

SPECIFICATIONS FOR LATERAL STRESSING,
PLACING OF ANCHOR RODS AND MISCELLANEOUS GROUTING

1042. 1. DESCRIPTION

The work will consist of:

- (a) The delivery and installation of cables and anchorages for lateral stressing, the stressing and grouting of all cables and the supply of all materials for the grouting of the cables.
- (b) The placing of anchor rods and supplying all materials for, and the grouting of, keys, anchor rods, dowel holes and lateral connection recesses.

1042. 3. SUPPLY OF MATERIALS

3.1 Materials to be Supplied by the Minister

The stressing strands, anchorages and other incidental materials for lateral stressing will be supplied to the Contractor by the Supplier of the precast prestressed girders, f.o.b. Contractor's truck at the supplier's yard in Winnipeg. The anchor rods will be supplied with the miscellaneous metal at the source of supply specified in the Special Provisions.

3.2 Materials to be Supplied by the Contractor

- (a) High early-strength cement, and Portland cement.
- (b) Clean water.
- (c) Mastic filler and waterproofing compound of a type approved by the Engineer.
- (d) Clean, fine sand.
- (e) Non-shrink grout of a type approved by the Engineer.
- (f) Oakum.

1042. 7. CONSTRUCTION METHODS

7.1 General

The installation, stressing and the grouting of lateral stress cables shall be done under the supervision of experienced personnel.

7.2 Stressing

The Contractor shall submit to the Engineer the following at least 7 d prior to the start of stressing operations:

- (a) Copies of all strand elongation calculations, as well as all data required for checking these calculations.
- (b) A calibration graph for each jack to be used in stressing operations.

1042. 7. CONSTRUCTION METHODS (Cont'd)

7.2 Stressing (Cont'd)

(c) Anchorage losses experienced by the Contractor under similar loading applications.

Elongation calculations shall be prepared by a Registered Professional Engineer and the required submission shall be sealed by a Registered Professional Engineer.

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

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 5.0 kN load shall be applied to each strand to eliminate slack and equalize stresses.

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

A pre-calibrated pressure gauge, tensionmeter 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 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 side of the structure, it will be necessary to complete the stressing from the other side. 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 cable or strand. If strands are tensioned individually, care shall be taken to ensure that unravelling of the strands does not take place.

The Contractor shall measure the out-to-out width of the girders prior to and after stressing operations, and shall re-stress each strand by the amount corresponding to the reduction in width.

Lateral stressing must be done prior to the placing of curb concrete.

After the completion of stressing operations, the ends of the anchorages shall be plugged temporarily to prevent the entry of debris and moisture into the ducts. Ends of the strands shall not be cut off before the Engineer is satisfied that stressing of the cables has been completed satisfactorily and permits the ends of the strands to be cut off. Methods for cutting off the strands which might cause damage to the cables and anchorages will not be permitted.

7.3 Grouting of Stress Cables

Grout shall have a compressive strength of 40.0 MPa at 28 d and shall consist of high early-strength cement and water.

Water-cement ratio of the grout shall be kept in the range of 0.45 and 0.55 and the grout shall have between 3% to 5% entrained air.

1042. 7. CONSTRUCTION METHODS (Cont'd)

7.3 Grouting of Stress Cables (Cont'd)

Admixtures to be used in concrete or grout must be approved by the Engineer. Before approval will be given, the Contractor shall satisfy the Engineer that the admixture to be used will have no adverse effect on the high-strength strand.

Grout shall be mixed preferably in a colloidal grout mixer of the roller type or a high speed stirring mixer capable of operating from 1,800 to 2,900 r.p.m. Mixing shall be done at high speeds for 2 min. followed by slow agitation until the grout is used up.

Immediately prior to grouting each duct, compressed air shall be forced through the duct. The compressor shall be equipped to ensure that air blown through the ducts is clean and, in particular, oil free. During the forcing of air through a duct, the Contractor shall inspect carefully the opposite end of the duct to ascertain that there is a free flow of clean air through each duct.

If required, spaces between the units shall be sealed to prevent loss of grout.

From the mixer, the grout shall pass through a strainer into positive displacement grouting pumps equipped with a recirculating device for use when the grout is not being injected.

Grouting shall be carried out quickly, completely filling a given duct within 30 min. after the cement and water are first brought together.

Sufficient grout shall always be available so that each duct can be grouted completely in one operation. A generous allowance shall be made for wastage. If, for any reason, a sufficient grout is not available to complete the grouting of a duct, grout already in the duct shall be forced out and the duct cleaned out completely with water and compressed air.

Grouting pressure shall be sufficiently high to cause a stream of grout to issue freely at the open end of the duct.

The Contractor shall supply and install grout fittings at the grouting anchorage and open anchorage, capable of maintaining the grout in the duct under pressure, from the time the duct has been filled with grout until the grout has set.

Grout shall be pumped through the duct and wasted continuously at the open anchorage until no visible slugs of water or air are ejected. Once a steady stream of pure grout is evident at the open anchorage, the grout fitting of this anchorage shall be closed and the pumping pressure shall be held for thirty seconds. Grout fittings of the grouting anchorage shall then be closed while maintaining this pressure.

After the grout has set, all grout fittings shall be cut off inside the recesses and the recesses shall be filled with mortar as specified in Section 7.4 of these Specifications.

7.4 Recesses

Recesses for the anchorage shall be patched with mortar after the grout has set. Mortar shall consist of water and one part of cement to three parts of clean, fine sand passed through a 6.7 mm sieve.

1042. 7. CONSTRUCTION METHODS (Cont'd)

7.4 Recesses (Cont'd)

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. Without delay, the recess shall be coated thoroughly with an approved epoxy resin and then patched immediately with mortar. Patched areas shall be rubbed flush with the surface of the girders after the mortar has hardened.

7.5 Placing and Grouting of Anchor Rods

After the girders have been erected and laterally stressed, the Contractor shall drill holes in the substructure unit to the size and depth as shown on the plans.

Drilling shall be done through holes already provided in the designated girders. The Contractor shall exercise utmost care not to damage the girders during drilling operations.

After the holes have been drilled and cleaned out by compressed air, anchor rods shall be placed and grouted as shown on the plans.

Cement grout shall be prepared as specified in Section 7.3 of this Specification.

7.6 Grouting of Keys Between Girders

When the roadway crown is built into the substructure units, the keys and joints on centreline of the structure or on each side of the centreline girder shall be grouted with non-shrink grout prior to lateral stressing. The crown creates a wedge type of gap between the vertical faces of these girders, therefore, sufficient grout must be used to fill the space between the girders, as well as the key. Oakum, if required, shall be placed only at the bottom of the gap in order to prevent leakage of grout from the joint at the bottom of the girders.

Grout for keys, other than as specified above, shall be in accordance with Section 7.4 of this Specification. Water shall be added to the ingredients to provide a dry, stiff mix with sufficient workability to fill completely all portions of the keys.

Keys between the remaining girders shall be grouted after the completion of lateral stressing and placing of the anchor rods. The bottoms of the keys shall be sealed with Oakum, if required, to prevent loss of grout. Girders shall be soaked thoroughly and kept moist for at least 12 h prior to the placing of grout.

Grouted keys shall be moist-cured for at least 72 h from the last placing of grout.

7.7 Grouting of Lateral Connection Recesses

After the precast girders have been erected and laterally connected, the lateral connection recesses and the anchor dowel holes shall be cleaned and maintained clean until they are grouted. After the anchor dowels have been installed, the recesses and dowel holes shall be filled with a non-shrink grout (cold weather grade if applicable). The grout shall not contain metallic aggregate.

Alternatively, and subject to the Engineer's approval, the Contractor may use cement grout as specified in Section 7.3 of this Specification to fill the dowel holes, and mortar as specified in Section 7.4 of this Specification to fill the recesses.

1042. 9. METHOD OF MEASUREMENT

- (a) The delivery and installation of cables and anchorages, lateral stressing, the supply of all materials for grouting and duct grouting operation will be paid for on a lump sum basis, and no measurement will be taken for this work.
- (b) The drilling of holes for anchor rods, the supply of all grouting material and grouting of keys, anchor rods, dowel holes and lateral connection recesses, will be paid for on a lump sum basis, and no measurement will be taken for this work.
- (c) The placing of anchor rods will be measured as per Section 9 of the "Specifications for Placing Miscellaneous Metal".

1042. 11. BASIS OF PAYMENT

- (a) The delivery and installation of cables and anchorages, lateral stressing, the supply of all materials for grouting and duct grouting operation will be paid for at the Contract Lump Sum Price for "Lateral Stressing", measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the work included in these Specifications.
- (b) Drilling holes for anchor rods, supplying grouting material and grouting of keys, anchor rods, dowel holes and lateral connection recesses will be paid for at the Contract Lump Sum Price for "Miscellaneous Grouting", measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the work included in these Specifications.
- (c) The placing of anchor rods will be paid for in accordance with Section 11 of the "Specifications for Placing Miscellaneous Metal".