**MARICOPA COUNTY**
*Department of Transportation*

**MEMORANDUM**

**Date:** December 26, 2012

**To:** MAG Specifications and Details Committee

**From:** Robert Herz, MCDOT Representative

**Subject:** Revision to Section 337 CRACK SEALING **Case 13-02**

**PURPOSE:** Obtain compatibility with Maricopa County requirements.

**REVISIONS:**

- Removed sealant material type from the general description.
- Range of crack sizes to be sealed: current ¼"-1"; proposed ⅛" - 1½".
- Material Requirements
  - Revised Brookfield Viscosity
  - Added: Flash Point (ASTM D92) - 450°F Minimum.
- Revised sequence of subsections to correspond with the sequence of occurrence during construction. Moved the CLEANING AND PREPARING CRACKS AND JOINTS section ahead of the APPLICATION section. Moved PAVEMENT TEMPERATURES requirements into the APPLICATION section.
- Removed design related content from the section on CLEANING AND PREPARING CRACKS AND JOINTS.
- Removed metric units from the EQUIPMENT, ROUTING and VACUUMING subsections.
- APPLICATION section:
  - Restructured into new subsections: Weather, Temperature, Placement of Sealant, Unacceptable Work, and Reporting Requirements.
  - Added new requirements concerning weather.
  - Added new section to address unacceptable work.
  - Added new reporting requirement.
- MEASUREMENT and PAYMENT changed from pounds of sealant used to the roadway surface area sealed. This discourages waste and over use of sealant.

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# SECTION 337

# CRACK SEALING

## 337.1 DESCRIPTION:

This work consists of furnishing and placing sealant material in Contractor prepared cracks and joints of asphalt concrete or Portland cement concrete pavements. All cracks and joints, including the space between asphalt concrete pavement and the curb and gutter, which have a clear opening of one-quarter inch (¼") or greater, shall be sealed for the length of the crack that equals or exceeds one-eighth inch (⅛") in width. The Contractor shall notify the Engineer when cracks are encountered that have an opening greater than one inch (>1"). The Engineer shall identify what is to be done with cracks having an average clear opening greater than one inch (>1").

## 337.2 MATERIALS:

Sealant materials shall be a premixed, single component mixture of asphalt cement, aromatic extender oils, polymers, and granulized rubber in a closely controlled manufacturing process. Materials shall conform to the following specifications when heated in accordance with ASTM D5078 and the manufacture's maximum safe heating temperature.

| | TEST | REQUIREMENT |
|---|---|---|
| | Cone Penetration (ASTM D5329) | 20-40 |
| | Resilience (ASTM D5329) | 30% Minimum |
| | Softening Point (ASTM D113) | 210°F (99°C) Minimum |
| | Ductility, 77°F (25°C) (ASTM D113) | 30 cm Minimum |
| | Flexibility (ASTM D3111 *Modified) | Pass at 30°F (-1°C) |
| | Flow 140°F (60°C) (ASTM D5329) | 3 mm Maximum |
| MCDOT Requirement | Brookfield Viscosity, 380°F (193°C) (ASTM D2669) | 40-90 Poise |
| Existing Requirement | Brookfield Viscosity, 400°F (204°C) (ASTM D2669) | 100 Poise Maximum |
| | Asphalt Compatibility (ASTM D5329) | Pass |
| | Bitumen Content (ASTM D4) | 60% Minimum |
| | Tensile Adhesion (ASTM D5329) | 400% Minimum |
| | Maximum Heating Temperature | 400°F (204°C) |
| | Minimum Heating Temperature | 380°F (193°C) |
| | Flash Point (ASTM D92) | 450°F Minimum |

*Specimen bent 90° over a 1-inch mandrel within 10 seconds.

**337.2.1 Certification and Quality Assurance:** Prior to application, the Contractor shall submit certification of compliance to the Engineer for all materials to be used in the work.

## 337.3 EQUIPMENT:

The melter applicator unit shall be a self-contained double boiler device with the transmittal of heat through heat transfer oil. It must be equipped with an on board automatic heat controlling device to permit the attainment of a predetermined temperature, and then maintain that temperature as long as required. The unit shall also have a means to vigorously and continuously agitate the sealant to meet the requirements of Appendix X1.1 of ASTM D6690. The sealant shall be applied to the pavement under pressure supplied by a gear pump with a hose and wand and direct connecting applicator tip. The pump shall have sufficient pressure to apply designated sealant at a rate of at least three (3) gallons (11.4 L) per minute. Melter applicators shall be approved for use by the sealant manufacturer.

## 337.4 CLEANING AND PREPARING CRACKS AND JOINTS:

Immediately prior to application of sealant, all cracks and joints shall be cleaned of debris and dust. Cracks and joints shall be vacuumed during final cleaning.

**337.4.1 Routing:** Routing, when specified, shall create a sealant reservoir. Cutting should remove at least ⅛" from each side and produce vertical, intact surfaces with no loosely bonded aggregate. Routing of joints and cracks shall produce a reservoir having a nominal size of ¾" wide x ¾" deep. Variations from the nominal size are subject to acceptance or rejection at the engineer's discretion.

**337.4.2 Vacuuming:** Final cleaning shall thoroughly clean cracks and joints to a minimum depth of 1". The vacuum unit shall use high pressure 90 psi minimum, dry oil free compressed air to remove remaining dust. The high pressure tool shall be integral with a vacuum unit to collect the dust and residue. Both sides of the crack or joint shall be cleaned. Surfaces will be inspected to assure adequate cleanliness and dryness.

**337.5 APPLICATION:**

**337.5.1 Weather**: In no case shall sealant be placed during damp roadway conditions such as wet roadway surfaces or damp material inside the cracks. Operations stopped by the Engineer, due to weather, shall be at no additional cost to the contracting Agency. If installing at night, ensure that dew is not forming on the pavement surface.

Sealant material shall only be applied when pavement temperature exceeds 40°F (4°C). If pavement temperature is lower than 40°F (4°C), it may be warmed using a heat lance that puts no direct flame on the pavement.

**337.5.2 Temperature:** Sealant temperatures should be maintained at the maximum heating temperature recommended by the manufacture.

**337.5.3 Placement of Sealant**: The sealant shall be applied in cracks, joints, and sealant reservoirs uniformly from bottom to top and shall be filled without formation of entrapped air or voids.

Cracks and joints shall be slightly overfilled then leveled with a 3" sealing disk or v-shaped squeegee to create a neat band extending approximately 1" on each side of the crack or joint for surface waterproofing. The band shall be as thin as possible and shall not extend more than ⅛ inch above the pavement surface.

If the pavement is to be overlaid with Hot Mix Asphalt within six months of sealant application, cracks shall be routed, and sealant placement shall be recessed ¼" in the crack or joint reservoir with no over band. If routing is not used, the sealant over band thickness and width should be kept as narrow and thin as possible.

During and after placement of the sealant, the Contractor shall protect against harm to persons or animals that may be exposed to the hot material.

**337.5.4 Unacceptable Work**: The Contractor, at no additional cost to the contracting Agency, shall correct unacceptable work. Unacceptable work shall include, but not be limited to, unsealed cracks, material wastage on the sides of the roadway, and excess quantities of material on the roadway that adversely affects driving.

Correction of unacceptable work shall be accomplished within five working days after notification from the Engineer of the unacceptable work. The Contractor shall not progress to a new area until the unacceptable work is corrected to the satisfaction of the Engineer.

**337.5.5 Reporting Requirements:** The Contractor shall meet with the Engineer or the Engineer's designated representative on a daily basis and supply a signed daily report indicating the amount of crack sealant material applied for the day in total pounds and total square yards of pavement sealed. In addition, the Contractor shall supply the Engineer with the dates of completion of each road segment.

**337.6 OPENING TO TRAFFIC:**

Sealant material shall not be exposed to traffic until fully cured. If the sealed area must be open to traffic, blotter material shall be applied to the surface of all uncured sealant material.

All sealed cracks that have an average clear opening of 1½ inches or greater shall have blotter material applied prior to opening to traffic.

**337.6.1 Blotter:** On two lane roads or where traffic may come in contact with the hot sealant before it cures, a blotter or specialized bond breaking material shall be used to prevent asphalt bleeding and/or pickup of sealant by vehicular traffic. Blotter material shall be compatible with the crack sealant and any surface treatment being used.

**337.7 MEASUREMENT:**

Accepted pavement crack sealing shall be measured as indicated in the fee proposal by one of the following methods: square yards of pavement surface area sealed, pounds of sealant placed, or linear feet of cracks sealed.

**337.8 PAYMENT:**

Payment for pavement crack sealing at the contract unit price shall be full compensation for all labor, materials, equipment, tools, and incidentals used for surface preparation, placement of crack sealant and blotter materials, and cleanup.

- ***End of Section*** -

**SECTION 337**

**CRACK SEALING**

**337.1 ~~GENERAL~~DESCRIPTION:**

This work ~~shall~~ consists of furnishing and placing sealant material in Contractor prepared cracks and joints of ~~an application of hot applied, single component polymer modified asphalt rubber, supplied in solid form used to seal cracks or joints in~~ asphalt concrete or Portland cement concrete pavements. All cracks ~~or~~ and joints, including the space between asphalt concrete pavement and the curb and gutter, which have an average clear opening ~~that~~ of one-eighth inch (⅛") or greater, shall be sealed for the entire length of the visible crack including portions of the crack smaller than one-eighth inch (⅛"). The maximum crack width to be sealed shall be one and one-half inches (1½") wide~~will be sealed shall be a minimum of ¼ inch wide at time of work, and have a maximum width of 1 inch~~. All cracks that have an average clear opening greater than 1½ inches shall not be sealed unless directed to do so by the Engineer.

~~The work involves furnishing and placing all materials on existing pavement surfaces in accordance with this specification.~~

**337.2 MATERIALS:**

Sealant materials shall be a premixed, single component mixture of asphalt cement, aromatic extender oils, polymers, and granulized rubber in a closely controlled manufacturing process. Materials ~~will~~ shall conform to the following specifications when heated in accordance with~~to~~ ASTM D5078 and~~to~~ the manufacture's maximum safe heating temperature~~s~~.

| **TEST** | **REQUIREMENT**~~Specification~~ |
|---|---|
| Cone Penetration (ASTM D5329) | 20-40 |
| Resilience (ASTM D5329) | 30% Minimum |
| Softening Point (ASTM D113) | 210°F (99°C) Minimum |
| Ductility, 77°F (25°C) (ASTM D113) | 30 cm Minimum |
| Flexibility (ASTM D3111 *Modified) | Pass at 30°F (-1°C) |
| Flow 140°F (60°C) (ASTM D5329) | 3 mm Maximum |
| Brookfield Viscosity, ~~400~~380°F (~~204~~193°C) (ASTM D2669) | ~~100~~40-90 Poise ~~Maximum~~ |
| Asphalt Compatibility (ASTM D5329) | Pass |
| Bitumen Content (ASTM D4) | 60% Minimum |
| Tensile Adhesion (ASTM D5329) | 400% Minimum |
| Maximum Heating Temperature | 400°F (204°C) |
| Minimum Heating Temperature | 380°F (193°C) |
| Flash Point (ASTM D92) | 450°F Minimum |

*Specimen bent 90° over a 1-inch mandrel within 10 seconds.

**337.2.1 Certification and Quality Assurance:** Prior to application, the Contractor shall submit certification of compliance to the Engineer for all materials to be used in the work.

**337.3 EQUIPMENT:**

The melter applicator unit shall be a self-contained double boiler device with the transmittal of heat through heat transfer oil. It must be equipped with an on board automatic heat controlling device to permit the attainment of a predetermined temperature, and then maintain that temperature as long as required. The unit shall also have a means to vigorously and continuously agitate the sealant to meet the requirements of Appendix X1.1 of ~~ATSM~~ASTM D6690. The sealant shall be applied to the pavement under pressure supplied by a gear pump with a hose and wand and direct connecting applicator tip. The pump shall have sufficient pressure to apply designated sealant at a rate of at least three (3) gallons (11.4 L) per minute. Melter applicators shall be approved for use by the sealant manufacturer.

**337.5~~3~~4 CLEANING AND PREPARING CRACKS ~~OR~~AND JOINTS:**

Immediately prior to application of ~~polymer modified asphalt rubber~~sealant, all cracks ~~or~~and joints shall be cleaned ~~out of any~~ debris and dust. ~~As directed by the Engineer, Final cleaning of the cracks or joints shall be vacuumed.~~Cracks and joints shall be vacuumed during final cleaning. ~~Routing cracks and joints will extend crack sealant life and performance. Most cracks in Maricopa County have less than 1/8" movement over the course of a year. On cracks that have spacing which creates more than 1/8" movement it is recommended that cracks be routed.~~

**Comment [rth1]:** Deleted since it addresses design issues not contractor requirements.

**337.5~~3~~4.1 Routing:**

Routing, when specified, ~~is incidental work and is included the project cost. Routing the cracks should be used to~~shall create a sealant reservoir. Cutting should remove at least ⅛~~1/8~~" ~~(3 mm)~~ from each side and produce vertical, intact surfaces with no loosely bonded aggregate. Routing of joints and cracks ~~should~~shall produce a reservoir having a nominal size of ~~be routed to a~~ ¾" ~~(19mm) W~~wide x ¾" ~~(19mm) D~~deep. Variations from the nominal size are subject to acceptance or rejection at the engineer's discretion ~~configuration for a typical application.~~

**337.5~~3~~4.2 Vacuuming:**

Final cleaning shall thoroughly clean cracks and joints to a minimum depth of 1". The vacuum unit shall use high pressure ~~-~~90 psi minimum ~~(620 kPa) minimum~~, dry~~,~~ oil free compressed air to remove ~~any~~ remaining dust.~~,~~ The high pressure tool shall be ~~directly attached to~~integral with a vacuum unit to collect the dust and residue. Both sides of the crack or joint shall be cleaned. Surfaces will be inspected to assure adequate cleanliness and dryness.

**337.~~4~~ 5 APPLICATION:**

**337.5.1 Weather**: In no case shall sealant be placed during damp roadway conditions such as wet roadway surfaces or damp material inside the cracks. Operations stopped by the Engineer, due to weather, shall be at no additional cost to the contracting Agency. If installing at night, ensure that dew is not forming on the pavement surface.

~~Polymer modified asphalt rubber~~Sealant material shall only be applied when pavement temperature exceeds 40°F (4°C). ~~Lower temperatures may result in reduced adhesion due to the presence of moisture or ice.~~ If pavement temperature is lower ~~that~~than 40°F (4°C), it may be warmed using a heat lance that puts no direct flame on the pavement.

**337.5.2 Temperature:** ~~If installing at lower pavement temperatures that 40°F (4°C), extreme care should be used to insure that cracks or joints are dry and free from ice and other contaminates. Product~~Sealant temperatures should be maintained at the maximum heating temperature recommended by the manufacture. ~~If installing at night, ensure that dew is not forming on the pavement surface. Applied product should be checked by qualified personnel to ensure that adhesion is adequate.~~

**337.5.3 Placement of Sealant**: The sealant shall be applied in ~~the~~ cracks~~, or~~ joints, and sealant reservoirs uniformly from bottom to top and shall be filled without formation of entrapped air or voids.

~~The~~ Cracks and ~~or~~ joints shall be slightly overfilled then leveled with a 3" sealing disk or v-shaped squeegee to create a neat band ~~aid~~ extending ~~±~~ approximately 1" on each side of the crack or joint for surface ~~strength and~~ waterproofing. The band ~~aid~~ shall be as thin as possible and shall not ~~be~~ extend more than ⅛ ~~1/8~~ inch ~~in thickness~~ above the pavement surface.

If the pavement ~~being sealed will~~is to be overlaid with Hot Mix Asphalt within six months of sealant application, cracks shall be routed, and sealant placement shall be recessed ¼" ~~(6 mm)~~ in the crack or joint reservoir with no over band. If routing is not used, the sealant over band thickness and width should be kept as narrow and thin as possible.

~~**337.5 CLEANING AND PREPARING CRACKS OR JOINTS:**~~

~~Prior to application of polymer modified asphalt rubber, all cracks or joints shall be cleaned out of any debris and dust. As directed by the Engineer, final cleaning of the cracks or joints shall be vacuumed. Routing cracks and joints will extend crack sealant life and performance. Most cracks in Maricopa County have less than 1/8" movement over the course of a year. On cracks that have spacing which creates more than 1/8" movement it is recommended that cracks be routed.~~

**~~337.5.1 Routing:~~**

~~Routing, when specified, is incidental work and is included the project cost. Routing the cracks should be used to create a sealant reservoir. Cutting should remove at least 1/8" (3 mm) from each side and produce vertical, intact surfaces with no loosely bonded aggregate. Joints and cracks should be routed to a ¾" (19mm) W x ¾" (19mm) D configuration for a typical application.~~

**~~337.5.2 Vacuuming:~~**
During and after placement of the sealant, the Contractor shall protect against harm to persons or animals that may be exposed to the hot material.

**337.5.4 Unacceptable Work**: The Contractor, at no additional cost to the contracting Agency, shall correct unacceptable work. Unacceptable work shall include, but not be limited to, unsealed cracks, material wastage on the sides of the roadway, and excess quantities of material on the roadway that adversely affects driving.

Correction of unacceptable work shall be accomplished within five working days after notification from the Engineer of the unacceptable work. The Contractor shall not progress to a new area until the unacceptable work is corrected to the satisfaction of the Engineer.

**337.5.5 Reporting Requirements:** The Contractor shall meet with the Engineer or the Engineer's designated representative on a daily basis and supply a signed daily report indicating the amount of crack sealant material applied for the day in total pounds and total square yards of pavement sealed. In addition, the Contractor shall supply the Engineer with the dates of completion of each road segment.

~~Final cleaning shall thoroughly clean cracks and joints to a minimum of 1". The vacuum unit shall use high pressure 90 psi (620 kPa) minimum, dry, oil free compressed air to remove any remaining dust, directly attached to a vacuum unit to collect the dust and residue. Both sides of the crack or joint shall be cleaned. Surfaces will be inspected to assure adequate cleanliness and dryness.~~

**337.6 OPENING TO TRAFFIC:**

Sealant material shall not be exposed to traffic until fully cured. If the sealed area must be open to traffic~~, a~~ blotter material ~~can~~ shall be applied to the surface of ~~polymer modified asphalt rubber~~all uncured sealant material.

All sealed cracks that have an average clear opening of 1½ inches or greater shall have blotter material applied prior to opening to traffic.

**337.6.1 Blotter:**

On two lane roads or where traffic may ~~be likely to~~ come in contact with the hot sealant before it cures, a blotter or specialized bond breaking material ~~may be required~~shall be used to prevent asphalt bleeding and/or pickup of sealant by vehicular traffic. Blotter material ~~should~~ shall be compatible with the crack sealant and any surface treatment being used.

**~~337.7 PAVEMENT TEMPERATURES:~~**

~~Polymer modified asphalt rubber shall be applied when pavement temperature exceeds 40°F (4°C). Lower temperatures may result in reduced adhesion due to the presence of moisture or ice. If pavement temperature is lower that 40°F (4°C), it may be warmed using a heat lance that puts no direct flame on the pavement. If installing at~~

~~lower pavement temperatures that 40°F (4°C), extreme care should be used to insure that cracks or joints are dry and free from ice and other contaminates. Product temperatures should be maintained at the maximum heating temperature recommended by the manufacture. If installing at night, ensure that dew is not forming on the pavement surface. Applied product should be checked by qualified personnel to ensure that adhesion is adequate.~~

**337.~~8~~ 7 MEASUREMENT:**

Pavement crack sealing shall be measured by the square yards of pavement surface area sealed and accepted. ~~The cleaning and sealing of cracks and joints shall be measured by pounds of sealant placed.~~

**337.~~9~~ 8 PAYMENT:**

Payment for pavement crack sealing at the contract unit price shall be full compensation for all labor, materials, equipment, tools, and incidentals used for surface preparation, placement of crack sealant and blotter materials, and cleanup.~~Payment will be full compensation for furnishing and placing all materials specified and used, with no allowance for waste, and shall include labor, equipment, tools, and incidentals to complete the work as prescribed and as directed by the Engineer.~~

**Comment [rth2]:** How is waste to be defined and measured.

~~No payment will be made for materials rejected due to improper placement, improper proportions of materials, or material found to be defective or out of specifications.~~

- ***End of Section*** -