

## **10-1. \_\_ RETROFIT EXISTING CONCRETE PAVEMENT WITH DOWELS AT TRANSVERSE JOINTS**

### **GENERAL**

Three epoxy-coated round steel dowels per wheel path shall be placed in existing concrete pavement at transverse weakened plane joints at the locations shown on the plans and as provided in these special provisions.

### **PRECONSTRUCTION CONFERENCE (DOWEL RETROFIT)**

Supervisory personnel of the Contractor and any subcontractor who are to be involved in the slot cutting and dowel placement work shall meet with the Engineer at a preconstruction conference, at a mutually agreed time and location, to discuss methods of accomplishing all phases of the work.

The Contractor shall provide a facility for the conference. The facility shall be within 5 km of the construction site or at a nearby location agreed to by the Engineer and Contractor. Attendance at the conference is mandatory for the project superintendent, construction foreman, subcontractors and equipment operators involved in cutting slots or placing dowels. All conference attendees shall sign an attendance sheet provided by the Engineer. Cutting of slots and placement of dowels shall not proceed unless the above-mentioned personnel have attended the conference.

The above-mentioned personnel along with the Engineer's representatives shall attend a 4-hour training class on dowel placement techniques as part of the preconstruction conference. This training class time shall be in addition to the conference time. The class shall be scheduled no more than 2 weeks prior to the placement of dowels. The class shall be held during normal working hours. Selection of the instructor shall be as agreed to by the Engineer and the Contractor.

The training class may be waived if the Contractor can provide written verification of prior acceptable work experience and training involving the placement of dowels in existing concrete pavement.

### **TEST STRIP**

The Contractor shall retrofit dowel bars, including concrete removal, placing fast setting grout, and pavement grinding, in an initial test strip of concrete pavement at a site directed by the Engineer prior to the start of major operations. The test strip shall be a minimum of one traffic lane width and a minimum of 100 m long. Twenty four hours after the completion of the dowel placement and the filling of the slots with fast setting grout, the Contractor shall take 3 full depth cores, at 3 separate joint locations directed by the Engineer to determine the completeness of the removal and installation operations. Core drilling shall conform to the requirements in these special provisions. If the results of the test strip conform with the plans and specifications, the Contractor may begin production operations using the methods and materials used in the test strip, and shall proceed on a performance basis. The working days for the test strip shall be considered as part of the total contract time.

### **MATERIALS**

### **Dowels**

Dowels shall be smooth, round, epoxy-coated steel conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 300 or 420 and shall conform to the details shown on the plans and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the Standard Specifications, except that references made to ASTM Designation: D 3963/D 3963M shall be considered to mean ASTM Designation: A 934/A 934M.

Dowels shall be plain, smooth, round bars. Dowels shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete.

### **Bond Breaker**

Dowels shall be lubricated with bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white pigmented curing compound shall be used to coat the dowels completely prior to concrete placement. Oil or asphalt based bond breakers shall not be used. Petroleum paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Petroleum paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C 309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in 2 separate applications. Each application of curing compound shall be applied at the approximate rate of one liter per 3.7 m<sup>2</sup>.

### **Expansion Cap**

Expansion caps shall be tight fitting, commercial quality nonmetallic, nonorganic material that will allow a minimum of 6 mm of movement at each end of the bar.

### **Caulking Filler**

Caulking filler used for sealing the transverse joint at the bottom and sides of the dowel bar slot shall be a silicone caulk containing a minimum of 50 percent silicone and designated as a concrete sealant. Caulking filler shall conform to the requirements of ASTM Designation: C 834.

### **Foam Core Insert**

The foam core insert shall be closed cell foam faced with poster board material or plastic faced material on each side, or rigid styrofoam material capable of remaining in a vertical position and tight to all edges during the placement of the fast setting grout.

### **Dowel Bar Support Chairs**

Chairs for supporting the dowel bars shall be either completely epoxy-coated steel conforming to the requirements of ASTM Designation: A 884/A 884M or shall be fabricated of commercial quality nonmetallic, nonorganic material. The dowel bar support chairs shall firmly hold the dowels centered in the slots during fast setting grout backfill operations. Dowel supports shall be designed to hold the bar a minimum of 13 mm above the bottom of the slot while the fast setting grout backfill is placed and consolidated.

### **Fast Setting Grout**

Fast setting grout materials shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and shall be either (1) magnesium phosphate grout, either single component water activated, or dual component with a prepackaged liquid activator;

or (2) modified high alumina based grout; or (3) portland cement based grout. Magnesium phosphate grout, modified high alumina based grout and portland cement based grout shall conform to the following requirements:

Property	Test Method	Requirements
Compressive Strength		
at 3 hours, MPa	California Test 551	21 min.
at 24 hours, MPa	California Test 551	35 min.
Flexure Strength		
at 24 hours, MPa	California Test 551	3.5 min.
Bond Strength: at 24 hours		
SSD Concrete, MPa	California Test 551	2.1 min.
Dry Concrete, MPa	California Test 551	2.8 min.
Water Absorption, %	California Test 551	10 max.
Abrasion Resistance		
at 24 hours, grams	California Test 550	25 max.
Drying Shrinkage at 4 days, %	ASTM Designation: C 596	0.13 max.
Soluble Chlorides by mass, %	California Test 442	0.05 max.
Water Soluble Sulfates by mass, %	California Test 417	0.25 max.

Clean, uniform rounded aggregate filler may be used to extend the prepackaged grout. The moisture content of the aggregate filler shall not exceed 0.5 percent. Grading of the aggregate filler shall conform to the following:

Sieve Size	Percentage Passing
9.5 mm	100
1.18 mm	0-5

The amount of aggregate filler shall conform to the manufacturer's recommendation, but in no case shall the grout strengths be less than specified in these special provisions.

Magnesium phosphate grout shall be formulated for a minimum initial set time of 15 minutes and a minimum final set time of 25 minutes at 21°C. The materials, prior to use, shall be stored in a cool, dry environment.

Mix water used with water activated material shall conform to the provisions in Section 90-2.03, "Water," of the Standard Specifications.

The quantity of water for single component type, or liquid activator for dual component type, to be blended with the dry component shall be within the limits recommended by the manufacturer and shall be the least amount required to produce a pourable batter.

Addition of retarders, when required, shall be in conformance with the manufacturer's recommendations.

### **Silicone Joint Sealant**

Low modulus silicone joint sealant shall be furnished in a one-part silicone formulation. Acid cure sealants shall not be used. The Contractor shall use the same brand of silicone joint sealant throughout the project. The compound shall be compatible with the surface to which it is applied and shall conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 412 (Die C)	310 kPa max.
Flow at 25° ± 1°C	ASTM C 639 <sup>a</sup>	shall not flow from channel
Extrusion Rate at 25° ± 1°C	ASTM C 603 <sup>b</sup>	75-250 g/min.
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at -18°C, Shore A, cured 7 days at 25° ± 1°C	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack free at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM C 679	less than 75 minutes
Elongation, 7 day cure at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 1640	less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 25° ± 1°C	AASHTO T 132 <sup>c</sup>	345 kPa min.
Movement Capability and Adhesion, 100% extension at -18°C after, air cured 7 days at 25° ± 1°C, and followed by 7 days in water at 25° ± 1°C	ASTM C 719 <sup>d</sup>	No adhesive or cohesive failure after 5 cycles

Notes:

- a. ASTM Designation: C 639 Modified (15 percent slope channel A).
- b. ASTM Designation: C 603, through 3-mm opening at 345 kPa.
- c. Mold briquets in accordance with AASHTO Designation: T 132, sawed in half and bonded with a 1.5 mm maximum thickness of sealant and tested in accordance with AASHTO Designation: T 132. Briquets shall be dried to constant mass at 100 ± 5° C.
- d. Movement Capability and Adhesion: Prepare 305 mm x 25 mm x 75 mm concrete blocks in accordance with ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 50 mm of block leaving 12.5 mm on each end of specimen unsealed. The depth of sealant shall be 9.5 mm and the width 12.5 mm.
- e. R.H. equals relative humidity.

The silicone joint sealant shall be formulated to cure after application, on grades of up to 15 percent, recessed below the final surface as shown on the plans.

A Certificate of Compliance for the silicone sealant shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate shall also be accompanied with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of silicone joint sealant prior to use on the project.

### Backer Rods

Backer rods shall have a diameter prior to placement at least 25 percent greater than the width of the sealant reservoir and shall be expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. In no case shall the Contractor use a hot pour sealant that will melt the backer rod. The Contractor shall submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

### **Submittals**

Samples of the following materials used in the work shall be submitted to the Engineer prior to installation or placement of the materials:

- Dowel Bars
- Dowel Bar Support Chairs
- Expansion Caps
- Bond Breaker
- Caulking Filler
- Foam Core Insert
- Fast Setting Grout
- Silicone Joint Sealant
- Backer Rods

The material samples, except fast setting grout, shall be submitted at least 10 days prior to use or at the preconstruction conference. If the preconstruction conference occurs before the 10 days prior to installation, then the samples shall be submitted no later than the conference. Fast setting grout shall be submitted for testing 30 days prior to use, and the sample size shall be 20 kg. Each shipment of grout material that has been previously submitted for testing shall be accompanied by a Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

### **DOWEL RETROFIT**

Dowel bars shall be installed in existing portland cement concrete pavement as shown on the plans and as specified in these special provisions.

#### **Saw Cutting**

Two saw cuts shall be made in the pavement to outline the longitudinal sides of each dowel bar slot. The outline of the longitudinal sides of the each dowel bar slot shall be sawn to the depth and length shown on the plans to place the center of the dowel bar at mid-depth in the pavement slab. The saw cuts for the dowel bar slots shall be parallel with each other and to the centerline of the roadway with a maximum tolerance of 6 mm. Saws shall be equipped with gang mounted diamond blades to provide the desired saw cut spacing and shall be capable of making 6 saw cuts for 3 dowel bar slots simultaneously. A minimum of 3 dowel bar slots in each wheel path will be required. Skewed joints or cracks may require slots longer than those shown on the plans. No additional compensation will be made for additional length or any component of the dowel bar retrofit beyond the limits shown on the plans. Pickup and removal of debris concrete, water residue, or paste from saw cutting shall be immediate. Pickup and removal shall include the use of a high power, mobile, vacuum cleaning machine capable of removing all displaced material with a minimum of dust.

Once the saw cutting operation to outline the longitudinal sides of the dowel bar slots has been completed for any work shift, the concrete remaining between the saw cuts shall be removed and replaced with dowel retrofit assembly and grout in place within 6 working days.

#### **Concrete Removal**

Concrete removal operations and the equipment used to remove the concrete remaining between the saw cuts shall not damage the pavement to remain. Jack hammers greater than 14 kg class shall not be used. If the concrete removal operations cause damage to the pavement that

is to remain, the concrete removal operations shall be discontinued, and shall not resume until the Contractor has taken corrective measures. Damage to the concrete to remain shall be repaired or replaced at the Contractor's expense.

After removal of large concrete pieces by jack hammering, a small hammerhead shall be used to chip off rocks and burrs from the slot bottom to produce a level surface for the dowel bar support chairs to sit.

Operations shall be scheduled so that the concrete removed during a work shift to shape the dowel bar slots, shall be replaced, in that same work shift, with dowel bars and fast setting grout, prior to the time the lane is to be opened to public traffic. In the event the concrete is removed to place the dowel bars and the Contractor is unable to place the dowels and fast setting grout and cure the grout by the time the lane is to be opened to public traffic, the slot shall be filled with a temporary backfill. In no case shall the Contractor leave any slot unfilled prior to opening to traffic.

### **Temporary Backfill**

A sufficient standby quantity of asphalt concrete shall be provided at the project site for placement of temporary backfill in slots where existing pavement is being dowel bar retrofitted. The temporary backfill shall be maintained and later removed as a first order of work when the Contractor places the dowel bar and fast setting grout and cures the grout within the specified time limit.

The asphalt concrete used as temporary backfill shall be produced from commercial quality aggregates and asphalt binder. The grading of the aggregate shall conform to the 9.5-mm maximum medium grading requirements in Section 39-2.02, "Aggregate," of the Standard Specifications.

Prior to placing temporary backfill, building paper shall be placed against all surfaces of the dowel bar slot to facilitate subsequent removal of the temporary backfill. Asphalt concrete for the temporary backfill shall be placed and compacted by methods that will produce a well-compacted backfill with a surface of uniform smoothness, texture, and density. The finished surface of the backfill shall match the elevation of the existing concrete pavement.

The material from the removed temporary backfill shall be disposed of in conformance with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. When no longer required, standby backfill material shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13.

### **Slot Cleaning and Preparation**

Exposed surfaces in the dowel bar slot shall be cleaned by sand blasting to remove debris and to clean surfaces such that clean aggregate is exposed. Where sand blasting operations are being performed within 3 m of a lane occupied by public traffic, the residue, including dust, shall be removed immediately after contact between the sand and the surface being treated. Removal shall be by a vacuum attachment operating concurrently with the sand blasting operation. Debris, excess moisture or residue in the dowel bar slot shall be vacuumed prior to bar installation.

Immediately after vacuuming all debris from the dowel bar slot, the slots shall be cleaned with moisture-free, oil-free compressed air having a minimum pressure of 620 kPa.

### **Seal Joints and Cracks in Slot**

The Contractor shall seal the existing transverse joint at the bottom and the sides of the dowel bar slot with caulking filler. The surfaces to receive caulking filler shall be clean and dry at the time the caulking filler is placed. Caulking filler shall be placed to a minimum of 13 mm beyond the edges of the slot in the existing transverse joint. The portion of any remaining saw cuts in the bottom of the slot which is deeper than the limits shown on the plans for concrete removal and within 150 mm of the existing transverse joint shall be filled with caulking filler. Any cracks exposed within the slot during concrete removal operations shall also be filled with caulking filler.

### **Placing Dowel Bars in Slots**

Dowel bar surfaces shall be cleaned prior to application of the bond breaker. The dowel bars shall be lightly coated with curing compound or factory applied paraffin lubricant prior to placement. The Contractor shall not allow the curing compound, when used, to drip onto the slot walls or bottom. The dowel bar support chair shall provide a minimum of 13 mm clearance between the bottom of the dowel bar and the bottom of the slot. The dowel bars shall be placed to the depth shown on the plans, parallel to the traffic lane centerline and the top of the pavement surface, and at the middle of the slot width within a tolerance of 6 mm. Dowels shall be centered at the transverse joint, such that not less than 205 mm and not more than 255 mm of the dowel extend into each adjacent panel. The dowel bar support chairs shall hold the dowel bar securely in place during placement of the fast setting grout.

The foam core insert shall be placed at the middle of the dowel bar to maintain the transverse weakened plane joint. The existing joint sealant, if any, shall be removed to accommodate the 6 mm to 13 mm thick foam core insert. Two 13 mm by 13 mm tabs to stabilize the foam core insert during backfilling with fast setting grout shall be used. The foam core insert shall be capable of remaining in a vertical position and tight to all edges during the placement of the fast setting grout.

### **Mixing Fast Setting Grout**

Fast setting grout shall be mixed in accordance with the manufacturer's instructions and these special provisions.

The components of prepackaged, dual component magnesium phosphate with a prepackaged liquid activator, shall be combined by mixing the units completely as supplied by the manufacturer. Portion of units shall not be used. Water shall not be added to dual component magnesium phosphate.

Magnesium phosphate grout shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper. Modified high alumina based grout shall not be mixed in containers or worked with tools containing aluminum.

### **Placing Fast Setting Grout**

The Contractor shall fill each dowel bar slot with fast setting grout with the installed dowel bar, expansion caps, support chairs, foam core insert, and caulking filler in place. The grout shall be vibrated with a small hand held vibrator capable of thoroughly consolidating the grout material into the slot and around the dowel bars and dowel bar support chairs. All grout shall be placed while fresh, and before the grout has taken an initial set.

Grout shall not be retempered. Finishing tools that are cleaned with water shall be dried thoroughly before working the grout.

The surface temperature of the areas to receive the grout shall be 5°C or above when grout is placed. Methods that are proposed to heat surfaces are subject to approval by the Engineer. The contact surfaces to receive magnesium phosphate grout shall be dry. The contact surfaces to receive modified high alumina based grout or portland cement based grout may be damp but not saturated.

### **Finishing Grout**

The surface of backfilled dowel bar slots shall be rounded 3 mm ± 1 mm above the existing concrete surface, which shall be removed during subsequent grinding work.

### **Curing Grout**

Fast setting grout shall be cured in conformance with the provisions in Section 90-7.01B, "Curing Compound Method," of the Standard Specifications. Attention is directed to "Allowing Traffic over Dowel Retrofitted Pavement," in these special provisions regarding grout curing time and strength gain requirements.

### **Grind Pavement**

Retrofit pavement lanes shall be ground, conforming to smoothness and finishing provisions in Section 42, "Groove and Grind Pavement," of the Standard Specifications and these special provisions. Pavement grinding shall be performed prior to sawing and sealing the transverse weakened plane joints within the retrofit lanes.

Dowel bar retrofitted transverse joints shall be ground smooth within 30 days from the initial saw cutting for the dowel bar slots. The width of the pavement lane, longitudinal joint to longitudinal joint, shall be ground. All fast setting grout backfilled into the dowel bar slots shall have a minimum cure time of 12 hours before grinding.

## **JOINT SEALING**

Transverse weakened plane joints within the retrofit lanes, longitudinal joint to longitudinal joint, shall be sealed as specified in this section.

Other joint sealing work shall be completed as specified elsewhere in these special provisions and as shown on the plans.

### **Removing Existing Sealant**

Existing sealant, if any, within the transverse joints of the dowel retrofit lane, shall be removed by manual removal, sawing, plowing or cutting. The Contractor shall propose the method of removal to the Engineer for approval 7 days before actual sealant removal. No sealant removal by the Contractor shall take place until the Engineer approves the sealant removal method. Only rectangular plows shall be allowed if plowing method is used. Any removal method selected shall not damage the pavement that is to remain.

### **Shape Sealant Reservoir**

The transverse joints of the dowel retrofit lane shall be saw cut to form a sealant reservoir as shown on the plans.

### **Joint Spalling Repair**

Minor spalling along joint faces shall be repaired in conformance with "Repair Spalled Joints" of these special provisions.

### **Cleaning the Joint**

The joint shall be cleaned of any dust, dirt, or visible traces of old sealant. Chemical solvents shall not be used to wash the joint. Immediately after sawing, plowing or cutting, or manual removal, any slurry or remaining debris from the removal operations shall be removed. The cleaning operation shall be performed in one direction to minimize contamination of surrounding areas. Surface moisture shall be removed at the sealant reservoir by means of compressed air or moderate hot compressed air or other means approved by the Engineer. Drying procedures that leave a residue or film on the reservoir wall shall not be used. After reservoir drying, the reservoir shall be sandblasted to remove any remaining residue. Sandblasting straight into the reservoir will not be allowed. The sandblast nozzle shall be pointed close to the surface at an angle to clean each reservoir face. A minimum of one pass along each reservoir face shall be made. The reservoir shall then be air blasted to remove sand, dirt, and dust, no more than one hour before placement of sealant. Compressed air used to air blast the reservoir shall not introduce oil into the reservoir. If oil is accidentally introduced into the reservoir, the Contractor shall begin the cleaning process again until the Engineer is satisfied that the reservoir is clean. Compressed air shall be delivered at a minimum rate of 3.40 m<sup>3</sup> per minute and develop at least 0.62 MPa nozzle pressure. A vacuum sweeper shall be used to remove all debris or contaminants from the surrounding pavement surfaces after air blasting.

### **Backer Rod Installation**

Backer rods shall be installed after joint cleaning. Backer rods shall be installed as shown on the plans. Backer rods shall be installed when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 4°C or above. Backer rod shall be installed when the joints to be sealed have been properly patched, cleaned and dried, as determined by the Engineer. Methods of placing backer rods that leave a residue or film on the reservoir walls, shall not be used.

### **Cleanness Inspection**

Before installing sealant, the reservoir sidewalls shall be checked for cleanness by the Engineer. The Engineer shall check for dirt and dust by finger wiping the sidewalls. If any traces of contamination are found, the Contractor shall reclean the joint.

### **Sealant Installation**

The reservoir walls shall be dry before installing the silicone sealant. No sealant shall be installed before it reaches proper manufacturer's recommended installation temperature. The Contractor shall evacuate any cooled sealant and flushing oil that remains from the pumping hoses and nozzle. This evacuated material shall be discarded. Installation of the sealant shall begin only after fresh sealant is ejected from the nozzle at an acceptable temperature.

Joints shall have the sealant recessed below the final finished surface as shown on the plans.

Sealant shall be pumped through a nozzle sized for the width of the sealant reservoir. The nozzle shall fit into the reservoir to allow pumping to the bottom. The nozzle shall be drawn toward the body of the installer versus pushing to reduce the possibility of air voids. Sealant shall not fill the reservoir to the top level of the joint surface.

After pumping the sealant, the Contractor shall draw a tool or backer rod strip over the fresh sealant. The sealant shall be tooled within 10 minutes of installation or before the sealant begins to form a skin as it cures.

After each joint is sealed, all surplus joint sealer on the pavement surface shall be removed. Traffic will not be permitted over the sealed joints until the sealant is track free and set sufficiently to prevent embedment of roadway debris into the sealant.

Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. The finished surface of joint sealant shall conform to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans, shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.

Removed material or material generated by the Contractor's operations shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

### **Core Drilling for Dowel Placement Alignment Assurance Testing**

Coring, to confirm dowel placement, shall be provided by the Contractor. Immediately after coring, the concrete cores shall be identified by the Contractor with a location description and submitted to the Engineer for inspection. The holes shall be cored by methods that will not shatter or damage the concrete adjacent to the holes.

After removal of cores, core hole voids in concrete pavement shall be cleaned and filled with fast setting grout as specified under "Materials," of this Section.

After placement of fast setting grout in the core hole, the grout while still plastic shall be troweled smooth to match the pavement surface. The grout material shall not evidence any depressions or surplus material above the level surface of the pavement.

Water for core drilling operations shall be from a local domestic water supply. Water used for coring shall not contain more than 1000 parts per million of chlorides as Cl, nor more than 1300 parts per million of sulfates as SO<sub>4</sub>, nor contain any impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

The Engineer will randomly check dowel positioning by coring. Retrofitting will be checked by the Engineer within 4 days by performing one test for every 600 dowels placed. One test shall consist of drilling 2 cores, one on each end of a dowel bar to expose both ends and allow measurement for proper alignment. If the dowel bars are located incorrectly or air voids exist surrounding the dowel bars, additional cores will be required to determine the severity. Two additional cores shall be provided, at the Contractor's expense, for every one core that is misaligned or poorly consolidated. The Engineer will select the location for performing any additional core testing.

Dowel alignment shall meet the specified tolerances. If at any time dowels are found to be installed improperly, the dowel retrofitting operations will be suspended and operations shall not begin until the Contractor has demonstrated to the Engineer that the problem which caused the improper dowel positioning has been corrected. In addition, all dowels identified as not in alignment or damaged, shall be removed and replaced at the Contractor's expense.

### **Pavement Delineation Repair**

Wherever pavement delineation is removed or damaged due to placement of dowels, the Contractor shall replace the pavement delineation as needed. The Contractor shall survey the existing traffic striping, pavement markings and pavement markers prior to slot cutting and determine at what locations delineation repairs shall be made. Removed or damaged pavement delineation shall be repaired to its original condition. Pavement delineation repairs shall be

made in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings" and Section 85, "Pavement Markers," of the Standard Specifications, and these special provisions, except for payment.

#### **Allowing Traffic over Dowel Retrofitted Pavement**

Unless otherwise permitted in writing by the Engineer, traffic shall not be permitted on dowel retrofitted pavement until the fast setting grout attains:

- (1) curing of two hours after final set, or
- (2) a compressive strength of 21 MPa or greater is achieved per ASTM Designation: C 109,  
or
- (3) a flexural strength of 2.4 MPa or greater is achieved per California Test 523.

Final set determination for the fast setting grout shall be in conformance with the requirements of ASTM Designation : C 403.

#### **MEASUREMENT AND PAYMENT**

The quantity of dowel bar retrofit to be paid for will be measured as units as determined from actual count in place.

The contract unit price paid for dowel bar retrofit shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing dowel bar retrofit, complete in place, including placing test strip, repairing any damaged or removed pavement delineation, cutting, blast cleaning, caulking, joint filler, grout backfill, sealing transverse weakened plane joints, and disposal of removed concrete, as shown on the plans, and as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing, stockpiling, and disposing of standby material for dowel bar slot temporary backfill; and for placing, maintaining, removing, and disposing of temporary backfill shall be considered as included in the contract unit price paid for dowel bar retrofit and no separate payment will be made therefor.

Full compensation for providing the facility, Contractor personnel and all the work involved in arranging for the preconstruction conference shall be considered as included in the contract unit price paid for dowel bar retrofit and no additional compensation will be allowed therefor.

The costs involved in providing an instructor at the 4-hour training class as part of the preconstruction conference will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications except that if payment is made by force account as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications, no markups will be allowed.