SECTION 908

DOWELS

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908.01 SCOPE

The scope of this section is to cover the supply, material, fabrication and placement of dowels in substructure and superstructure where drilling and grouting of rock or existing structure is required.

Dowel is defined as a deformed coated reinforcing steel bar, reinforcing steel bar or stainless steel reinforcing bar placed into a hole of specified dimensions drilled into a concrete structure and bonded to the concrete by dowel adhesive.

Dowel Adhesive is defined as an epoxy or acrylic resin adhesive used to secure the dowel in concrete, rock or another material.

Dowel Grout is defined as a mixture of water cement, and sand used to secure a dowel in concrete, rock, or another material.

Dowel Type is defined as a dowel differentiated by bar size, embedment length, orientation of embedment and by bar material, such as 15M stainless steel reinforcing bar and 20M reinforcing steel bar.

Pull Test is defined as an in situ test consisting of the application of a specified tensile axial load for a specified time period to installed dowels selected for testing. As referenced

in Ontario Ministry of Transportation Publications: Pull Test Guide for Testing of Metallic Dowels, of Uncoated, Coated or Stainless Steel.

Lot is defined as any number of dowels installed within a 48 hour period or installed since the last round of pull testing, whichever period is shorter.

908.02 MATERIAL

The Contractor shall supply all the reinforcing steel used as dowels and dowel pins to be incorporated in the work. All reinforcing steel for dowels shall be in accordance with Section 905.

Dowels shall be new, clean, and free of deleterious material. Dowels shall be capable of sustaining the pull test loads specified in Table 1 without displacement for a time period of not less than 1 minute.

Dowel adhesive shall be epoxy or acrylic resin accepted by the Owner's Representative.

Dowel grout shall be a low slump, expansive type neat grout with a minimum compressive strength of 30 MPa in 28 days unless specified otherwise in the contract documents.

908.03 FABRICATION, TRANSPORTATION AND STORAGE

All steel shall be fabricated to sizes and shapes as shown on the drawings.

The Contractor shall transport the reinforcing steel and dowel pins to the site and shall store in an accessible place where identification checking can take place prior to placement.

All dirt, grease or other foreign materials shall be removed from the steel prior to placement.

908.04 DOWEL PLACEMENT IN STRUCTURES

Dowels shall be placed in locations as shown on the contract drawings. The Contractor shall drill holes to the required dimensions, clean holes, place dowel adhesive or grout, and properly position the dowels as specified in the contract documents. Core drilling of the dowel holes shall not be permitted.

Steel reinforcement and other existing embedment's shall not be cut or damaged by the drilling process. Prior to drilling holes, the Contractor shall locate existing steel

reinforcement using a covermeter, Utility ducts, post tensioning hardware, and any unsound concrete in the vicinity of the dowel locations. If any of the above is encountered during drilling operations, the Owner's Representative shall be notified immediately.

The Contractor's operations shall not cause spalling, cracking, or other damage to the surrounding concrete. Concrete spalled or otherwise damaged by the Contractor's operations shall be repaired in a manner acceptable to the Owner's Representative.

For doweling adhesive the Contractor shall clean the holes using compressed air to remove all deleterious material, including dust and debris, and shall dry them prior to placing the dowel adhesive.

The handling and placement of the dowel adhesive and grout shall conform to the manufacturer's written instructions. All excess dowel adhesive shall be struck-off flush with the concrete surface and removed from the surrounding concrete surface area.

Where dowels are to be grouted, the hole diameter shall be two times the nominal diameter of the dowel. The holes shall be flushed out, saturated with water and blown out with oil free compressed air immediately before the grout is injected.

Dowel holes that are started but not completed shall be cleaned and filled with an appropriate patching material.

The Contractor shall maintain dowels in the proper position during the setting of the dowel adhesive or grout and shall prevent the loss of dowel adhesive from the holes.

908.05 DOWEL PLACEMENT IN ROCK

Dowels shall be placed in locations as shown on the contract drawings. The Contractor shall drill holes to the required dimensions, clean holes, place dowel adhesive or grout, and properly position the dowels as specified in the Contract Documents. Core drilling of the dowel holes shall not be permitted.

Where dowels are to be placed in rock, holes shall be drilled to the required depth and size. Hole diameter shall be two times the nominal diameter of the dowel. Each hole shall be cleaned out, grouted and the dowel set in place.

If the hole contains water, the contractor shall remove the water otherwise a tremmie procedure accepted by the Owner's Representative shall be used to completely fill the

hole with grout. The dowel shall be forced into the hole after the grout has been placed and while it is still fresh.

Dowel holes that are started but not completed shall be cleaned and filled with an appropriate patching material.

The Contractor shall maintain dowels in the proper position during the setting of the dowel adhesive or grout and shall prevent the loss of dowel adhesive from the holes.

908.06 PULL TESTING OF DOWELS

When indicated in the contract documents, the Contractor shall complete Pull Tests of the installed dowels in accordance with the applicable sections of ASTM E488 “Standard Test Methods for Strength of Anchors in Concrete Elements.” The required number of pull tests shall be as indicated in the contract documents.

The Contractor shall not install formwork or attach anything to the dowels such as steel reinforcement and Utility ducts until the pull tests have been completed and the dowels are accepted into the work.

The Contractor shall conduct pull testing within 3 business days of installation. A Departmental Representative shall be present during the testing procedure and the Department shall select the dowels to be tested. The applicable pull test load shown in Table 1 must be sustained by the dowel, without displacement, for a time period of no less than one minute.

TABLE 1: Pull Test Loads

Dowel Size	Test Loads	
	Embedment less than 200mm	Embedment 200mm or greater
10M	20 kN	35 kN
15M	40 kN	70 kN
20M	60 kN	110 kN
25M	100 kN	180 kN
30M	140 kN	250 kN
35M	190 kN	340 kN

All dowels failing the pull test requirement shall be replaced by the Contractor by installing a new dowel in an adjacent location accepted by the Owner’s Representative.

Dowels failing the pull test requirement shall be removed and the hole filled with an appropriate patching material.

If more than one dowel fails, the lot of dowels shall be considered unacceptable and the Contractor shall complete the following:

a) Conduct pull tests on all remaining untested dowels of the lot.
b) On the subsequent lot, conduct pull tests on 10% of dowels or 20 dowels, whichever is greater. If more than one dowel fails, all remaining untested dowels of that lot shall be tested.
c) The subsequent lot shall be tested at the higher frequency until no more than one tested dowel fails.

The Contractor shall pull test all replacement dowels in the presence of the Owner's Representative. Each replacement dowel shall be accepted individually.

Dowels shall not be subjected to more than one pull test.

908.07 MEASUREMENT FOR PAYMENT

The quantity of dowels for which payment shall be made shall be the total number of (a) "Dowels in Rock" and (b) "Dowels in Concrete" which require installation as shown on the drawings.

908.08 BASIS OF PAYMENT

Payment at the contract price for "Dowels in Rock" and the "Dowels in Concrete" in the Unit Price Table shall be full compensation for furnishing all labour, tools, equipment, materials and incidental items required to supply, install, drill holes, apply adhesive/grout, and conduct pull testing on the dowels as indicated in the contract documents.

Where dowel pins are projecting through elastomeric bearing pads, the cost associated with these dowels shall be considered incidental to the supply and installation of bearing pads and separate payment will not be made for the same.