



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Janet T. Mills
GOVERNOR

Bruce A. Van Note
COMMISSIONER

April 22, 2024
Subject: Pavement Milling, Hot Mix
Asphalt
WIN: 026057.00, 026059.00 & 026061.00
Location: Frankfort, Hampden, Prospect,
Stockton Springs & Winterport
Amendment No. 1

Dear Sir/Ms.:

Question: Will a notched wedge joint be required on the 1 1/4" surface?

Response: The Department will not require the use of a notched wedge, however the option is available to the Contractor.

Question: Will MaineDOT be adding any specifications to the special provisions for items 410.153, 424.22, 424.38, 424.386 on this project?

Response: Please see the attached documents for the contract.

Question: Is the project intended to have a centerline joint density specification?

Response: Longitudinal Joint density for the 1.25" layer will not be required. Please see the attached revised 403SP dated April 22, 2024.

Consider these changes and information prior to submitting your bid on **April 24, 2024**.

Sincerely,

A handwritten signature in blue ink, reading "George Macdougall".

George M. A. Macdougall P.E.
Contracts & Specifications Engineer

SPECIAL PROVISION
SECTION 403
HOT MIX ASPHALT

Desc. Of Course	Grad Design.	Item Number	Total Thick	No. Of Layers	Comp. Notes
<u>26057.00 - 1 ¼" HMA Overlay w/ Variable Depth Shim</u>					
<u>Travel Lane, Truck Lane & Shoulders (As Indicated)</u>					
Wearing	9.5 mm	403.2101	1 ¼"	1	2,4,7,24,25,43
Shim	9.5 mm	403.2111	variable	1/more	2,4,7,20,25,30,43
<u>26057.00 - 1" HMA Overlay w/ Variable Depth Shim</u>					
<u>Turn Out Area (As Indicated)</u>					
Wearing	9.5 mm	403.2101	1"	1	2,4,7,24,30,31
Shim	9.5 mm	403.2111	variable	1/more	2,4,7,20,30,31
<u>26059.00 & 26061.00 - 1 ½" Mill & 1 ½" HMA Overlay</u>					
<u>Travel Lane, Truck Lane & Shoulders (As Indicated)</u>					
Wearing	9.5 mm	403.2101	1 ½"	1	2,4,7,22,24,25,43
<u>Shoulder Rehabilitation Areas (As Indicated or Directed)</u>					
Base	12.5 mm	403.213	2"	1	4,8,30
<u>Drainage Cross Trench (As Indicated or Directed)</u>					
Base	12.5 mm	403.213	4 ¾" or match	2	4,8,30,32,34
<u>Spot Shims (As Directed)</u>					
Shim	9.5 mm	403.2111	variable	1/more	2,4,7,20,25,30,51
<u>CBs & Structure Adjustments (As Directed)</u>					
Shim	9.5 mm	403.213	6" or match	3/more	4,8,30,32
<u>Drives, ADA, Sidewalks, Misc. (As Directed)</u>					
Wearing	9.5 mm	403.209	2"	1/more	3,20,30,32

COMPLEMENTARY NOTES

2. The required PGAB shall be a storage-stable, homogeneous, polymer modified asphalt binder that meets **PG 64E-28** grading requirements in AASHTO M 332. All polymer modified asphalt grades utilized on the Project shall be treated with an approved liquid anti-strip. PG binders shall be treated either at the asphalt source terminal with the required dose rate on the delivery documentation, or at the hot mix asphalt plant utilizing a system integrated with the plants controls that will introduce a minimum 0.50 percent anti-strip by weight of asphalt binder used unless a rate is otherwise recommended by the anti-strip manufacturer. The PGAB and anti-strip blend shall meet the **PG 64E-28** requirements. The Contractor shall provide supporting test data showing the PGAB and anti-strip blend meet the required criteria.
3. The design traffic level for mix placed shall be <3 million ESALS. The design, verification, Quality Control, and Acceptance tests for this mix will be performed at **65 gyrations**.
4. The aggregate qualities shall meet the design traffic level of 3 to <10 million ESALS for mix placed under this contract. The design, verification, Quality Control, and Acceptance tests for this mix will be performed at **65 gyrations**.
7. Section 106.6 Acceptance, (1) **Method A** as specified Section 401.20 - Quality Assurance Methods A and C.

Stockton Springs - Frankfort, Winterport - Hampden, Winterport
26057.00, 26059.00, 26061.00
US Route 1A
1 ¼" Overlay, 1 ½" Mill & Fill
Pavement Preservation
REVISED - April 22, 2024

8. Section 106.6 Acceptance, (2) **Method B** as specified Section 401.21 - Quality Assurance Methods B and D.
20. The combined aggregate gradation required for this item shall be classified as a 9.5mm Thin Lift Mixture (TLM) mixture, using the Aggregate Gradation Control Points as defined in 703.09.
22. Longitudinal joint density testing shall be applied to the specified HMA layer. See Special Provision 401 – Hot Mix Asphalt Longitudinal Joint Density for project specifics.
24. See Special Provision 401 - HMA with Fine Micro-Deval Requirement for project specifics.
25. The Contractor may, at their option, use a Material Transfer Vehicle (MTV) for **all mainline travelway and adjacent shoulders surface course** if paved in the same operation. See Special Provision 401 – Material Transfer Vehicle for specifics.
30. The incentive/disincentive provisions for density shall not apply. Rollers shall meet the requirements of this special provision. The use of an oscillating steel roller shall be required to compact all mixtures pavements placed on bridge decks.
31. Compaction of the new Hot Mix Asphalt Pavement will be obtained using a minimal roller train consisting of a **10 ton** vibratory and **3-5 Ton** finish roller for roadway work. A **Quality Control Technician (QCT)** shall be required for all roadway mixtures placed under this contract. A daily paving report, summarizing the mixture type, mixture temperature, equipment used, environmental conditions, and number of roller passes, shall be recorded and signed by the QCT and presented to the Department's representative by the **end of the working day**.
32. In areas inaccessible to a **10 ton** roller, compaction of the new Hot Mix Asphalt Pavement will be obtained using a minimal roller train consisting of a **3-5 ton** vibratory roller. Areas less than 2 feet wide shall be compacted with a minimum of a **150 pound** plate compactor. An approved release agent is required to ensure the mixture does not adhere to hand tools, rollers, pavers, and truck bodies. The use of petroleum based fuel oils, or asphalt stripping solvents will not be permitted.
34. The Contractor shall saw cut at a consistent width to allow transverse rolling of the trench. When applicable, a **10 ton** roller will be required. In areas inaccessible to a **10 ton** roller, compaction of the new Hot Mix Asphalt Pavement will be obtained using a minimal roller train consisting of a **3-5 ton** vibratory roller. The **minimum width of the trench shall be 5 feet** to accommodate a **3-5 ton** vibratory roller. Payment for additional milling or saw cutting required shall not be considered directly, but instead shall be considered incidental to the paving items.
43. The Department shall profile railroad and bridge approaches every 10 feet along the roadway center line and edge of travelways, out to a match point at a minimum of 75 feet from the structure, to determine the approach pavement taper, elevations, and pavement removal or shim requirements. This work shall be accomplished in cooperation with the Contractor by means of conventional surveying equipment or blocking and string lines as cooperatively determined by the Contractor and Department. At minimum, the survey work will be completed 10 days prior to milling and/or paving operations.
51. A mixture meeting the gradation of 12.5 mm hot mix asphalt may be used at the option of the contractor. Should this option be used, the maximum depth for spot shims shall not exceed a compacted depth of 3". The 12.5 mm shim shall be tested under 403.2131 utilizing method B testing and will be paid as 403.2111.

Tack Coat

A tack coat of emulsified asphalt, RS-1, RS-1h, CRS-1 or CRS-1h, Item 409.15 shall be applied to any existing pavement at a rate of approximately 0.030 gal/yd², and on milled pavement approximately 0.05 gal/yd² prior to placing a new course. A fog coat of emulsified asphalt shall be applied between shim /base courses and surface course as well as to any bridge membrane prior to the placement of HMA layers at a rate not to exceed 0.030 gal/yd². Tack used will be **paid for at the contract unit price** for Item 409.15 Bituminous Tack Coat.

SPECIAL PROVISION
SECTION 400
Pavements

(Emulsified Asphalt Seal Coat with/without Cover Coat)

Description This work consists of furnishing and applying one or more applications of emulsified asphalt sealcoat, with or without cover coat material as described in the contract, on an approved surface in accordance with these specifications and in reasonably close conformity with the contract.

Materials The emulsified bituminous asphalt sealant shall meet the applicable requirements of Section 702 – Bituminous Materials. Liquid asphalt grades for the fog coat treatment shall meet the requirements for CSS-1, CSS-1h, CRS-2h, or CRS-2P. The emulsion type selected shall be used for the entire fog seal application areas unless otherwise approved by the Department.

The emulsified asphalt shall be produced with an approved, certified emulsion product, diluted, and thoroughly mixed into a homogenous liquid at the emulsion manufacturing facility. Each load shall be accompanied by a loading invoice listing the material supplier, emulsion type, dilution rate, total quantity loaded, and copy of the undiluted emulsified asphalt product certification. The diluted emulsion shall meet the requirements listed in Table 1 of this specification.

Table 1 – Diluted Asphalt Emulsion for Seal Coat

<u>Test requirements for diluted material</u>	<u>Range</u>
Sieve test %	0 – 0.10
Residue by distillation, %	28 - 40
Penetration	40 - 90
Application Temperature	100 - 180°F

Cover coat material, if required by the contract, shall be black or dark brown in color. Cover coat materials shall be dried and free from moisture, and be of similar type and size as aluminum oxide or silicon carbide abrasive sandblasting grit meeting the “fine” or “extra fine” gradation requirements (ref: Black Beauty abrasive or similar product).

Equipment Emulsified asphalt sealcoat material application equipment shall meet the requirements specified in Section 409 – Bituminous Tack Coat, subsection 409.05 – Equipment with the addition of the following:

The asphalt distributor shall contain suitable mechanical circulating and heating mechanisms to provide a uniform approved temperature of the entire mass of material. The distributor shall be equipped with a radar type sensor used to measure ground speed, and feed a Digital Volumetric Accumulator capable of measuring gallons applied and distance traveled.

The asphalt distributor be capable of applying asphalt material in accurately measured quantities at any rate between 0.01 to 2.0 gallons per square yard, of roadway surface, at any length of spray bar up to 16 feet. The distributor shall be capable of maintaining a uniform rate of distribution of asphalt material regardless of change in grade, width or direction of the road. It shall be equipped with an electronic control for setting asphalt pump discharge rate and on/off switching of spray for nozzles in one (1) foot, increments which shall be located in the truck cab. The spray nozzles and pressure system shall provide a sufficient and uniform fan-shaped spray of asphalt material throughout the entire length of the spray bar at all times while operating. The spray shall completely cover the roadway surface receiving the treatment.

If cover coat material is required by the contract it shall be applied by means of mechanical aggregate spreader. The aggregate spreader shall be mounted on the asphalt distributor. The spreader shall have a hopper with a minimum capacity of 2000 lbs, and shall be equipped with vibratory agitation to facilitate material flow. Aggregate spinners shall be variable speed, capable of distributing cover aggregate consistently over variable roadway widths in a single pass. All controls shall be cab-mounted and capable of being operated during the application of the asphalt emulsion by the distributor operator.

CONSTRUCTION PROCEDURES

Weather Limitations Emulsified asphalt sealcoat material with or without aggregate cover shall not to be applied when the atmospheric temperature is below 50°F, or pavement surface temperature below 50°F.

Emulsified asphalt sealcoat with or without aggregate cover shall not be applied in wet conditions, or when wet weather conditions are forecasted within a 6 hour period after application.

Preparation of Surface Before application of the emulsion seal coat material with or without aggregate cover the surface shall be thoroughly cleaned of all loose and objectionable material. Preparation of the surface shall be considered incidental to the contract. The Contractor shall be responsible for covering all utility irons just prior to application of emulsion and uncovering utilities after application.

Immediately before applying an emulsified asphalt seal coat, the pavement surface must be cleaned with a road sweeper, power broom to remove dust, dirt, and debris. The pavement surface must be clean and dry before applying the emulsified asphalt sealcoat.

Application Emulsified asphalt seal coat materials with or without aggregate cover shall be applied by a pressure distributor in a uniform, continuous spread over the area to be treated. The target application rate shall be 0.12 gallons per square yard. Emulsion application rates may be adjusted within the range of 0.10 to 0.14 gallons per square yard, as determined by the test section and as directed by the Department. No additional payment consideration or adjustment shall be made unless the required application rate varies from the rate as specified above.

The cover coat aggregate shall be applied immediately after the emulsion, prior to the emulsion break or cure, and simultaneously with the pressure distributors pass.

Equipment or traffic will not be allowed on the emulsion treated surface until the emulsion has fully cured. Emulsion materials will be applied within the temperature range specified in Section 702.05 – Application Temperatures, or as otherwise listed in this specification. No moisture shall be present on the roadway surface.

The Contractor shall provide dry cover material meeting the requirements of this specification and at a spread rate of 0.35 to 0.75 lbs./ s.y. as determined by the control section. The Contractor shall be required to apply additional cover material above the prescribed rate in the event that excessive emulsion materials are applied. Use of cover material shall be paid for by the pound, by means of verified bagged quantity, or by scaled weight of actual materials applied.

A test section shall be established to verify emulsion and cover coat material target application rates. The section shall be of sufficient length to verify the approximate emulsion use at the prescribed rate. Generally, the length of test section shall be approximately 200-500 linear feet. During emulsion seal material application, adequate provisions shall be made to prevent marring and discoloration of adjacent pavements, structures, vehicles, foliage or personal property. The use of skirting or end panels may be required to control application widths, and limit overspray.

Areas found to lack the proper emulsified asphalt seal coat application rate will require a re-application of emulsion material to meet the required rate. Areas requiring re-application will not be paid for directly but shall be considered incidental to the emulsified asphalt seal coat pay item,

In the event that excessive emulsion materials are applied, the use of cover coat material shall be used to reduce the risk of bleeding and tracking by traffic. Additional aggregate cover material, if required, will be considered incidental to the emulsified asphalt seal coat pay item.

Traffic Control The Contractor may be allowed a limited lane closure lengths if outlined in the contract. If allowed in the contract, traffic volumes shall be monitored to determine peak traffic levels, and lane closures shall be allowed outside peak traffic level times. The Traffic Control Plan will be amended to address traffic control at intersections, businesses, or other high traffic areas. Additional signage shall be used to at .5 mile intervals to warn motorists to stay out of the closed lane and off the sealant. When mainline travelway sealing work is required adequate quantity and properly spaced cones for travelway delineation along with cones or barricades shall be required. Whether treating travelway or shoulders, cones or barricades shall be placed across the treated area every 500 ft immediately after the emulsion and aggregate application to prevent vehicles from traveling through the sealant during the cure period.

All traffic shall be kept off the emulsified asphalt seal coat areas for a minimum of 4 hours or until curing is complete. The emulsified asphalt seal coat surface will be considered cured when the emulsion or cover coat material does not track off the treated surface, and no visible uncured emulsion remains on the surface. The Contractor may elect to use a polymer modified emulsion to further reduce cure time. No additional payment will be made should a polymer modified emulsion be used.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Method of Measurement The Department will measure the emulsified asphalt seal coat with or without aggregate cover (grit) by the square yard. Payment will be for the actual number of square yards applied in accordance with the contract or as directed by the Department.

Basis of Payment The Department will pay for the work, in place and accepted, in accordance with the applicable sections of the Special Provisions at the contract unit price per square yard of seal coat applied, with or without cover coat, as outlined in the contract or as directed by the Department.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
410.151 Emulsified Asphalt Seal Coat, Applied	Square Yard
410.153 Emulsified Asphalt Seal Coat with Grit, Applied	Square Yard

SPECIAL PROVISION
SECTION 424
ASPHALT RUBBER CRACK SEALER – Type 2

Description This work shall consist of furnishing all labor, equipment and materials necessary to clean, fill and seal longitudinal and transverse cracks in bituminous concrete pavement courses. Materials are to be thoroughly applied to seal the cracks. This work shall consist of the furnishing and placement of crack sealing material in the cracks of existing bituminous concrete pavement in accordance with these Special Provisions. This work shall consist of crack cleaning and drying, material supply and heating, preparation and application material, material finishing or shaping, and providing and installing barrier material or curing materials as required.

Materials Asphalt Rubber Crack Sealer shall be an asphalt and rubber compound designed for a temperature range of 64-28 °C, and which improves the strength and performance of the base asphalt cement. Hot pour rubber crack sealant material shall conform to ASTM D-6690, Type 2.

Cone Penetration	90 max
Flow @ 60°C [140°F]	< 1/4 inch
Bond, non-immersed	Three ½ inch specimens pass 3 cycles @ 50% extension @ -20
Resilience, %	N/A
Asphalt Compatibility, ASTM D5329	pass*

* There shall be no failure in adhesion, formation of any oily exudate at the interface between the sealant and asphaltic concrete or other deleterious effects on the asphaltic concrete or sealant when tested at 140°F.

The Contractor shall provide the Resident or authorized representative with a copy of the material manufacturer's recommendations pertaining to heating, application, and reheating prior to the beginning of operations or the changing of materials.

EQUIPMENT

Equipment Equipment used in the performance of the work shall be subject to the Resident's or authorized representative's approval and shall be maintained in a satisfactory working condition at all times. As a minimum, the equipment required will consist of the following:

- (1) Air Compressor and air wand: A portable air compressor and air wand shall be supplied to clean the cracks to be sealed prior to using a hot air lance. The air compressor shall be coupled with hose and air wand and be capable of furnishing not less than 150 CFM of air and not less than 100 psi pressure through a 5/8"- inch diameter nozzle. A 1/2 -inch or 3/4-inch nozzle may be used with approval of the Inspector as long as the pressure requirements are being met. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. A single air compressor may be utilized to supply air to both the air wand and hot air lance with the condition that it will consistently supply the required air volume and pressures for each operation simultaneously.
- (2) Sweeper: Manually operated, gas powered air-broom or self-propelled sweeper designed especially for use in cleaning highway and airfield pavements shall be used to remove debris, dirt, and dust from the cracks.
- (3) Hot Air Lance: The hot air lance shall be independent of the air wand unit. The hot air lance shall be operated with propane and compressed air in combination and provide 1000 ft/sec of heated air at 2000°F - 3000°F. The lance should draw propane from no smaller than a 100 lb tank using separate hoses for propane and air draw. The hoses shall be wrapped together with reflectorized wrap to keep them together and to protect workers in low light situations. A single air compressor may be utilized to supply air to both the air wand and hot air lance with the condition that it will consistently supply the required air volume and pressures for each operation simultaneously.
- (4) Hand Tools: Hand tools shall consist of shall consist of brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to prepare cracks to be sealed. Other tools such as, but not limited to, V-shaped squeegee or flat squeegee may be necessary to prevent excessive overband width and thickness.
- (5) Melting Kettle: The unit used to melt the joint sealing compound shall be a double boiler, indirect fired type. The space between inner and outer shells shall be filled with a suitable heat transfer oil or substitute having a flash point of not less than 608°F. The kettle shall be equipped with a satisfactory means of agitating and mixing the joint sealer at all times. This may be accomplished by continuous stirring with mechanically operated paddles and/or a continuous circulating gear pump attached to the heating unit. The kettle must be equipped with thermostatic control calibrated between 200°F and 550°F. The Contractor shall either provide a jacketed thermometer that accurately displays the sealant temperature within the kettle or provide the Resident or authorized representative with a suitable device for verifying the sealant temperature in the kettle. Temperatures must be able to be checked at any time during the heating of material, application of material, or at the end of the application operation.

GENERAL CONSTRUCTION REQUIREMENTS

Weather Asphalt Rubber Crack Sealer shall not be applied on a wet surface, or when the atmospheric temperature is below 50°F in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper construction procedures.

Preparations of Cracks All cracks shall be blown free of loose material, dirt, vegetation, and other debris by high pressure air prior to the used of the hot air lance. Material removed from the crack shall be removed from the pavement surface by means of compressed air, power sweeper or appropriate hand tools as required. Cracks showing evidence of vegetation after being blown out shall be additionally cleaned by appropriate hand tools and additionally blown out. All cracks must be blown clean with the high-pressure air wand in advance of the hot air lance. All cracks shall be heated via the hot air lance no more than 5 minutes prior to the crack being sealed. Distance between the hot air lance and the crack sealing unit should be no more than 50 ft to eliminate re-invasion of water, debris, and other incompressible materials. All debris, vegetation, and water shall be removed to enhance adhesion of the crack sealing material. THIS WORK SHALL NOT BE DONE IN INCLEMENT WEATHER.

Preparation and Placement of Sealer The rubber crack sealer material shall be heated and applied at the temperature specified by the manufacturer and approved by the Resident or authorized representative. Any material that has been heated above the manufacturer's specification shall not be used. Material that is reheated or held at temperature for an extended period of time may be used as allowed by the manufacturer's specification and approval of the Resident or authorized representative. A copy of the manufacture's specification shall be provided to the Project when requested.

The Contractor shall provide the Resident or authorized representative with a suitable device for verifying the sealant temperature in the kettle and at the application site.

Any loose material on the surface or in the crack, which may contaminate the crack sealer or impede bonding of the sealant to the pavement, is to be removed by hand tools prior to crack filling. No crack filling material shall be applied in a crack that is wet or where frost, snow, or ice is present. The ambient air temperature must be 50 or higher.

Any over application or spills are to be removed to the satisfaction of the Resident or authorized representative. Any sealed areas with damaged or contaminated sealer or visible voids are to be removed, prepared and resealed. Defective or leaking valves and wands will be repaired or replaced before work continues. If repairs or replacement of defective equipment cannot be accomplished immediately then the Department may permit work to continue but deduct any excess quantities placed as it determines.

Cracks ½ inch up to 1 ½ inch in may be sealed with Type II crack seal. Generally, repairs wider than 1 ½ inches or those that extend below the surface layer may require a change to different sealant material type or treatment method in order repair cracks.

For projects where sealants will be covered and a hot mix asphalt overlay is being installed over the sealant all cracks will be “**flush filled**”, meaning cracks are filled to a point that the sealant is flush with the existing pavement surface. If the work scope requires a flush fill a nozzle sized to fill the cracks shall be used. Minimal to no overbanding will be permitted.

For projects where the sealants are left un-covered with a hot mix overlay and traffic will be permitted to travel over the sealants for the anticipated sealant life, some overband may be permitted. If the work scope required crack filling and sealing with overband, then a shoe sized to meet the overband width shall be used. Generally, the shoe width and the sealer overbanding area shall range from 1 inch – 1.5 inch. Overbanding width may vary from the range specified depending on the width and severity of the cracks.

Sealer shall be delivered to the crack while the cracks are still hot from the hot air lance preparation through a pressure hose line and applicator nozzle or shoe.

The applicator shall be followed by a V-shaped squeegee to minimize the thickness of any overband. The sealer shall be applied at a rate that produces a coating thickness of 1/8 - inch, typical.

If the sealed area is to be opened to traffic immediately, a barrier material (de-tackifier) such as Glenzoi, Black Beauty grit, or an equivalent product approved by the Resident shall be provided by the Contractor and shall be applied to the crack sealer to prevent pickup as directed by the Resident or authorized representative.

If sealed areas are to be paved over with a hot mix asphalt treatment a 48 hour minimum cure time and use of barrier material (de-tackifier) will be required. Cure times may be extended if excessive pick-up of the crack sealants occurs.

Quality of Work Any excess of sealer, spilled or overapplied, shall be removed from the pavement by approved methods and discarded. Any quality of work determined to be below normal acceptable standards will not be accepted and will be corrected and/or replaced as directed by the Resident or authorized representative.

Method of Measurement Asphalt Rubber Crack Sealer will be measured by the pound of sealant used. The manufacturer's weights of the sealant for each block (pill), counted as they are loaded, will be accepted as a basis for measurement.

Should tank checks be approved to verify material usage or calculate initial or final gallons remaining in the tanker, a calibrated tank gauge or tank stick shall be used to measure the tank gallons. Volume corrections shall be calculated using Table:1 to correct the gallon volume to 60 ° F.

For those approved cases the Department has determined the weight of this material to be 9.7 pounds per gallon. The Department will use this conversion value for all materials measured by the gallon and converted to pounds. The corrected volume and resultant pounds shall be made part of the method of measurement, with consideration given to blocks (pills) added during the day and applied in an acceptable manner.

Basis of Payment The accepted quantity of Asphalt Rubber Crack Sealer will be paid for at the contract unit price per pound complete in place. This price shall be full compensation for furnishing and placing crack sealer, including cleaning cracks and furnishing and placing barrier materials if necessary.

Payment will be made under:

Pay Item

Pay Unit

424.22 Asphalt Rubber Crack Sealer Type 2, Applied

Pound

Conversion Table:1

t	M	t	M	t	M	t	M	t	M	t	M
100	0.9861	135	0.9740	170	0.9621	205	0.9503	240	0.9385	275	0.9269
101	0.9857	136	0.9737	171	0.9618	206	0.9499	241	0.9382	276	0.9266
102	0.9854	137	0.9734	172	0.9614	207	0.9496	242	0.9379	277	0.9263
103	0.9851	138	0.9730	173	0.9611	208	0.9493	243	0.9375	278	0.9259
104	0.9847	139	0.9727	174	0.9607	209	0.9489	244	0.9372	279	0.9256
105	0.9844	140	0.9723	175	0.9604	210	0.9486	245	0.9369	280	0.9253
106	0.9840	141	0.9720	176	0.9601	211	0.9483	246	0.9365	281	0.9250
107	0.9837	142	0.9716	177	0.9597	212	0.9479	247	0.9362	282	0.9246
108	0.9833	143	0.9713	178	0.9594	213	0.9476	248	0.9359	283	0.9243
109	0.9830	144	0.9710	179	0.9590	214	0.9472	249	0.9356	284	0.9240
110	0.9826	145	0.9706	180	0.9587	215	0.9469	250	0.9352	285	0.9236
111	0.9823	146	0.9703	181	0.9584	216	0.9466	251	0.9349	286	0.9233
112	0.9819	147	0.9699	182	0.9580	217	0.9462	252	0.9346	287	0.9230
113	0.9816	148	0.9696	183	0.9577	218	0.9459	253	0.9342	288	0.9227
114	0.9813	149	0.9693	184	0.9574	219	0.9456	254	0.9339	289	0.9223
115	0.9809	150	0.9689	185	0.9570	220	0.9452	255	0.9336	290	0.9220
116	0.9806	151	0.9686	186	0.9567	221	0.9449	256	0.9332	291	0.9217
117	0.9802	152	0.9682	187	0.9563	222	0.9446	257	0.9329	292	0.9213
118	0.9799	153	0.9679	188	0.9560	223	0.9442	258	0.9326	293	0.9210
119	0.9795	154	0.9675	189	0.9557	224	0.9439	259	0.9322	294	0.9207
120	0.9792	155	0.9672	190	0.9553	225	0.9436	260	0.9319	295	0.9204
121	0.9788	156	0.9669	191	0.9550	226	0.9432	261	0.9316	296	0.9200
122	0.9785	157	0.9665	192	0.9547	227	0.9429	262	0.9312	297	0.9197
123	0.9782	158	0.9662	193	0.9543	228	0.9426	263	0.9309	298	0.9194
124	0.9778	159	0.9658	194	0.9540	229	0.9422	264	0.9306	299	0.9190
125	0.9775	160	0.9655	195	0.9536	230	0.9419	265	0.9302	300	0.9187
126	0.9771	161	0.9652	196	0.9533	231	0.9416	266	0.9299	301	0.9184
127	0.9768	162	0.9648	197	0.9530	232	0.9412	267	0.9296	302	0.9181
128	0.9764	163	0.9645	198	0.9526	233	0.9409	268	0.9293	303	0.9177
129	0.9761	164	0.9641	199	0.9523	234	0.9405	269	0.9289	304	0.9174
130	0.9758	165	0.9638	200	0.9520	235	0.9402	270	0.9286	305	0.9171
131	0.9754	166	0.9635	201	0.9516	236	0.9399	271	0.9283	306	0.9167
132	0.9751	167	0.9631	202	0.9513	237	0.9395	272	0.9279	307	0.9164
133	0.9747	168	0.9628	203	0.9509	238	0.9392	273	0.9276	308	0.9161
134	0.9744	169	0.9624	204	0.9505	239	0.9389	274	0.9273	309	0.9158

Legend: t = observed temperature in degrees Fahrenheit.

M = multiplier for reducing volumes to the basis of 60° F.

Conversion Table:1

t	M	t	M	t	M	t	M	t	M
310	0.9154	350	0.9024	390	0.8896	430	0.8768	470	0.8643
311	0.9151	351	0.9021	391	0.8892	431	0.8765	471	0.8640
312	0.9148	352	0.9018	392	0.8889	432	0.8762	472	0.8636
313	0.9145	353	0.9015	393	0.8886	433	0.8759	473	0.8633
314	0.9141	354	0.9011	394	0.8883	434	0.8756	474	0.8630
315	0.9138	355	0.9008	395	0.8880	435	0.8753	475	0.8627
316	0.9135	356	0.9005	396	0.8876	436	0.8749	476	0.8624
317	0.9132	357	0.9002	397	0.8873	437	0.8746	477	0.8621
318	0.9128	358	0.8998	398	0.8870	438	0.8743	478	0.8618
319	0.9125	359	0.8995	399	0.8867	439	0.8740	479	0.8615
320	0.9122	360	0.8992	400	0.8864	440	0.8737	480	0.8611
321	0.9118	361	0.8989	401	0.8861	441	0.8734	481	0.8608
322	0.9115	362	0.8986	402	0.8857	442	0.8731	482	0.8605
323	0.9112	363	0.8982	403	0.8854	443	0.8727	483	0.8602
324	0.9109	364	0.8979	404	0.8851	444	0.8724	484	0.8599
325	0.9105	365	0.8976	405	0.8848	445	0.8721	485	0.8596
326	0.9102	366	0.8973	406	0.8845	446	0.8718	486	0.8593
327	0.9099	367	0.8969	407	0.8841	447	0.8715	487	0.8590
328	0.9096	368	0.8966	408	0.8838	448	0.8712	488	0.8587
329	0.9092	369	0.8963	409	0.8835	449	0.8709	489	0.8583
330	0.9089	370	0.8960	410	0.8832	450	0.8705	490	0.8580
331	0.9086	371	0.8957	411	0.8829	451	0.8702	491	0.8577
332	0.9083	372	0.8953	412	0.8826	452	0.8699	492	0.8574
333	0.9079	373	0.8950	413	0.8822	453	0.8696	493	0.8571
334	0.9076	374	0.8947	414	0.8819	454	0.8693	494	0.8568
335	0.9073	375	0.8944	415	0.8816	455	0.8690	495	0.8565
336	0.9070	376	0.8941	416	0.8813	456	0.8687	496	0.8562
337	0.9066	377	0.8937	417	0.8810	457	0.8683	497	0.8559
338	0.9063	378	0.8934	418	0.8806	458	0.8680	498	0.8556
339	0.9060	379	0.8931	419	0.8803	459	0.8677	499	0.8552
340	0.9057	380	0.8928	420	0.8800	460	0.8674		
341	0.9053	381	0.8924	421	0.8797	461	0.8671		
342	0.9050	382	0.8921	422	0.8794	462	0.8668		
343	0.9047	383	0.8918	423	0.8791	463	0.8665		
344	0.9044	384	0.8915	424	0.8989	464	0.8661		
345	0.9040	385	0.8912	425	0.8984	465	0.8658		
346	0.9037	386	0.8908	426	0.8781	466	0.8655		
347	0.9034	387	0.8905	427	0.8778	467	0.8652		
348	0.9031	388	0.8902	428	0.8775	468	0.8649		
349	0.9028	389	0.8899	429	0.8772	469	0.8646		

Legend: t = observed temperature in degrees Fahrenheit.

M = multiplier for reducing volumes to the basis of 60° F.

SPECIAL PROVISION
SECTION 424
 CRACK REPAIR with HOT POUR MASTIC

Description This work shall consist of preparing and repairing areas identified for crack repair in existing bituminous or concrete pavement layers using hot pour mastic. The hot pour mastic shall be supplied in solid form in boxes containing pre-measured binder blended with aggregates. Products to be used will be subject to approval by the Department. Repair areas will be free of sand, vegetation, water, and any previously placed rubber crack seal or crack repair materials, including cold patch. Preparation, such as cleaning and drying of the cracks by use of oil free compressed air and hot air lance shall be considered included the price per pound of crack repair mastic. Any pavement removal required will be paid for under the appropriate item as described in this Special Provision.

MATERIALS

The hot pour mastic materials are hot-applied, pourable, self-adhesive mastics blended with aggregates designed for maintenance and repair of asphalt and Portland cement concrete pavements. The hot pour mastic materials are composed of highly modified polymer asphalt binder and standard weight aggregates as required by the application.

The mastic materials shall be delivered in the manufacturer's original container. The material shall be pre-packaged with the manufacturers name and product name marked on each container. The materials shall conform to the following requirements:

Property Requirement

POLYMER MODIFIED BINDER

Cone Penetration, 77°F (25°C) (ASTM D5329)	60 max
Cone Penetration, 122°F (50°C) (ASTM D5329)	120 max
Softening Point, (ASTM D36)	200°F (93°C) min
Flexibility, 1" (25.4 mm), 180°, 10 sec) (ASTM D3111 modified)	Pass at 32°F (0°C)

AGGREGATE

Abrasion Resistance (ASTM C131)	35% max
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BLENDED PRODUCT

Flexibility, 32°F (0°C) (ASTM D5329)	Pass
Adhesion, 77°F (25°C) (ASTM D5329)	25 PSI (172 KPA) min
Specific Gravity	1.7 -2.0
Minimum Application Temperature	375°F (190°C) *
Maximum Application Temperature	400°F (204°C)
Test ASTM D8260	Type I Specification Limits
Mastic Resilience (ASTM (8260)	50% minimum
Effects of Rapid Deformation (ASTM D2794) (-7°C)	3 passing specimens no chipping, cracking or separation 8 N-m
Crack Bridging (ASTM C1305 modified) (-7°C)	Pass 3 cycles
Mastic Stability (ASTM D8260) (70°C)	40.0 mm maximum

EQUIPMENT

Equipment Equipment used in the performance of the work shall be subject to the Departments or authorized representative's approval and shall be maintained in a satisfactory working condition at all times.

(a) Air Compressor Air compressors shall be portable and capable of furnishing not less than 4 yd³ of air per minute at not less than 90 psi pressure at the nozzle. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water.

(b) Sweeper Manually operated, gas powered air-broom or self-propelled sweeper designed especially for use in cleaning pavements shall be used to remove debris, dirt, and dust from the cracks.

(c) Hot Air Lance Should operate with propane and compressed air in combination at 2000°F - 3000°F, exit air heated at 1000 ft/s. The lance should draw propane from no smaller than a 100 lb tank using separate hoses for propane and air draw. The hoses shall be wrapped together with reflectorized wrap to keep them together and to protect workers in low light situations.

(d) Hand Tools Shall consist of Boxed or V-shaped squeegee, brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to accomplish this work.

(e) Melting Kettle The unit used to heat the mastics shall be a double boiler unit equipped with continuous horizontal full sweep agitation and have separate thermostatic control devices that will automatically regulate hot oil and material temperature. Separate digital readouts shall display the temperatures of the hot oil and material. The kettle shall be equipped with mixing paddles, blending augers, or other satisfactory means of agitating, mixing, and blending the aggregates and mastic together. The kettle must be equipped with thermostatic control calibrated between 200°F and 550°F.

If required in the contract the router or crack saw equipment for preparing cracks shall be of a rotary impact type cutter, equipped with a carbide bit or a diamond-blade crack saw which will provide a reservoir of specified dimensions.

CONSTRUCTION REQUIREMENTS

Weather Hot Pour Mastics shall not be applied on a wet or damp surface, or when the atmospheric temperature is below 45°F in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper crack repair procedures.

Preparation All cracks shall be prepared to receive the mastic material. All cracks must be cleaned of debris, dried and heated to ensure optimal bonding of the sealant material to the existing pavement and crack edges. All cracks shall be flush filled with pre-blended mastic with minimal overband in the same workday as directed by the Resident or authorized representative.

Cracks greater than 1 inch in width shall be thoroughly cleaned by use of compressed air and dried by use of a hot air lance. Any loose or broken materials will be removed from the repair area before placing mastic materials. If it is determined that additional pavement removal or preparation is needed by means of milling, sawing, or cutting of existing pavement the work will be paid under an appropriate pay item. All materials routed, sawn, cut, or otherwise removed from the areas to be repaired shall immediately be removed from the crack and surrounding paved area by use of compressed air sweeping, or combination of both.

Cracks 1 inch in width to 6 inch width, or repairs that are more structural in nature, such as potholes, depressions, fills or repairs around utility adjustments shall be filled with mastic pre-blended with standard weight aggregates. Generally repairs wider than 6 inches, or those that extend below the surface layer may require additional pavement removal or change in crack treatment type.

All mastic materials shall be heated to between 380°F and 410°F and thoroughly agitated prior to application. A non-contact infrared thermometer shall be used periodically to monitor the temperature of the material as it exits the kettle. Material may not be used if it is heated beyond the safe heating temperature of 410°F, exceeds the recommended pot life, or is reheated more than one time.

The mastics may be applied to large or excessive slope repair areas when the material has been heated to the lower end of the temperature range, or with the addition of 1% of an approved synthetic fiber to minimize material flow and cooling time.

Mastics shall be applied to the repair areas directly from the melting kettle chute, wand or other conveyance method filled from the kettle. If bucketed, material cooling during transfer must be minimized.

The repair area shall be filled flush to the pavement surface. The material shall be poured into the repair area and worked using boxed or v-shaped squeegees, tools, lutes or heated irons. Care should be taken not to over work the material and cause unequal dispersion of the aggregate within the repair. The material may be applied in multiple lifts to accommodate material shrinkage or flow during cooling.

After materials have been applied to the repair, indirect heating by torch or hot air lance can be used to heat the edges and ensure a watertight seal. Do not burn, scorch or ignite the mastic or adjoining pavement when heating.

Do not allow traffic on the repaired areas for one ½ hour, or until the material has cooled enough to support traffic and tracking is minimal.

Quality of Work Excess mastic shall be removed from the pavement by approved methods and discarded. Any work determined to be below normal acceptable standards will not be accepted, and will be corrected and/or replaced as directed by the Resident or authorized representative.

Method of Measurement Crack Repair with Hot Pour Mastic will be measured by the pound of mastic used. The manufacturer's weights of the mastic for each block (pill), counted as they are loaded, will be accepted as a basis for measurement.

Should tank checks be approved to verify material usage or calculate initial or final gallons remaining in the kettle, a calibrated kettle gauge or tank stick shall be used to measure the kettle gallons. Volume corrections shall be calculated using Table:1 to correct the gallon volume to 60 ° F.

For those approved cases the Department has determined the weight of this material to be 15.5 pounds per gallon. The Department will use this conversion value for all materials measured by the gallon and converted to pounds. The corrected volume and resultant pounds shall be made part of the method of measurement, with consideration given to blocks (pills) added during the day and applied in an acceptable manner

Basis of Payment The accepted quantity of Crack Repair with Hot Pour Mastic will be paid for at the contract unit price per pound. This price will be full compensation for furnishing the appropriate material type for the repair being done, heating, placing and finishing the mastic materials, as well as cleaning and preparing the areas for installation of the mastic, including the use of compressed air, hot air lance, and any sweeping required to remove contaminants from and dry the areas to be treated. Areas identified as requiring pavement removal by means of cutting, sawing, grinding, or routing will be paid under an appropriate contract item.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
424.38 Crack Repair, Hot Pour Mastic	Pound

Conversion Table:1

t	M	t	M	t	M	t	M	t	M	t	M
100	0.9861	135	0.9740	170	0.9621	205	0.9503	240	0.9385	275	0.9269
101	0.9857	136	0.9737	171	0.9618	206	0.9499	241	0.9382	276	0.9266
102	0.9854	137	0.9734	172	0.9614	207	0.9496	242	0.9379	277	0.9263
103	0.9851	138	0.9730	173	0.9611	208	0.9493	243	0.9375	278	0.9259
104	0.9847	139	0.9727	174	0.9607	209	0.9489	244	0.9372	279	0.9256
105	0.9844	140	0.9723	175	0.9604	210	0.9486	245	0.9369	280	0.9253
106	0.9840	141	0.9720	176	0.9601	211	0.9483	246	0.9365	281	0.9250
107	0.9837	142	0.9716	177	0.9597	212	0.9479	247	0.9362	282	0.9246
108	0.9833	143	0.9713	178	0.9594	213	0.9476	248	0.9359	283	0.9243
109	0.9830	144	0.9710	179	0.9590	214	0.9472	249	0.9356	284	0.9240
110	0.9826	145	0.9706	180	0.9587	215	0.9469	250	0.9352	285	0.9236
111	0.9823	146	0.9703	181	0.9584	216	0.9466	251	0.9349	286	0.9233
112	0.9819	147	0.9699	182	0.9580	217	0.9462	252	0.9346	287	0.9230
113	0.9816	148	0.9696	183	0.9577	218	0.9459	253	0.9342	288	0.9227
114	0.9813	149	0.9693	184	0.9574	219	0.9456	254	0.9339	289	0.9223
115	0.9809	150	0.9689	185	0.9570	220	0.9452	255	0.9336	290	0.9220
116	0.9806	151	0.9686	186	0.9567	221	0.9449	256	0.9332	291	0.9217
117	0.9802	152	0.9682	187	0.9563	222	0.9446	257	0.9329	292	0.9213
118	0.9799	153	0.9679	188	0.9560	223	0.9442	258	0.9326	293	0.9210
119	0.9795	154	0.9675	189	0.9557	224	0.9439	259	0.9322	294	0.9207
120	0.9792	155	0.9672	190	0.9553	225	0.9436	260	0.9319	295	0.9204
121	0.9788	156	0.9669	191	0.9550	226	0.9432	261	0.9316	296	0.9200
122	0.9785	157	0.9665	192	0.9547	227	0.9429	262	0.9312	297	0.9197
123	0.9782	158	0.9662	193	0.9543	228	0.9426	263	0.9309	298	0.9194
124	0.9778	159	0.9658	194	0.9540	229	0.9422	264	0.9306	299	0.9190
125	0.9775	160	0.9655	195	0.9536	230	0.9419	265	0.9302	300	0.9187
126	0.9771	161	0.9652	196	0.9533	231	0.9416	266	0.9299	301	0.9184
127	0.9768	162	0.9648	197	0.9530	232	0.9412	267	0.9296	302	0.9181
128	0.9764	163	0.9645	198	0.9526	233	0.9409	268	0.9293	303	0.9177
129	0.9761	164	0.9641	199	0.9523	234	0.9405	269	0.9289	304	0.9174
130	0.9758	165	0.9638	200	0.9520	235	0.9402	270	0.9286	305	0.9171
131	0.9754	166	0.9635	201	0.9516	236	0.9399	271	0.9283	306	0.9167
132	0.9751	167	0.9631	202	0.9513	237	0.9395	272	0.9279	307	0.9164
133	0.9747	168	0.9628	203	0.9509	238	0.9392	273	0.9276	308	0.9161
134	0.9744	169	0.9624	204	0.9505	239	0.9389	274	0.9273	309	0.9158

Legend: t = observed temperature in degrees Fahrenheit.
M = multiplier for reducing volumes to the basis of 60° F.

Conversion Table:1

t	M	t	M	t	M	t	M	t	M
310	0.9154	350	0.9024	390	0.8896	430	0.8768	470	0.8643
311	0.9151	351	0.9021	391	0.8892	431	0.8765	471	0.8640
312	0.9148	352	0.9018	392	0.8889	432	0.8762	472	0.8636
313	0.9145	353	0.9015	393	0.8886	433	0.8759	473	0.8633
314	0.9141	354	0.9011	394	0.8883	434	0.8756	474	0.8630
315	0.9138	355	0.9008	395	0.8880	435	0.8753	475	0.8627
316	0.9135	356	0.9005	396	0.8876	436	0.8749	476	0.8624
317	0.9132	357	0.9002	397	0.8873	437	0.8746	477	0.8621
318	0.9128	358	0.8998	398	0.8870	438	0.8743	478	0.8618
319	0.9125	359	0.8995	399	0.8867	439	0.8740	479	0.8615
320	0.9122	360	0.8992	400	0.8864	440	0.8737	480	0.8611
321	0.9118	361	0.8989	401	0.8861	441	0.8734	481	0.8608
322	0.9115	362	0.8986	402	0.8857	442	0.8731	482	0.8605
323	0.9112	363	0.8982	403	0.8854	443	0.8727	483	0.8602
324	0.9109	364	0.8979	404	0.8851	444	0.8724	484	0.8599
325	0.9105	365	0.8976	405	0.8848	445	0.8721	485	0.8596
326	0.9102	366	0.8973	406	0.8845	446	0.8718	486	0.8593
327	0.9099	367	0.8969	407	0.8841	447	0.8715	487	0.8590
328	0.9096	368	0.8966	408	0.8838	448	0.8712	488	0.8587
329	0.9092	369	0.8963	409	0.8835	449	0.8709	489	0.8583
330	0.9089	370	0.8960	410	0.8832	450	0.8705	490	0.8580
331	0.9086	371	0.8957	411	0.8829	451	0.8702	491	0.8577
332	0.9083	372	0.8953	412	0.8826	452	0.8699	492	0.8574
333	0.9079	373	0.8950	413	0.8822	453	0.8696	493	0.8571
334	0.9076	374	0.8947	414	0.8819	454	0.8693	494	0.8568
335	0.9073	375	0.8944	415	0.8816	455	0.8690	495	0.8565
336	0.9070	376	0.8941	416	0.8813	456	0.8687	496	0.8562
337	0.9066	377	0.8937	417	0.8810	457	0.8683	497	0.8559
338	0.9063	378	0.8934	418	0.8806	458	0.8680	498	0.8556
339	0.9060	379	0.8931	419	0.8803	459	0.8677	499	0.8552
340	0.9057	380	0.8928	420	0.8800	460	0.8674		
341	0.9053	381	0.8924	421	0.8797	461	0.8671		
342	0.9050	382	0.8921	422	0.8794	462	0.8668		
343	0.9047	383	0.8918	423	0.8791	463	0.8665		
344	0.9044	384	0.8915	424	0.8989	464	0.8661		
345	0.9040	385	0.8912	425	0.8984	465	0.8658		
346	0.9037	386	0.8908	426	0.8781	466	0.8655		
347	0.9034	387	0.8905	427	0.8778	467	0.8652		
348	0.9031	388	0.8902	428	0.8775	468	0.8649		
349	0.9028	389	0.8899	429	0.8772	469	0.8646		

Legend: t = observed temperature in degrees Fahrenheit.
M = multiplier for reducing volumes to the basis of 60° F.

SPECIAL PROVISION
SECTION 424
Mastic-Based Crack Sealing

Description This work shall consist of furnishing all labor, equipment and materials necessary to clean, fill and seal longitudinal and transverse cracks in bituminous concrete pavement courses. Materials are to be thoroughly applied to seal the cracks. This work shall consist of the furnishing and placement of mastic-based crack sealing material in the cracks of existing bituminous concrete pavement in accordance with these Special Provisions. This work shall consist of crack cleaning and drying, material supply and heating, preparation and application material, material finishing or shaping, and providing and installing barrier material or curing materials as required.

The Department will allow mastic-based sealing materials as an option for Ultra-Thin Bonded Wearing Course (UTBWC) and other treatments that specify Type 2 or Type 4 sealants in the contract. If the option to utilize Mastic based sealing materials is requested the change shall be subject to approval by the Department prior to the start of work, and sealant and equipment requirements shall meet the following criteria.

MATERIALS

The mastic-based materials are hot-applied, pourable, self-adhesive mastics designed for maintenance and repair of asphalt and Portland cement concrete pavements. Hot pour mastic materials are composed of highly modified polymer asphalt binder and up to 2% synthetic fiber (by weight) as required by the application and approved by the Department.

Mastic based sealing materials shall be delivered in the manufacturer's original container. Mastic material based sealing materials shall be pre-packaged with the manufacturers name and product name marked on each container. The materials shall conform to the following requirements:

POLYMER MODIFIED BINDER

Cone Penetration, 77°F (25°C) (ASTM D5329)	60 max
Cone Penetration, 122°F (50°C) (ASTM D5329)	120 max
Softening Point, (ASTM D36)	200°F (93°C) min
Flexibility, 1" (25.4 mm), 180°, 10 sec) (ASTM D3111 modified)	Pass at 32°F (0°C)

AGGREGATE

Abrasion Resistance (ASTM C131)	35% max
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BLENDED PRODUCT

Flexibility, 32°F (0°C) (ASTM D5329)	Pass
Adhesion, 77°F (25°C) (ASTM D5329)	25 PSI (172 KPA)
min	
Specific Gravity	1.7 -2.0
Minimum Application Temperature	375°F (190°C) *
Maximum Application Temperature	400°F (204°C)

Test ASTM D8260	Type I Specification Limits
Mastic Resilience (ASTM (8260)	50% minimum
Effects of Rapid Deformation (ASTM D2794) (-7°C)	3 passing specimens no chipping, cracking or separation 8 N-m
Crack Bridging (ASTM C1305 modified) (-7°C)	Pass 3 cycles
Mastic Stability (ASTM D8260) (70°C)	40.0 mm maximum

EQUIPMENT

Equipment Equipment used in the performance of the work shall be subject to the Resident's or authorized representative's approval and shall be maintained in a satisfactory working condition at all times. As a minimum, the equipment required will consist of the following:

(1) Air Compressor and air wand: A portable air compressor and air wand shall be supplied to clean the cracks to be sealed prior to using a hot air lance. The air compressor shall be coupled with hose and air wand and be capable of furnishing not less than 150 CFM of air and not less than 100 psi pressure through a 5/8"- inch diameter nozzle. A 1/2 - inch or 3/4-inch nozzle may be used with approval of the Inspector as long as the pressure requirements are being met. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. A single air compressor may be utilized to supply air to both the air wand and hot air lance with the condition that it will consistently supply the required air volume and pressures for each operation simultaneously.

(2) Sweeper: Manually operated, gas powered air-broom or self-propelled sweeper designed especially for use in cleaning highway and airfield pavements shall be used to remove debris, dirt, and dust from the cracks.

(3) Hot Air Lance: The hot air lance shall be independent of the air wand unit. The hot air lance shall be operated with propane and compressed air in combination and provide 1000 ft/sec of heated air at 2000°F - 3000°F. The lance should draw propane from no smaller than a 100 lb tank using separate hoses for propane and air draw. The hoses shall be wrapped together with reflectorized wrap to keep them together and to protect workers in low light situations. A single air compressor may be utilized to supply air to both the air wand and hot air lance with the condition that it will consistently supply the required air volume and pressures for each operation simultaneously.

(4) Hand Tools: Hand tools shall consist of shall consist of brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to prepare cracks to be sealed. Other tools such as, but not limited to, V-shaped squeegee or flat squeegee may be necessary to prevent excessive overband width and thickness.

(5) Melting Kettle: The unit used to melt the mastic-based crack sealing material shall be a double boiler, indirect fired type. The space between inner and outer shells shall be filled with a suitable heat transfer oil or substitute having a flash point of not less than 608°F. The kettle shall be equipped with a satisfactory means of agitating and mixing the joint

sealer at all times. This may be accomplished by continuous stirring with mechanically operated paddles and/or a continuous circulating gear pump attached to the heating unit. The kettle must be equipped with thermostatic control calibrated between 200°F and 550°F. The Contractor shall either provide a jacketed thermometer that accurately displays the sealant temperature within the kettle or provide the Resident or authorized representative with a suitable device for verifying the sealant temperature in the kettle. Temperatures must be able to be checked at any time during the heating of material, application of material, or at the end of the application operation.

GENERAL CONSTRUCTION REQUIREMENTS

Weather Mastic based crack sealing materials shall not be applied on a wet surface, or when the atmospheric temperature is below 45 °F in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper construction procedures.

Preparations of Cracks All cracks shall be blown free of loose material, dirt, vegetation, and other debris by high pressure air prior to the used of the hot air lance. Material removed from the crack shall be removed from the pavement surface by means of compressed air, power sweeper or appropriate hand tools as required. Cracks showing evidence of vegetation after being blown out shall be additionally cleaned by appropriate hand tools and additionally blown out. All cracks must be blown clean with the high-pressure air wand in advance of the hot air lance. All cracks shall be heated via the hot air lance no more than 5 minutes prior to the crack being sealed. Distance between the hot air lance and the crack sealing unit should be no more than 50 ft to eliminate re-invasion of water, debris, and other incompressible materials. All debris, vegetation, and water shall be removed to enhance adhesion of the crack sealing material. THIS WORK SHALL NOT BE DONE IN INCLEMENT WEATHER.

Preparation and Placement of Sealer Mastic based crack sealing material shall be heated and applied at the temperature specified by the manufacturer and approved by the Resident or authorized representative. Any material that has been heated above the manufacturer's specification shall not be used. Material that is reheated or held at temperature for an extended period of time may be used as allowed by the manufacturer's specification and approval of the Resident or authorized representative. A copy of the manufacture's specification shall be provided to the Project when requested.

The Contractor shall provide the Resident or authorized representative with a suitable device for verifying the sealant temperature in the kettle and at the application site.

Any loose material on the surface or in the crack, which may contaminate the crack sealer or impede bonding of the sealant to the pavement, is to be removed by hand tools prior to crack filling. No crack filling material shall be applied in a crack that is wet or where frost, snow, or ice is present. The ambient air temperature must be 50 or higher.

Any over application or spills are to be removed to the satisfaction of the Resident or authorized representative. Any sealed areas with damaged or contaminated sealer or visible voids are to be removed, prepared and resealed. Defective or leaking valves and wands will be repaired or replaced before work continues. If repairs or replacement of defective

equipment cannot be accomplished immediately then the Department may permit work to continue but deduct any excess quantities placed as it determines.

Cracks ½ inch up to 1 ½ inch in may be sealed with mastic-based crack seal. Generally, repairs wider than 1 ½ inches or those that extend below the surface layer may require a change to different mastic material type or treatment method in order repair cracks.

For projects where mastic-based crack sealing materials will be covered and a hot mix asphalt overlay is being installed over the sealant all cracks will be **“flush filled”**, meaning cracks are filled to a point that the sealant is flush with the existing pavement surface. If the work scope requires a flush fill a nozzle sized to fill the cracks shall be used. Minimal to no overbanding will be permitted.

For projects where the mastic-based crack sealing materials are left un-covered with a hot mix overlay and traffic will be permitted to travel over the sealants for the anticipated sealant life, some overband may be permitted.

If the work scope allows crack filling and sealing with overband, then a shoe sized to meet the overband width shall be used. Generally, the shoe width and the sealer overbanding area shall range from 1 inch – 1.5 inch. Overbanding width may vary from the range specified depending on the width and severity of the cracks.

Sealer shall be delivered to the crack while the cracks are still hot from the hot air lance preparation through a pressure hose line and applicator nozzle or shoe.

The applicator shall be followed by a V-shaped squeegee to minimize the thickness of any overband. The sealer shall be applied at a rate that produces a coating thickness of 3/32 - inch, typical.

If the sealed area is to be opened to traffic immediately, a barrier material (de-tackifier) such as Glenzoi, Black Beauty grit, or an equivalent product approved by the Resident shall be provided by the Contractor and shall be applied to the crack sealer to prevent pickup as directed by the Resident or authorized representative.

If sealed areas are to be paved over with a hot mix asphalt treatment then a 48 hour minimum cure time and use of barrier material (de-tackifier) will be required. Cure times may be extended if excessive pick-up of the crack sealants occurs.

Quality of Work Any excess of sealer, spilled or overapplied, shall be removed from the pavement by approved methods and discarded. Any quality of work determined to be below normal acceptable standards will not be accepted and will be corrected and/or replaced as directed by the Resident or authorized representative.

Method of Measurement Mastic based crack sealing materials will be measured by the pound of sealant used. The manufacturer's weights of the sealant for each block (pill), counted as they are loaded, will be accepted as a basis for measurement.

Should tank checks be approved to verify material usage or calculate initial or final gallons remaining in the tanker, a calibrated tank gauge or tank stick shall be used to measure the tank gallons. Volume corrections shall be calculated using Table:1 to correct the gallon volume to 60 ° F.

For those approved cases the Department has determined the weight of this material to be 10.63 pounds per gallon. The Department will use this conversion value for all materials measured by the gallon and converted to pounds. The corrected volume and resultant pounds shall be made part of the method of measurement, with consideration given to blocks (pills) added during the day and applied in an acceptable manner

Basis of Payment The accepted quantity of Mastic-Based Crack Sealing will be paid for at the contract unit price per pound complete in place. This price shall be full compensation for furnishing and placing crack sealer, including cleaning cracks and furnishing and placing barrier materials if necessary.

Conversion Table:1

t	M	t	M	t	M	t	M	t	M	t	M
100	0.9861	135	0.9740	170	0.9621	205	0.9503	240	0.9385	275	0.9269
101	0.9857	136	0.9737	171	0.9618	206	0.9499	241	0.9382	276	0.9266
102	0.9854	137	0.9734	172	0.9614	207	0.9496	242	0.9379	277	0.9263
103	0.9851	138	0.9730	173	0.9611	208	0.9493	243	0.9375	278	0.9259
104	0.9847	139	0.9727	174	0.9607	209	0.9489	244	0.9372	279	0.9256
105	0.9844	140	0.9723	175	0.9604	210	0.9486	245	0.9369	280	0.9253
106	0.9840	141	0.9720	176	0.9601	211	0.9483	246	0.9365	281	0.9250
107	0.9837	142	0.9716	177	0.9597	212	0.9479	247	0.9362	282	0.9246
108	0.9833	143	0.9713	178	0.9594	213	0.9476	248	0.9359	283	0.9243
109	0.9830	144	0.9710	179	0.9590	214	0.9472	249	0.9356	284	0.9240
110	0.9826	145	0.9706	180	0.9587	215	0.9469	250	0.9352	285	0.9236
111	0.9823	146	0.9703	181	0.9584	216	0.9466	251	0.9349	286	0.9233
112	0.9819	147	0.9699	182	0.9580	217	0.9462	252	0.9346	287	0.9230
113	0.9816	148	0.9696	183	0.9577	218	0.9459	253	0.9342	288	0.9227
114	0.9813	149	0.9693	184	0.9574	219	0.9456	254	0.9339	289	0.9223
115	0.9809	150	0.9689	185	0.9570	220	0.9452	255	0.9336	290	0.9220
116	0.9806	151	0.9686	186	0.9567	221	0.9449	256	0.9332	291	0.9217
117	0.9802	152	0.9682	187	0.9563	222	0.9446	257	0.9329	292	0.9213
118	0.9799	153	0.9679	188	0.9560	223	0.9442	258	0.9326	293	0.9210
119	0.9795	154	0.9675	189	0.9557	224	0.9439	259	0.9322	294	0.9207
120	0.9792	155	0.9672	190	0.9553	225	0.9436	260	0.9319	295	0.9204
121	0.9788	156	0.9669	191	0.9550	226	0.9432	261	0.9316	296	0.9200
122	0.9785	157	0.9665	192	0.9547	227	0.9429	262	0.9312	297	0.9197
123	0.9782	158	0.9662	193	0.9543	228	0.9426	263	0.9309	298	0.9194
124	0.9778	159	0.9658	194	0.9540	229	0.9422	264	0.9306	299	0.9190
125	0.9775	160	0.9655	195	0.9536	230	0.9419	265	0.9302	300	0.9187
126	0.9771	161	0.9652	196	0.9533	231	0.9416	266	0.9299	301	0.9184
127	0.9768	162	0.9648	197	0.9530	232	0.9412	267	0.9296	302	0.9181
128	0.9764	163	0.9645	198	0.9526	233	0.9409	268	0.9293	303	0.9177
129	0.9761	164	0.9641	199	0.9523	234	0.9405	269	0.9289	304	0.9174
130	0.9758	165	0.9638	200	0.9520	235	0.9402	270	0.9286	305	0.9171
131	0.9754	166	0.9635	201	0.9516	236	0.9399	271	0.9283	306	0.9167
132	0.9751	167	0.9631	202	0.9513	237	0.9395	272	0.9279	307	0.9164
133	0.9747	168	0.9628	203	0.9509	238	0.9392	273	0.9276	308	0.9161
134	0.9744	169	0.9624	204	0.9505	239	0.9389	274	0.9273	309	0.9158

Legend: t = observed temperature in degrees Fahrenheit.

M = multiplier for reducing volumes to the basis of 60° F.

Conversion Table:1

t	M	t	M	t	M	t	M	t	M
310	0.9154	350	0.9024	390	0.8896	430	0.8768	470	0.8643
311	0.9151	351	0.9021	391	0.8892	431	0.8765	471	0.8640
312	0.9148	352	0.9018	392	0.8889	432	0.8762	472	0.8636
313	0.9145	353	0.9015	393	0.8886	433	0.8759	473	0.8633
314	0.9141	354	0.9011	394	0.8883	434	0.8756	474	0.8630
315	0.9138	355	0.9008	395	0.8880	435	0.8753	475	0.8627
316	0.9135	356	0.9005	396	0.8876	436	0.8749	476	0.8624
317	0.9132	357	0.9002	397	0.8873	437	0.8746	477	0.8621
318	0.9128	358	0.8998	398	0.8870	438	0.8743	478	0.8618
319	0.9125	359	0.8995	399	0.8867	439	0.8740	479	0.8615
320	0.9122	360	0.8992	400	0.8864	440	0.8737	480	0.8611
321	0.9118	361	0.8989	401	0.8861	441	0.8734	481	0.8608
322	0.9115	362	0.8986	402	0.8857	442	0.8731	482	0.8605
323	0.9112	363	0.8982	403	0.8854	443	0.8727	483	0.8602
324	0.9109	364	0.8979	404	0.8851	444	0.8724	484	0.8599
325	0.9105	365	0.8976	405	0.8848	445	0.8721	485	0.8596
326	0.9102	366	0.8973	406	0.8845	446	0.8718	486	0.8593
327	0.9099	367	0.8969	407	0.8841	447	0.8715	487	0.8590
328	0.9096	368	0.8966	408	0.8838	448	0.8712	488	0.8587
329	0.9092	369	0.8963	409	0.8835	449	0.8709	489	0.8583
330	0.9089	370	0.8960	410	0.8832	450	0.8705	490	0.8580
331	0.9086	371	0.8957	411	0.8829	451	0.8702	491	0.8577
332	0.9083	372	0.8953	412	0.8826	452	0.8699	492	0.8574
333	0.9079	373	0.8950	413	0.8822	453	0.8696	493	0.8571
334	0.9076	374	0.8947	414	0.8819	454	0.8693	494	0.8568
335	0.9073	375	0.8944	415	0.8816	455	0.8690	495	0.8565
336	0.9070	376	0.8941	416	0.8813	456	0.8687	496	0.8562
337	0.9066	377	0.8937	417	0.8810	457	0.8683	497	0.8559
338	0.9063	378	0.8934	418	0.8806	458	0.8680	498	0.8556
339	0.9060	379	0.8931	419	0.8803	459	0.8677	499	0.8552
340	0.9057	380	0.8928	420	0.8800	460	0.8674		
341	0.9053	381	0.8924	421	0.8797	461	0.8671		
342	0.9050	382	0.8921	422	0.8794	462	0.8668		
343	0.9047	383	0.8918	423	0.8791	463	0.8665		
344	0.9044	384	0.8915	424	0.8989	464	0.8661		
345	0.9040	385	0.8912	425	0.8984	465	0.8658		
346	0.9037	386	0.8908	426	0.8781	466	0.8655		
347	0.9034	387	0.8905	427	0.8778	467	0.8652		
348	0.9031	388	0.8902	428	0.8775	468	0.8649		
349	0.9028	389	0.8899	429	0.8772	469	0.8646		

Legend: t = observed temperature in degrees Fahrenheit.
M = multiplier for reducing volumes to the basis of 60° F.

SPECIAL PROVISION
SECTION 424

Mastic for Asphaltic Plug Joint Replacement

Description This work consists of the preparation, cleaning, furnishing and installing of asphaltic mastic materials in one or more layers over prior installed asphaltic plug joint (APJ) systems or in new locations as indicated in the contract documents, or shown on the Plans, in accordance with these Specifications or as directed by the Department.

This work will include the removal of any existing pavement over the prior existing APJ or bridge joint to a width of 24 inches, or as otherwise described in the contract. It shall also include any required trimming, cleaning or drying of the pavement, supply, installation and finishing of asphaltic mastic materials to the required depth, grade and cross slope. This work may include the installation of headers or templates before the placement of the surrounding pavement surface layers with the intent to form an area above the existing asphaltic plug joint channel and provide an installation reservoir for the asphaltic mastic materials without the need to remove pavement layers.

MATERIALS

The hot pour mastic materials required are hot-applied, pourable, self-adhesive type mastics blended with aggregates designed for maintenance and repair of asphalt and Portland cement concrete pavements. Hot pour mastic materials are composed of highly modified polymer asphalt binder and fine graded aggregates as required by the application.

The mastic materials shall be delivered in the manufacturer's original container. The material shall be pre-packaged with the manufacturers name and product name marked on each container. The materials shall conform to the following requirements:

Parameter

Color	Black
Pourability @ 400F (PTM1)*	1000-1400 gm
Stability @ 158F (PTM2)	.6in. max
Flexibility @ Low Temperature (PTM3)	Pass @ -20F
Adhesion @ 77F (PTM4)	15psi min.
Specific Gravity (ASTM D792)	1.35max.
Skid Resistance, BPN (ASTM E303)	40 min.
Minimum Application Temperature	375°F
Maximum Application Temperature	410°F

The density of the mastic with aggregate weight per gallon is 15.5 lbs/gal at 60°F.

EQUIPMENT

Equipment Equipment used in the performance of the work shall be subject to the Departments or authorized representative's approval and shall be maintained in a satisfactory working condition at all times.

(a) Air Compressor: Air compressors shall be portable and capable of furnishing not less than 4 yd³ of air per minute at not less than 90 psi pressure at the nozzle. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water.

(b) Sweeper: Manually operated, gas powered air-broom or self-propelled sweeper designed especially for use in cleaning pavements shall be used to remove debris, dirt, and dust from the cracks.

(c) Hot Air Lance: Should operate with propane and compressed air in combination at 2000°F - 3000°F, exit air heated at 1000 ft/s. The lance should draw propane from no smaller than a 100 lb tank using separate hoses for propane and air draw. The hoses shall be wrapped together with reflectorized wrap to keep them together and to protect workers in low light situations.

(d) Hand Tools: Shall consist of Boxed or V-shaped squeegee, brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to accomplish this work.

(e) Melting Kettle: The unit used to heat asphaltic mastics shall be a double boiler unit equipped with continuous horizontal full sweep agitation and have separate thermostatic control devices that will automatically regulate hot oil and material temperature. Separate digital readouts shall display the temperatures of the hot oil and material. The kettle shall be equipped with mixing paddles, blending augers, or other satisfactory means of agitating, mixing, and blending the aggregates and mastic together. The kettle must be equipped with thermostatic control calibrated between 200°F and 550°F.

An application wand may be required for the work type, and shall apply a controlled flow of material via an insulated or heated hose. The nozzle shall distribute the material as called for in this specification. A pressure regulator shall be provided to regulate pressure at the nozzle. A bypass line into the holding tank is required for use when the nozzle is shut off.

CONSTRUCTION REQUIREMENTS

Weather Asphaltic mastics shall not be applied on a wet or damp surface, or when the atmospheric temperature is below 40°F in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper crack repair procedures.

Preparation All reservoirs shall be prepared to receive the asphaltic mastic material. All cracks must be cleaned of debris, dried and heated to ensure optimal bonding of the sealant material to the existing pavement and crack edges.

Reservoirs shall be thoroughly cleaned by use of compressed air, hand tools and brooms as needed, and dried by use of a hot air lance. The area shall be free of any moisture, pavement debris, dirt, dust, moisture, petroleum or solvents that might contaminate the mastic materials, or

reduce the bond of the joint system to the substrate or vertical faces. Any loose or broken materials will be removed from the repair area before placing asphaltic mastic materials.

Installation Asphaltic mastic materials shall be installed in accordance with manufacturer's latest instructions and this specification.

Asphalt pavement layers shall be removed to a 24 inch width centered over the previously installed APJ location, visible bridge joint, or as otherwise described in the contract. The asphalt pavement shall be sawcut or milled to the required surface layer depth, but not to a depth that will damage the underlying existing APJ material or HMA layer. The pavement layer shall be removed in a manner that will not damage any existing APJ material or underlying HMA layer.

Interlayers, fabrics, or headers may be used as required to form an installation reservoir and protect the existing APJ channel from damage. Vertical surfaces of the asphalt pavement layers shall be trimmed as needed to provide a straight, uniform width reservoir and shall be cleaned to remove all water, dust, or other contaminants.

All reservoirs shall be flush filled with pre-blended mastic with minimal overband in the same workday as directed by the Resident or authorized representative. The mastic material shall be poured into the repair area and worked using boxed or v-shaped squeegees, tools, lutes or heated irons. Care should be taken not to over work the material and cause unequal dispersion of the aggregate within the repair. The material may be applied in multiple lifts to accommodate material shrinkage or flow during cooling.

Mastics shall be applied in one or more layers to prepared areas directly from the melting kettle chute, wand or other conveyance method filled from the kettle. If bucketed, material cooling during transfer must be minimized.

All asphaltic mastic materials shall be heated to between 380°F and 410°F and thoroughly agitated prior to application. A non-contact infrared thermometer shall be used periodically to monitor the temperature of the material as it exits the kettle. Material may not be used if it is heated beyond the safe heating temperature of 410°F, exceeds the recommended pot life, or is reheated more than one time. Mastics may be applied to prepared areas when the material has been heated to the lower end of the temperature range to minimize material flow and cooling time.

After the material has been applied to the areas, indirect heating by torch or hot air lance can be used to heat the edges and ensure a watertight seal. Do not burn, scorch or ignite the mastic or adjoining pavement when heating.

Traffic will not be allowed on the filled area for one ½ hour, or until the material has cooled enough to support traffic, divots do not occur, and tracking is minimal. Vehicular traffic may pass over finished joints two-hours after completion.

Quality of Work Excess mastic shall be removed from the pavement by approved methods and discarded. Any work determined to be below normal acceptable standards will not be accepted, and will be corrected and / or replaced as directed by the Resident or authorized representative.

Method of Measurement Mastic for Asphaltic Plug Joint Replacement will be measured by the linear foot along the top surface of the installation to the required limits. Preparation of surfaces for the proposed joint system including cutting, grinding, trimming, drying and cleaning will not be measured separately for payment, but shall be incidental to the Asphaltic Plug Joint Replacement.

Basis of Payment Mastic for Asphaltic Plug Joint Replacement will be paid for at the Contract unit price per linear foot which will be full compensation for furnishing the mastic material, heating, placing and finishing the mastic materials, as well as cleaning and preparing the areas for installation of the mastic, including the use of compressed air, hot air lance, grinding, trimming or saw cutting, any sweeping required to remove contaminates from and drying the areas to be treated.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
424.385 Mastic for Asphaltic Plug Joint Replacement , 0.75 – 1.25 inch	Linear Foot
424.386 Mastic for Asphaltic Plug Joint Replacement , >1.25 inch	Linear Foot

SPECIAL PROVISION
SECTION 424
POLYMER MODIFIED ASPHALT CRACK SEALANT w/ FIBER

Description This work shall consist of crack cleaning utilizing compressed air and hand tools as required to prepare cracks for sealant installation, drying of the prepared cracks, material supply and heating, preparation and application of material, material finishing or shaping, and providing and installing barrier material or curing materials used to seal longitudinal and transverse cracks in bituminous concrete pavements as directed and in accordance with these Special Provisions.

The Department will allow Polymer Modified Asphalt Crack Sealant with fiber as an option for Ultra-Thin Bonded Wearing Course (UTBWC) and other treatments that specify Type 2 or Type 4 sealants in the contract. If the option to utilize Polymer Modified Asphalt Crack Sealant with fiber is selected the sealant and equipment requirements shall meet the following criteria and shall be subject to approval by the Department prior to the start of work.

MATERIALS

Polymer Modified Asphalt Crack Sealant with fiber (PMACS) shall be a polymer modified asphalt-fiber compound designed specifically for improving the strength and performance of the parent asphalt used in the sealant.

The asphalt binder shall consist of a blend of neat asphalt binder, crumb rubber, and SBS polymer and meet the following specifications:

- Modification at a minimum shall consist 7% crumb rubber and 3-4% SBS polymer. The maximum particle size for the crumb rubber shall be 80 mesh
- The performance grade of the base asphalt binder prior to modification shall be a PG 58-28
- OB DSR (AASHTO T315) @ 76: Min 1.00 kPa
- MSCR (AASHTO T350) @ 64 JnR3.2 < 0.50

As a minimum the sealant will meet PG 64E-28 requirements after modification. The asphalt supplier shall provide testing results for both the neat and modified asphalt binders

Fiber reinforcing materials shall be short-length polyester fibers having the following properties:

Length*	0.25 in. ± 0.02 in.
Elongation at Break (ASTM D2256-90)	35% ± 3%
Melting Point (ASTM D3418-82)	>475°F
Crimps/Inch (ASTM 03937-90)	None
Cross-Section	Round
Denier (ASTM D1577-90)	4.5 Nominal dpf
Tensile Strength (ASTM D2256-90)	>70,000 psi
Diameter	0.0008 in.**
Specific Gravity (ASTM D792-91)	1.32 to 1.40

* At temperatures ranging from ambient to maximum finished product mix temperature

** Subject to normal variations

The modified asphalt-fiber compound shall be mixed to a maximum rate of 8% fiber (weight to weight) of asphalt cement unless otherwise approved by the Department.

The polymer modified asphalt-fiber compound shall be thoroughly mixed for a minimum of one hour at the required temperature range of 320°F to 375°F before application can begin. To ensure a uniform fiber distribution in the sealant, and also to limit fluctuations in the application temperature of the blended material, the contractor must have a full tanker of sealant mixed, heated to the proper application temperature, and ready for testing at the start of each work day. Once that batch of sealant is emptied from the tanker, crack sealing operations will cease for the remainder of the day.

No new material will be allowed to be added to the tanker during the workday under any circumstances. Bulk tankers shall be filled at the approved asphalt supplier's facility, and accompanied by a bill of lading, material data sheet, and total pounds of material loaded.

A Manufacturer's certificate of material compliance will be furnished to the Department certifying conformance to the above material specifications, including the following:

- Performance Grade of Unmodified Asphalt: PG 58-28 (standard) AASHTO M-320, Table 1
- 7% chemically-modified crumb rubber (CMCR) Composed of 100% 80-mesh recycled tire rubber
- Specially formulated polymer package to include 3-4% polymer
- Performance Grade of Modified Asphalt: PG 64E-28
- A maximum of 8% polyester reinforcing fibers

Blending of the fibers with the modified asphalt binder shall be in accordance with the recommendations of the manufacturer of the fibers and supplier of the polymer modified asphalt, with final approval made by the Department.

The contractor shall provide the Resident or authorized representative with a copy of the material manufacturer's recommendations for the sealant material being provided pertaining to heating, mixing, application, and reheating prior to the beginning of operations, or the changing of materials.

Material Temperatures Minimum polymer modified asphalt-fiber sealant application temperature shall be 320°F and not exceed 375°F.

EQUIPMENT

Equipment used in the performance of the work shall be subject to the Resident's or authorized representative's approval and shall be maintained in a satisfactory working condition at all times. As a minimum, the equipment required will consist of the following:

(1) Air Compressor and air wand A portable air compressor and air wand shall be supplied to clean the cracks to be sealed prior to using a hot air lance. The air compressor shall be coupled with hose and air wand and be capable of furnishing not less than 150 CFM of air at not less than 100 psi pressure through a 5/8"- inch diameter nozzle. A 1/2 -inch or 3/4-inch nozzle may be used with approval of the Inspector as long as the pressure requirements are being met. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. A single air compressor may be utilized to supply air to both the air wand and hot air lance with the condition that it will consistently supply the required air volume and pressures for each operation simultaneously.

(2) Sweeper Manually operated, gas powered air-broom or self-propelled sweeper designed especially for use in cleaning highway and airfield pavements shall be used to remove debris, dirt and dust from the cracks.

(3) Hot Air Lance The hot air lance shall be independent of the air wand unit. The hot air lance shall be operated with propane and compressed air in combination and provide 1000 ft/sec of heated air at 2000°F - 3000°F, at not less than 120 psi. The lance should draw propane from no smaller than a 100 lb. tank using separate hoses for propane and air draw. The hoses shall be wrapped together with reflectorized wrap to keep them together and to protect workers in low light situations. A single air compressor may be utilized to supply air to both the air wand and hot air lance with the condition that it will consistently supply the required air volume and pressures for each operation simultaneously.

(4) Application Wand The application wand shall apply a controlled flow of material via an insulated or heated hose. The nozzle shall distribute the material as called for in this specification.

A pressure regulator shall be provided to regulate pressure at the nozzle. A bypass line into the holding tank is required for use when the nozzle is shut off. Sealant shall be installed using a nozzle for flush filled applications, or a small to medium application disc for overband permitted installations, selected to give a narrow overband over the cracks being sealed and minimize final overband thickness above the pavement surface.

(5) Hand Tools Hand tools shall consist of shall consist of brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to prepare cracks to be sealed. Other tools such as, but not limited to, V-shaped squeegee or flat squeegee may be necessary to prevent excessive overband width and thickness.

(6) Bulk Tanker: The bulk tanker unit used to heat and maintain the modified asphalt crack sealant compound shall have an approximate capacity of 3,000 to 5,000 gallons and be equipped to maintain the sealant compound at the recommended application temperature. The unit shall be of the indirect fired type, and shall be equipped with a remote heat exchanger and hot oil circulation pump capable of maintaining a consistent temperature of the heat transfer oil. The heat transfer oil shall be circulated to all sides and the bottom of the tank containing the crack sealant compound making a continuous loop back to the heat exchanger and having a flash point of not less than 600°F. The bulk tanker shall be equipped with a satisfactory means of mixing and agitating the crack sealant at all times. This may be accomplished by continuous stirring with mechanically operated paddles and/or by a circulating gear pump attached to the bulk tanker. The bulk tanker must be equipped with a thermostatic control calibrated between 200°F and 550°F and must be capable of pumping an 8% fiber content blend.

Documentation shall be provided for each tanker use with verified gallons or pounds of material that each tanker holds. If full tankers are provided on a daily basis, and each tanker is emptied daily, then the verified gallons or pounds each tanker holds may be used for calculation of payment.

If partial loads are supplied, or material remains in the tanker at the end of the day or contract, a means to calculated material usage must be provided in the form of either calibrated tank checks corrected to 60°F, or certified scale weights of the material load at the beginning or end of the day as applicable.

GENERAL CONSTRUCTION REQUIREMENTS

Weather Crack Sealant Material shall not be applied on a wet surface, when the atmospheric temperature is below 50°F in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper construction procedures.

Equipment Equipment used in the performance of the work shall meet the requirements of the material and equipment section of this special provision and approved by the Department. Equipment shall be maintained in a satisfactory working condition at all times.

Preparation All cracks to be sealed shall be blown free of loose material, dirt, vegetation, and other debris by the high pressure air wand. Material removed from the crack shall be removed from the pavement surface by means of a power sweeper or appropriate hand tools as required. Cracks showing evidence of vegetation after being blown out shall be additionally cleaned by appropriate hand tools and additionally blown out. All cracks must be blown clean with the high-pressure air wand in advance of the hot air lance. All cracks shall be heated via the hot air lance a maximum of 5 minutes prior to the crack sealant being applied. Distance between the hot air lance and the crack sealing unit should be no more than 50 ft to eliminate reinvasion of water, debris, and other incompressible material. All debris, vegetation, and water shall be removed to enhance adhesion of the crack sealing material. **THIS WORK SHALL NOT BE DONE IN INCLEMENT WEATHER.**

Preparation and Placement of Sealer The polymer modified asphalt-fiber material shall be heated, mixed and applied at the temperature specified by the manufacturer and approved by the Resident or authorized representative. The polymer modified asphalt-fiber compound shall be thoroughly mixed for a minimum of one hour before application can begin. Any material that has been heated above the manufacturer's specification shall not be used. and approval of the Resident or authorized representative. The Contractor shall provide the Resident or authorized representative with a suitable device for verifying the sealant temperature in the kettle and at the application site. Any over application or spills are to be removed to the satisfaction of the Resident or authorized representative. Any sealed areas with damaged or contaminated sealer or visible voids are to be removed, prepared and resealed at no additional cost to the Department.

Sealer shall be delivered to the crack while cracks are still hot from the hot air lance preparation through a pressure hose line, applicator nozzle or applicator shoe depending on crack filling requirements.

For projects where sealants will be covered and a hot mix asphalt overlay is being installed over the sealant cracks will be **“flush filled”**, meaning cracks are filled to a point that the sealant is flush with the existing pavement surface. Minimal, to no overbanding will be permitted.

For projects where the sealants are left un-covered and traffic will be permitted to travel over the sealants for the anticipated sealant life, some overband may be permitted. The sealer overbanding wand shall be equipped with an applicator disc or shoe that allows for a minimal final overband and depth. Overband will be kept to a minimum and not exceed a maximum of 1 1/2-inch-wide and 3/32 inch thick. The applicator may be followed by a squeegee to minimize the thickness of the overband.

Any loose material on the surface or in the crack which may contaminate the crack sealer or impede bonding of the sealant to the pavement, is to be removed by hand tools prior to crack filling. No crack filling material shall be applied in a crack that is wet or where frost, snow, or ice is present.

Minimum polymer modified asphalt-fiber sealant_application temperature shall be 320°F and not exceed 375°F.

If the sealed area is to be opened to traffic immediately, a barrier material (de-tackifier) such as Glenzoi, Black Beauty grit, or an equivalent product approved by the Resident shall be provided by the Contractor be applied to the crack sealer to prevent pickup as directed by the Resident or authorized representative.

If the sealed areas are to be paved over with a hot mix treatment, then a 48-hour minimum cure time and use of barrier material (de-tackifier) will be required. Cure times may be extended if excessive pick-up of the crack sealants occurs.

Quality of Work Excess of spilled sealer shall be removed from the pavement by approved methods and discarded. Any quality of work determined to be below normal acceptable standards will not be accepted, and will be corrected and/or replaced as directed by the Resident or authorized representative at no additional cost to the Department.

Method of Measurement Polymer modified asphalt-fiber sealant will be measured by the pound of sealant used. The manufacturer's weight per tanker of sealant will be accepted as the basis for measurement. Materials supplied by weight will be accompanied by a bill of lading and material certification.

The Department may, at their discretion, verify the manufacturers weights provided by re-weighing the tankers at independent scale facilities.

The Department may, on a case-by-case basis, approve and perform tank checks to measure the sealant by the gallon and convert to pounds.

Should tank checks be approved to verify material usage or calculate initial or final gallons remaining in the tanker, a calibrated tank gauge or tank stick shall be used to measure the tank gallons. Volume corrections shall be calculated using Table:1 to correct the gallon volume to 60 ° F.

For those approved cases the Department has determined the weight of this material to be 8.37 pounds per gallon. The Department will use this conversion value for all materials measured by the gallon and converted to pounds.

Basis of Payment The accepted quantity of polymer modified asphalt-fiber sealant will be paid for at the contract unit price per pound for the item listed in the contract schedule of items, complete in place. This price shall be full compensation for furnishing and placing crack sealer, including cleaning cracks, heating and drying cracks, all labor, and furnishing and placing barrier or blotter materials as necessary.

Conversion Table:1

t	M	t	M	t	M	t	M	t	M	t	M
100	0.9861	135	0.9740	170	0.9621	205	0.9503	240	0.9385	275	0.9269
101	0.9857	136	0.9737	171	0.9618	206	0.9499	241	0.9382	276	0.9266
102	0.9854	137	0.9734	172	0.9614	207	0.9496	242	0.9379	277	0.9263
103	0.9851	138	0.9730	173	0.9611	208	0.9493	243	0.9375	278	0.9259
104	0.9847	139	0.9727	174	0.9607	209	0.9489	244	0.9372	279	0.9256
105	0.9844	140	0.9723	175	0.9604	210	0.9486	245	0.9369	280	0.9253
106	0.9840	141	0.9720	176	0.9601	211	0.9483	246	0.9365	281	0.9250
107	0.9837	142	0.9716	177	0.9597	212	0.9479	247	0.9362	282	0.9246
108	0.9833	143	0.9713	178	0.9594	213	0.9476	248	0.9359	283	0.9243
109	0.9830	144	0.9710	179	0.9590	214	0.9472	249	0.9356	284	0.9240
110	0.9826	145	0.9706	180	0.9587	215	0.9469	250	0.9352	285	0.9236
111	0.9823	146	0.9703	181	0.9584	216	0.9466	251	0.9349	286	0.9233
112	0.9819	147	0.9699	182	0.9580	217	0.9462	252	0.9346	287	0.9230
113	0.9816	148	0.9696	183	0.9577	218	0.9459	253	0.9342	288	0.9227
114	0.9813	149	0.9693	184	0.9574	219	0.9456	254	0.9339	289	0.9223
115	0.9809	150	0.9689	185	0.9570	220	0.9452	255	0.9336	290	0.9220
116	0.9806	151	0.9686	186	0.9567	221	0.9449	256	0.9332	291	0.9217
117	0.9802	152	0.9682	187	0.9563	222	0.9446	257	0.9329	292	0.9213
118	0.9799	153	0.9679	188	0.9560	223	0.9442	258	0.9326	293	0.9210
119	0.9795	154	0.9675	189	0.9557	224	0.9439	259	0.9322	294	0.9207
120	0.9792	155	0.9672	190	0.9553	225	0.9436	260	0.9319	295	0.9204
121	0.9788	156	0.9669	191	0.9550	226	0.9432	261	0.9316	296	0.9200
122	0.9785	157	0.9665	192	0.9547	227	0.9429	262	0.9312	297	0.9197
123	0.9782	158	0.9662	193	0.9543	228	0.9426	263	0.9309	298	0.9194
124	0.9778	159	0.9658	194	0.9540	229	0.9422	264	0.9306	299	0.9190
125	0.9775	160	0.9655	195	0.9536	230	0.9419	265	0.9302	300	0.9187
126	0.9771	161	0.9652	196	0.9533	231	0.9416	266	0.9299	301	0.9184
127	0.9768	162	0.9648	197	0.9530	232	0.9412	267	0.9296	302	0.9181
128	0.9764	163	0.9645	198	0.9526	233	0.9409	268	0.9293	303	0.9177
129	0.9761	164	0.9641	199	0.9523	234	0.9405	269	0.9289	304	0.9174
130	0.9758	165	0.9638	200	0.9520	235	0.9402	270	0.9286	305	0.9171
131	0.9754	166	0.9635	201	0.9516	236	0.9399	271	0.9283	306	0.9167
132	0.9751	167	0.9631	202	0.9513	237	0.9395	272	0.9279	307	0.9164
133	0.9747	168	0.9628	203	0.9509	238	0.9392	273	0.9276	308	0.9161
134	0.9744	169	0.9624	204	0.9505	239	0.9389	274	0.9273	309	0.9158

Legend: t = observed temperature in degrees Fahrenheit.

M = multiplier for reducing volumes to the basis of 60° F.

Conversion Table:1

t	M	t	M	t	M	t	M	t	M
310	0.9154	350	0.9024	390	0.8896	430	0.8768	470	0.8643
311	0.9151	351	0.9021	391	0.8892	431	0.8765	471	0.8640
312	0.9148	352	0.9018	392	0.8889	432	0.8762	472	0.8636
313	0.9145	353	0.9015	393	0.8886	433	0.8759	473	0.8633
314	0.9141	354	0.9011	394	0.8883	434	0.8756	474	0.8630
315	0.9138	355	0.9008	395	0.8880	435	0.8753	475	0.8627
316	0.9135	356	0.9005	396	0.8876	436	0.8749	476	0.8624
317	0.9132	357	0.9002	397	0.8873	437	0.8746	477	0.8621
318	0.9128	358	0.8998	398	0.8870	438	0.8743	478	0.8618
319	0.9125	359	0.8995	399	0.8867	439	0.8740	479	0.8615
320	0.9122	360	0.8992	400	0.8864	440	0.8737	480	0.8611
321	0.9118	361	0.8989	401	0.8861	441	0.8734	481	0.8608
322	0.9115	362	0.8986	402	0.8857	442	0.8731	482	0.8605
323	0.9112	363	0.8982	403	0.8854	443	0.8727	483	0.8602
324	0.9109	364	0.8979	404	0.8851	444	0.8724	484	0.8599
325	0.9105	365	0.8976	405	0.8848	445	0.8721	485	0.8596
326	0.9102	366	0.8973	406	0.8845	446	0.8718	486	0.8593
327	0.9099	367	0.8969	407	0.8841	447	0.8715	487	0.8590
328	0.9096	368	0.8966	408	0.8838	448	0.8712	488	0.8587
329	0.9092	369	0.8963	409	0.8835	449	0.8709	489	0.8583
330	0.9089	370	0.8960	410	0.8832	450	0.8705	490	0.8580
331	0.9086	371	0.8957	411	0.8829	451	0.8702	491	0.8577
332	0.9083	372	0.8953	412	0.8826	452	0.8699	492	0.8574
333	0.9079	373	0.8950	413	0.8822	453	0.8696	493	0.8571
334	0.9076	374	0.8947	414	0.8819	454	0.8693	494	0.8568
335	0.9073	375	0.8944	415	0.8816	455	0.8690	495	0.8565
336	0.9070	376	0.8941	416	0.8813	456	0.8687	496	0.8562
337	0.9066	377	0.8937	417	0.8810	457	0.8683	497	0.8559
338	0.9063	378	0.8934	418	0.8806	458	0.8680	498	0.8556
339	0.9060	379	0.8931	419	0.8803	459	0.8677	499	0.8552
340	0.9057	380	0.8928	420	0.8800	460	0.8674		
341	0.9053	381	0.8924	421	0.8797	461	0.8671		
342	0.9050	382	0.8921	422	0.8794	462	0.8668		
343	0.9047	383	0.8918	423	0.8791	463	0.8665		
344	0.9044	384	0.8915	424	0.8989	464	0.8661		
345	0.9040	385	0.8912	425	0.8984	465	0.8658		
346	0.9037	386	0.8908	426	0.8781	466	0.8655		
347	0.9034	387	0.8905	427	0.8778	467	0.8652		
348	0.9031	388	0.8902	428	0.8775	468	0.8649		
349	0.9028	389	0.8899	429	0.8772	469	0.8646		

Legend: t = observed temperature in degrees Fahrenheit.

M = multiplier for reducing volumes to the basis of 60° F.