

**ITEM 18502.7001 M - RETROFIT DOWELS IN PORTLAND CEMENT CONCRETE (PCC) PAVEMENT**

**DESCRIPTION.** Install new load transfer devices (LTDs) at transverse cracks and joints where indicated in the contract documents.

**MATERIALS.**

Retrofit LTDs. Obtain retrofit LTDs from a supplier appearing on the Approved List for §705-15, Transverse Joint Supports. Each retrofit LTD consists of 1 dowel, 2 expansion caps providing 6 mm of expansion room each, a joint forming medium, and 2 epoxy coated or non-metallic supporting chairs having a width equal to the channel width, 65 - 70 mm.

Use 460 mm long, 38 mm diameter, smooth, epoxy coated, Grade 420 steel dowels coated with a bond breaker. Use an epoxy coating appearing on the Approved List for “Epoxy Coatings for Longitudinal Joint Ties” or “Epoxy Coatings for Steel Reinforcing Bars” that is applied by an applicator appearing on the Approved List for “Applicators for Steel Reinforcing Bars”.

At least 14 days before saw cutting channels, provide the Engineer:

- The name and address of the retrofit LTD supplier.
- Material certification from the supplier that dowels meet the “Tests” and “Material Requirements” portions of §705-15, except Grade 420 steel is supplied.
- Material certification from the rolling mill as to the type and grade of steel used.
- The brand of epoxy coating and the name and address of the Manufacturer.
- The name and address of the epoxy coating applicator.
- The brand of bond breaker and the name and address of the Manufacturer.
- Material certification from the epoxy coating applicator that the bars have been coated, tested, and meet the requirements of §705-14, Longitudinal Joint Ties.
- At least 2 shop drawings from the supplier that detail the:
  - Expansion caps.
  - Width, type, and positioning of chairs used to support and align the LTD.
  - Material used as a joint forming medium.

The Engineer will transmit a shop drawing to the Director, Materials Bureau, for approval. The Materials Bureau will approve, approve as noted, or reject the drawing within 14 days of submission to the Engineer. Revise rejected drawings as required by the Materials Bureau and re-submit them to the Engineer. Do not saw cut channels until the Materials Bureau approves the drawings.

Epoxy coating field repairs are not permitted. The Department may perform supplementary sampling and testing of the bars and assemblies to ensure conformance with §705-14 and §705-15.

Use a joint forming medium that is:

- Compressible, yet rigid enough to maintain it’s shape during installation and backfilling.
- Treated with a release agent that prevents bond to the backfill material.
- Deep enough to extend from the channel bottom to the pavement surface.
- Equal to the joint or crack width (+ 6 mm/ - 0 mm).
- Capable of being routed to accommodate joint or crack sealing.

Different widths of joint forming material are required for cracks of different crack widths.

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**Backfill Material.** Use DBR Retrofit Mortar, HD-50, Five Star Highway Patch, or an alternate prepackaged portland cement based patching material submitted for use as an approved equal. Extend the prepackaged material with clean, surface dry crushed stone or crushed gravel meeting §703-02, Coarse Aggregate, and having a 1A gradation, maximum. Use an extension rate of 50 - 60 % by weight of the prepackaged material. Do not use crushed slag aggregate. Follow the Manufacturer's mixing instructions. Provide those instructions to the Engineer.

Submit alternate patching material and extension aggregate in 30 kg (maximum) bags to the Engineer for transmittal to the Materials Bureau for approval. Provide the same aggregate that will be used on the contract. Alternate material must meet the requirements of Table 1, Backfill Material Requirements. The Materials Bureau will render a decision on material acceptability within 45 days of submission to the Engineer.

**TABLE 1 - BACKFILL MATERIAL REQUIREMENTS**

Property	Extension	Minimum	Maximum
3 Hour Compressive Strength	None	24 MPa	-
24 Hour Compressive Strength	None	35 MPa	-
Contraction	None	-	0.05 %
Freeze - Thaw Loss	60 %	-	1.0 %
Bond to SSD PCC	60 %	2.8 MPa	-
Bond to Dry PCC	60 %	2.1 MPa	-
Working Time	60 %	15 Minutes	-
Chloride Content		-	0.0 %
Magnesium Phosphate Content		-	0.0 %

### **CONSTRUCTION DETAILS.**

**Channel Construction.** Construct 4 channels per wheelpath (8 per lane). Space channels 300 mm apart on center. Determine the location and length of longitudinal joint ties in the concrete to remain in place outside the repair area. Use a pachometer or other device capable of locating steel embedded in concrete.

If a longitudinal joint tie is within 300 mm of the joint or crack being retrofit, construct the outer channels 75 - 100 mm from the end of the tie. If no ties are within 300 mm of the joint or crack being retrofit, construct the outer channels 450 mm from a longitudinal joint between 2 travel lanes and 300 mm from a longitudinal joint between a travel lane and a shoulder.

For 4.2 m wide slabs, slabs with nonstandard widths, or pavements with longitudinal joints offset from permanent longitudinal pavement markings that define a travel lane, construct the outer channels 450 mm from the nearest edge of the permanent longitudinal marking between 2 travel lanes and 300 mm from the marking between a travel lane and a shoulder. In any case, do not construct a channel within 75 mm of the end of a longitudinal joint tie. The Engineer may require additional dowel bar retrofit construction in nonstandard slab widths to ensure 4 dowels are placed in each wheelpath.

Make saw cuts with a diamond blade concrete saw equipped with a minimum of 3 saw blades of the same diameter. Space the blades on the saw arbor such that resulting channel width equals the supporting chair width. Make the saw cuts parallel to the pavement longitudinal joint and to each other, with equal lengths on either side of the crack. Make the saw cuts sufficiently deep such that, when placed, the longitudinal axes of the dowels are at midslab and 13 - 19 mm of backfill material will surround the dowels and expansion caps.

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Remove concrete between the outer saw cuts with a chipping hammer weighing no more than 13.6 kg, including muffler and bit. Remove concrete burrs such that the dowels will sit parallel to the pavement surface and the backfill material will completely encase the dowel. Schedule operations such that the concrete between saw cuts is removed as close to dowel installation as possible. Do not allow traffic on the channels after the concrete has been removed.

**Cleaning Channels.** As close to backfill placement as possible, thoroughly abrasive blast all faces of the channel to remove all residue and roughen the surface. Immediately before placement, air blast the channel to remove any remaining debris. The Engineer will check for dust by wiping the channel faces with a dark cloth or glove. Immediately after cleaning, apply a commercial caulk to all crack faces within the channel.

**LTD Installation.** Apply bonding agents, including water, to the channel faces in accordance with the backfill Manufacturer's instructions. Provide those instructions to the Engineer. If water is used, blow the excess from the repair such that no standing water remains. Do not place primer or backfill material when the concrete substrate is outside the temperature range of 7\_C to 38\_C.

Immediately after applying the bonding agent, place and support the LTDs in accordance with the approved shop drawings such that the:

- Joint forming medium is aligned with the crack or joint such that no backfill material can enter the joint or crack.
- Supporting chair abuts the vertical channel faces to prevent movement during backfilling.
- Longitudinal axis of each dowel is at the mid-depth of the pavement slab (± 6 mm).
- Longitudinal midpoint of each dowel is within 25 mm of the crack.
- Longitudinal axis of each dowel is aligned parallel with the pavement centerline and pavement surface such that the maximum misalignment of one dowel end relative to the other is 4 mm.

**Backfill Placement.** After the dowel is positioned, slightly overfill the entire channel with backfill material. Follow Manufacturer's instructions regarding placement time limits, including those of the bonding agent. Provide those instructions to the Engineer. Thoroughly consolidate the material using narrow (less than 25 mm), hand-held spud vibrators. Do not touch the LTD with the vibrator.

Fill whole channels with each batch of material. Discard the remaining portion of a mixed batch if it will not completely fill a channel, if placement time limits are exceeded, or if the material is not uniformly consolidating under vibration.

Finish the backfill material flush with the surrounding pavement surface with as little hand finishing as possible.

Cure the backfill material in accordance with the Manufacturer's instructions. Provide those instructions to the Engineer.

**Opening to Traffic.** Open the repairs to traffic no sooner than 3 hours after finishing.

**METHOD OF MEASUREMENT.** The work will be measured for payment as the number of dowels satisfactorily retrofit into the pavement.

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**BASIS OF PAYMENT.** Include the cost of all labor, material, and equipment necessary to satisfactorily perform the work in the unit price bid for Retrofit Dowels in Portland Cement Concrete Pavement. No additional payment will be made for extra work required to repair damage to the adjacent pavement that occurred during any operation.