Dowel Bar Retrofit

416.1 DESCRIPTION

This section describes the requirements for installing epoxy-coated dowel bars into existing transverse joints in concrete pavement.

416.2 MATERIALS

Provide materials in accordance with the following:

Material	Subsection
Bond-Breaking Compound	810.2
Caulking Filler	810.3
Chairs	811.2.5
Dowel Bar Retrofit Concrete	810.5
Dowel Bars and Tie Bars	811.2
Dowel Bar End Caps	811.2.2
Foam Core Board	810.4

416.3 EQUIPMENT

Ensure that equipment meets the following:

1. A concrete saw capable of cutting at least three slots simultaneously at least 7.25 in [184 mm] deep;
2. Jack hammers no larger than the nominal 30-pound [14 kg] class;
3. A sandblaster and an air compressor able to produce oil-free compressed air;
4. A mobile, continuous mixer or a small, portable, motor-driven, batch-type mixer at the placement site that accurately proportions materials for the mixture, discharges a uniform mixture, and maintains a continuous, steady flow of mixture; and
5. If necessary, a scale, accurate to the nearest pound [kilogram] and other equipment to charge the mixer with the correct proportions of materials.

416.4 CONSTRUCTION

416.4.1 General

Submit a sample of each of the following items to the engineer for approval at least 14 calendar days before use:

1. End caps;
2. Chair devices;
3. Caulking filler;
4. Foam core board filler;
5. Bond breaking compound; and
6. Enough patching material, including the extension aggregate, for a 0.5 ft^3 [0.01 m^3] batch.

Provide saw-cut dowels, free of burrs or projections that restrict movement, with tight-fitting end caps. Repair damage to epoxy coating in the field.

Place dowel bar retrofit concrete in accordance with the manufacturer's recommendations. Ensure that samples acquired during production achieve a compressive strength of at least 4000 psi [27.6 MPa] in 24 hours. Conduct quality acceptance sampling of the patching material at a minimum frequency of one slump test per 100 dowels placed, and one set of three strength tests per 300 dowels placed. Any slump test exceeding 10 in [225 mm] will be cause for rejection of all material placed since the previous slump test. Test each set of three 4-inch [100 mm] cylinders for strength at between 24 and 36 hours after molding. If the average of the three test results is less than 4000 psi [28 MPa], the 300 dowels the sample represents will be rejected. This will include 25 joints before and 25 joints after the location of sampling. Test locations will be as directed by the engineer.

If a mobile mixer is used, provide separate bins for cement, fine aggregate, and extension aggregate. Calibrate the proportioning equipment for each component of the mixture in the presence of the engineer. During calibration checks and normal use, operate proportioning equipment at the speed recommended by the manufacturer. When a portable batch type mixer is used, provide measuring devices and other necessary equipment.

416.4.2 Test Section

Provide a test section consisting of complete dowel bar retrofit, to include at least 24 retrofits, at a location determined by the engineer before start of major operations. Twenty-four hours after completing the test section, take three 6-inch [150 mm] diameter full-depth cores at locations determined by the engineer to assess the installation. Take and inspect cores in the presence of the engineer. Ensure proper dowel placement and no voids around the bar circumference. Backfill core locations using the approved dowel bar retrofit concrete. Make visual observations of the backfill concrete and inspect for cracking. After obtaining the engineer's approval, begin production operations and proceed on a performance basis.

416.4.3 Installation

Retrofit only existing type A, weakened plane transverse joints with dowels. Cut slots in the pavement, parallel to the centerline of the roadway, to place the center of the dowel at mid-depth in the concrete slab. Simultaneously cut at least three slots per wheel path along the transverse joint or crack, or as approved. If necessary, make multiple cuts in the slot, parallel to the centerline, to properly remove material. Collect and dispose of slurry and residue at an approved location.

Close the lane if slots are sawn too far ahead of the operation and the "fins" formed by the saw cuts begin to break and become a traffic hazard or if traffic begins to cause corner breaks from cracks that develop between slots and the longitudinal shoulder or center line joint. Reopen the lane after the damaged areas are repaired and the retrofitting of the dowel bars is completed. Repair corner breaks or cracks caused by traffic on unfinished slots at no additional cost to the department.

Use a 15-pound [7 kg] jack hammer when breaking the concrete out of the slot, if the 30-pound [14 kg] hammer damages the pavement,.

Before installing dowel bars, sandblast and clean the slot of saw slurry and loose concrete. If the crack width of the transverse contraction joint equals or exceeds c in [3 mm], fill the joint on the bottom and the sides of the slot with silicone. Minimize the amount of silicone on the side and bottom surfaces of the slot.

Coat bars with a bond breaking compound, place in the approved dowel chair, and place as follows:

1. To the depth specified;
2. Parallel to the centerline;
3. At the middle of the slot;
4. With the mid-point of the dowel within 1 in [25 mm] of the centerline of the transverse joint; and
5. Parallel to the pavement surface (ensure that the bar does not deviate more than 3 in [6 mm] from a plane parallel to the pavement surface, when measured along the length of the bar).

Do not allow movement of the dowel bar in the chair during placement of the grout. The engineer will reject chairs that allow movement of the bar. Ensure that dowel bar sleeves do not collapse during construction.

Place foam core board filler at the middle of the dowel to maintain the transverse joint or crack. Fit the board tightly around the dowel and edges of the slot. Cut or remove existing joint sealant to accommodate the board tabs (which stabilize the board during placement of patching material). Place the board so that it remains vertical and tight against all edges during placement of the patching material.

Fill the slot (with the installed dowel bar with caps, chairs, foam core board, and silicone in place) with an approved patching material. Thoroughly moisten all surfaces of the slot immediately before filling. Do not allow standing water in the slot. Remove excess water with compressed air. Thoroughly consolidate the dowel bar retrofit concrete in the slot and around the dowel bar with a vibrator of appropriate size and ensure there are no voids. Trowel the material toward the hardened concrete to prevent voids at the edges of the patch.

Cure the surface of the filled area immediately after finishing, in accordance with the patching material manufacturer's recommendations. Maintain joints by saw-cutting the surface within 24 hours of placing the grout.

Seal transverse contraction joints and cracks in accordance with Section 417, Sealing Existing Concrete Pavement Joints and Cracks.

Repair or replace damaged and nonfunctioning dowels at no additional cost to the department. During production, if cores indicate incomplete consolidation of the patching material under or around the dowel bars, stop placement and take corrective action. Obtain the engineer's approval before restarting. If

cracks develop in the dowel bar retrofit concrete or if there is any separation or debonding between the dowel bar retrofit concrete and the existing concrete, remove and replace at no additional cost to the department.

416.5 MEASUREMENT and PAYMENT

416.5.1 General

The engineer will measure Dowel Bar Retrofit by each dowel installed, including dowels in the test section.

The department will pay as follows:

Pay Item	Pay Unit	Measure to the Nearest	Pay to the Nearest
Dowel Bar Retrofit	EA [Ea]	EA [Ea]	EA [Ea]