

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

ATTACHMENT 09

DETAILED SPECIFICATIONS

LIQUID BITUMINOUS MATERIALS

IFB #23059

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

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DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – CHIP SEAL

SECTION 410 – CHIP SEAL

410-1 DESCRIPTION. This work shall consist of the construction of a single course chip seal for pavements and/or shoulders in accordance with the contract documents.

410-2 MATERIALS

410-2.01 Bituminous Materials. The bituminous material shall meet the applicable requirements of Section 702.

A. Bituminous Material – Pavement and Shoulders. Ensure that the bituminous material is compatible with the selected aggregate; use item 702-3301P, 702-3102P or 702-4101P.

B. Bituminous Material – Shoulders. For shoulders only, the Contractor shall use item 702-3301P.

C. Fog Seal. The Contractor shall provide material meeting the requirements of Section 702, Table 702-7, Diluted Tack Coat; or use an alternate material approved by the Director, Materials Bureau.

410-2.02 Aggregates. The aggregate shall conform to the requirements of §703-02, Coarse Aggregates, except as modified herein. The aggregate size shall be No. 1ST or No. 1A, as specified. The aggregate's flakiness index shall meet the requirements of Materials Method 410, *Chip Seal Mix Design*.

A. Aggregate – Pavement. The aggregate shall meet one of the following requirements:

1. Limestone or a blend of limestone and dolomite having an acid insoluble residue content not less than 20.0%
2. Dolomite.
3. Sandstone, granite, chert, trap rock, ore tailings, or other similar non-carbonate materials.
4. Use gravel or blend two or more of: gravel, limestone, dolomite, sandstone, granite, chert, trap rock, ore tailings, or other similar materials to meet the following requirements:
 - a. Size 1ST Aggregate. Produce a final blend having noncarbonate plus 1/4 inch particles comprising at least 20.0% of the total aggregate by weight with adjustments to equivalent volumes for materials of different specific gravities.
 - b. Size 1A Aggregate. Produce a final blend having noncarbonate plus 1/8 inch particles comprising at least 20.0% of the total aggregate by weight with adjustments to equivalent volumes for materials of different specific gravities.

B. Aggregate - Shoulders. The aggregate shall conform to the requirements of §703-02, Coarse Aggregates.

C. Stockpile. Build an aggregate stockpile at a location approved by the Engineer. When blending multiple aggregates, use automated proportioning and blending equipment to produce a uniformly graded stockpile.

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DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

410-2.03 Cover Sand. Use cover sand conforming to the requirements of §703-01, Fine Aggregate or §703-02, Coarse Aggregate except as modified in Table 410-1 Cover Sand.

Table 410-1 Cover Sand	
Screen Size	Percent Passing
1/8	90-100
No. 200	0-3

410-2.04 Material Sampling and Testing

A. Aggregate Stockpile.

- 1. Contractor Testing.** The Contractor shall perform the following tests and submit the results to the Regional Materials Engineer.
 - a. Obtain three samples, according to ASTM D75, *Standard Practice for Sampling Aggregates*. Each sample must contain material from each face of the stockpile.
 - b. Test samples in accordance with AASHTO T 11, *Materials Finer than #200 Sieve in Mineral Aggregates by Washing*, and AASHTO T 27, *Sieve Analysis of Fine and Coarse Aggregates*. Test results shall be based on the average of three tests.
 - c. When required, sample and test the aggregate in accordance with Materials Method 28, *Friction Aggregate Control and Test Procedures*.
 - d. Determine the aggregate's flakiness index as defined by Materials Method 410, *Chip Seal Mix Design*.

- 2. Department Testing and Approval.** The Department may elect to sample the aggregate stockpile prior to allowing the Contractor to begin work.

Aggregate is subject to quality assurance (QA) testing by the Regional Materials Engineer. Each day of work, the Department will witness and take possession of an aggregate sample obtained by the Contractor. The sample will be taken from the portion of the stockpile to be used in that day's production, and represent the entire quantity of aggregate placed that day.

The Department will evaluate any material failing QA testing to determine if it will be left in place. Material represented by a sample failing QA testing that is left in place will be subject to pay reductions.

Samples shall meet appropriate friction values. All chip seal previously placed with material from a stockpile rejected for non-carbonate or acid insoluble residue content will be rejected.

B. Cover Sand. Sampling and gradation testing of cover sand shall be performed according to the requirements of 410-2.04 A.1. Copies of test results shall be furnished to the Department prior to applying the cover sand.

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DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

C. Bituminous Material. Bituminous material is subject to QA testing by the Materials Bureau.

The Engineer will evaluate any material failing QA testing to determine if it will be left in place. Material represented by a sample failing QA testing that is left in place will be subject to pay reductions.

410-2.05 Mix Design. Complete a mix design for pavements and/or shoulders in accordance with Materials Method 410. A shoulder mix design is required when Contractor operations require the shoulder to be treated separately from the mainline. Mix designs shall be submitted to the Engineer a minimum of two weeks prior to the start of the work.

410-3 CONSTRUCTION DETAILS

410-3.01 General

A. Weather and Seasonal Limitations. Chip Seal shall be placed during the period from May 1st through September 7th. Material shall not be applied to a pavement surface when the:

1. Surface has standing water or is saturated.
2. Surface temperature is less than 60°F.
3. Ambient temperature is less than 50°F.
4. Weather conditions would prevent proper construction of the chip seal.

B. Equipment. All equipment shall be maintained in satisfactory working conditions at all times.

1. Sweepers

- a. Self-propelled Rotary Power Broom.** The self-propelled rotary power broom shall be designed, equipped, maintained and operated so the pavement surface can be swept clean.
- b. Self-propelled Pick Up Broom or Vacuum Sweeper.** The self-propelled equipment shall be designed, equipped, maintained and operated so that the pavement can be swept clean. Excess aggregate shall be contained in an onboard hopper and disposed of.

2. Bituminous Material Distributor

- a. The distributor shall be equipped, maintained, and operated so that bituminous material can be applied uniformly on variable widths up to 15 feet; and at controlled temperature and rates from 0.05 to 0.55 gallons per square yard. Prior to starting work, the distributor shall be calibrated for transverse and longitudinal application rate by ASTM D 2995, *Standard Practice for Estimating Application Rate of Bituminous Distributors*, or an equivalent method approved by the Engineer. The Engineer will witness the equipment calibration or require the Contractor to provide documentation certifying the calibration.
- b. The distributor shall uniformly apply the bituminous material at the specified rate with a maximum allowable variation of 0.02 gallons per square yard.

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DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

c. Distributor equipment shall include accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with full circulation spray bars adjustable laterally and vertically. The distributor shall be equipped with a bituminous material sampling valve.

3. Aggregate Spreader

The aggregate spreader shall be a self-propelled unit capable of uniformly spreading the aggregate at the required rate on a minimum width of 6 inches wider than the width of the lane to be treated. Prior to starting work, the spreader shall be calibrated using ASTM D 5624, *Standard Test Method for Determining the Transverse-Aggregate Spread Rate for Surface Treatment Applications*. The Engineer will witness the equipment calibration or require the Contractor to provide documentation certifying the calibration.

4. Pneumatic Tire Roller

Pneumatic tire rollers shall be self-propelled and have oscillating wheels with smooth tread tires and will have a minimum ground contact pressure of 80 psi. The tire pressure for all wheels shall be uniform within ± 5 psi. The rollers shall be operated at a maximum speed of 5 mph. Refer to Table 410-2 Number of Rollers for the minimum number of rollers required.

C. Surface Preparation. Perform all surface preparations prior to applying the chip seal.

1. Thoroughly clean the entire area to be overlaid of dirt, oil, and other foreign materials. Remove all debris and standing water.
2. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area being treated with plastic, building felt, or other material approved by the Engineer. Remove the covers each day.
3. The Contractor shall remove pavement markings.

410-3.02 Chip Seal

A. Application of Bituminous Material. Bituminous material shall be applied in a uniform, continuous spread over the section to be treated and within the temperature range recommended by the manufacturer. The Contractor shall document and report to the Engineer any field changes in application rates from the mix design submittal.

Where longitudinal joints are to occur, the application of bituminous material from the initial pass shall extend 6 inches beyond the area to be covered with aggregate. Subsequent passes of the bituminous spreader shall overlap the exposed bituminous material and the edge of the initial aggregate pass.

Uncovered bituminous material shall not be exposed to traffic. All bituminous material shall be covered with aggregate before opening to traffic.

The distributor shall be moving forward at proper application speed at the time the spray bar is opened. If any skipped areas or deficiencies occur, the operation shall be immediately stopped. The bituminous material shall not be applied more than 200 feet in advance of the self-propelled aggregate spreader. The distributor, when not spreading, shall be parked so that the spray bar or mechanism will not drip bituminous material on the surface of the roadway.

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DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

B. Application of Cover Aggregate. Immediately following the application of the bituminous material, cover aggregate shall be spread at the rate established by the Contractor in the mix design. The Contractor shall document and report to the Engineer any field changes in application rates from the mix design submittal. Spreading shall be accomplished in such a manner that construction equipment or other vehicles shall not drive on the uncovered and newly applied bituminous material. Any free bituminous material on the surface caused by a deficient amount of cover aggregate shall be covered by broadcasting additional aggregate over the deficient area.

Longitudinal joints shall be parallel to the centerline. Ensure that longitudinal joints will correspond with the edges of the proposed traffic lane. Where any construction joint occurs, the edges shall be broomed back and blended so there are no gaps and the elevations are the same, and free from ridges and depressions.

Initial rolling of cover aggregate shall occur within 5 minutes after the application of bituminous material. Cover aggregate shall receive a minimum of three roller passes within 30 minutes of bituminous material application. Use Table 410-2 Number of Rollers to determine the minimum number of rollers required:

Table 410-2 Number of Rollers	
Overlay width (feet)	Number of Rollers (minimum)
≤ 6	1
$> 6 \leq 9$	2
$> 9 \leq 12$	3
> 12	4

C. Sweeping. Prior to opening the roadway to unguided traffic, sweep loose stone from the newly treated surface. Additional sweeping shall be performed as directed by the Engineer during a 5-day period following placement of the chip seal.

D. Opening to Traffic. After chip seal application, controlled traffic may be permitted at the Contractor's option. Traffic shall be maintained at a speed not to exceed 15 mph for a period of 3 hours after placement of the chip seal by the use of pilot vehicles or an alternative method approved by the Engineer. Post warning signs as described in the Special Note entitled *Traffic Advisory Signs for Chip Seal Projects*.

Use Table 410-3 Pilot Vehicles to determine the number of pilot vehicles required:

Table 410-3 Pilot Vehicles	
Lane Miles Surfaced In Previous Three Hours	Number of Pilot Vehicles
< 2	1
≥ 2	2

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DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

E. Application of Fog Seal. Prior to applying fog seal, the surface shall be swept. Follow the requirements of Application of Bituminous Material. The fog seal application rate is 0.05 to 0.15 gallons per square yard.

F. Application of Cover Sand. Within 5 minutes of applying the fog seal, spread the cover sand uniformly over the fog seal at an application rate of 2-5 pounds per square yard.

G. Opening to Traffic After Fog Seal and Cover Sand. The Contractor shall determine when traffic may be permitted on the treated chip seal. More time may be required for areas with limited exposure to sunlight.

410-4 METHOD OF MEASUREMENT. The quantity of chip seal to be measured for payment will be square yards of material in place, making no deductions for minor untreated areas such as catch basins and manholes.

The bituminous material for the chip seal will be measured by the number of 60°F gallons incorporated in the work.

The bituminous material for the fog seal will be measured by the number of 60°F gallons incorporated in the work.

The following formula will be used to calculate bituminous material quantity at 60°F:

$$\text{Volume @ 60°F} = \text{Volume}_D \times [1 - (\Delta T \times 0.00025)]$$

Where:

ΔT = Delivered Temperature (°F) – 60

Volume_D = Quantity Delivered (gallons)

Cover Sand will be measured by the number of square yards of material in place, making no deductions for minor untreated areas such as catch basins and manholes.

410-5 BASIS OF PAYMENT. The unit price bid per square yard for chip seal shall include the cost of all labor, materials and equipment necessary to perform the work.

If QA test results for aggregate exceed the rejection limit in Table 410-4, the Regional Materials Engineer will evaluate if the material can remain in place. If the material is left in place, the chip seal item will be subject to a reduction in payment according to Table 410-4:

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DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

TABLE 410-4 CHIP SEAL PAY TABLE		
1ST Aggregate		
	Pay Reduction	Rejection Limit % Passing
1/2 Sieve	$(100 - X) * 10$	< 97
1/4 Sieve	$(X - 15) * 5$	> 20
200 Sieve	$(X - 1.5) * 50$	> 2
Flakiness Index	$(X - 25) * 5$	> 30
1A Aggregate		
	Pay Reduction	Rejection Limit % Passing
1/2 Sieve	$(100 - X) * 10$	< 97
1/4 Sieve	$(90 - X) * 5$	< 85
1/8 Sieve	$(X - 15) * 5$	> 20
200 Sieve	$(X - 1.5) * 50$	> 2
Flakiness Index	$(X - 25) * 5$	> 30

X = QA % Passing test value. Negative values indicate full payment. The QA results for the 200 sieve and Flakiness Index will be calculated to the nearest tenth. All other QA values will be rounded to the nearest whole number.

Bituminous material used for chip seal will be paid for under a separate item as the number of 60°F gallons of material used.

Bituminous material for the fog seal will be paid for under a separate item as the number of 60°F gallons of material used.

The Engineer will evaluate any bituminous material failing QA testing to determine if it will be left in place. If the material is left in place, the bituminous material will be subject to a reduction in payment according to Table 410-5:

Table 410-5 Bituminous Material Pay Table	
Number of Failing QA Test Results	Pay Reduction of Bituminous Material Item
1	15%
2	25%

Cover sand will be paid for under a separate item.

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Payment will be made under:

Item No.	Item	Pay Unit
410.10	Chip Seal (1A)	Square Yard
410.20	Chip Seal (1ST)	Square Yard
410.30	Bituminous Material (Chip Seal)	Gallons
410.40	Bituminous Material (Fog Seal)	Gallons
410.50	Cover Sand	Square Yard
410.60	Pick Up Broom or Vacuum Sweeper (optional)	Per Day

SPECIAL NOTES CHIP SEALS

1. Fog Seal and Cover Sand are required for all NYSDOT projects.
2. Use 1ST aggregate if traffic volumes exceed 2000 AADT.
Note – Shoulders are assumed to have 0 AADT.
3. 1A aggregate produces a finer, less aggressive surface. Consider use of 1A aggregate in areas of frequent bicycle/pedestrian use.
4. Consider an optional pickup sweeper where loose stones on road side would be undesirable.
5. Immediately after completion of the chip seal, the section shall be signed with black on orange W8-7 *LOOSE STONE* signs and black on orange 30 MPH W13-1P advisory speed plaques for a period of seven days. The warning sign and the advisory speed plaque shall be installed on the same post as specified in the MUTCD. The signs should be posted at ½ mile intervals. The first sign shall be posted in advance of the section in accordance with the MUTCD. The day and night visibility of the sign assemblies shall be enhanced by either 18 inch square orange flags for daytime visibility and low intensity Type A flashing warning lights for night visibility or high intensity Type B flashing warning lights for 24 hour visibility.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS**DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)****BONDING REQUIREMENTS:**

- A. Within 10 calendar days of receipt of a purchase order from the State, the contractor shall provide the State agency the following:
1. **Maintenance Material Bond.** A bond in the form similar to the sample included in this Invitation for Bids with sufficient sureties approved by the State's resident engineer guaranteeing replacement of deficient material in the form included in this Invitation for Bids. This bond shall remain in place for one year after final acceptance of the project by the State or until August 1 of the year following completion of the project, whichever is later.
 2. **Amount of Bond.** The amount of the Maintenance Material Bond shall be 100% of the amount of the project's cost.
 3. **Requirements of Bonds.** All Bonds shall be issued by a surety company approved by NYSDOT and authorized to do business in the State of New York as a surety.
- B. The procedure of the Maintenance Material Bond shall be as follows:
1. No later than June 1 of the year following the State's acceptance of work completed under this contract, the State will evaluate the project for aggregate retention, flushing or bleeding, aggregate embedment and bonding to the existing pavement.
 2. The contractor agrees to repair all areas that demonstrate less than 90% aggregate retention, as determined by the State, on the overall project caused by improper workmanship and/or defective materials. In addition, the contractor agrees to repair individual areas that are flushed or bleeding, as determined by the State, caused by improper workmanship and/or defective materials irrespective of the percent of aggregate retained. Such repairs, however, shall not include any damage resulting from any forces or circumstances beyond the control of the contractor. The evaluation of the chip seal (conventional and fiber reinforced) shall be made by the State's resident engineer. If the contractor does not agree with the evaluation it may appeal to the State's Regional Director of Operations whose decision shall be final. Any resultant property damage deemed by the State's Regional Director of Operations caused by improper workmanship and/or defective materials shall be the responsibility of the Contractor.
 3. On or before June 10, in the year immediately following the State's acceptance of the chip seal project, the State shall notify the contractor of any areas deemed deficient by the State. The contractor will initiate and complete the remediation within 30 days of notification.
 4. Prior to the performance of repairs in the field, the contractor shall supply the State's resident engineer with copies of applicable insurance certificates. During the performance of any necessary repairs, the contractor shall comply with the all provisions of the original contract including among other things the work zone traffic control provisions.

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S A M P L E

MAINTENANCE BOND

KNOW ALL PEOPLE BY THESE PRESENTS, That we, (hereinafter called the "PRINCIPAL")

_____ of _____, and _____ of _____ (hereinafter called the "SURETY") are held and firmly

bound unto the people

of the State of New York in the full and just sum of _____ Dollars

(\$ _____) good and lawful money of the United States of America, to the payment of which said sum of money, well and truly to be made and done the said PRINCIPAL binds itself, its heirs, executors, administrators or assignees and the SURETY binds itself, its successors or assigns, jointly and severally, firmly by these presents.

Signed and dated this ___ day of _____, 20__.

WHEREAS, the PRINCIPAL has entered into a certain written contract bearing date on the day of _____, 20__, with the People of the State of New York for the improvement of _____, in the County of _____, New York.

NOW THEREFORE, the PRINCIPAL warrants the workmanship and all materials used in the work and agrees that during the guarantee period of one year beginning after final acceptance by the State or political subdivision or until August 1 of the year following acceptance of work completed under the contract, whichever is later, it will, at its own expense make repairs which may become necessary by reason of improper workmanship or defective materials as per the following procedure:

1. No later than June 1 of the year following the State's or the political subdivision's acceptance of work completed under the contract, the State or political subdivision will evaluate the project for aggregate retention, flushing or bleeding, aggregate embedment and bonding to the existing pavement.
2. The PRINCIPAL agrees to repair all areas that demonstrate less than 90% aggregate retention, as determined by the State, on the overall project caused by improper workmanship and/or defective materials. In addition, the PRINCIPAL agrees to repair individual areas that are flushed or bleeding, as determined by the State, caused by improper workmanship and/or defective materials irrespective of the percent of aggregate retained. Such repairs, however, shall not include any damage resulting from any forces or circumstances beyond the control of the PRINCIPAL. The evaluation of the chip seal (conventional and fiber reinforced) shall be made by the State's resident

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engineer. If the contractor does not agree with the evaluation it may appeal to the State’s Regional Director of Operations whose decision shall be final.

- 3. On or before June 10, in the year immediately following the State’s acceptance of the chip seal project, the State shall notify the PRINCIPAL of any areas deemed deficient by the State. The PRINCIPAL will initiate and complete the remediation within 30 days of notification.

In the event of the failure of performance by the PRINCIPAL who has failed to make repairs which may become necessary by reason of improper workmanship or defective materials, said SURETY, for value received, hereby stipulates and agrees, if requested to do so by the State, to commence such repairs within five (5) days of notification by the State of such failure by the PRINCIPAL. Such repairs shall be performed in accordance with the provisions of the current contract which require among other provisions that the SURETY shall provide necessary Work zone traffic control as well as provide the required insurance before any work is conducted.

In the event both the SURETY and the PRINCIPAL fail to perform such repairs, the State shall cause the repair to be completed by others and the SURETY and PRINCIPAL shall be jointly and severally liable for such costs.

And the said SURETY thereby stipulates and agrees that no change, extension, alteration, deduction or addition in or to the terms of the said contract or the plans or specifications accompanying same, shall in any way affect the obligations of said SURETY of its bond.

PRINCIPAL _____

BY _____

SURETY _____

BY _____

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – COLD RECYCLING**416 - COLD RECYCLING ASPHALT CONCRETE****416-1 DESCRIPTION**

Cold recycling asphalt concrete consists of milling the existing pavement, mixing with bituminous material and aggregate, and compacting the mixture as indicated in the contract documents.

416-2 MATERIALS

416-2.01 Bituminous Material. Obtain liquid bituminous material from a Department approved facility.

A. Asphalt Emulsion: Use 702-3301 or 702-3301R as specified. Other grades of asphalt emulsion having a certified minimum of 65% asphalt residue may be used with the approval of the Materials Bureau Director.

Asphalt emulsion will be sampled according to Materials Method 702-2, "Asphalt Emulsion – Quality Assurance."

B. Performance Graded Binder: Use an appropriate performance graded binder with foaming characteristics meeting the requirements of Materials Procedure 416. Obtain a minimum of one sample per lot of performance graded binder delivered to the project.

C. Fog Seal: Use material meeting the requirements of Section 702, Diluted Tack Coat. Fog seal emulsion will be sampled according to Materials Method 702-2, "Asphalt Emulsion – Quality Assurance."

416-2.02 Aggregates. Use aggregate meeting the requirements of §703-02, Coarse Aggregate. Aggregate are required to have less than 1.5% material by weight, passing the #200 sieve.

416-2.03 Portland Cement. Use material meeting the requirements of Section 701-01 Type I/II Cement. Other cements may be used with the approval of the Director of the Materials Bureau

416-2.04 Mix Design. Formulate and submit a mix design in accordance with Materials Method 416. Identify type and amount of all additives incorporated.

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DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**416-2.05 EQUIPMENT.**

A. Recycling Equipment. Use equipment capable of:

- Milling the existing pavement to within 1/4" of required depth and cross slope.
- Producing a uniform surface texture free from gouges and ridges greater than 3/8" in depth.
- Controlling profile with a moving reference at least 30 feet in length. The moving reference may be a floating beam or ski.
- Processing the reclaimed material to pass a 2 inch sieve
- Mixing the reclaimed material with bituminous material
- Paving the reclaimed material to the correct grade using a paver described by §402-3.02
- Controlling surge material caused by irregularities in the pavement surface or width.
- Measuring water usage with a totalizing water meter.

Calibration: Calibrate the mixing equipment prior to the start of work, in accordance with Materials Procedure 416. Submit the calibration results for approval to the Director, Materials Bureau at least 7 days prior to the start of work.

B. Rollers. Use a Pneumatic tire roller and a tandem steel wheel roller meeting the requirements of 402-3.04.

416-3 CONSTRUCTION DETAILS

416-3.01 Temperature & Seasonal Limitations. Perform all work between May 1 and October 7. Work is not permitted when the air or surface temperature is below 45 °F or is expected to drop below 40 °F within 24 hours.

416.3.02 Pilot Vehicle. Maintain traffic using a pilot vehicle to escort traffic through the work zone.

416-3.03 Materials Management Plan (MMP). Complete and submit to the Engineer an MMP in accordance with Materials Procedure 416, 7 days prior to the pre-pave meeting.

416-3.04 Milling. Mill to depth indicated in the contract documents. The depth of the milling will be measured at centerline. Maintain existing cross slope unless otherwise noted.

Mill the full width of the existing pavement and shoulder.

All milled surfaces will be repaved with recycled material the same day milling is performed.

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416-3.05 Recycling. Maintain bituminous material rates within 10% of the design rate. Changes exceeding 10% of the design rate require Engineer's approval. Do not exceed the following rates without the approval of the Materials Bureau Director.

Maximum Liquid Application Rates Gallons / Square Yard Recycled		
Depth of Recycle	Emulsion	PG Binder
3 inch	1.45	1.09
4 inch	1.93	1.45

Do not adjust add stone rates without the Engineer's approval.

Report the water usage rate and any subsequent changes to the Engineer.

Minimum Water Rates Gallons / Square Yard Recycled	
Depth of Recycle	Water
3 inch	0.36
4 inch	0.48

416-3.06 Quality Control Testing. Once continuous production has been achieved, test two samples of the recycled mixture for gradation and total asphalt content. Submit the test results to the Engineer and Regional Materials Engineer before the end of the next workday.

For each subsequent day of production, take a minimum of one sample of the recycled mixture for each lane mile of pavement recycled. Test each sample for gradation and total asphalt content. Submit the test results before the end of the next workday.

If a second recycling train is brought to the project, take samples following the frequencies detailed above, including taking two samples on the first day of use.

416-3.07 Spreading. Place millings, add stone, bituminous material, additives and water as a homogeneous mixture in a uniform layer.

416-3.08 Compaction. Compact the mixture in accordance with §402-3.07 Compaction, 70 Series Compaction and Table 416-1 – Rolling Requirements, with the following exception.

- Reestablish a new Project Target Density, PTD, when two consecutive density readings are recorded less than 96%, or greater than 110% of the previous PTD.

Changes to the roller pattern require approval of the Engineer. Remove material that cannot be properly and adequately compacted to a stable condition.

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DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

Operate rollers at a uniform speed. Complete all turning of the compaction equipment on material which has had a minimum of one roller pass.

TABLE 416-1 – ROLLING REQUIREMENTS

Compaction Sequence	Roller Type	Compaction Type	Minimum # of Passes
Initial	Steel or Pneumatic ¹	Vibratory or Static ²	2
Intermediate	Steel or Pneumatic ¹	Vibratory or Static ²	2
Finish	Steel or Pneumatic	Static	2

¹ Either the initial or intermediate passes will use a pneumatic roller

² Either the initial or intermediate passes will operate using vibratory compaction

Dual vibrating drum rollers meeting the requirements of a tandem roller and operating in the static mode may be used for the finish roller.

416-3.09 Longitudinal Joints. Construct a longitudinal joint at the centerline. Subsequent recycling passes will reclaim a minimum of 6 inches of the adjacent compacted recycled mat.

If any length of the recycled materials longitudinal joint is exposed at the end of the working day, construct a wedge of recycled material at a slope of 1 on 8 or flatter to meet the existing pavement elevation. Do not overlap recycled material onto the existing pavement.

416-3.10 Temporary Pavement Markings. Apply temporary pavement markings meeting the requirements of Section 619 at the centerline and edge line of the recycled material before the end of each workday. Maintain temporary markings until the recycled material is overlaid.

416-3.11 Surface Tolerance:

Construct the recycled surface to a 3/8th inch tolerance in 15 feet parallel to centerline, or 10 feet perpendicular to centerline. Construct the longitudinal joint such that the elevation difference of the joint is less than 3/16th inch.

Tolerance requirements apply from the time of recycling until the recycled material is overlaid, not exceeding 30 days.

416-3.12 Brooming. Broom the pavement and shoulders to remove loose stone or reclaimed material.

Brooming requirements apply from the time of recycling until the recycled material is overlaid, not to exceed 30 days.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

416-3.13 Cure Times. Recycled mixtures cannot be overlaid until the minimum cure times in Table 416-2 have been met.

TABLE 416-2 Cure Time

Bituminous Material Used	Cure Period
Asphalt Emulsion	10 Days
PG Binder	3 Days

416-3.14 Fog Seal. Application of fog seal requires the Engineer's daily approval. The maximum rate of application is 0.1 gallons/square yard.

Provide a work zone traffic control plan for the fog seal operation and submit to the Engineer for approval. Stopped traffic will not be allowed on a fog sealed surface for a minimum of 1 hour after application.

416-3.15 Damaged or Deficient Areas. Rework or replace all mix that ravel, is loose or broken, or is not uniform.

Correct any area showing an excess or deficiency of bituminous material.

Correct all areas not meeting the requirements of the surface tolerance. The repair method will be approved by the Engineer.

All repairs of damaged areas will be completed at no additional cost to the State.

416-4 METHOD OF MEASUREMENT

Cold recycling Asphalt Concrete is measured by the number of square yards of existing pavement surface milled and recycled.

The liquid bituminous material will be measured by the number of 60°F gallons actually incorporated in the work. The following formulas will be used to calculate 60°F gallons:

Asphalt Emulsion:

$$\text{Volume}_{60^{\circ}\text{F}} = \text{Volume}_{\text{D}} \times [1 - (\Delta\text{T} \times 0.00025)]$$

Where:

ΔT = Delivered Temperature (°F) – 60

Volume_D = Quantity Delivered (gallons)

PG Binder:

$$\text{Volume}_{60^{\circ}\text{F}} = \text{Volume}_{\text{D}} \times [1 - (\Delta\text{T} \times 0.00035)]$$

Where:

ΔT = Delivered Temperature (°F) – 60

Volume_D = Quantity Delivered (gallons)

Portland Cement will be measured by the number of tons incorporated into the work.

Additional aggregate will be measured in accordance with section 623.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

416-5 BASIS OF PAYMENT

The unit price bid per square yard for cold recycling asphalt concrete will include the cost of all labor, materials and equipment necessary to perform the work.

The unit price bid per gallon for bituminous material will include the cost of all labor, materials and equipment necessary to perform the work

The unit price bid per ton for Portland cement will include the cost of all labor, materials and equipment necessary to perform the work

Additional aggregate will be paid in accordance with section 623.

Payment will be made under:

Item No.	Item	Pay Unit
416.10	Cold Recycling Asphalt Concrete	Square Yards
416.20	Asphalt Emulsion	Gallons
416.21	Polymer Modified Asphalt Emulsion	Gallons
416.22	Performance Graded Binder	Gallons
416.30	Fog Seal	Gallons
416.40	Portland Cement	Tons
623.0X	Aggregate	Tons

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – HEATER SCARIFICATION**402.99010005 Heater Scarification of Hot Mix Asphalt (HMA) Pavement
402.99010105 Recycling Agent****1 DESCRIPTION**

This work shall consist of recycling the existing hot mix asphalt (HMA) pavement surface. The HMA pavement surface is heated using specialized equipment causing the asphalt to soften. In a continuous process, the softened HMA surface is scarified to a specified depth as detailed in the Contract documents. The scarified asphalt pavement is then mixed with a recycling agent that rejuvenates the asphalt. This mix is then placed and compacted back onto the roadway. All work under this item shall be in accordance with the Standard Specifications and as detailed in this specification.

2 MATERIALS**A. Recycling Agent.**

Use recycling agent specifically designed as a rejuvenator meeting the requirements outlined in Section 702 – *Bituminous Materials, 9. Asphalt Rejuvenating Agent* of the Standard Specifications. At the start of production and during, provide certified test results and documented quantities to the Engineer for each shipment of recycling agent. Acceptance of this material is based on a signed Manufacturer's Certification stating conformance to this specification. The use of any other grade of recycling agent requires prior approval from the Director, Materials Bureau. A 2-week notice is needed for this approval.

B. Mixture Design.

The Regional Materials office will take a minimum of three cores per lane mile or a maximum of 20 cores per project from the existing HMA pavement to be analyzed by the Department. These cores will be taken from locations that will represent the entire project condition. Provided in the Contract documents is the following information:

1. Descriptive notes of the core locations along with their test results showing percent of recovered asphalt content, aggregate gradation, and original penetration value for each sample.
2. The required depth, in inches, of the loose heater scarified HMA behind the screed unit.

Based on the information provided above, determine the application rate of the recycling agent such that the penetration value of the recovered performance-graded (PG) binder from the loose mix samples taken during the heater scarification process is at least 30% more than the average penetration value of the recovered PG binder from the existing pavement cores. Testing of all samples for the penetration values required using this specification will be performed in accordance with AASHTO T 49, Penetration of Bituminous Materials.

The Contractor may request to take additional cores from the existing HMA pavement to determine the mixture design. A 2-week notice shall be given to the Regional Materials Engineer requesting permission for coring.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)**3 EQUIPMENT****A. Heating Unit**

This unit shall generate sufficient heat to soften the asphalt pavement to the depth required. Care shall be taken not to overheat the existing pavement thereby softening the underlying asphalt pavement not to be scarified. The burner assembly shall be adjustable to heat between 8 and 14 feet in width. The entire heating unit shall be enclosed and vented to contain the heat and prevent damage to adjacent properties and landscape. In cooler temperatures, an additional heating unit may be required. Page 19 of 61

B. Heater Scarification Train

This equipment shall be a self-contained machine designed to reprocess only the upper layers of the existing HMA pavement. The heater scarification train shall be self-propelled and capable of operating at speeds of 8 to 26 feet per minute while uniformly heating and scarifying the existing HMA pavement to the minimum loose mix depth specified in the Contract documents. Listed below are the various units that are part of the heater scarification train.

1. Scarifying Unit – The scarifying unit shall contain at least 2 rows of spring-loaded tines that are adjustable to scarify 8 to 14 feet wide. The tines in row shall be no more than 1.0 inch apart. This unit shall also be able to conform to the pavement contours to insure a uniform penetration from the tines and prevent damage to utility structures.
2. Spray Unit – This unit shall be immediately behind the scarifying unit and capable of applying the recycling agent to the reclaimed asphalt pavement at the approved rate. The size of the nozzles located on the spray bar and pump shall be selected based upon the rate of application and the forward speed of the heater scarification unit. This unit shall be equipped with a measuring system, which shall be capable of maintaining the required application rate of the recycling agent with a tolerance of $\pm 5\%$ for the mix design. The measuring system shall continuously verify and display the application rate of recycling agent and cumulative total with respect to the volume of scarified material for the road surface.

Calibration

Calibrate the measuring system in the presence of the Regional Materials Engineer or designee. A minimum 2-week notice is required when scheduling this calibration. Approved calibrations are required for each project. If the calibration date exceeds 90 days, then the bituminous meters will need to be recalibrated. Work shall not progress until the calibration has been completed and verified. The equipment shall be calibrated in accordance with *ASTM D2995 Standard Practice for Estimating Application Rate of Bituminous Distributors*. Other calibration methods may be used with the approval of the Engineer.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

3. Mill/Remixer Unit – Immediately following the application of the recycling agent, a dual-drum enclosed milling unit shall mill the asphalt pavement to the loose mix depth specified in the Contract documents, thoroughly mixing the recycling agent with the scarified and milled pavement. The mill/remixer unit shall be an integral part of the scarifying machine and shall be located between the spray unit, which applies the recycling agent, and the screed. This unit shall be operated hydraulically, able to work at variable speeds up to 120 rpm, and shall be retractable from 14 to 8 feet wide. In addition, this unit shall be able to break in the center to allow for quarter point and crown control.

4. Screed Unit – The hot scarified material shall be uniformly distributed to the desired longitudinal and transverse section by the use of an attached heated, augured vibratory screed. The screed shall be equipped with an adjustable crown control and each end of the screed shall have hand wheel adjusting screws for providing the desired longitudinal grade and transverse slope.

C. Rollers

Shall meet §402-3.04, Rollers in the Standard Specifications.

4 CONSTRUCTION DETAILS

§402-3, Construction Details applies except as modified below:

A. Weather and Seasonal Limitations

Heater scarification is allowed only when the surface temperature is 50°F or above.

B. Pavement Markings

Remove any epoxy or thermoplastic pavement markings. Other markings shall be removed as ordered by the Engineer. Removal of pavement markings will be paid under a separate pay item in the Contract documents.

C. Cleaning

Clean the existing pavement and shoulder to be scarified by using mechanical sweepers, hand brooms, or other effective means until the surface is free of all material, which might interfere with the scarification process.

D. Heater Scarification

At least two heating units must be used. Operate the heating units in a manner to prevent damage to adjacent property and vegetation. Repair all heat-damaged areas immediately, at no additional cost to the Department.

Control the heater scarification equipment to insure the temperature of the scarified mixture is maintained between 275°F and 325°F. Verify this temperature within 5 feet behind the screed unit.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

Control the speed of the equipment to ensure that the recycled pavement is properly milled, mixed, and uniformly distributed to the proper thickness, slope, and crown shown on the Contract plans. Take extra care in controlling heater scarification equipment to prevent segregation of the recycled mix at the start and end of paving production as well as any points where the heater scarification train needs to stop and restart.

Construct the pavement so that it conforms to the requirements of Sections 402-3.10, *Surface Tolerance* and 402-3.11, *Thickness Tolerance*, of the Standard Specifications. Measure the depth of the loose scarified mix behind the screed unit prior to rolling operation. Adjust the paving equipment if the loose mix depth does not meet the depth specified in the Contract documents.

Control the width of each pass to provide proper placement of longitudinal joints including a 3-inch overlap onto adjacent lane passes.

Add recycling agent uniformly to the scarified HMA pavement at the predetermined application rate to produce a homogenous HMA recycled mix.

In areas such as catch basins or manholes not accessible to scarifying equipment, the Engineer will determine if they require repair. Pavement surfaces that are in good condition and are less than one square yard in size do not require repair. Areas with cracks or spalls that are greater than one square yard in size shall be repaired as approved by the Engineer at no additional cost to the State.

E. Compaction

Compact the recycled mixture in accordance with §402-3.07, D., 80 Series Compaction Method.

F. Scarified Mixture Verification:

1. **First day:** The Engineer will select two core locations on the existing pavement. These locations will be within a lane mile or fraction thereof if production is less than one mile. Drill two cores at each location and test one from each location for penetration of the existing PG binder from the surface layer only. Provide the companion core from each location to the Engineer.

During the scarification process, the Engineer will request the Contractor take two sets of two loose mix samples prior to compaction at the locations where cores were taken. These samples will be representative of the day's production. Take samples either behind the screed or any place after the spraying and mixing units. Identify all samples by their locations at the project site. Test one set for penetration and provide the other set to the Engineer, which may be evaluated by the Department's Lab to verify test results.

All the required core and loose mix samples must be taken after the first 500 feet of the day's production.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

Submit penetration test results to the Engineer by the end of the next day's production. If test results are not provided, the Engineer may shutdown the paving operation until the results are submitted. The average penetration value of the loose mix samples must be at least 30% more than the penetration of the core sample from the existing pavement.

If the average penetration values of the loose mix samples fail to meet this requirement, adjust the application rate and submit the new adjusted application rate to the Engineer. Repeat the procedure described above of taking and testing samples. Submit the penetration test results to the Engineer by end of the next day's production. Continue taking these samples until average penetration values of the loose mix samples meet the specification requirement of at least 30% more than the penetration value of the core samples.

2. If the specification requirements are met after the first day's production, take samples as described above every three days of production for quality control and quality assurance purposes. When sample results do not meet the specification requirements, make adjustment to the application rate and take samples as described above.

If, at anytime, the average penetration value of the loose mix samples is greater than 90, the Engineer may evaluate the pavement section and request the scarified pavement be removed and replaced at no additional cost to the State. The evaluation may include, but not limited to, testing penetration of the core sample, location of the section, etc. If samples are required, the Contractor will take them at no additional cost to the State and will submit them to the Department for testing. Also, if the recycled pavement is not satisfactory to the Engineer, additional tests may be performed at no cost to the State.

G. Overlay

The heater scarified HMA pavement can be overlaid once work is completed to the satisfaction of the Engineer. The overlay shall be placed prior to the end of the paving season. This work shall be done under a separate pay item in the Contract documents.

5 METHOD OF MEASUREMENT

This work will be measured as the number of square yards of pavement surface recycled as detailed in this specification.

The quantity of recycling agent to be measured for payment will include the number of gallons incorporated in the work, measured at a temperature of 60°F.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

6 BASIS OF PAYMENT

The unit price bid per square yard for this item shall include the cost of all labor, tools, equipment, and incidentals necessary to satisfactorily complete the work including cleaning debris from the existing pavement, heating and scarifying, mixing, paving, compaction, and coring and testing of the recycled materials. No deduction will be made in areas such as catch basins or manholes where the scarifying equipment cannot be used.

The unit price bid per gallon of recycling agent shall include the cost of all labor, material, and equipment necessary to complete the work satisfactorily. ***The Regional Materials Engineer will evaluate the material represented by any failing sample of recycling agent. If the Engineer elects to leave the material in place, the Contractor shall receive no payment for the bid price of the recycling agent for the pavement section represented by the failing sample.***

Payment will be made under:

Item No.	Item	Pay Unit
402.99010005	Heater Scarification of Hot Mix Asphalt (HMA) Pavement	Square Yards
402.99010105	Recycling Agent	Gallons

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER**CRACK AND JOINT FILLING MATERIAL (PG 64S-22 + FIBERS)****1. DESCRIPTION**

This item is a hot-applied material consisting of PG 64S-22 and polyester fibers. PG 64S-22 + Fibers can only be used for filling shoulder joints between PCC pavement and HMA shoulder. Political subdivisions may use this material as a filler prior to overlay.

2. MATERIAL REQUIREMENTS**A. PG Binder**

Use a PG binder meeting the requirements of PG 64S-22 as specified in accordance with AASHTO M 332, PG Binders for Paving. Acceptance for use is contingent upon certification of compliance to these specification requirements by the primary source and subsequent suppliers.

B. Fibers

Acceptance of the fibers is based on the manufacturer certification that the fibers meet the following:

- a. Type of Fiber: Polyester
- b. Tensile Strength: 480 MPa min.
- c. Specific Gravity: 1.32-1.40
- d. Melt Temperature: 475°F min.
- e. Elongation: 33% ± 9%
- f. Length of Fiber: 1/4 inch ± 1/32 inch

Legibly mark containers with the following information:

- a. Manufacturer's Name
- b. Trade Name of Fiber
- c. Type of Fiber

C. Composition of PG Binder and Fiber Mixture

Mix a minimum of 5.0%, by weight, of fibers with PG binder.

D. Mixing Temperatures

Mix the PG binder and fiber at the temperature recommended by the fiber manufacturer. The mixing temperature is not to exceed 325°F.

Prior to commencing work, provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the filler.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)****PLASTIC JOINT MATERIAL (ASTM D6690 TYPE II)****1. DESCRIPTION**

This item is a hot applied material conforming to the requirements of ASTM D6690 Type II.

2. MATERIAL REQUIREMENTS

Use a sealant meeting the requirements of Section 705-02, Highway Joint Sealants, and ASTM D6690 Type II. Deliver the sealant in the manufacturer's original sealed container legibly marked with the following information:

- a. Manufacturer's name.
- b. Trade name of sealant.
- c. Manufacturer's batch or lot number.
- d. ASTM D6690, Type II.
- e. Minimum application temperature.
- f. Maximum (or Safe) heating temperature.

Prior to commencing work, provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the sealant.

3. TEMPERATURE REQUIREMENTS

All crack filling and sealing work done under this contract shall be performed when ambient temperatures are 40° F or higher.

4. EQUIPMENT REQUIREMENTS

When the filler or sealant is required to be supplied in hot oil-heated, containerized, mobile tanks, the equipment shall consist of a double boiler type melter.

The filler or sealant shall be heated in a melter constructed either as a double boiler with the space between the inner and outer shells filled with a heat-transfer medium, or with internal tubes or coils carrying the filler or sealant through a heated oil bath and into a heated double wall hopper. Direct heating shall not be used. The melter shall be capable of maintaining the specific pouring temperature within ± 40 °F. The melter shall be equipped with positive temperature controls, and with mechanical agitation or a re-circulation pump capable of assuring a homogeneous blend of the filler or sealant. The melter shall have separate thermometers to indicate the temperature of the heat-transfer medium, and the filler or sealant material in the hopper. Before any crack filling or sealing shall commence, the Engineer or agency representative shall inspect the melter to ascertain the presence and working conditions of the thermometers. Under no circumstances will the Engineer or agency representative permit any crack filling or sealing if the thermometers are found to be defective or missing.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)**

The Contractor shall be responsible for a safe and efficient method by which the engineer or agency representative will be able to accurately measure the temperature of the filler or sealant as it is discharged to the applicator wand. The proposed method must be submitted to the engineer or agency representative for their approval prior to the start of crack filling or sealing operations. The Contractor shall provide the engineer or agency representative with two (18 inch stem) thermometers having a temperature range sufficient to meet this requirement.

The discharge hose shall be equipped with a thermostatically controlled heating apparatus or shall be insulated sufficiently to maintain the proper sealant or filler temperature. The application wand shall be returned to the machine if it is not thermostatically heat controlled, and material recirculated as necessary to maintain the proper sealant or filler pouring temperature between individual crack sealing or filling operations.

When compressed air equipment (125 cubic feet per minute minimum) is required to be supplied, suitable traps or devices shall be installed on this equipment to prevent moisture and oil from contaminating the crack surfaces. The Contractor shall maintain these devices and see that they are functioning properly.

CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT**1. DESCRIPTION**

Clean and seal only primary cracks along their entire length at locations shown in the contract documents or where directed by the Engineer. Do not treat secondary radial cracks. The Engineer will determine which cracks are to be cleaned and sealed. In this specification, the word crack also means joint.

Primary cracks are defined as those greater than or equal to 1/8 inch and less than or equal to 1 inch wide.

2. MATERIAL REQUIREMENTS**A. Crack Sealant**

Use a sealant meeting the requirements of Section 705-02, Highway Joint Sealants, and ASTM D6690 Type II. Deliver the sealant in the manufacturer's original sealed container legibly marked with the following information:

- a. Manufacturer's name.
- b. Trade name of sealant.
- c. Manufacturer's batch or lot number.
- d. ASTM D6690, Type II.
- e. Minimum application temperature.
- f. Maximum (or Safe) heating temperature.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)**

Prior to commencing work, provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the sealant.

3. CONSTRUCTION REQUIREMENTS**A. General**

Prior to commencing work, complete all pavement repairs that border pavement cracks, as outlined in the contract documents.

Furnish all equipment that is necessary for cleaning and sealing the pavement cracks. Use equipment meeting the description and/or performance requirements described herein and approved by the Engineer. Replace pavement markings that become covered and/or obliterated with sealant over an area greater than 25% of their width at no additional cost to the State.

B. Crack Preparation

Prepare cracks for sealing on the same day that they are to be sealed.

Use a high pressure air lance or hot air lance to thoroughly clean and dry cracks of dust, dirt, foreign material, sand and any other extraneous materials to a minimum depth of 1/2 inch immediately prior to sealing. Do not burn, scorch or ignite the adjoining pavement when using a hot air lance.

Install suitable traps or devices on the compressed air equipment to prevent moisture and oil from contaminating the crack surfaces. Maintain these devices and see that they are functioning properly.

Protect the public from potentially objectionable and/or hazardous airborne debris.

C. Sealant Melting

Heat and melt the sealant in a melter constructed either as a double boiler filled with a heat-transfer medium between the inner and outer shells, or with internal tubes or coils carrying the sealant through a heated oil bath and into a heated double wall hopper. The melter will be equipped with separate thermometers to indicate the temperature of the heat transfer medium and the sealant material, positive temperature controls and a mechanical agitator or a recirculating pump to ensure a homogeneous blend of the sealant. Maintain the sealant at the pouring temperature ± 10 °F, as indicated on the material packaging.

Check the discharge temperature of the sealant with a non-contact infrared thermometer. Discharge the sealant at a temperature between the manufacturer's recommended pouring and safe heating temperatures indicated on the material packaging. Submit an alternate method for measuring the discharge temperature to the Engineer for approval, if desired.

Sealing is not permitted if the melter and discharge temperatures do not meet the requirements described above.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER (Cont'd)

Equip the discharge hose with a thermostatically controlled heating apparatus or insulate it to maintain the proper sealant pouring temperature. Holster the discharge hose to the melter if it is not thermostatically heat controlled. Circulate the sealant from the discharge hose into the melter to maintain the proper sealant pouring temperature.

Do not use sealant material heated beyond the safe heating temperature.

If the manufacturer's recommendations allow the sealant to be reheated or heated in excess of six hours, recharge the melter with fresh material amounting to at least 20 percent of the volume of the material remaining in the melter.

D. Sealing

Sealing is to be done when ambient air temperature is at or above 40°F.

Seal the crack by placing the applicator wand in or directly over the crack opening and carefully discharging the sealant. Strike-off the sealant flush with the pavement surface using a squeegee or sealing shoe pressed firmly against the pavement. Only a narrow thin film of material measuring from 1 to 2 inches wide and 1/16 inch thick is allowed on the pavement surface after sealing the crack. If the sealant sinks into the crack more than 3/8 inch below the pavement surface, clean it with high pressure air and reseal as instructed above. Properly sealed cracks shall be watertight.

A low pressure, light spray of water may be used to accelerate cooling of the sealant. Blotting the sealant with fine aggregate is not allowed. Remove and dispose of sealant that is in excess of the specified thin film dimensions or that has not bonded to both sides of the crack.

To avoid tracking, do not allow traffic on the sealed cracks until the sealant has cured sufficiently. Clean sealed cracks damaged by traffic with high pressure air and reseal them to meet the specified thin film amount at no additional cost to the State.

ROUTING, CLEANING AND SEALING CRACKS IN HOT MIX ASPHALT PAVEMENT USING HOT APPLIED SEALANT

1. DESCRIPTION

Rout, clean and seal only primary cracks along their entire length at locations shown in the contract documents or where directed by the Engineer. Do not treat secondary radial cracks. The Engineer will determine which cracks are to be routed prior to cleaning and sealing. In this specification, the word crack also means joint.

Primary cracks are defined as those greater than or equal to 1/8 inch and less than or equal to 1 inch wide.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)****2. MATERIAL REQUIREMENTS****A. Crack Sealant**

Use a sealant meeting the requirements of Section 705-02, Highway Joint Sealants, and ASTM D6690 Type II. Deliver the sealant in the manufacturer's original sealed container legibly marked with the following information:

- a. Manufacturer's name.
- b. Trade name of sealant.
- c. Manufacturer's batch or lot number.
- d. ASTM D6690, Type II.
- e. Minimum application temperature.
- f. Maximum (or Safe) heating temperature.

Prior to commencing work, provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the sealant.

3. CONSTRUCTION REQUIREMENTS**A. General**

Prior to commencing work, complete all pavement repairs that border pavement cracks, as outlined in the contract documents.

Furnish all equipment that is necessary for routing, cleaning, and sealing the pavement cracks. Use equipment meeting the description and/or performance requirements described herein and approved by the Engineer. Replace pavement markings that become covered and/or obliterated with sealant over an area greater than 25% of their width at no additional cost to the State.

B. Crack Preparation

Prepare cracks for sealing on the same day that they are to be sealed.

Rout all primary cracks as defined above with a router to provide at least a 5/8 inch wide by 1/2 inch deep vertical-edged reservoir with minimal spalls at its edges.

Use a high pressure air lance or hot air lance to thoroughly clean and dry routed cracks of dust, dirt, foreign material, sand and any other extraneous materials immediately prior to sealing cracks. Do not burn, scorch or ignite the adjoining pavement when using a hot air lance.

Install suitable traps or devices on the compressed air equipment to prevent moisture and oil from contaminating the crack surfaces. Maintain these devices and see that they are functioning properly.

Protect the public from potentially objectionable and/or hazardous airborne debris.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)****C. Sealant Melting**

Heat and melt the sealant in a melter constructed either as a double boiler filled with a heat-transfer medium between the inner and outer shells, or with internal tubes or coils carrying the sealant through a heated oil bath and into a heated double wall hopper. The melter will be equipped with separate thermometers to indicate the temperature of the heat transfer medium and the sealant material, positive temperature controls and a mechanical agitator or a recirculating pump to ensure a homogeneous blend of the sealant. Maintain the sealant at the pouring temperature $\pm 10^{\circ}\text{F}$, as indicated on the material packaging.

Check the discharge temperature of the sealant with a non-contact infrared thermometer. Discharge the sealant at a temperature between the manufacturer's recommended pouring and safe heating temperatures indicated on the material packaging. Submit an alternate method for measuring the discharge temperature to the Engineer for approval, if desired.

Sealing is not permitted if the melter and discharge temperatures do not meet the requirements described above.

Equip the discharge hose with a thermostatically controlled heating apparatus or insulate it to maintain the proper sealant pouring temperature. Holster the discharge hose to the melter if it is not thermostatically heat controlled. Circulate the sealant from the discharge hose into the melter to maintain the proper sealant pouring temperature.

Do not use sealant material heated beyond the safe heating temperature.

If the manufacturer's recommendations allow the sealant to be reheated or heated in excess of six hours, recharge the melter with fresh material amounting to at least 20 percent of the volume of the material remaining in the melter.

D. Sealing

Sealing is to be done when ambient air temperature is at or above 40°F .

Seal the routed crack by placing the applicator wand in or directly over the recess and carefully discharging the sealant. Strike-off the sealant flush with the pavement surface using a squeegee or sealing shoe pressed firmly against the pavement. Only a narrow thin film of material measuring from 1 to 2 inches wide and 1/16 inch thick is allowed on the pavement surface after sealing the reservoir. If the sealant sinks into the reservoir more than 3/8 inch below the pavement surface, clean it with high pressure air and reseal as instructed above. Properly sealed cracks shall be watertight.

A low pressure, light spray of water may be used to accelerate cooling of the sealant. Blotting the sealant with fine aggregate is not allowed. Remove and dispose of sealant that is in excess of the specified thin film dimensions or that is not bonded to both sides of the reservoir.

To avoid tracking, do not allow traffic on the sealed reservoirs until the sealant has cured sufficiently. Clean sealed reservoirs damaged by traffic with high pressure air and reseal them to meet the specified thin film amount at no additional cost to the State.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)****FILLING SHOULDER JOINTS BETWEEN PCC PAVEMENT AND HMA SHOULDERS
USING FIBER REINFORCED PG BINDER OR HOT APPLIED SEALANT****1. DESCRIPTION**

Clean and fill/seal the shoulder joint between Portland cement concrete (PCC) pavement and hot mix asphalt (HMA) shoulders in accordance with the contract documents and as directed by the Engineer.

2. MATERIAL REQUIREMENTS

Use fiber reinforced PG binder or crack sealant that meets the following requirements:

A. Fiber Reinforced PG Binder**PG Binder**

Use a PG binder meeting the requirements of PG 64S-22 or PG 64S-28 as specified in Section 702, PG Binders for Paving. Acceptance for use is contingent upon certification of compliance to these specification requirements by the primary source and subsequent suppliers.

Fibers

Acceptance of the fibers is based on the manufacturer certification that the fibers meet the following:

- a. Type of Fiber: Polyester
- b. Tensile Strength: 480 MPa min.
- c. Specific Gravity: 1.32-1.40
- d. Melt Temperature: 475°F min.
- e. Elongation: 33% ± 9%
- f. Length of Fiber: 1/4 inch ± 1/32 inch

Legibly mark containers with the following information:

- a. Manufacturer's Name
- b. Trade Name of Fiber
- c. Type of Fiber

Composition of PG Binder and Fiber Mixture

Mix a minimum of 5.0 %, by weight, of fibers with PG binder.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)****Mixing Temperatures**

Mix the PG binder and fiber at the temperature recommended by the fiber manufacturer. The mixing temperature is not to exceed 325°F. Prior to commencing work, provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the filler.

B. Crack Sealant

Use a sealant meeting the requirements of Section 705-02, Highway Joint Sealants, and ASTM D6690 Type II. Deliver the sealant in the manufacturer's original sealed container legibly marked with the following information:

- a. Manufacturer's name.
- b. Trade name of sealant.
- c. Manufacturer's batch or lot number.
- d. ASTM D6690, Type II.
- e. Minimum application temperature.
- f. Maximum (or Safe) heating temperature.

Prior to commencing work, provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the sealant.

3. CONSTRUCTION REQUIREMENTS

Use fiber reinforced PG binder or crack sealant that meets the following requirements:

A. General

Prior to commencing work, complete all pavement repairs that border the pavement/shoulder joint, as outlined in the contract documents.

Furnish all equipment that is necessary for cleaning and filling/sealing the shoulder joints. Use equipment meeting the description and/or performance requirements described herein and approved by the Engineer. Replace pavement markings that become covered and/or obliterated with sealant over an area greater than 25% of their width at no additional cost to the State.

B. Joint Preparation

Prepare joints for filling/sealing on the same day that they are to be sealed.

Use a high pressure air lance or hot air lance to thoroughly clean and dry joints of dust, dirt, foreign material, sand and any other extraneous materials immediately prior to filling/sealing joints. Do not burn, scorch or ignite the adjoining pavement when using a hot air lance.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)**

Install suitable traps or devices on the compressed air equipment to prevent moisture and oil from contaminating the joint surfaces. Maintain these devices and see that they are functioning properly.

Protect the public from potentially objectionable and/or hazardous airborne debris.

C. Filler/Sealer Melting

Heat and melt the filler/sealer in a melter constructed either as a double boiler filled with a heat-transfer medium between the inner and outer shells, or with internal tubes or coils carrying the filler/sealer through a heated oil bath and into a heated double wall hopper. The melter will be equipped with separate thermometers to indicate the temperature of the heat transfer medium and the filler/sealer material, positive temperature controls and with a mechanical agitator or a recirculating pump to ensure a homogeneous blend of the filler/sealer. Maintain the filler/sealer at the pouring temperature $\pm 10^{\circ}\text{F}$, as indicated on the material packaging.

Check the discharge temperature of the filler/sealer with a non-contact infrared thermometer. Discharge the filler/sealer at a temperature between the manufacturer's recommended pouring and safe heating temperatures indicated on the material packaging. Submit an alternate method for measuring the discharge temperature to the Engineer for approval, if desired.

Filling/sealing joints is not permitted if the melter and discharge temperatures do not meet the requirements described above.

Equip the discharge hose with a thermostatically controlled heating apparatus or insulate it to maintain the proper filler/sealer pouring temperature. Holster the discharge hose to the melter if it is not thermostatically heat controlled. Circulate the filler/sealer from the discharge hose into the melter to maintain the proper filler/sealer pouring temperature.

Do not use filler/sealer material heated beyond the safe heating temperature.

If the manufacturer's recommendations allow the filler/sealer to be reheated or heated in excess of six hours, recharge the melter with fresh material amounting to at least 20 percent of the volume of the material remaining in the melter.

D. Filling/sealing

Filling/sealing is to be done when ambient air temperature is at or above 40 °F.

Overfill the joint by placing the applicator wand in or directly over the recess and carefully discharging the filler/sealer. Strike off the joint using a neoprene type "V" shaped squeegee or sealing shoe that is capable of conforming to the pavement surface. Form a film of material 4 inches wide and 1/16 to 1/8 inch thick, with tapered edges, centered over the joint. The distance between the filler/sealer applicator wand and the squeegee/sealing shoe shall not exceed 2 feet. Properly filled/sealed joints shall be watertight.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER
(Cont'd)**

A low pressure, light spray of water may be used to accelerate cooling of the filler/sealer. Blotting the filler/sealer with fine aggregate is not allowed. Remove and dispose of filler/sealer that is in excess of the specified film dimensions or that has not bonded to both sides of the joint.

Protect filled/sealed joints until the filler/sealer has cured sufficiently. Clean filled/sealed joints that become damaged with high pressure air and refill/reseal them to meet the specified film amount at no additional cost to the State.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICROSURFACING

413.02010118 Micro-Surfacing, Type II, F1
413.02020118 Micro-Surfacing, Type II, F2
413.02030118 Micro-Surfacing, Type II, F3
413.03010118 Micro-Surfacing, Type III, F1
413.03020118 Micro-Surfacing, Type III, F2
413.03030118 Micro-Surfacing, Type III, F3
413.04030118 Micro-Surfacing, Type III, Rut Filling
407.01000118 Fog Seal Prior to Micro-Surfacing

DESCRIPTION:

This work shall consist of applying a proportioned mixture of polymer modified asphalt emulsion, aggregate, mineral filler, water and other additives to a paved surface.

MATERIALS:

Asphalt Emulsion: §702 - Bituminous Materials, use item 702-4601P.

Fog Seal – Use material meeting the requirements of §702, Table 702-7, Diluted Tack Coat, or material approved by the Director of the Materials Bureau.

Aggregates: Use material meeting the requirements of §703-02, Coarse Aggregate, with the following modifications.

- A. Sand Equivalency.** Minimum sand equivalency is 65%, as determined by AASHTO T 176, “Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.” Material not meeting the minimum sand equivalent requirement may be used if it is classified as non-plastic according to AASHTO T 89, “Determining the Liquid Limit of Soils” and AASHTO T 90, “Determining the Plastic Limit and Plasticity Index of Soils.”
- B. Type F1 Conditions.** Use aggregate containing at least 90.0% acid insoluble residue in the plus and minus No. 30 size fractions.
- C. Type F2 Conditions.** Use aggregate meeting one of the following requirements:
 1. Limestone, dolomite, or blend of the two containing at least 20.0% acid insoluble residue in the plus and minus No. 30 size fractions.
 2. Gravel or blend of a natural or manufactured, limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, having at least 25.0% acid insoluble residue in the plus and minus No. 30 size fractions.
- D. Type F3 Conditions.** Use aggregate meeting one of the following requirements:
 1. Limestone or a blend of limestone and dolomite containing at least 20.0% acid insoluble residue in the plus and minus No. 30 size fractions.
 2. Dolomite.
 3. Gravel or blend of a natural or manufactured, limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, having at least 25.0% acid insoluble residue in the plus and minus No. 30 size fractions.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

- E. Stockpile.** Build an aggregate stockpile at a location approved by the Engineer. When blending multiple aggregates, use automated proportioning and blending equipment to produce a uniformly graded stockpile. Screen the aggregate at the stockpile, prior to delivering it to the micro-surfacing equipment.

Use aggregate meeting the gradation requirements listed in §703-02, Table 703-5, Sizes of Crushed Gravel, Stone, and Slag for Slurry with the following exceptions: the range for the No. 100 sieve on the 2MS designation is 10-22% passing; and the range for the #200 sieve on the 2MS and 3MS designation is 5-15%.

The aggregate stockpile gradation shall not deviate from the mix design gradation by more than the tolerances given in Table 1 - Maximum Stockpile Tolerance. The mix design gradation value plus the stockpile tolerance cannot exceed the mix type general gradation limits.

TABLE 1 - MAXIMUM STOCKPILE TOLERANCE

Sieve (in)	3/8	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
Stockpile Tolerance	-	± 5.0%	± 5.0%	± 5.0%	± 5.0%	± 4.0%	± 3.0%	± 2.0%

Water: §712-01, Water.

Mineral Filler: §703-08, Mineral Filler.

Mix Design: Employ a Department approved laboratory to develop a job mix formula, following the procedure outlined in ASTM D 3910, Standard Practices for Design, Testing, and Construction of Slurry Seal that meets the requirements listed in Table 2 - Proportional Requirements and Table 3 - Physical Requirements, and Table 4 - Gradation Requirements. All materials used to develop the mixture design must be representative of the materials to be used on the project. The mixture design must clearly list the proportions of mineral aggregate, mineral filler, water, additive(s), percent asphalt emulsion based on the dry weight of aggregate, and design set and cure times. The mix design shall be submitted at least 14 days before the beginning of work to the Engineer in Charge, the Regional Materials Engineer and the Director of the Materials Bureau. Mixture designs are valid until 3rd Saturday in September of the year in which they are submitted.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

TABLE 2 - PROPORTIONAL REQUIREMENTS	
Constituent	Proportional Requirement
Residual Asphalt	5.5 to 10.5% (by dry mass of aggregate).
Mineral Filler	0.0 to 3.0% by dry mass of aggregate.
Water	As required to produce proper mixture consistency.
Field Control Additive	As required to control the emulsion's set properties or increase adhesion, but must be part of the mixture design and compatible with all other components.

TABLE 3 - PHYSICAL REQUIREMENTS		
Property	Test Method	Requirement
Wet Cohesion	ISSA TB 139; 30 minutes ISSA TB 139; 60 minutes	12 kg-cm, minimum 20 kg-cm, minimum
Wet Track Abrasion Loss	ASTM D 3910; 1 hour soak ASTM D 3910; 6 day soak	538 g/m ² , maximum 807 g/m ² , maximum
Mix Time	ISSA TB 113	Controllable to 120 seconds
Classification Compatibility	ISSA TB 144	11 grade points, minimum
Wet Stripping	ISSA TB 114	Pass (90.0% minimum)
Excess Asphalt by LWT Sand Adhesion	ISSA TB 109	538 g/m ² , maximum
Lateral Displacement	ISSA TB 147A	5.0% maximum
Specific Gravity after 1000 cycles of 125 lbs.	ISSA TB 147A	2.10 maximum

TABLE 4 - GRADATION REQUIREMENTS	
Mixture Type	Aggregate Gradation
Type II	2MS ⁽¹⁾
Type III	3MS ⁽¹⁾

⁽¹⁾ § 703-02 Material Requirements, Table 703-5 Sizes of Crushed Gravel, Stone, and Slag for Slurry.

Material Sampling and Testing:

A. Aggregate Stockpile

1. **Contractor Testing.** The contractor shall perform and submit the following tests to the Regional Materials Engineer.
 - a. Take three samples, according to Materials Method 5, Plant Inspector's Manual for Bituminous Concrete Mix Production. Each sample must contain material from each face of the stockpile.
 - b. Test samples in accordance with AASHTO T 11, Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing, and AASHTO T 27, Sieve Analysis of Fine and Coarse Aggregates. Test results shall be based on the average of three tests.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

- c. Sample and test the aggregate in accordance with Materials Method 28, "Friction Aggregate Control and Test Procedures," Appendix B, Table B1 – Minimum Testing Frequencies for Slurry Surfacing Aggregates.

2. Department Testing and Approval. The Regional Materials Engineer will review the Contractor's submission for specification compliance. The Regional Materials Engineer will base final approval of the stockpile on the Contractor's submission or Department sampling and testing. Re-approval is required if additional material is added to the stockpile.

- a. Gradation - Test results shall be the average of three tests. If the percent passing is outside the gradation limits for any sieve, the stockpile will be rejected.
- b. Friction Requirements - Samples shall meet appropriate friction values. All micro-surfacing previously placed with material from a stockpile rejected for non-carbonate or acid insoluble residue content will be rejected.

B. Emulsion. Asphalt emulsion shall be sampled according to Materials Method 702-2, "Asphalt Emulsion – Quality Assurance."

CONSTRUCTION DETAILS:

Weather and Seasonal Limitations: The requirements of §402-3.01 Weather and Seasonal Limitations apply, except as modified herein. Do not place micro-surfacing in the rain, fog, or if the air temperature is expected to fall below freezing within 24 hours after application. Application shall not occur unless pavement and ambient temperatures are above 50°F and rising. Stop micro-surfacing if the surface or air temperature drops below 50°F. No work will be performed after the third Saturday in September.

Equipment: Equipment must be designed and manufactured specifically for mixing and placing micro-surfacing. The equipment must be capable of accurately proportioning the constituent materials, thoroughly mixing those materials, and placing the micro-surfacing in conformance with this specification.

Calibrate each mixing unit according to Materials Procedure 09-01. Calibrations must be performed using the aggregate sources listed in the mix design. Calibrations are valid for 90 days. Submit a copy of the equipment calibration to the Engineer prior to the start of work. The emulsion, aggregate and mineral filler counters must be accessible to the Engineer and inspectors. Adjust the material delivery settings on the micro-surfacing equipment to produce the mix design. Recalibrate equipment to adjust for bulking effect of aggregate reported on mix design.

A pneumatic tire roller meeting the requirements of §402, shall be used.

Surface Preparation:

1. Ensure that pavement markings have been abraded in accordance with contract documents.
2. Remove all debris and standing water.
3. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area being paved with plastic, building felt, or other material approved by the Engineer. Remove the covers each day.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

4. If directed by the engineer, dampen the pavement surface with water or apply a fog seal to the pavement surface before applying micro-surfacing. If prior to or during the preconstruction meeting, it is determined that the road surface requires a fog seal application, it shall be paid for in accordance with the appropriate pay item.

Mixture Consistency: Produce a homogeneous mixture, without lumps, balls, unmixed aggregate, segregation, excess water, or excess emulsion. The maximum allowable adjustment of the mineral filler is 1.0%. Report all mixture adjustments to the Engineer before they are made.

Application: Micro-surfacing is placed in multiple lifts; use at least two applications consisting of a scratch course and finish course for the finished product. When necessary, a rut filling course is also specified and paid for separately. Do not apply scratch course to the shoulder unless otherwise directed.

1. **Scratch Course.** Use a steel strike off on the spreader box in order to level the pavement surface. The scratch course surface shall be constructed to a ¼ inch tolerance. Measure the tolerance using a 10-foot straight edge or string line placed transversely to the center line of the pavement. Variations exceeding ¼ inch shall be satisfactorily corrected or resurfaced at no additional cost to the Department as ordered by the Engineer.
2. **Finish Course.** Apply the micro-surfacing to the pavement evenly across the entire width of the spreader box to produce a smooth riding surface with no streaks, excess buildup, thin or uncovered areas. The finish course surface shall be constructed to a ¼ inch tolerance. Measure the tolerance using a 10 foot straight edge or string line placed transversely to the center line of the pavement. Variations exceeding ¼ inch shall be satisfactorily corrected or resurfaced at no additional cost to the Department as ordered by the Engineer.
3. **Rut Filling.** Use a rut box to fill wheel rutting. Allow rut-filled sections to cure for a minimum of two hours after rolling.

Application rate limits are given in Table 5 - Application Limits. Application rates for rut filling operations are found in Table 6 - Rut Filling Application Rate.

TABLE 5 - APPLICATION LIMITS		
Gradation	Course	Application Rate (lb/yd ²)
Type II	Scratch	15 maximum
	Finish	15-20
Type III	Scratch	20 maximum
	Finish	20-30

TABLE 6 - RUT FILLING APPLICATION RATE	
Rut Depth	Application Rate (lbs/yd ²)
½" to ¾"	20 – 30
¾" to 1"	25 – 35
1" to 1-¼"	28 – 38

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

Coverage: Do not use hand tools to expand the width of application wider than the spreader box, except as described under *Hand Finishing* below.

Joints: Minimize the number of joints. Construct joints such that no gap is present between adjacent applications. Place longitudinal joints at the edges of traffic lanes, adjacent to where pavement markings will be located. Other longitudinal joint arrangements require the Engineer's approval. Measure the difference in grade across joints by laying a 10 foot straight edge centered on the joint perpendicular to the direction of the joint. Joint overlap and grade difference requirements are given in Table 7 - Joint Requirements.

TABLE 7 - JOINT REQUIREMENTS		
Requirement	Minimum (in.)	Maximum (in.)
Difference in Grade	-	¼
Longitudinal Joint Overlap	2	6
Transverse Joint Overlap	2	12

Variable-Width Passes: Apply no more than one variable-width pass. Variable-width passes will not be permitted as the last pass unless approved by the Engineer.

Hand Finishing: Use hand held squeegees to finish areas which cannot be reached with the spreader box, and, when necessary, to produce straight lines along curbs, shoulders, and through intersections. Apply the same type of finish to the surface as is applied by the spreader box.

Excess Material: Remove all excess material in areas such as driveways, gutters, intersections, etc. each day.

Rolling: The mat shall be rolled with a pneumatic tire roller. A minimum of 3 passes of the pneumatic tire roller shall be required. One pass is defined as one movement of the roller over any point of the pavement in either direction. The rolling of the surface shall not cause the stone to stick to the wheels of the roller.

Curing: Allow each coat to cure sufficiently to resist damage from the micro-surfacing equipment, before applying the next coat. Protect the micro-surfacing from traffic until the mixture has cured sufficiently to resist damage. The time required will vary based on the mix design and environmental conditions. Repair damage from micro-surfacing equipment or traffic to the Engineer's satisfaction.

Milling for Pavement Markings: Mill recesses for pavement markings as required by contract documents.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

Quality Control Reports: The contractor shall submit a signed report daily with the following information:

Quality Control Reports	
Gradation	Daily ¹
Moisture Content Aggregate	Daily
Gate Setting	Daily ²
Area Paved	Daily
Counter Reading	Daily
Field Control (Type/Amount)	Daily ²
Filler (Type/Amount)	Daily ²
Water Rate	Daily ²
Water Content	Daily ^{1,3}
Air Temperature (AM/PM)	Daily

- ¹ These tests will be performed on samples that are representative of that day's production. If control test results are not complete at the end of the day, the contractor will be allowed to submit the data at a later date, not to exceed 7 days. The contractor shall provide a split of their daily sample to the Engineer.
- ² These parameters may change throughout the day. Record the amount and location of any change on the report. Record the amount and location of any change on the report.
- ³ Water content will be determined by taking a sample of mixed material and drying to a constant weight.

METHOD OF MEASUREMENT:

Micro-surfacing shall be measured by the total tons of aggregate, mineral filler and asphalt emulsion used according to Materials Procedure 09-01, "Micro-surfacing and Slurry Guidelines."

Fog seal shall be measured by the number of 60° F gallons actually incorporated in the work.

The following formula will be used to calculate material quantity at 60° F:

$$\text{Volume}_{60^{\circ}\text{F}} = \text{Volume}_D \times [1 - (\Delta T \times 0.00025)]$$

Where:

ΔT = Delivered Temperature (° F) – 60

Volume_D = Quantity Delivered (gallons)

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

BASIS OF PAYMENT:

The unit price bid per ton of Micro-surfacing shall include the cost of all labor, materials and equipment necessary to perform the work. All necessary pavement cleaning, joint sealing, crack filling, pavement markings removal, milling for pavement markings and utility grade adjustments will be paid for under their appropriate items.

Payment will be made under:

<u>Item No.</u>	<u>Item</u>	<u>Pay Unit</u>
413.02010118	Micro-Surfacing, Type II, F1	Ton
413.02020118	Micro-Surfacing, Type II, F2	Ton
413.02030118	Micro-Surfacing, Type II, F3	Ton
413.03010118	Micro-Surfacing, Type III, F1	Ton
413.03020118	Micro-Surfacing, Type III, F2	Ton
413.03030118	Micro-Surfacing, Type III, F3	Ton
413.04030118	Micro-Surfacing, Type III, Rut Filling	Ton
407.01000118	Fog Seal prior to Microsurfacing	Gallon

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)**BONDING REQUIREMENTS:**

- A. Within 10 calendar days of receipt of a purchase order from the State, the contractor shall provide the State agency the following:
1. Maintenance Material Bond. A bond in the form similar to the sample included in this Invitation for Bids with sufficient sureties approved by the State's resident engineer guaranteeing replacement of deficient material in the form included in this Invitation for Bids. This bond shall remain in place for one year after final acceptance of the project by the State or until September 15 of the year following completion of the project, whichever is later.
 2. Amount of Bond. The amount of the Maintenance Material Bond shall be 100% of the amount of the project's cost.
 3. Requirements of Bonds. All Bonds shall be issued by a surety company approved by NYSDOT and authorized to do business in the State of New York as a surety.
- B. The procedure of the Maintenance Material Bond shall be as follows:
1. No later than August 1 of the year following the State's acceptance of work completed under this contract, the State will evaluate the project for plow damage, flushing, delamination or raveling.
 2. The contractor agrees to repair all areas that demonstrate plow damage, flushing, delamination or raveling greater than 2.0 yd² for any single location, or greater than 5.0 yd² for any 0.1 lane mile. Such repairs, however, shall not include any damage resulting from any forces or circumstances beyond the control of the contractor. The evaluation of the micro-surfacing shall be made by the State's resident engineer. If the contractor does not agree with the evaluation it may appeal to the State's Regional Director of Operations whose decision shall be final.

Any resultant property damage deemed by the State's Regional Director of Operations caused by improper workmanship and/or defective materials shall be the responsibility of the Contractor.
 3. On or before August 15, in the year immediately following the State's acceptance of the micro-surfacing project, the State shall notify the contractor of any areas deemed deficient by the State. The contractor will initiate and complete the remediation within 30 days of notification.
 4. Prior to the performance of repairs in the field, the contractor shall supply the State's resident engineer with copies of applicable insurance certificates. During the performance of any necessary repairs, the contractor shall comply with the all provisions of the original contract including among other things the work zone traffic control provisions.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

SAMPLE

MAINTENANCE BOND

KNOW ALL PEOPLE BY THESE PRESENTS, That we, (hereinafter called the "PRINCIPAL")

_____ of _____, and _____ of _____ (hereinafter called the "SURETY") are held and firmly

bound unto the people of the State of New York in the full and just sum of _____ Dollars

(\$ _____) good and lawful money of the United States of America, to the payment of which said sum of money, well and truly to be made and done the said PRINCIPAL binds itself, its heirs, executors, administrators or assignees and the SURETY binds itself, its successors or assigns, jointly and severally, firmly by these presents.

Signed and dated this ___ day of _____, 20__.

WHEREAS, the PRINCIPAL has entered into a certain written contract bearing date on the _____ day of _____, 20__, with the People of the State of New York for the improvement of _____, in the County of _____, New York.

NOW THEREFORE, the PRINCIPAL warrants the workmanship and all materials used in the work and agrees that during the guarantee period of one year beginning after final acceptance by the State or political subdivision or until September 15 of the year following acceptance of work completed under the contract, whichever is later, it will, at its own expense make repairs which may become necessary by reason of improper workmanship or defective materials as per the following procedure:

1. No later than August 1 of the year following the State's or the political subdivision's acceptance of work completed under the contract, the State or political subdivision will evaluate the project for plow damage, flushing, delamination or raveling.
2. The PRINCIPAL agrees to repair all areas that demonstrate plow damage, flushing, delamination or raveling greater than 2.0 square yards for any single location, or greater than 5.0 square yards for any 0.1 lane mile, as determined by the State. Such repairs however, shall not include any damage resulting from any forces or circumstances beyond the control of the PRINCIPAL. The evaluation of the micro surfacing shall be made by the Resident Engineer. If the PRINCIPAL does not agree with the evaluation it may appeal to the Regional Director of Operations whose decision shall be final.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

3. On or before August 15 in the year immediately following the State's acceptance of the micro surfacing project, the State shall notify the PRINCIPAL of any areas deemed deficient by the State. The PRINCIPAL will initiate and complete the remediation, within 30 days of notification.
4. Prior to the performance of repairs the PRINCIPAL shall supply the Resident Engineer with copies of all acceptable insurance certificates. During the performance of any necessary repairs, the PRINCIPAL shall comply with the all provisions of the original contract including among other things the Work Zone Traffic Control provisions.

In the event of the failure of performance by the PRINCIPAL who has failed to make repairs which may become necessary, said SURETY, for value received, hereby stipulates and agrees, if requested to do so by the State, to commence such repairs within five (5) days of notification by the State of such failure by the PRINCIPAL. Such repairs shall be performed in accordance with the provisions of the current contract which require among other provisions that the SURETY shall provide necessary Work zone traffic control as well as provide the required insurance before any work is conducted.

In the event both the SURETY and the PRINCIPAL fail to perform such repairs, the State shall cause the repair to be completed by others and the SURETY and PRINCIPAL shall be jointly and severally liable for such costs.

And the said SURETY thereby stipulates and agrees that no change, extension, alteration, deduction or addition in or to the terms of the said contract or the plans or specifications accompanying same, shall in any way affect the obligations of said SURETY of its bond.

PRINCIPAL _____

BY _____

SURETY _____

BY _____

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – QUICK SET SLURRY SEAL

414.02030118 Quick-Set Slurry, Type II, F3
414.03030118 Quick-Set Slurry, Type III, F3

DESCRIPTION:

This work shall consist of applying a proportioned mixture of asphalt emulsion, aggregate, mineral filler and water to a paved surface. Use quick-set slurry only on highways with 2 or 3 lanes and design year two-way AADTs under 4000.

MATERIALS:

Asphalt Emulsion: §702 - Bituminous Materials, use item 702-4601.

Aggregates: Use material meeting the requirements of §703-02, Coarse Aggregate, with the following modifications.

- A. **Sand Equivalency.** Minimum sand equivalency is 45%, as determined by AASHTO T 176, "Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test." Material not meeting the minimum sand equivalent requirement may be used if it is classified as non-plastic according to AASHTO T 89, "Determining the Liquid Limit of Soils" and AASHTO T 90, "Determining the Plastic Limit and Plasticity Index of Soils."
- B. **Friction Requirements.** Use aggregate meeting one of the following requirements:
 1. Limestone or a blend of limestone and dolomite containing at least 20.0% acid insoluble residue in the plus and minus No. 30 size fractions.
 2. Dolomite.
 3. Gravel or blend of a natural or manufactured, limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, having at least 25.0% acid insoluble residue in the plus and minus No. 30 size fractions.
- C. **Stockpile.** Build an aggregate stockpile at a location approved by the Engineer. When blending multiple aggregates, use automated proportioning and blending equipment to produce a uniformly graded stockpile. Screen the aggregate at the stockpile, prior to delivering it to the quick-set slurry equipment.

Use aggregate meeting the gradation requirements listed in §703-02, Table 703-5, Sizes of Crushed Gravel, Stone, and Slag for Slurry with the following exception: the range for the No. 100 sieve on the 2MS designation will be 10-22% passing.

The aggregate stockpile gradation shall not deviate from the mix design gradation by more than the tolerances given in Table 1 - Maximum Stockpile Tolerance. The mix design gradation value plus the stockpile tolerance cannot exceed the mix type general gradation limits.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – QUICK-SET SLURRY SEAL (Cont'd)

TABLE 1 - MAXIMUM STOCKPILE TOLERANCE								
Sieve (in)	3/8	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
Stockpile Tolerance	-	± 5.0%	± 5.0%	± 5.0%	± 5.0%	± 4.0%	± 3.0%	± 2.0%

Water: §712-01, Water.

Mineral Filler: §703-08, Mineral Filler.

Mix Design: Employ a Department approved laboratory to develop a job mix formula, following the procedure outlined in ASTM D 3910, Standard Practices for Design, Testing, and Construction of Slurry Seal that meets the requirements listed in Table 2 - Proportional Requirements and Table 3 - Physical Requirements, and Table 4 - Gradation Requirements. All materials used to develop the mixture design must be representative of the materials to be used on the project. The mixture design must clearly list the proportions of mineral aggregate, mineral filler, water, additive(s), percent asphalt emulsion based on the dry weight of aggregate, and design set and cure times. The mix design shall be submitted at least 14 days before the beginning of work to the Engineer in Charge, the Regional Materials Engineer and the Director of the Materials Bureau. Mixture designs are valid until 3rd Saturday in September of the year in which they are submitted.

TABLE 2 - PROPORTIONAL REQUIREMENTS	
Constituent	Proportional Requirement
Residual Asphalt	Type II, 7.5 to 13.5%; Type III, 6.5 to 12.0% (by dry mass of aggregate).
Mineral Filler	0.0 to 2.0% by dry mass of aggregate.
Water	As required to produce proper mixture consistency.
Field Control Additive	As required to control the emulsion's set properties or increase adhesion, but must be part of the mixture design and compatible with all other components.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – QUICK-SET SLURRY SEAL (Cont'd)

TABLE 3 - PHYSICAL REQUIREMENTS		
Property	Test Method	Requirement
Consistency	ASTM D 3910	2 to 3 cm
Mix Time	ISSA TB 113	Controllable to 180 second
Set Time	ASTM D 3910	1 hour, maximum
Cure Time	ASTM D 3910	24 hour, maximum
Wet Track Abrasion Loss	ASTM D 3910; 1 hour soak	807 g/m ² , maximum
Excess Asphalt by LWT Sand Adhesion	ISSA TB 109	538 g/m ² , maximum
Wet Cohesion (quick traffic systems)	ISSA TB 139; 30 minutes ISSA TB 139; 60 minutes	12 kg-cm, minimum 20 kg-cm, minimum

TABLE 4 - GRADATION REQUIREMENTS	
Mixture Type	Aggregate Gradation
Type II	2MS ⁽¹⁾
Type III	3MS ⁽¹⁾

⁽¹⁾ § 703-02 Material Requirements, Table 703-5 Sizes of Crushed Gravel, Stone, and Slag for Slurry.

Material Sampling and Testing:

A. Aggregate Stockpile

1. **Contractor Testing.** The Contractor shall perform and submit the following tests to the Regional Materials Engineer:
 - a. Take three samples, according to Materials Method 5, Plant Inspector's Manual for Bituminous Concrete Mix Production. Each sample must contain material from each face of the stockpile.
 - b. Test samples in accordance with AASHTO T 11, Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing, and AASHTO T 27, Sieve Analysis of Fine and Coarse Aggregates. Test results shall be based on the average of three tests.
 - c. Sample and test the aggregate in accordance with Materials Method 28, "Friction Aggregate Control and Test Procedures," Appendix B, Table B1 – Minimum Testing Frequencies for Slurry Surfacing Aggregates.

2. **Department Testing and Approval.** The Regional Materials Engineer will review the Contractor's submission. If the submission meets the requirements of the specification, the Regional Materials Engineer will sample and test the stockpile. The final approval of the stockpile will be based on the results of the Department's sampling and testing. Stockpile approval is valid until new material is added to the stockpile.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – QUICK-SET SLURRY SEAL (Cont'd)

- a. Gradation - Test results shall be the average of three tests. If the percent passing is outside the gradation limits for any sieve, the stockpile will be rejected.
- b. Friction Requirements - Samples shall meet appropriate friction values. All quick-set slurry previously placed with material from a stockpile rejected for non-carbonate or acid insoluble residue content will be rejected.

B. Emulsion. Asphalt emulsion shall be sampled according to Materials Method 702-2, "Asphalt Emulsion – Quality Assurance."

CONSTRUCTION DETAILS:

Weather and Seasonal Limitations: The requirements of §402-3.01 Weather and Seasonal Limitations apply, except as modified herein. Do not place quick-set slurry in the rain, fog, or if the air temperature is expected to fall below freezing within 24 hours after application. Application shall not occur unless pavement and ambient temperatures are above 50°F. Stop the quick-set slurry application if the surface or air temperature drops below 50°F. No work will be performed after the third Saturday in September.

Equipment:

Equipment must be designed and manufactured specifically for mixing and placing quick-set slurry or micro-surfacing. The equipment must be capable of accurately proportioning the constituent materials, thoroughly mixing those materials, and placing the quick-set slurry in conformance with this specification.

Calibrate each mixing unit according to Materials Procedure 09-01. Calibrations must be performed using the aggregate sources listed in the mix design. Calibrations are valid for 90 days. Submit a copy of the equipment calibration to the Engineer prior to the start of work.

The emulsion, aggregate and mineral filler counters must be accessible to the Engineer and inspectors. Adjust the material delivery settings on the quick-set slurry equipment to produce the mix design.

Surface Preparation:

- A. Ensure that pavement markings have been abraded in accordance with contract documents.
- B. Remove all debris and standing water.
- C. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area being paved with plastic, building felt, or other material approved by the Engineer. Remove the covers each day.

Mixture Consistency: Produce a homogeneous mixture, without lumps, balls, unmixed aggregate, segregation, excess water, or excess emulsion. The maximum allowable adjustment of the mineral filler is 1.0%. Report all mixture adjustments to the Engineer before they are made.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – QUICK-SET SLURRY SEAL (Cont'd)

Application: Apply the quick-set slurry to the pavement evenly across the entire width of the spreader box to produce a smooth riding surface with no streaks, excess buildup, thin or uncovered areas.

Application rate limits are given in Table 5 - Application Rate

TABLE 5 - APPLICATION RATE	
Gradation	Application Rate (lb/yd ²)
Type II	14-20
Type III	18-24

Coverage: Do not use hand tools to expand the width of application wider than the spreader box, except as described under *Hand Finishing* below.

Joints: Minimize the number of joints. Construct joints such that no gap is present between adjacent applications. Place longitudinal joints at the edges of traffic lanes, adjacent to where pavement markings will be located. Other longitudinal joint arrangements require the Engineer's approval. Measure the difference in grade across joints by laying a 10 foot straight edge centered on the joint perpendicular to the direction of the joint. Joint overlap and grade difference requirements are given in Table 6 - Joint Requirements.

TABLE 6 - JOINT REQUIREMENTS		
Requirement	Minimum (in.)	Maximum (in.)
Difference in Grade	-	1/4
Longitudinal Joint Overlap	2	6
Transverse Joint Overlap	2	12

Variable-Width Passes. Variable width passes will not be permitted unless approved by the Engineer.

Hand Finishing. Use hand held squeegees to finish areas which cannot be reached with the spreader box, and, when necessary, to produce straight lines along curbs, shoulders, and through intersections. Apply the same type of finish to the surface as is applied by the spreader box.

Excess Material. Remove all excess material in areas such as driveways, gutters, intersections, etc. each day.

Curing. Protect the quick-set slurry from traffic until the mixture has cured sufficiently to resist damage. The time required will vary based on the mix design and environmental conditions. Repair damage from quick-set slurry equipment or traffic to the Engineer's satisfaction.

METHOD OF MEASUREMENT:

Quick-set slurry shall be measured by the total tons of aggregate, mineral filler and asphalt emulsion used according to Materials Procedure 09-01, "Micro-surfacing and Slurry Guidelines."

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – QUICK-SET SLURRY SEAL (Cont'd)**BASIS OF PAYMENT:**

The unit price bid per ton of quick-set slurry shall include the cost of all labor, materials and equipment necessary to perform the work. All necessary pavement cleaning, joint sealing, crack filling, pavement markings removal and utility grade adjustments will be paid for under their appropriate items.

Payment will be made under:

Item Number	Item	Pay Unit
414.02030118	Quick-set slurry, Type II, F3	Ton
414.03030118	Quick-set slurry, Type III, F3	Ton

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT

415.0X0F0118 PAVER PLACED SURFACE TREATMENT

DESCRIPTION

This work shall consist of providing and placing ITEM 415.0X0F0118 - PAVER PLACED SURFACE TREATMENT in accordance with the contract documents and as directed by the Engineer.

Paver Placed Surface Treatment consists of a polymer modified asphalt emulsion coat followed immediately with a thin hot mix asphalt wearing course.

MATERIALS

Mix Designs: Formulate a job mix formula that satisfies the design limits listed in Table 1- Mixture Requirements and submit it to the Regional Materials Engineer for approval. The use of recycled asphalt pavement in these mixes is prohibited

TABLE 1 - MIXTURE REQUIREMENTS⁽¹⁾

	Type A		Type B		Type C	
Sieve Sizes (in)	Design Limits (% Passing)	Production Tolerance (%)	Design Limits (% Passing)	Production Tolerance (%)	Design Limits (% Passing)	Production Tolerance (%)
3/4					100	
1/2			100		85 - 100	± 4
3/8	100		85 - 100	± 4	60 - 90	± 4
1/4	85 - 100	± 4	30 - 55	± 4	30 - 55	± 4
No. 4	40 - 80	± 3	24 - 45	± 3	24 - 45	± 3
No. 8	21 - 45	± 3	21 - 37	± 3	21 - 37	± 3
No. 16	16 - 32	± 3	16 - 26	± 3	16 - 26	± 3
No. 30	12 - 25	± 2	12 - 20	± 2	12 - 20	± 2
No. 50	8 - 16	± 2	8 - 16	± 2	8 - 16	± 2
No. 100	5 - 10	± 2	5 - 10	± 2	5 - 10	± 2
No. 200	5 - 7	± 2	5 - 7	± 2	5 - 7	± 2
% PG Binder	4.9 - 5.4		4.8 - 5.2		4.8 - 5.2	

(1) All aggregate percentages are based on total mass of aggregate.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREAT.
(Cont'd)**

Aggregate: §703-02 except as modified herein. Use coarse aggregate with a minimum coarse-aggregate angularity (CAA) of 90% one fractured face and 85% two fractured faces. The aggregate's flakiness index shall meet the requirements of Materials Method 410.

1. Coarse Aggregate Type F1 Conditions.

- a. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.
- b. Gravel, a natural, or a manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials meeting the following requirements:

Type A Mixes – Noncarbonate plus No. 8 particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus No. 4 particles must be noncarbonate.

Type B Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus No. 4 particles must be noncarbonate.

Type C Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus 3/8 inch particles must be noncarbonate.

2. Coarse Aggregate Type F2 Conditions.

- a. Limestone, dolomite, or a blend of the two having an acid insoluble residue content of not less than 20.0%.
- b. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.
- c. Gravel, or a natural, or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, meeting the following requirements:

Type A Mixes – Noncarbonate plus No. 8 particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

Type B Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREAT.
(Cont'd)**

Type C Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3/8 inch particles must be noncarbonate.

3. Coarse Aggregate Type F3 Conditions.

- a. Limestone or a blend of limestone and dolomite having an acid insoluble residue content of not less than 20.0%.
- b. Dolomite.
- c. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.
- d. Gravel, a natural, or a manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, meeting the following requirements:

Type A Mixes – Noncarbonate plus No. 8 particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

Type B Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 inch particles must be noncarbonate.

Type C Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3/8 inch particles must be noncarbonate.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREAT.
(Cont'd)**

- 4. Fine Aggregate.** Use 100% screenings, free from deleterious materials and manufactured from sources of stone or slag meeting the requirements of §703-02, Coarse Aggregate, having a minimum sand equivalent of 60%, as determined by AASHTO T 176, "Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test."

Mineral Filler: § 703-08, Mineral Filler.

Asphalt Binder: §401-2.04 Performance-Graded Binder. Use the appropriate performance graded binder for the project's location.

Polymer Modified Asphalt Emulsion: §702 - Bituminous Materials, 702- 4001P.

Equipment:

- 1. Paving.** Use a self-priming paver capable of spraying the polymer modified asphalt emulsion, applying the hot mix asphalt overlay and smoothing the surface of the mat in one pass. The self-priming paver must be equipped with a receiving hopper, feed conveyor, emulsion storage tank, metered high-pressure emulsion spray bar, and a variable width, heated screed. The screed must have the ability to be crowned at the center both positively and negatively and have vertically adjustable extensions to accommodate the desired pavement profile.
- 2. Compaction.** Use steel wheeled double drum rollers weighing at least 10 tons, equipped with functioning water systems and scrapers to prevent material from adhering to the roller drums.
- 3. Hauling.** Use vehicles that meet § 402-3.03, Hauling Equipment, to transport the hot mix asphalt wearing course.

CONSTRUCTION DETAILS:

Hot Mix Production: The requirements of §401-3, Construction Details apply with the following modifications. If a test value for any sieve varies from the target value by more than the production tolerance given in Table 1 - Mixture Requirements, the Regional Materials Engineer will evaluate the material represented by that test to determine acceptability.

A delivery ticket meeting the requirements of §401-4, Method of Measurement shall accompany each vehicle supplying Hot Mix Asphalt.

Surface Preparation: Perform all surface preparation prior to applying the wearing course.

1. Thoroughly clean the entire area to be overlaid. The surface of the area to be overlaid must be free of dirt, oil, and other foreign materials. A damp surface is acceptable if favorable weather conditions are expected during paving operations.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREAT. (Cont'd)

2. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area to be paved with plastic, building felt, or other material approved by the Engineer. Reference each for location and adjustment after paving. Remove the covers each day.
3. Abrade pavement markings in accordance with contract documents.

Application: The requirements of § 402-3.01, Weather and Seasonal Limitations apply.

1. Apply the polymer modified asphalt emulsion at a temperature of 140 - 175°F. Provide a uniform application across the entire width to be overlaid, at a rate of 0.15 - 0.25 gallons/square yard. Continuously monitor the spray rate.
2. No equipment shall come in contact with the polymer modified asphalt emulsion before the hot mix asphalt wearing course is applied.
3. Immediately after applying the polymer modified asphalt emulsion, apply the hot mix asphalt overlay across the full width of the emulsion at a temperature of 290 - 325°F.
4. Apply the hot mix asphalt at a rate within the appropriate application range, listed in Table 2 – Wearing Course Application Ranges. The finished treatment has a minimum thickness of 1/2 inch for Type A, and 5/8 inch for Type B and Type C.
5. Paver Placed Surface Treatment shall not be applied to freshly placed concrete surfaces. Concrete surfaces must cure for a minimum of 90 days before being overlaid.

TABLE 2 - WEARING COURSE APPLICATION RANGES

Type	Minimum (lb/yd ²)	Maximum (lb/yd ²)
A	60	70
B	65	75
C	70	80

Compaction: Begin compaction immediately after application of the wearing course. Use a minimum of two static passes. Avoid using vibratory compaction. The roller(s) will not be allowed to stop on the freshly placed wearing course. Use an adequate number of rollers to complete compaction before the pavement temperature falls below 185°F. Protect the wearing course from traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage.

Paver and Equipment Cleaning: The requirement of § 402-3.12, Paver and Equipment Cleaning apply.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREAT.
(Cont'd)**

Coring: The Engineer will require four cores from each section of compacted paver placed surface treatment applied below the appropriate minimum application rate listed in Table 2. The Engineer will randomly locate the four core locations. The Engineer will determine the thickness of the paver placed surface treatment and reject sections not meeting the required minimum thickness.

The Engineer may require four cores from each section of compacted paver placed surface treatment exceeding the appropriate maximum application rate, listed in Table 2, to determine the thickness of the paver placed surface treatment. The Engineer may stop paving operations immediately if the over application of the paver placed surface treatment will create problems, such as, but not limited to, reducing overhead clearance, curb reveal or guiderail height. The Engineer and Contractor will agree upon and document a maximum application rate and maximum thickness to prevent problems created by over applying the paver placed surface treatment. The Engineer will reject any additional paver placed surface treatment sections determined to exceed the maximum agreed upon application rate and thickness.

Coring is not required for sections paved within the appropriate application range, listed in Table 2 - Wearing Course Application Ranges.

All labor, materials and equipment associated with required pavement coring, including maintenance and protection of traffic and filling core holes, will be done at the Contractor's expense.

METHOD OF MEASUREMENT

This work will be measured as the number of tons of Paver Placed Surface Treatment satisfactorily placed.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREAT. (Cont'd)

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work. All necessary pavement repairs, joint sealing, crack filling, pavement markings removal, milling of rebates and utility grade adjustments will be paid for under their appropriate items.

Payment will be made under:

Item No.	Item	Pay Unit
415.01010118	Paver Placed Surface Treatment Type A, F1	Tons
415.01020118	Paver Placed Surface Treatment Type A, F2	Tons
415.01030118	Paver Placed Surface Treatment Type A, F3	Tons
415.02010118	Paver Placed Surface Treatment Type B, F1	Tons
415.02020118	Paver Placed Surface Treatment Type B, F2	Tons
415.02030118	Paver Placed Surface Treatment Type B, F3	Tons
415.03010118	Paver Placed Surface Treatment Type C, F1	Tons
415.03020118	Paver Placed Surface Treatment Type C, F2	Tons
415.03030118	Paver Placed Surface Treatment Type C, F3	Tons

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT

415.0X0F0118R RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT

DESCRIPTION

This work shall consist of providing and placing ITEM 415.0X0F0118R – RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT in accordance with the contract documents and as directed by the Engineer.

Rubber Modified Paver Placed Surface Treatment consists of a polymer modified asphalt emulsion coat followed immediately with a rubber modified thin hot mix asphalt wearing course.

MATERIALS

Mix Designs: Formulate a job mix formula that satisfies the design limits listed in Table 1- Mixture Requirements and submit it to the Regional Materials Engineer for approval. The use of recycled asphalt pavement in these mixes is prohibited.

TABLE 1 - MIXTURE REQUIREMENTS⁽¹⁾

	Type A		Type B		Type C	
Sieve Sizes (in)	Design Limits (% Passing)	Production Tolerance (%)	Design Limits (% Passing)	Production Tolerance (%)	Design Limits (% Passing)	Production Tolerance (%)
3/4					100	
1/2			100		85 - 100	± 4
3/8	100		85 - 100	± 4	60 - 90	± 4
1/4	85 - 100	± 4	30 - 55	± 4	30 - 55	± 4
No. 4	40 - 80	± 3	24 - 45	± 3	24 - 45	± 3
No. 8	21 - 45	± 3	21 - 37	± 3	21 - 37	± 3
No. 16	16 - 32	± 3	16 - 26	± 3	16 - 26	± 3
No. 30	12 - 25	± 2	12 - 20	± 2	12 - 20	± 2
No. 50	8 - 16	± 2	8 - 16	± 2	8 - 16	± 2
No. 100	5 - 10	± 2	5 - 10	± 2	5 - 10	± 2
No. 200	5 - 7	± 2	5 - 7	± 2	5 - 7	± 2
% PG Binder	5.8 - 6.4		5.8 - 6.4		5.8 - 6.4	

(1) All aggregate percentages are based on total mass of aggregate.

Aggregate: §703-02 except as modified herein. Use coarse aggregate with a minimum coarse-aggregate angularity (CAA) of 90% one fractured face and 85% two fractured faces. The aggregate's flakiness index shall meet the requirements of Materials Method 410.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED
SURFACE TREATMENT (Cont'd)****1. Coarse Aggregate Type F1 Conditions.**

- a. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.
- b. Gravel, a natural, or a manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials meeting the following requirements:

Type A Mixes – Noncarbonate plus No. 8 particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus No. 4 particles must be noncarbonate.

Type B Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus No. 4 particles must be noncarbonate.

Type C Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus 3/8 inch particles must be noncarbonate.

2. Coarse Aggregate Type F2 Conditions.

- a. Limestone, dolomite, or a blend of the two having an acid insoluble residue content of not less than 20.0%.
- b. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.
- c. Gravel, or a natural, or manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, meeting the following requirements:

Type A Mixes – Noncarbonate plus No. 8 particles must comprise a minimum of 30.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 90.0% of plus No. 4 particles must be noncarbonate.

Type B Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

**DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED
SURFACE TREATMENT (Cont'd)**

Type C Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3/8 inch particles must be noncarbonate.

3. Coarse Aggregate Type F3 Conditions.

- a. Limestone or a blend of limestone and dolomite having an acid insoluble residue content of not less than 20.0%.
- b. Dolomite.
- c. Sandstone, granite, chert, traprock, ore tailings, slag or other similar non-carbonate materials.
- d. Gravel, a natural, or a manufactured blend of the following types of materials: limestone, dolomite, gravel, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, meeting the following requirements:

Type A Mixes – Noncarbonate plus No. 8 particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 particles must be noncarbonate.

Type B Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus No. 4 inch particles must be noncarbonate.

Type C Mixes – Noncarbonate plus 1/8 inch particles must comprise a minimum of 10.0% of the total aggregate (by weight with adjustments to equivalent volumes for materials of different specific gravities). Additionally, a minimum of 20.0% of plus 3/8 inch particles must be noncarbonate.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT (Cont'd)

- 4. Fine Aggregate.** Use 100% screenings, free from deleterious materials and manufactured from sources of stone or slag meeting the requirements of §703-02, Coarse Aggregate, having a minimum sand equivalent of 60%, as determined by AASHTO T 176, "Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test."

Mineral Filler: § 703-08, Mineral Filler.

Asphalt-Rubber Binder (ARB): The ARB shall consist of performance-graded binder and crumb rubber blended to conform to ASTM D6114, Standard Specification for Asphalt-Rubber Binder, Table 1, Type II with the following addition:

Minimum elastic recovery of 65% at 50°F using ASTM D6084, Elastic Recovery of Bituminous Material by Ductilometer, Procedure A.

1. **Performance-Graded Binder (PGB).** Use the appropriate performance graded binder for the project's location.
2. **Crumb Rubber.** Use crumb rubber conforming to ASTM D6114, section 3.2, Ground Recycled Tire Rubber, and meeting the gradation requirements given in Table 2 – Crumb Rubber Gradation. The crumb rubber shall be accepted by certification from the rubber supplier.

TABLE 2 – CRUMB RUBBER GRADATION

Sieve Size	% Passing
No. 30	100
No. 40	45-100

3. **Anti-stripping Agent.** Contractor may add an anti-stripping agent that is heat stable into the ARB at the dosage required by the job-mix formula (up to 1.0% by weight of PGB). Add the anti-stripping agent to the PGB prior to blending with the crumb rubber

Polymer Modified Asphalt Emulsion: §702 - Bituminous Materials, 702- 4001P.

Equipment:

1. **Paving.** Use a self-priming paver capable of spraying the polymer modified asphalt emulsion, applying the hot mix asphalt overlay and smoothing the surface of the mat in one pass. The self-priming paver must be equipped with a receiving hopper, feed conveyor, emulsion storage tank, metered high-pressure emulsion spray bar, and a variable width, heated screed. The screed must have the ability to be crowned at the center both positively and negatively and have vertically adjustable extensions to accommodate the desired pavement profile.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT (Cont'd)

2. **Compaction.** Use steel wheeled double drum rollers weighing at least 10 tons, equipped with functioning water systems and scrapers to prevent material from adhering to the roller drums.
3. **Hauling.** Use vehicles that meet § 402-3.03, Hauling Equipment, to transport the hot mix asphalt wearing course.

CONSTRUCTION DETAILS:

Hot Mix Production: The requirements of §401-3, Construction Details apply with the following modifications. If a test value for any sieve varies from the target value by more than the production tolerance given in Table 1 - Mixture Requirements, the Regional Materials Engineer will evaluate the material represented by that test to determine acceptability.

A delivery ticket meeting the requirements of §401-4, Method of Measurement shall accompany each vehicle supplying Hot Mix Asphalt.

Surface Preparation: Perform all surface preparation prior to applying the wearing course.

1. Thoroughly clean the entire area to be overlaid. The surface of the area to be overlaid must be free of dirt, oil, and other foreign materials. A damp surface is acceptable if favorable weather conditions are expected during paving operations.
2. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area to be paved with plastic, building felt, or other material approved by the Engineer. Reference each for location and adjustment after paving. Remove the covers each day.
3. Abrade pavement markings in accordance with contract documents.

Application: The requirements of § 402-3.01, Weather and Seasonal Limitations apply.

1. Apply the polymer modified asphalt emulsion at a temperature of 140 - 175°F. Provide a uniform application across the entire width to be overlaid, at a rate of 0.15 - 0.25 gallons/square yard. Continuously monitor the spray rate.
2. No equipment shall come in contact with the polymer modified asphalt emulsion before the hot mix asphalt wearing course is applied.
3. Immediately after applying the polymer modified asphalt emulsion, apply the hot mix asphalt overlay across the full width of the emulsion at a temperature of 290 - 325°F.
4. Apply the hot mix asphalt at a rate within the appropriate application range, listed in Table 3 – Wearing Course Application Ranges. The finished treatment has a minimum thickness of 1/2 inch for Type A, and 5/8 inch for Type B and Type C.
5. Rubber Modified Paver Placed Surface Treatment shall not be applied to freshly placed concrete surfaces. Concrete surfaces must cure for a minimum of 90 days before being overlaid.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT (Cont'd)

TABLE 3 - WEARING COURSE APPLICATION RANGES

Type	Minimum (lb/yd ²)	Maximum (lb/yd ²)
A	60	70
B	65	75
C	70	80

Compaction: Begin compaction immediately after application of the wearing course. Use a minimum of two static passes. Avoid using vibratory compaction. The roller(s) will not be allowed to stop on the freshly placed wearing course. Use an adequate number of rollers to complete compaction before the pavement temperature falls below 185°F. Protect the wearing course from traffic until the rolling operation is complete and the material has cooled sufficiently to resist damage.

Paver and Equipment Cleaning: The requirement of § 402-3.12, Paver and Equipment Cleaning apply.

Coring: The Engineer will require four cores from each section of compacted paver placed surface treatment applied below the appropriate minimum application rate listed in Table 3. The Engineer will randomly locate the four core locations. The Engineer will determine the thickness of the paver placed surface treatment and reject sections not meeting the required minimum thickness.

The Engineer may require four cores from each section of compacted paver placed surface treatment exceeding the appropriate maximum application rate, listed in Table 3, to determine the thickness of the paver placed surface treatment. The Engineer may stop paving operations immediately if the over application of the paver placed surface treatment will create problems, such as, but not limited to, reducing overhead clearance, curb reveal or guiderail height. The Engineer and Contractor will agree upon and document a maximum application rate and maximum thickness to prevent problems created by over applying the paver placed surface treatment. The Engineer will reject any additional paver placed surface treatment sections determined to exceed the maximum agreed upon application rate and thickness.

Coring is not required for sections paved within the appropriate application range, listed in Table 3 - Wearing Course Application Ranges.

All labor, materials and equipment associated with required pavement coring, including maintenance and protection of traffic and filling core holes, will be done at the Contractor's expense.

DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS

DETAILED SPECIFICATIONS – RUBBER MODIFIED PAVER PLACED SURFACE TREATMENT (Cont'd)

METHOD OF MEASUREMENT

This work will be measured as the number of tons of Rubber Modified Paver Placed Surface Treatment satisfactorily placed.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work. All necessary pavement repairs, joint sealing, crack filling, pavement markings removal, milling of rebates and utility grade adjustments will be paid for under their appropriate items.

Payment will be made under:

Item No.	Item	Pay Unit
415.01010118R	Rubber Modified Paver Placed Surface Treatment Type A, F1	Tons
415.01020118R	Rubber Modified Paver Placed Surface Treatment Type A, F2	Tons
415.01030118R	Rubber Modified Paver Placed Surface Treatment Type A, F3	Tons
415.02010118R	Rubber Modified Paver Placed Surface Treatment Type B, F1	Tons
415.02020118R	Rubber Modified Paver Placed Surface Treatment Type B, F2	Tons
415.02030118R	Rubber Modified Paver Placed Surface Treatment Type B, F3	Tons
415.03010118R	Rubber Modified Paver Placed Surface Treatment Type C, F1	Tons
415.03020118R	Rubber Modified Paver Placed Surface Treatment Type C, F2	Tons
415.03030118R	Rubber Modified Paver Placed Surface Treatment Type C, F3	Tons