

SPECIFICATIONS FOR ERECTION OF
PRECAST REINFORCED CONCRETE BOX CULVERTS

1046. 1. DESCRIPTION

The work will include:

- (a) The delivery and erection of precast concrete box culvert units, the delivery and installation of the strand, anchorages and other incidental material, the stressing of the strands and the supply and installation of insulation and other incidental materials not noted specifically herein but which are required to complete the work.
- (b) Excavating, dewatering and preparing the base of the excavation for the concrete box culverts; supplying, placing and compacting granular fill; and backfilling of the culvert as shown on the plans.

1046. 3. SUPPLY OF MATERIALS

3.1 Material to be Supplied by the Minister

The culvert units, strand, anchorages and other material incidental to fabrication will be supplied by the Minister f.o.b. Contractor's truck at the supplier's yard in Winnipeg. The Bridge Contractor shall give the Supplier (Precast Contractor) 48 h notice of its intention to pick up the culvert units and shall co-operate with the Precast Contractor as to the loading procedure.

3.2 Material to be Supplied by the Contractor

3.2.1 Insulation

Insulation shall be in accordance with the specification as shown on the plans.

3.2.2 Granular Fill

Granular fill shall: (i) consist of tough, durable pebbles or rock fragments, sand and fine soil particles, (ii) conform to the following grading requirement:

Passing 75 mm sieve	100%
Passing 4.75 mm sieve	45 - 70%
Passing 75 um sieve	5 - 15%

3.2.3 Incidental Material

Incidental materials will be subject to the approval of the Engineer.

3.3 Replacement of Damaged Materials

All culvert units or other material supplied by the Minister which, in the opinion of the Engineer, has been damaged or otherwise rendered unusable by improper storage or handling by the Contractor shall be replaced by the Contractor at his own expense.

1046. 7. CONSTRUCTION METHODS

7.1 Handling and Erection

The precast concrete units shall be picked up only by the lifting devices and such devices shall be cut off flush after the units are in place.

All units shall be placed tight against each other. Care shall be exercised to prevent dirt from falling in between the units. All dirt, which does fall in between the units, shall be removed prior to stressing.

In cases where insulation is not specified and the boxes are to be erected directly on the base of the excavation or on granular backfill material, the Contractor shall place a 1.0 m wide strip of heavy building paper under every joint in the culvert in order to prevent the entrance of foreign material into the joints during erection and stressing.

7.2 Excavation

The Contractor shall excavate the base of the excavation to the limits of excavation and to such depths below the invert elevations as shown on the plans. The length of the base shall extend 1.25 m beyond each end of the culvert and the excavation shall be transitioned to meet the existing channel slopes. If cutoff walls are shown on the plans, the excavations for them shall be done "neat" to the given dimensions of these walls. The excavation shall be dewatered in order to prevent disturbing the natural soil conditions at the base of the excavation and to allow for the placing and compacting of the granular fill in the dry.

Dewatering shall be accomplished by constructing cutoff trenches around the outside perimeter of the culvert bed and by excavating sump pits to a depth of not less than 1.0 m below the bottom of the culvert base, or by other means subject to the Engineer's approval. When trenches and sump pits are used, the excavation shall be shored or braced with cribs to permit pumping. The ground water shall be lowered at least 0.5 m below the base of the excavation.

The slopes or sides of the excavation where backfilling is required shall be shored or stepped subject to the Engineer's approval.

Equipment used for excavation or backfilling purposes may travel or move on the base of the excavation only if it is of such a nature that the base of the excavation is not disturbed. All additional excavation and backfilling required, as a result of improper equipment being used for excavation or backfilling purposes, shall be done at the Contractor's expense.

The excavated base shall be inspected by the Engineer prior to the Contractor being allowed to continue with any further operations. In the event that the Engineer deems further excavation to be required below the bottom of the excavation line shown on the plans, the Contractor shall excavate such additional materials as directed by the Engineer.

The work involved in doing this additional excavating will be classed as Extra Work and will be paid for as such in accordance with the General Conditions.

Excavated material not required for backfill or deemed to be unsuitable backfill material by the Engineer, will be classed as "Surplus Material".

Unless otherwise shown on the plans or specified in the Special Provisions, "Surplus Material" shall become the property of the Contractor and shall be removed by him, from the right-of-way.

1046. 7. CONSTRUCTION METHODS (Cont'd)

7.3 Backfill

The limits and type of backfill material shall be as shown on the plans.

Granular backfill shall be deposited in horizontal, uniform and even layers not exceeding 150 mm before compaction, and each layer shall be compacted to a relative compaction of not less than 95% Standard Proctor.

The quantity of granular backfill shown in the tender is only an estimate. The final quantity may be smaller or greater than that shown.

Backfill, other than granular, shall be deposited in horizontal, uniform and even layers not exceeding 300 mm, before compaction, and each layer shall be compacted to a relative compaction of not less than 90% Standard Proctor.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacements or which may damage the installation, shall not be used. The use of equipment such as sheepfoot, wobbleys, or other equipment of a similar weight and nature, will not be allowed within 1.0 m of the sides of the culvert or on top of the culvert if the backfill cover is less than 300 mm.

7.4 Insulation

The Insulation shall be: (i) installed as shown and described on the plans, and (ii) wrapped completely in a layer of 150 um polyethylene.

7.5 Stressing

The Contractor shall provide the Engineer with the following at least 7 days prior to the start of stressing operations:

- (a) A copy of all strand elongation calculations, sealed and signed by a Professional Engineer registered with the Association of Professional Engineers of the Province of Manitoba, as well as all data required for the checking of these calculations.
- (b) A calibration graph for each jack to be used in the stressing operation.
- (c) The anchorage losses experienced by the Contractor under similar loading application.

The submission of the stressing calculations to the Engineer shall in no way relieve the Contractor of the full responsibility for the success or failure of the stressing operations.

The stressing of the post-tensioning strands shall be done under the supervision of experienced personnel.

The initial force in each strand shall be as shown on the plans or as specified by the Engineer. Prior to the stressing of the strands to the initial force, a 4.0 kN preload shall be applied to each strand to eliminate slack and equalize stresses.

The Contractor shall keep a log of the actual gross and net elongations, the actual anchorage losses, and the actual jack pressures for the strands, a copy of which shall be submitted to the Engineer upon completion of the stressing.

1046. 7. CONSTRUCTION METHODS (Cont'd)

7.5 Stressing (Cont'd)

The final elongation shall be adjusted by the actual anchorage losses and the shortening of the out-to-out distance of the culvert as measured prior to the preloading and after the initial stressing. Initial stressing shall be deemed to have been reached once all strands are stressed to the calculated gross elongation.

A pre-calibrated pressure gauge, tensiometer or load cell shall be used as a check on the elongation. Their accuracy shall be verified by the Contractor whenever the Engineer considers it necessary.

At no time shall the jack pressure exceed the pressure corresponding to the calculated gross elongation by more than 5%. If the required gross elongation is not obtained by stressing to this maximum allowable jack pressure at one end of the culvert, it will be necessary to complete the stressing from the other end of the culvert. The final net elongation of the strand shall not vary from the calculated net elongation by more than 3 mm.

Tensioning shall be carried out in a manner such that the jack is coaxial with the strand. Care shall be taken to ensure that unravelling of the strand does not take place.

The ends of the strands shall not be cut off before the Engineer is satisfied that the stressing of the cables has been completed satisfactorily and permits the ends of the strands to be cut off. Methods for cutting off strands which might cause damage to the cables and anchorages will not be permitted.

7.6 Recesses

Recesses for the post-tensioning anchorages shall be patched with mortar or a non-shrink grout of a type subject to the Engineer's approval. Mortar shall consist of water and one part of cement to three parts of clean, fine sand passed through a 6.7 mm sieve. Before patching, recesses shall be cleaned by abrasive blast to remove all dirt and residue which is not bonded firmly to the metal or concrete surfaces. The recesses shall be coated with an approved epoxy resin and then patched immediately. Patched areas shall be rubbed flush with the surface of the units after the mortar has hardened. After the mortar or grout has cured, the patched areas shall be coated with a waterproofing compound meeting the approval of the Engineer.

1046. 9. METHOD OF MEASUREMENT

- (a) The delivery and erection of precast reinforced concrete box culverts will be measured on a unit basis, and the number to be paid for will be the total number of units placed in position and accepted by the Engineer.

No extra allowance will be made for the delivery and installation of the anchorages, strands, and other incidental materials, the supply and installation of the insulation and other incidental materials or for the stressing of the strands, all of which will be considered to be included in the Contract Unit Price for "Erection of Precast Reinforced Concrete Box Culverts."

1046. 9. METHOD OF MEASUREMENT (Cont'd)

- (b) Excavation will be paid for on a lump sum basis and no measurements will be taken for this work.

All costs resulting from the dewatering of the excavation and the disposal of excavated surplus material shall be included in the Contract Lump Sum Price for "Lump Sum Excavation" and no additional compensation will be allowed, except as noted in section 7.2.

- (c) Backfill, other than granular fill, will be paid for on a lump sum basis and no measurements will be taken for this work.
- (d) Granular backfill will be measured in cubic metres of material delivered to the area being backfilled at the time of placing. The capacity of vehicles hauling granular backfill will be derived from measurements made by the Engineer. These measurements will be used to establish the box capacity to the nearest 0.1 m^3 and the capacity of a vehicle box so determined shall not be changed while in use on the project without the consent of the Engineer. Loads shall be measured at the point of dumping at the site. The Contractor shall level all loads before they are measured by the Engineer. Measurements will not be made for material heaped above the water level capacity of the box and deductions will be made in 0.1 m^3 increments for loads which do not contain full water level capacity.

1046. 11. BASIS OF PAYMENT

- (a) Erection of precast reinforced concrete box culverts will be paid for at the Contract Unit Price for "Erection of Precast Reinforced Concrete Box Culverts", measured as specified herein, which price will be payment in full for performing all operations herein described for erecting culverts and all other items incidental to the work included in this Specification.
- (b) Excavation will be paid for at the Contract Lump Sum Price for "Lump Sum Excavation", which price will be payment in full for performing all operations herein described for excavation and all other items incidental to the work included in this Specification.
- (c) Backfill, other than granular backfill, will be paid for at the Contract Lump Sum Price for "Lump Sum Backfill", which price will be payment in full for performing all operations herein described for this class of backfill and all other items incidental to the work included in this Specification.
- (d) Granular backfill will be paid for at the Contract Unit Price per cubic metre for "Supplying and Placing Granular Backfill", measured as specified herein, which price will be payment in full for performing all operations herein described for this class of backfill and all other items incidental to the work included in this Specification.