SECTION 403 JOINT AND CRACK SEALING

Five types of pavement preventive maintenance joint and crack sealing projects are included in Engineering Instruction 97-030 (EI 97-030). These include:

1. Routing and Sealing Cracks in Hot Mix Asphalt Pavement
2. Sealing Cracks in Hot Mix Asphalt Pavement
3. Resealing Transverse and Longitudinal Joints in Portland Cement Concrete Pavement
4. Sealing Cracks in Portland Cement Concrete Pavement
5. Filling Joints Between Portland Cement Concrete Pavement and Hot Mix Asphalt Shoulders

Maintenance Resident Engineers are responsible for selecting projects and appropriate treatments as discussed in EI 97-030. The purpose of this instruction is to help inspectors enforce the specification items for joint and crack sealing projects.

The following specification items cover Pavement Preventive Maintenance Guidelines for Joint and Crack Filling:

HOT MIX ASPHALT PAVEMENT (HMA)
ITEM 18403.7601 M ROUTING, CLEANING, AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405
ITEM 18403.7601 ROUTING, CLEANING, AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405
ITEM 18403.7602 M CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405
ITEM 18403.7602 CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405
ITEM 18403.7603 M ROUTING, CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405 (PAYMENT BY LITER)
ITEM 18403.7603 ROUTING, CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT, ASTM D3405 (PAYMENT BY GALLON)
ITEM 18403.78 M SELECTIVE ROUTING OF CRACKS IN HOT MIX ASPHALT PAVEMENT
ITEM 18403.78 SELECTIVE ROUTING OF CRACKS IN HOT MIX ASPHALT PAVEMENT
ITEM 18403.79 CLEANING AND SEALING CRACKS WITH SELECTIVE ROUTING IN HOT MIX ASPHALT PAVEMENT, ASTM D3405
ITEM 18403.79 M CLEANING AND SEALING CRACKS WITH SELECTIVE ROUTING IN HOT MIX ASPHALT PAVEMENT, ASTM D3405

PORTLAND CEMENT CONCRETE PAVEMENT (PCC)
ITEM 18502.701002 M - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 63 FT. PAVEMENT SLABS - SILICONE SEALANT
ITEM 18502.701002 - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 19 m PAVEMENT SLABS - SILICONE SEALANT
ITEM 18502.702002 M - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE
SECTION 403 JOINT AND CRACK SEALING

PAVEMENT, 20 FT. PAVEMENT SLABS - SILICONE SEALANT

ITEM 18502.702002 - RESEALING TRANSVERSE JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT, 6 m PAVEMENT SLABS - SILICONE SEALANT

ITEM 18502.7401 M - RESEALING LONGITUDINAL JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT

ITEM 18502.7401 - RESEALING LONGITUDINAL JOINTS IN PORTLAND CEMENT CONCRETE PAVEMENT

ITEM 18502.7601 M - SEALING CRACKS IN PCC PAVEMENT - SILICONE SEALANT

ITEM 18502.7601 - SEALING CRACKS IN PCC PAVEMENT - SILICONE SEALANT

JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS (SHOULDER JOINTS)

ITEM 18403.7507 M FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING FIBER REINFORCED ASPHALT CEMENT

ITEM 18403.7507 FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING FIBER REINFORCED ASPHALT CEMENT

ITEM 18403.7508 M FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING ASTM D3405

ITEM 18403.7508 FILLING SHOULDER JOINTS BETWEEN PORTLAND CEMENT CONCRETE PAVEMENT AND ASPHALT CONCRETE SHOULDERS USING ASTM D3405

BACKGROUND

These specifications became effective as of April 23, 1998 under Engineering Instruction 97-030, Pavement Preventive Maintenance Guidelines for Joint and Crack Sealing. EI 97-030 superseded EI 90-001, EI 94-034, EB 90-011 and EB 95-036 to consolidate new and existing sealing specifications, improved guidelines for project and treatment selection and to update bid price estimates.

EI 90-001 issued preventive maintenance guidelines and specifications that allowed cracks to be filled with liquid sealant material (silicone, D3405, AC-20 with fibers) and struck off with squeegees to a finished width of 100 mm (4 in.). Material applied in this manner resulted in inadequate lateral support for two wheeled vehicles (motorcycles) because of the low friction associated with the smooth surface particularly when it becomes wet. In 1995, the Department responded to complaints from motorcyclist regarding slippery pavement conditions by specifying a flush-fill, strike-off method of crack sealing.

Draft versions of the flush-fill, strike-off method specifications were refined during the 1996 construction season. The maximum overband width of sealants was reduced from 100 mm to 50 mm. Training seminars for regional personnel included sealing principles and techniques, selection and application of sealing materials and selection of projects for sealing. Seminars concluded with field demonstrations and were recorded on video tape that are available in each region for training purposes.

GENERAL REQUIREMENTS

Because the general requirements for the specifications in EI 97-030 are very similar, categorizing
them by wearing surface is appropriate. The three wearing surface categories are Hot Mix Asphalt (HMA), Portland Cement Concrete (PCC) and Shoulder Joints.

Three general requirements pertain to all treatments:

1. The maximum overband width of sealed cracks is 50 mm (2 in.)
2. Should more than 25% of pavement marking widths be obliterated by crack sealants the marking shall be replaced at the Contractor’s expense
3. All materials (D3405, Silicones and Backer Rod) used in any joint or crack sealing project shall appear on the Department’s approved list.

ITEMS IMPORTANT TO INSPECTORS
The following items are important to inspectors assigned to joint and crack sealing projects. Subtle differences between items are pointed out by wearing surface category, HMA, PCC and Shoulder Joints:

1. RESIDENT ENGINEERS (HMA, PCC and Shoulder Joints)
The EIC should give Resident Engineers an opportunity to review scheduled work to prevent conflicts between other maintenance and construction projects and allow them to inspect completed work.

2. EQUIPMENT (HMA, PCC and Shoulder Joints)
   a) Air Compressor (HMA, PCC and Shoulder Joints)
      Air compressors must be equipped with filters and traps to collect moisture and oil. Inspectors should conduct periodic checks for moisture and oil in the compressed air by placing either a clean cloth or paper in the air stream. Checks are especially important when there are ambient changes in temperature and/or humidity. Maintenance, including changing of traps and filters, is to be provided by the Contractor with no additional cost to the State.

   b) Melters (HMA and Shoulder Joints)
      Melters must be double boilers (indirect heating) using either a heat transfer liquid or tubes to carry sealants (HMA)/fillers (Shoulder Joints) through a heated oil bath. Separate working thermometers are required to record temperatures of the sealant/fillers and the heat transfer medium. The melter must maintain the pouring temperature for sealants/fillers as indicated on their containers. Positive temperature controls and mechanical agitation or recirculating pumps are also required to maintain homogeneous mixtures.

      Inspectors should witness the loading of material into the melter to ensure that it appears on the Department’s Approved List and to record the amount of material being used. Samples may be taken by the inspector should the quality of the material be suspect.

   c) Sealant Pump (PCC)
      Sealant pumps must be capable of discharging moisture curing silicone sealants.

   d) Saws and Routers (HMA, PCC)
      Grooves (HMA) and reservoirs (PCC) must have vertical sides with minimal spalling at their edges. The Contractor must affect repairs or replace saws and routers to maintain vertical sides in grooves and/or reservoirs at no additional cost to the State.

   e) Hot Air Lance (HMA, PCC and Shoulder Joints)
      Hot air lances may be used by the Contractor to dry cracks. Care must be taken not to burn the existing HMA pavement as temperatures may reach 1,000°C (2,000°F).
SECTION 403 JOINT AND CRACK SEALING

3. CRACK/JOINT PREPARATION (HMA and Shoulder Joints)
Crack and joint preparation is most critical to ensure proper adhesion of sealants (D3405) and fillers (AC-20 with fibers). Only primary or well-defined cracks, 3 mm (1/8") to 25 mm (1") wide, are to be sealed especially when low severity secondary cracks (alligator cracks) exist to prevent over application. When cracks are routed, their finished dimensions are 16 mm (5/8") wide by 13 mm (1/2") deep. When shoulder cracks are sealed they shall be thoroughly cleaned to a minimum depth of 13 mm (1/2"). The maximum overband width of sealant shall not exceed 50 mm (2 in.).

Cracks and joints must be thoroughly clean and dry before sealing or filling and may require additional cleaning especially when nearby cracks are being routed. The Contractor should be instructed to allow for more drying time or may opt to use a hot air lance should there be more than a few isolated air bubbles appearing after the hot sealant is placed in the crack or joint.

4. JOINT PREPARATION (PCC)
Like HMA and Shoulder Joints, joint preparation is most critical in sealing PCC joints and requires the same level of attention to cleaning and drying joint surfaces. The main difference between PCC joints and those is HMA and Shoulder Joints is a joint reservoir as shown in EI 97-030 under items 18502.XXXXXX (M).

When replacing compression seals and previously sealed joints, inspectors should make sure that existing lubricants and sealants are completely removed. Abrasive blasting of all reservoir surfaces followed by cleaning with compressed air will leave the concrete with a rough finish to improve bonding. All joints must be sealed on the same day that they are prepared.

For PCC pavements, transverse joints are sealed with silicone only and longitudinal joints may be sealed with either silicone or ASTM D3405 sealant. In either case, backer rod or bond breaker tape is used to isolate the joint sealant from the substrate. Backer rod that is approximately 25% larger than the joint shall be installed to a depth that allows for the proper thickness of sealant and recess below the pavement surface as depicted in EI 97-030 under items 18502.XXXXXX (M).

5. DISCHARGE TEMPERATURES of D3405 and AC-20 WITH FIBERS
Discharge hoses must be insulated and capable of recirculating material through the melter. Discharge temperatures of the sealant material are checked by the inspector using thermometers supplied by the Contractor. Any method used in checking temperatures should be considered safe by the inspector to avoid burns from exposure to hot materials. Discharge temperatures must be above the manufacturer’s recommended pouring temperatures but never exceed 163°C (325°F) for fiber reinforced material.

Do not use sealants or fillers heated above their safety heating temperatures.

Sealants and fillers may be heated longer than six hours if the manufacturer’s recommendation allows it. Melters containing material heated more than six hours must be recharged with at least twenty percent more new material and provide a homogeneous mixture before being applied.

6. CURING OF D3405 and AC-20 WITH FIBERS
Traffic shall not be allowed on the sealant until it has cooled sufficiently and will not track. A low pressure, light spray of water may be used to accelerate cooling of the sealant and fillers. Blotting with fine aggregate is allowed when using filler material only but not when using D3405.

The cooled sealant shall produce a water tight seal and be approximately flush with the pavement surface. Sealants and fillers that are not satisfactory will be replaced by the Contractor at no additional charge to the State.

7. MEASURING QUANTITIES
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SECTION 403 JOINT AND CRACK SEALING

a) Silicone Sealant
   Silicone sealant used by the Contractor is based on the linear meter or foot.

b) D3405 and Fiber Reinforced Asphalt (FRA)
   A volumetric (liters or gallons) method of measurement, corrected to 15°C (60°F) is used for D3405 and FRA. Correcting volumes to these temperatures is necessary because sealants and fillers expand when heated.

Determining corrected quantities of these materials are illustrated as follows:

1. Obtain the specific gravity of the material at 15°C (60°F) from the manufacturer or the Regional Materials Bureau.

2. Use the following formulas to convert to the volume measure:

   Metric Units D3405
   \[
   \text{Weight of D3405 used (kg)} = \frac{\text{liters of D3405 used}}{\text{Sp. Gr. of D3405 @ 15°C}}
   \]

   English Units D3405
   \[
   \text{Weight of D3405 used (lbs)} = \frac{\text{gal of D3405 used}}{\text{Sp. Gr. of D3405 @ 60°F x 8.345 lbs/gal}}
   \]

   Metric Units (FRA)
   \[
   \text{Weight of FRA used (kg)} = \frac{\text{liters of FRA used}}{\text{Sp. Gr. of FRA @ 15°C}}
   \]

   English Units (FRA)
   \[
   \text{Weight of FRA used (lbs)} = \frac{\text{gal of D3405 used}}{\text{Sp. Gr. of FRA @ 60°F x 8.345 lbs/gal}}
   \]