

DOWEL BAR RETROFIT (Tollway)

Effective date – March 30, 2009

DESCRIPTION

This work shall consist of furnishing and installing epoxy coated round steel dowels into existing concrete pavement across transverse joints and/or cracks, in accordance with this Specification, at locations shown in the Plans and/or as directed by the Engineer. This work shall include sawing channels into the pavement, cleaning the channels, placing dowel into the channels, filling the channels and transverse joints with adhesive, sawing and sealing the retrofitted joints, cleanup and other related work.

MATERIALS

- (a) Dowels. The dowel bars shall consist of a smooth, round, epoxy and bond breaker coated 14-inch long, 1.5-inch diameter steel dowels meeting the requirements of Article 1006.06(b).
- (b) Bond Breaker. Acceptable bond-breaker compounds include white pigmented curing compound, concrete form oil, or other approved bond breaker materials.
- (c) Expansion Caps. Use tight-fitting, commercial quality end caps made of a non-metallic, non-organic material that allows for ½ inch of movement at each end of the dowel bar.
- (d) Dowel Bar Support Chairs. Use chair devices for supporting the dowel bars that conform to the epoxy-coated steel requirements of ASTM A 884. Dowel bar chairs are used to firmly hold the dowels centered in the slots during backfill operations. The dowel bar chairs must hold the bar a minimum of ½ inch above the bottom of the slot while the backfill material is placed and consolidated.
- (e) Caulking Filler. Caulking filler used for sealing the existing transverse or crack at the bottom and sides of the slot shall be concrete sealant that is compatible with the patch material being used.
- (f) Non-Shrink Concrete Backfill Material. Use concrete backfill material tested as Rapid Set Concrete Patching materials per AASHTO or a Tollway approved equivalent which conforms to ASTM C 928. Use material that: (1) provides a compressive strength of 4,000 psi in 24 hours (opening to traffic after 2,500 psi) per ASTM C 39; (2) exhibits expansion of less than 0.10 percent per ASTM C 531; and (3) has a calculated durability factor of 90.0 percent minimum at the end of 300 freeze-thaw cycles per ASTM C 666. Submit the proposed concrete backfill material to the Engineer 14 days prior to any placement operations. For any backfill material that is extended with aggregate, the maximum aggregate size shall be no more than 3/8 inch.
- (g) Curing Compound. Use a Type I, II, or III curing compound to cure the approved concrete backfill material that conforms to Article 1022.01 of the Standard Specifications.
- (h) Joint / Crack Sealer. Hot poured joint / crack sealer used at retrofitted joints shall be in accordance with Article 1050.02 of the Standard Specifications. Any proposed sealant product shall be approved in writing by the Engineer prior to the delivery to the work site.

The backer rod if needed shall consist of a material capable of withstanding the application temperatures of hot poured sealant to 400° F. The backer rod shall be extruded from a cross-linked, closed cell polyolefin and shall be available in a variety of diameters to readily meet the requirements of any particular application.

EQUIPMENT

- (a) A template shall be used to locate the sawcuts on any nonskewed crack or joint in order to align the sawcuts consistently. Either single diamond bladed saws or diamond bladed gang saws shall be used to make the saw cuts to allow for dowel bar placements within the specified tolerances.
- (b) Chipping hammers shall be hand held and have a maximum weight of 30 lbs. prior to any handle modification where applicable to minimize damage to the concrete pavement that remains.
- (c) The compressor for air blasting shall have a minimum capacity of 120 cu. ft. per minute. The compressed air shall be free from oil and other contaminants.
- (d) Consolidation equipment used to consolidate the concrete repair material in the dowel bar slats shall be internal vibrators with a maximum diameter of 1 inch and shall have a resilient covering that will not damage the epoxy coated reinforcement during use.
- (e) Equipment for mixing and pumping any backfill materials for retrofitting the dowel bars shall be in accordance with the material manufacturer's instructions and specifications.
- (f) Routing or sawing equipment for crack sealant, where required, shall be power driven and be capable of cutting the cracks to the required dimensions without excessive spalling of the adjacent surface. Equipment for heating and placing hot poured sealant material shall be an oil jacketed, double boiler type, heating kettle or other thermostatically controlled equipment of a type approved by the Engineer, capable of heating the material to 400° F (205° C) and pumping the material into the prepared crack or joint.

SUBMITTALS

Submit samples to the Engineer for approval prior to the installation of the following items:

- a. Dowel bars
- b. Dowel bar chairs
- c. Dowel bar end caps
- d. Backfill material
- e. Aggregate for extension of backfill material

Submit the material samples, except for the backfill and aggregate, at least 10 days prior to use. Submit backfill material and aggregate used for extension 30 days prior to use.

DRAWINGS

The proposed location of the dowel bars is shown in the Plans. Before any fabrication is started, the Contractor shall prepare and submit shop drawings and/or catalog cuts to the Engineer for approval, in accordance with the provisions of Article 105.04 of the Tollway

Supplemental Specifications. The shop drawings shall give full detailed dimensions and sizes of the channels to be sawed and the dowel bar retrofit.

CONSTRUCTION METHODS

Install dowel bars in the existing portland cement concrete pavement as shown on the Plans and in the Specifications.

- (a) Concrete Removal. Create slots to a depth and length that allows the center of the dowel to be placed at mid-depth in the pavement slab and parallel to the pavement surface. Slots can be created with a gang saw, or by making two saw cuts and removing the concrete between the sawcuts with a 30-lb maximum jackhammer or handtools. Slots are to be parallel to each other and to the centerline of the roadway with a maximum tolerance of $\frac{1}{4}$ inches per 12 inches of dowel bar length to allow for the dowel bar to be placed parallel to the centerline of the roadway. For non-skewed cracks and joints, the saw cut locations shall be pre-marked using a template. Skewed joints or cracks may require slots longer than the length specified in the plans to allow for equal length of the dowel bar to be placed across the transverse joint or crack. Remove water and residue immediately after sawing. If the concrete removal operations cause damage to the pavement that is to remain, discontinue concrete removal operations and only resume after taking corrective measures. Repair or replace pavement damaged during concrete removal operations at no additional expense to the Tollway. The bottom of the slot must be flat and level. Dispose of any concrete removal debris.
- (b) Slot Cleaning and Preparation. Sandblast all exposed surfaces in the dowel bar slot to remove saw slurry and debris such that clean aggregate is exposed. After sandblasting, clean the slot by blowing with moisture-free, oil-free compressed air having a minimum capacity of 120 cu. ft. per minute to remove any dust, residue or debris left in the slot.
- (c) Sealing Joints and Cracks in Slot before Backfilling. Seal the existing transverse contraction joint and/or all cracks at the bottom and the sides of the dowel bar slot with an approved caulking or silicone filler to prevent any of the backfill material from entering these areas. The caulking filler should not be placed any farther than $\frac{1}{2}$ inch outside either side of the joint. Excessive sealant around the slot does not allow the concrete patching material to bond to the sides of the slot. Prior to slot sealing, ensure that surfaces receiving the caulking filler are clean and free of moisture. Do not extend the caulking filler beyond $\frac{3}{8}$ inches of each side of the existing joint or crack.
- (d) Placing Dowel Assembly in Slot. Prevent contamination of the cleaned slot before or while placing dowel assemblies to limit the potential of bonding loss with the backfill material. Place the dowel bars to within 0.5 inches of the midpoint of the slab. Ensure that the bar is parallel to the traffic lane centerline and the top of the roadway surface within a tolerance of $\frac{1}{4}$ inch per 12 inches of dowel bar length. Center dowels at the nonskewed transverse joints such that at least 6 inches of the dowel extends into each adjacent panel. For dowel bars at any skewed joint and at all cracks, the dowel shall be centered over the joint or crack in each slot. Cease and adjust operations if the chairs do not hold dowel bars securely in place during placement of the backfill material.

Place a foam core insert at the middle of the dowel bar and to the surface of the pavement. Place insert so it covers the existing transverse joint or crack and is capable of remaining in a vertical position, tight to all edges during backfill placement operations. Re-establish the

joint or crack above the foam core insert within 4 hours of backfill placement by sawing after the backfill material has hardened sufficiently.

- (e) Mixing and Placing Backfill Material. Mix backfill material in accordance with the manufacturer's instructions and the specifications. Refer to manufacturer's information on handling, mixing, and placing backfill material.

Fill each dowel bar slot with backfill material after placement of the caulking filler, the coated dowel bar, expansion caps, support chairs, and the foam core insert. Ensure that the foam core inserts remain upright, extends to the surface of existing pavement, and is over the existing joint or crack during the backfill process. Vibrate the backfill material with a small hand held vibrator capable of thoroughly consolidating the backfill material into the slot around the dowel bars and support chairs.

Slightly overfill the slot and finish the surface of the filled slot level with to no more than ¼" above the existing concrete. Any slots insufficiently filled below existing pavement surfaces shall be redone at the contractor's expense. Cure the backfill material in accordance with the manufacturer's recommendations. Apply curing compound per the manufacturer's recommendation.

- (f) Sawing Cracks after Backfilling. After installation of dowel bars and backfill material is completed for retrofitting mid-slab cracks, where the foam insert is not observed present on the finished surface of the patch the patched channels shall be saw cut by the Contractor between existing crack openings within 24 hours of placement to a nominal 1.5 inch depth to reduce surface stress and spalling at the surface of the backfilled slot. Such sawcutting will be at no additional cost to the Tollway.

METHOD OF MEASUREMENT

DOWEL BAR RETROFIT will be measured for payment by each dowel bar assembly installed.

BASIS OF PAYMENT

Payment for DOWEL BAR RETROFIT, measured as specified, will be made at the Contract unit price per each.