall have match marks painted during manufacturing to ensure proper field installation of cut end segments.
 - 2.2.2.8.1 Match marks shall consist of a horizontal line on the outside of the CSP culvert, as well as transposed to the inside of the CSP culvert (double marked).
 - 2.2.2.8.2 For multiple CSP culvert installations, each culvert shall be marked with an individual installation number.
- 2.2.3 For RCP culverts:
 - 2.2.3.1 Comply with the requirements of the most recent edition of ASTM Specification C76M.
 - 2.2.3.2 Minimum 1.8 m segment length.

- 2.2.3.3 A CL-750 design vehicle shall be used in the determination of live load in the design procedure for the selection of pipe strength.
- 2.2.3.4 The Contractor shall provide the Engineer with the class, wall type and concrete strength for the RCP culvert to be installed at each location.
 - 2.2.3.4.1 The Contractor shall obtain a copy of certification from the supplier showing the material has appropriate structural strength and is appropriate for the location and installation method. The certification must be signed by a Professional Engineer.
- 2.2.3.5 Standard rubber gaskets complete with the necessary lubricant shall be installed at the culvert joints on culverts installed through Roadway embankments. The gaskets shall comply with the following:
 - 2.2.3.5.1 The requirements of the most recent edition of ASTM Specification C443M.
- 2.2.4 For HDPE pipe culverts:
 - 2.2.4.1 Culverts shall be open or closed profile with smooth interiors.
 - 2.2.4.2 Comply with the requirements of the most recent edition of CSA Standard B182.8.
 - 2.2.4.3 Pipe stiffness of 320 kPa at 5% deflection for pipe sizes up to and including 900 mm.
 - 2.2.4.4 Type 1 (watertight) joints.
 - 2.2.4.5 Minimum 6 m segment length.
 - 2.2.4.5.1 Acceptance of alternate HDPE segment lengths will be as approved by the Engineer.
 - 2.2.4.6 All culverts supplied shall be clearly marked with the following information at intervals of not more than 3 m:
 - 2.2.4.6.1 Manufacturer's name or trademark.

- 2.2.4.6.2 Nominal diameter.
- 2.2.4.6.3 Material designation and cell class: 424420C.
- 2.2.4.6.4 Pipe stiffness.
- 2.2.4.6.5 Standard designation.
- 2.2.4.6.6 Date of manufacture and plant designation.

2.2.5 For culvert markers:

- 2.2.5.1 Comply with requirements of SMM 706 in the Specifications For Manufactured Materials Manual.

2.3 The Contractor may be allowed to use good condition salvaged culvert materials, as deemed acceptable by the Engineer, for field approach culvert installations.

2.4 The Contractor may elect to supply and install the equivalent size CSP culvert, RCP culvert or HDPE pipe culvert to that shown on the Plans. The culvert equivalencies shall be as follows:

CSP Culvert Diameter* (mm)	Minimum Equivalent RCP Culvert or HDPE Pipe Culvert Diameter* (mm)
500	450
600	600
700	600
800	750
900	900
1 000	900
1 200	1 200
1 400	1 350
1 500	1 500

* All diameters shown are inside culvert diameters.

2.5 The minimum inside diameter of new culverts installed through Roadway embankments shall be as follows:

2.5.1 800 mm diameter for CSP culverts.

2.5.2 750 mm diameter for RCP culverts and HDPE pipe culverts.

2.6 The minimum size of all culvert types installed through median crossings shall be 600 mm.

3 CONSTRUCTION

- 3.1 The location, elevation, and excavation for the culvert will be staked by the Engineer.
- 3.2 The excavation for the culvert and the culvert bed shall be in accordance with Specification 2200 For Earth Excavation and/or Specification 2250 For Rock Excavation.
 - 3.2.1 The Work shall be completed to the lines, grades, and dimensions as shown on the Plans, or as designated by the Engineer.
 - 3.2.2 Unless otherwise specified in the Plans or Special Provisions, the excavated slope shall be in accordance with the following:
 - 3.2.2.1 8:1 for excavations ≤ 2 m.
 - 3.2.2.2 For excavations > 2 m and < 4 m, maintain the distance between the toe and top of excavated slope at 16 m.
 - 3.2.2.3 4:1 for excavations ≥ 4 m.
- 3.3 The culvert shall be installed on the prepared bed to the lines, grades, and dimensions shown on the Plans, or as designated by the Engineer.
 - 3.3.1 The bedding depth and material type requirements shall be in accordance with the manufacturer's specifications and be shown on Project specific Plan(s) to be approved by the manufacturer's engineer for the following culvert installations:
 - 3.3.1.1 All HDPE pipe culvert installations.
 - 3.3.1.2 All RCP culvert installations.
 - 3.3.2 At all couplings and joint areas and at areas of concrete pipe that have external bells, depressions shall be constructed in the culvert bed so that the pipe is uniformly supported along its entire length.
 - 3.3.3 Blocking shall not be used to bring HDPE pipe culverts to grade.
- 3.4 RCP culverts shall be placed starting at the downstream or lower end of the culvert, with the bell or grooved ends of the segments pointing upgrade.
 - 3.4.1 Joints shall be as tight as possible.

- 3.5 The ends of CSP culverts shall be separated as per the manufacturer's specifications to achieve a proper fit for the coupler.
 - 3.5.1 All CSP culverts with a diameter of 1 500 mm and greater shall be installed as per manufacturer's match marks to ensure the cut ends match the same position as they were prior to being cut during manufacturing.
- 3.6 The Contractor shall repair or remove damaged ends of existing culverts prior to the installation of culvert extensions. The Engineer will approve the means of coupling the culvert extension to the existing culvert prior to installation of the culvert extension.
 - 3.6.1 The culvert extensions shall be the same material type as the culvert being extended.
 - 3.6.2 The minimum extension length of CSP culvert shall be 4 m for pipe diameters up to and including 1 800 mm. For CSP culverts with a diameter greater than 1 800 mm, the extension length shall be determined by the Engineer based on site specific considerations. If the extension length required is less than 4 m or the required length as determined by the Engineer for culverts with a diameter greater than 1 800 mm, a sufficient length of the existing culvert shall be cut-off to match the extension design length and disposed of.
 - 3.6.2.1 If the remaining length of existing culvert back to the last joint is less than 4 m, the entire last segment of existing culvert shall be removed and disposed of.
 - 3.6.2.2 All cut edges shall be made smooth by grinding so that all of the burrs are removed. Any damaged protective coating shall be recoated with appropriate material in accordance with CSA Standard G401.
- 3.7 All CSP couplers and the culvert joints on RCP culverts installed through Roadway embankments shall be wrapped with a non woven geotextile fabric. The geotextile fabric wrapping shall comply with the following:
 - 3.7.1 The width of the wrap shall be a minimum of 2.3 m (one-half of a standard roll width).
 - 3.7.2 The wrap shall be overlapped a minimum of 0.3 m such that the end of the overlap is facing down at the side of the coupler/joint.
 - 3.7.3 The wrap shall be mechanically held in place until backfilled.

- 3.8 The backfill requirements shall be in accordance with the manufacturer's specifications and be shown on Project specific Plan(s) to be approved by the manufacturer's engineer for the following culvert installations:
 - 3.8.1 All HDPE pipe culvert installations.
 - 3.8.2 All RCP culvert installations.
- 3.9 When granular material is used to construct the culvert bed or to backfill the culvert, an impervious and compacted clay seepage cut-off shall be constructed to the lines, grades and dimensions as shown on the Plans.
 - 3.9.1 The clay seepage cut-off shall extend to the full width of the excavation.
 - 3.9.1.1 The width of the clay seepage cut-off shall be the same as the width of the prepared culvert bed in fill sections.
 - 3.9.2 The Contractor shall supply the material for the clay seepage cut-off and bear the cost for exploring and developing sources, including but not limited to removing and replacing stripping and acquiring the necessary rights to take the material.
 - 3.9.3 The Contractor shall ensure that the clay seepage cut-off material does not become contaminated with granular materials.
- 3.10 When crushed aggregate is required to be compacted, it shall be compacted to not less than 95% of the maximum dry density as determined in accordance with STP 205-5 for Moisture-Density Standard Proctor.
 - 3.10.1 If the moisture content in the crushed aggregate material is insufficient for compacting to the specified density, the Contractor may elect to add water. The water shall be added in accordance with Specification 2500 For Watering.
 - 3.10.2 If excess moisture exists in the crushed aggregate material, it shall be dried to the optimum moisture content as determined in accordance with STP 205-5 for Moisture-Density Standard Proctor.
- 3.11 The embankment, within three diameters or three spans of the culvert barrel, shall be free from rocks having a dimension of 80 mm or greater when measured in any direction.
- 3.12 Each layer of earth embankment required to backfill the culvert and to backfill the excavation required to remove the existing culvert(s) shall be dried to at least the

optimum moisture content and compacted to not less than 100% of the maximum dry density as determined in accordance with STP 205-5 for Moisture-Density Standard Proctor.

- 3.12.1 For fill sections, the compaction zone shall extend to 10 m beyond the culvert barrel.
- 3.13 The density for the earth embankment, crushed aggregate and granular backfill material will be determined in accordance with STP 205-7 for Density-In-Place By Nuclear Gauge.
- 3.14 The diameter or the span and rise of CSP culverts and HDPE pipe culverts shall not vary from the manufactured dimensions by more than 5% during cover and backfill placing operations.
 - 3.14.1 If the distortion is greater than 5% the culvert installation will be rejected.
- 3.15 Various culverts and culvert extensions may not have the minimum cover specified for the culvert. The Contractor shall take necessary precautions to prevent damage to these culverts. The Contractor may follow Hydraulic Manual Section HM 701-01 as a guideline.
- 3.16 The Contractor shall repair or replace, at no direct expense to the Ministry, any culvert damaged by their operations.
- 3.17 On divided highways, flared end treatments shall be installed at the following locations:
 - 3.17.1 Through grade culverts up to 2 400 mm diameter – median end only.
 - 3.17.2 Median crossing culverts (RCP only) – both ends.
- 3.18 On divided highways, sloping end treatments with a slope of 6:1 shall be installed at the following locations:
 - 3.18.1 Median crossing culverts (CSP and HDPE pipe) – both ends.
 - 3.18.2 Safety bars shall be used on end treatments larger than 800 mm diameter in accordance with Hydraulic Manual Section HM 608-00.
- 3.19 The Contractor shall clean out the entire length of all new and existing culverts.
- 3.20 The Contractor shall supply and install culvert markers on the inlet and outlet ends of all culverts as directed by the Engineer.

4 MEASUREMENT

4.1 Measurement for the supply and installation of culverts will be made in metres. Measurements will be taken along the invert, including end treatments, parallel to the barrel of the culvert.

4.2 For the purpose of this specification, culvert groups are defined as follows:

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| Group I | This group will include all sizes of CSP culverts up to and including a diameter of 610 mm and approved equivalent culverts. |
| Group II | This group will include all sizes of CSP culverts greater than a diameter of 610 mm and up to and including a diameter of 1 000 mm and approved equivalent culverts. |
| Group III | This group will include all sizes of CSP culverts greater than a diameter of 1 000 mm and up to and including a diameter of 1 600 mm and approved equivalent culverts. |
| Group IV | This group will include all sizes of CSP culverts greater than a diameter of 1 600 mm and up to and including a diameter of 2 400 mm and approved equivalent culverts. |
| Group V | This group will include all sizes of CSP culverts greater than a diameter of 2 400 mm and approved equivalent culverts. |

5 PAYMENT

5.1 Payment for Supply And Install Culverts will be at the contract unit price per metre for the group specified in the Bid Form. The contract unit price will be full compensation for completing the Work, except for those activities for which specific provision for payment is made in this section.

5.2 If the Contract includes a Bid Item for:

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| 5.2.1 | Earth Excavation, payment will be made in accordance with Specification 2200 For Earth Excavation. |
| 5.2.2 | Rock Excavation, payment will be made in accordance with Specification 2250 For Rock Excavation. |
| 5.2.3 | Disposal Of Surplus Rock, payment will be made in accordance with Specification 2320 For Disposal Of Surplus Rock. |

- 5.2.4 Watering On The Road Including Hauling, payment will be made in accordance with Specification 2500 For Watering.
- 5.2.5 Granular Backfill In Place, payment will be made in accordance with Specification 6600 For Granular Backfill.