

Section 407—Asphalt-Rubber Joint and Crack Seal

407.1 General Description

This work includes filling (Type M) or sealing (Type S) joints and cracks in existing pavements with rubber asphalt mixtures. A polymer-modified asphalt rubber (PMAR) blend may be used in lieu of both Type M and Type S.

407.1.01 Definitions

Type M: Used to fill joints and cracks in Portland cement concrete or asphaltic concrete pavements when required by the Plans before placing an overlay.

Type S: Used to seal joints and cracks in Portland cement concrete and asphaltic concrete pavements and shoulders when not placing an overlay.

407.1.02 Related References

A. Standard Specifications

Section 820—Asphalt Cement

B. Referenced Documents

AASHTO PP5

ASTM D 4

ASTM D36

ASTM D3407

ASTM D 3583

407.1.03 Submittals

Certify that each lot of premixed material meets the requirements of this Specification and shall submit the test results of each lot for each Project. Ensure that each sealant lot is delivered in containers with the manufacturer's name or trademark and lot number plainly marked.

Furnish samples of the individual components of premixed material as follows:

- At least 20 lbs (10 kg) of rubber representative of each lot
- At least 5 gal (15 L) of asphalt containing additives as proportioned
- Proportional quantities of mixing aids or additives not included above

407.2 Materials

Ensure that the sealant material is a premixed, asphalt-rubber sealant mixture. Ensure that the mixture is a blend of asphalt cement, aromatic extender oil(s), and recycled or reclaimed tire crumb rubber (18 ± 1 percent and 22 ± 1 percent by weight for Type S and Type M, respectively based on weight) in a closely controlled manufacturing process. The dosage rates of tire crumb rubber may be reduced if a polymer modifier is added to the mixture. Produce a mixture with the following properties:

A. Workability

The mixture pours readily and penetrates a 1/4 in (6 mm) pavement joint or crack to a depth of at least 1 in (25 mm) when the application temperature of the fully reacted mixture is 350 °F (204 °C) and the air temperature is 35 °F (2 °C) or higher.

The mixture, when placed in conventional field installation equipment, readily melts to a pumping consistency after being heated to 400 °F (204 °C) for 2 hours maximum. The mixture remains in a pumping consistency when the temperature of the field installation equipment is reduced to the normal operating temperature range of 300 °F to 350 °F (150 °C to 175 °C).

B. Curing

The mixture contains no water or volatile solvents and cures immediately when cooled to a sufficient viscosity to prevent tracking caused by traffic.

C. Softening Point and Flexibility

When a fully reacted mixture sample of asphalt-rubber has been heated at 350 °F (175 °C) for one hour, or when a PMAR blend has been heated at 380 °F (195 °C) for one hour, it shall pass the following laboratory tests:

1. Softening Point

The minimum softening point by ring and ball described in ASTM D 36 is as follows:

PMAR	185 °F (85 °C)
Type S	135 °F (60 °C)
Type M	150 °F (65 °C)

2. Flexibility

Bend a 1/8 in (3 mm) thick x 1 in (25 mm) wide x 6 in (150 mm) long mixture specimen after conditioning to 10 °F (-12 °C) at a minimum bending rate of 9 degrees per second (10 seconds maximum for a 90° bend) over a 1 in (25 mm) diameter mandrel without cracking.

D. Separation

Test the PMAR blend for phase separation by pouring a representative sample of the mixture into aluminum tubes 1 in (25 mm) in diameter and 5-1/2 in (137 mm) long as described in AASHTO PP5. Cure the samples at 325 °F (165 °C) for 48 hours. Take samples from the top and bottom of the tube and determine softening point as described in ASTM D 36. Average the test results from the top and bottom samples. If there is 4% or more difference between the average test result and either of the top or bottom test results, reject the mixture due to separation.

E. Adhesion

When cooled, the mixture bonds strongly to both asphalt and concrete pavement surfaces. The mixture contains no materials that chemically react with these surfaces to reduce the short-term and long-term adhesion bonds.

F. Acceptable Recycled or Reclaimed Tire Crumb Rubber

Before the rubber is added, ensure the asphalt cement used in the mixture conforms to the requirements of Section 820.2.01, PG 58-22 or PG 64-22.

Ensure that the recycled, reclaimed tire crumb rubber used in the mixture meets the following requirements:

- Was obtained from used pneumatic tires (such as automobile, truck, bus, etc.)—not solid tires and non-tire rubber sources
- Was produced from an ambient grinding process (crushes, tears, grinds, or wears the used rubber tires at or above ordinary room temperature that produces rubber particles with a ragged, sponge-like surface). Cryogenically ground rubber or tire buffings are prohibited.
- Contains recycled, vulcanized crumb rubber and/or reclaimed (devulcanized) rubber
- Contains at least 25 percent natural rubber by weight of the total rubber portion of the mixture
- Contains no more than a trace of fabric
- Is free of wire and other contaminating materials, except up to four percent calcium carbonate or talc to prevent rubber particles from sticking
- Contains no rubber particles greater than 1/4 in (6 mm) long
- Meets the following gradation requirements:

Sieve Size	Percent Passing
No. 10 (2.0 mm)	100%
No. 16 (1.18 mm)	95 to 100%
No. 30 (600 µm)	40 to 80%
No. 80 (180 µm)	0 to 5%

G. Poly-modified Asphalt Rubber

If a PMAR blend is used, ensure it meets the following additional requirements:

PROPERTY	SPECIFICATION LIMITS
Cone Penetration, 77 °F (25 °C)	30 - 60 dmm
Resilience, 77 °F (25 °C), % Recovery	30% minimum
Ductility, 77 °F (25 °C), 50 mm/minute	300 mm minimum
Asphalt Compatibility (ASTM D 3407)	Pass
Bitumen Content (ASTM D 4)	60% minimum
Tensile Adhesion (ASTM D 3583)	500% minimum
Rotational Viscosity (Brookfield), No. 5 spindle, 20 RPM, 400 °F (205 °C)	3,000 – 15,000 cp

407.2.01 Delivery, Storage, and Handling

Package the premixed sealant material in units weighing no more than 30 lbs (15 kg) with a maximum of two 30 lbs (15 kg) units per shipping container. Ensure that the plastic film used to package the units melts at normal application temperatures when placed in the installation equipment.

407.3 Construction Requirements**407.3.01 Personnel**

General Provisions 101 through 150.

407.3.02 Equipment**A. Field Installation Equipment**

Use field installation equipment that produces or maintains specified temperatures, even if filled to capacity.

Ensure that the equipment produces or maintains a homogenous mixture of asphalt and rubber at a uniform temperature without hot or cool spots or rubber and asphalt segregation in the mixture.

B. Crack Filling Equipment

Ensure that the equipment for filling the joints and cracks directs the sealant into the crack. Seal large cracks from the bottom up. Provide squeegees as necessary.

C. Air Compressor(s)

Ensure that the air compressors are satisfactory to the Engineer.

407.3.03 Preparation**A. Joint and Crack Preparation**

Use compressed air to thoroughly clean the joints and cracks to be sealed.

Clean the pavement surface and check the joints and cracks to ensure that they are free of vegetation, dirt, dust, moisture, and other foreign material.

407.3.04 Fabrication

General Provisions 101 through 150.

407.3.05 Construction**A. Restrictions**

Do not seal joints and cracks if:

- The joint or crack surface to be treated is not thoroughly dry.
- Rain is imminent.
- The air temperature is below 35 °F (2 °C).

B. Procedure

Follow this procedure to seal joints and cracks:

1. Place the prepackaged sealant mixture in the field installation equipment.
2. Heat the sealant mixture for the proper time and temperature to provide a full reaction between the asphalt and rubber.
3. Apply the mixture at the specified application temperature according to the manufacturer's recommendations or the laboratory's approval.
4. Carefully fill the joint or cracks, slightly overfull. Strike off the excess with a V-shaped squeegee to feather the sealant out to a width of approximately 2 in (50 mm).

407.3.06 Quality Acceptance

If the packaged units are bonded or stuck together or to the shipping container, or if packaging staples or fasteners cause sealant contamination, the material may be rejected as determined by the Engineer.

The manufacturer must meet the requirements of this Specification and furnish evidence of successful field installation and performance under similar environmental and project conditions.

407.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

407.4 Measurement

Joints and cracks will be measured by the linear foot (meter) by surface measure.

407.4.01 Limits

General Provisions 101 through 150.

407.5 Payment

Joints and cracks sealed according to the Plans and this Specification will be paid for at the Contract Unit Price bid.

Payment is full compensation for furnishing all materials and performing the work.

Payment will be made under:

Item No. 407	Polymer-modified asphalt –rubber joint and crack seal	Per linear foot (meter)
Item No. 407	Asphalt-rubber joint and crack seal, type "S"	Per linear foot (meter)
Item No. 407	Asphalt-rubber joint and crack seal, type "M"	Per linear foot (meter)

407.5.01 Adjustments

General Provisions 101 through 150.

Section 408—Joint and Crack Cleaning and Seal**408.1 General Description**

Specifications for this work will be included elsewhere in the Contract.

Section 411—Asphaltic Concrete Pavement, Partial Removal**411.1 General Description**

This work includes removing portions of existing asphaltic concrete pavement, removing base and subgrade as shown on the Plans or as directed by the Engineer, and sawing joints in the existing asphaltic concrete pavement.

411.1.01 Definitions

General Provisions 101 through 150.