

ATTACHMENT 10
DETAILED SPECIFICATIONS
LIQUID BITUMINOUS MATERIALS
IFB #23195

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DETAILED SPECIFICATIONS – CHIP SEAL

SECTION 410 – CHIP SEAL

All Chip Seal items shall be furnished in accordance with Sections 410 of the New York State Department of Transportation Standard Specifications, Construction and Materials most current version at the time of the bid opening, except as modified below:

410-4 METHOD OF MEASUREMENT. §410-4 Method of Measurement shall apply except the Pay Unit for the optional Pick Up Broom or Vacuum Sweeper be measured per day.

Payment will be made under:

Item No.	Item	Pay Unit
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.

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.

DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

**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 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.

DETAILED SPECIFICATIONS – CHIP SEAL (Cont'd)

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 _____

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 meeting §702, supplied from a Department approved facility.

A. Asphalt Emulsion. Use material meeting 702-4 Anionic and Cationic Asphalt Emulsions, material designation 702-3301.

B. Polymer-Modified Asphalt Emulsion. Use material meeting 702-5 Polymer-Modified Asphalt Emulsion, material designation 702-3301P. Except that the minimum elastic recovery will be 25%.

Other grades of asphalt emulsion having a certified minimum of 65% asphalt residue may be used with the approval of the Materials Bureau Director.

C. Performance Graded Binder. Use material meeting 702-1 Performance-Graded Binders for Paving.

Other grades of performance grade binder may be used with the approval of the Materials Bureau Director.

D. Fog Seal. Use material meeting 702-6 Asphalt Emulsion – Diluted Tack Coat.

416-2.02 Aggregates. Use material meeting the requirements of §703-02 Coarse Aggregate.

416-2.03 Portland Cement. Use material meeting the requirements of §701-01 Portland Cement, Type I/II.

Other types of cement may be used with the approval of the Director of the Materials Bureau

416-2.04 Water: Meeting §712-01.

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.
- Processing the reclaimed material to pass a 2-inch sieve.
- Mixing the reclaimed material with bituminous material and other additives.
- Controlling surge material caused by irregularities in the pavement surface or width.
- Measuring water usage with a totalizing water meter.
- Measuring emulsion or performance-grade binder usage with a mass flow meter.

Calibration: Annual calibration of the mixing equipment is due prior to the start of the season, in accordance with Materials Procedure 417. Subsequent calibrations in accordance with manufacturers recommendations. Submit the calibration results for approval to the Director, Materials Bureau at DOT.sm.Pavement.Preservation.Friction@dot.ny.gov , at least 7 days prior to the start of work.

B. Miller. Meeting §490-2.01

C. Paver. Meeting §402-3.02

DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

- D. Rollers.** Meeting §402-3.04.
- E. Emulsion Distributer.** Meeting §407-3.01
- F. Pilot Vehicle.** Shall be equipped with; a two-way radio, construction sign meeting the requirements of Section 6F.58 of the MUTCD, an amber beacon, and have the name of the Contractor prominently displayed.

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 Mix Design. Formulate a mix design in accordance with Materials Method 416. Identify type and amount of all additives incorporated. Submit to the Engineer, Regional Materials Engineer, and Director of the Materials at DOT.sm.Pavement.Preservation.Friction@dot.ny.gov , 7 days prior to the pre-recycling meeting.

416-3.03 Materials Management Plan (MMP). Complete in accordance with Materials Method 416. Submit to the Engineer, Regional Materials Engineer, and Director of the Materials at DOT.sm.Pavement.Preservation.Friction@dot.ny.gov, 7 days prior to the pre-recycling meeting.

416-3.04 Pilot Vehicle. Maintain traffic using a pilot vehicle to escort traffic through the work zone at a maximum speed of 20 mph.

416-3.05 Milling. Mill to depth indicated in the contract documents. The depth of the milling will be measured at centerline. Mill the full width of the existing pavement and shoulder. Maintain existing cross slope unless otherwise noted. The milled surface will meet the requirements of §490.

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

416-3.06 Recycling. Maintain bituminous material rates within 10% of the design rate. Make field changes in 0.10% - 0.20% increments. Changes exceeding 10% of the design rate require Regional Materials 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 Regional Materials Engineer’s approval.

Portland cement maximum rate of application is 1% by weight of recycled material. Portland cement shall be spread in a uniform manner, across the pavement, in front of the recycling equipment or as a slurry through the recycling equipment.

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

Minimum Water Application Rates Gallons / Square Yard Recycled		
Depth of Recycle	Emulsion	PG Binder
3-inch	0.36	0.72
4-inch	0.48	0.96

DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

416-3.07 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, Regional Materials Engineer, and Director of the Materials at DOT.sm.Pavement.Preservation.Friction@dot.ny.gov , 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 to the Engineer, Regional Materials Engineer, and Director of the Materials at DOT.sm.Pavement.Preservation.Friction@dot.ny.gov , within two workdays.

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.

Perform any additional quality control tests as described in Materials Method 416.

416-3.08 Spreading. Place millings, add stone, bituminous material, recycling additives, and water as a homogeneous mixture in a hopper or windrow. Use paver to reestablish cross slope of milled surfaces, unless noted otherwise.

416-3.09 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.

Provide a minimum of three rollers.

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	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

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

Changes to the roller pattern require approval of the Engineer.

Remove material that cannot be properly and adequately compacted to a stable condition.

416-3.10 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.

416-3.11 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.

DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

416-3.12 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.

416-3.13 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.

416-3.14 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
PG Binder	3 Days
Asphalt Emulsion	10 Days

416-3.15 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.

416-3.16 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:

Fog Seal:

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

Where:

ΔT = Delivered Temperature (°F) – 60

Volume_D = Quantity Delivered
(gallons)

DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)

A temperature conversion is not required for recyclers equipped with a mass flow meter. The liquid bituminous material will be measured from the following formula:

Asphalt Emulsion and Performance Graded Binder:

$$\text{Volume}_D = (\text{Mass}_D / 8.34 \text{ ppg}) \times \text{Liquid Bituminous Material Specific Gravity at } 60^\circ\text{F}$$

Where:
 $\text{Mass}_D = \text{Quantity Delivered (pounds)}$
 $\text{Volume}_D = \text{Quantity Delivered (gallons)}$

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

Additional aggregate will be measured in accordance with section 623..

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-Coarse	Square Yards
416.11	Cold Recycling Asphalt Concrete-Fine	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

DETAILED SPECIFICATIONS – HEATER SCARIFICATION

417 – HEATER SCARIFICATION OF HOT MIX ASPHALT (HMA) PAVEMENT

417-1 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 and milled asphalt pavement is then mixed with a recycling agent that rejuvenates the asphalt. This mix is then placed and compacted back onto to the roadway. The scarified layer must be covered by a wearing surface.

417-2 MATERIALS

417-2.01 Recycling Agent. Use a recycling agent specifically designed as a rejuvenator meeting the requirements outlined in Section 702 – *Bituminous Materials*, 8. *Asphalt Recycling Agent*, Table 702-9 *Recycling Agent* or Table 702-10 *Emulsified Recycling Agent*. At the start of and during production, provide certified test results and documented quantities to the Engineer for each shipment of recycling agent. The use of any other grade of recycling agent or other product requires prior approval from the Director, Materials Bureau. A minimum 2-week notice is needed for this approval.

417-2.02 Mixture Design. Determine the application rate of the recycling agent for heater scarification by taking and analyzing a minimum of three cores per lane mile or a maximum of 20 cores per project from the existing HMA pavement. Take these cores from locations that represent the entire project condition.

The design application rate of the recycling agent should provide an average penetration value of at least 30% or more than the average penetration value of the recovered asphalt binder from the existing pavement cores. Do not exceed the final penetration value of 90. Perform all the sample tests for the penetration values in accordance with AASHTO T 49, *Penetration of Bituminous Materials*.

417-3 CONSTRUCTION DETAILS.

417-3.01 Equipment. The heater scarification train consists of at least two heating units and a heater scarification unit consisting of a scarifier, a sprayer, a milling/remixer drum, and a screed.

A. Preheating or Heating Unit. This unit must generate sufficient radiant heat with no open flame to soften the asphalt pavement to the depth required. The burner assembly must be adjustable up to 14 feet wide. The entire heating unit must be enclosed and vented to contain the heat and prevent damage to adjacent properties and landscape. A minimum of two pre-heater units shall be used to allow lower heating temperatures and longer durations to enhance temperature penetration. Additional heating units may be required if the temperature behind the screed does not meet specification requirements.

B. Heater Scarification Unit. This equipment must be a self-contained machine designed to reprocess only the upper layers of the existing HMA pavement. The heater scarification unit must 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. Scarifier.** The scarifying unit must contain at least 2 rows of spring-loaded tines that are adjustable to scarify up to 14 feet wide. The tines in a row must be no more than 1.0 inch apart. This unit must also be able to conform to the pavement contours to ensure a uniform penetration from the tines and prevent damage to utility structures.

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

2. **Sprayer.** This unit must be immediately behind the scarifying unit and capable of uniformly applying the recycling agent to the reclaimed asphalt pavement at the approved rate. Select the size of the nozzles located on the spray bar and pump based upon the rate of application and the forward speed of the heater scarification unit. This unit must be equipped with a measuring system which is capable of maintaining the required application rate of the recycling agent within a tolerance of $\pm 5\%$ for the mix design. The measuring system must 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.
 3. **Mill/Remixer.** Immediately following the application of the recycling agent, an enclosed milling unit is required to 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. If a loose mix depth is not specified, the loose mix shall be 1.5 inches. The mill/remixer unit must be located between the spray unit, which applies the recycling agent, and the screed. This unit must be operated hydraulically, be able to maintain depth control, and able to work at variable speeds up to 120 rpm. The mill must be adjustable up to 14 feet wide.
 4. **Screed.** The attached heated, augured vibratory screed must be able to uniformly distribute the hot scarified material to the desired longitudinal and transverse section. The screed must be adjustable up to 14 feet wide, equipped with an adjustable crown control and each end of the screed must have hand wheel adjusting screws for providing the desired longitudinal grade and transverse slope.
- C. **Safety Requirements.** Each unit shall have an integrated water spray system and water misters to pre-wet vegetation and provide heat control. Hand hoses with adjustable nozzles will be placed on each unit to allow for pre-wetting specific plants or objects. Each unit shall have integrated water tanks having a minimum 500 gallon capacity. The operation of these systems shall be demonstrated to the Engineer to be fully functional prior to the commencement of work and shall be refilled as required during daily production.

All propane tanks on recycling equipment units shall conform to Federal, State and local regulations and laws relative to the transportation of Liquid Propane Gas. Tanks are to be inspected and certified by a Federal and DOT registered inspection and repair facility. Certification compliance stickers shall be prominently displayed on recycling units. Each propane tank on the recycling units will have a ground fill system and meter to ensure safety of personnel during propane fill operations.

Recycling units shall be equipped with a wireless remote safety shut down system. This allows the operators to immediately shut down propane flow, hydraulic power units and activate brakes on the recycling units. Each recycling unit operator shall carry a wireless remote control device. The wireless remote system shall meet all FCC requirements and have proper documentation.

417-3.02 Calibration. Calibrate the metering system in accordance with NYSDOT's Materials Procedure (MP) 417-01 - *Calibration of Metering System for Recycling Equipment*. A minimum 2-week notice is required when scheduling this calibration. Perform the calibration of the metering system in the presence of the Regional Materials Engineer or designee. Work shall not progress until the calibration has been completed and verified. Approved calibrations are valid for 90 days and may be used for more than one project.

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

If the unit is equipped with a mass flow meter capable of self calibration,, the system calibration can be submitted in lieu of the above method. The self-calibrating meter shall be a continuous flow system that verifies and validates the application rate on-demand and at any time during production. The measuring system shall continuously verify and display the application rate of recycling agent and cumulative total with respect to volume of recycled material for the recycled surface.

Calibration of the self-calibration system shall be performed prior to the start of a project in the presence of the Regional Materials Engineer or designee.

417-3.03 Weather Limitations. Heater scarification is allowed only when the surface temperature is 45F or above.

417-3.04 Surface Preparation.

- A. Pavement Markings.** Remove epoxy or thermoplastic pavement markings, and other markings as directed.
- B. Cleaning.** Clean the existing pavement and shoulder to be heater scarified by using mechanical sweepers, or other effective means until the surface is free of all debris material, which might interfere with the scarification or milling process.
- C. Mastic Repair Material.** Remove mastic patches greater than 5 square feet. Remove other mastic patches as directed by the Engineer.

417-3.05 Recycling and Placement. Radiantly heat the existing HMA pavement surface with no open flame using specialized equipment to soften the HMA surface and scarify to a specified depth as detailed in the contract documents. HMA pavement to be recycled shall be heated in a manner so the underlying asphalt layers not to be recycled, are not disturbed or overheated. Operate the heating unit(s) in a manner to prevent damage to adjacent property and vegetation. Repair all heat-damaged areas immediately, at no additional cost to the State.

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

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. Material placed should be consistent and free from segregation. 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 documented on the mix design.

Ensure that the final recycled pavement conforms to the requirements of §402-3.10, *Surface Tolerance* and §402-3.11, *Thickness Tolerance*. Measure the depth of the loose scarified mix behind the screed unit prior to the rolling operation. Adjust the paving equipment if the loose mix depth does not provide the compacted depth specified in the contract documents.

In areas not accessible to scarifying equipment, such as around catch basins or manholes, the Engineer will determine if they require repair. Pavement surfaces that are in good condition do not require repair. Repair all areas with cracks or spalls, as approved by the Engineer, at no additional cost to the State.

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)

417-3.06 Compaction – Compact the recycled mixture in accordance with 402-3.07, D., 80 Series Compaction Method.

417-3.07 Mixture Verification and QC Testing.

- A. First day:** Prior to the scarification process, 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. Extract two cores at each location and test one core from each location for penetration of the extracted asphalt binder from

- B.** the surface layer only. Provide the companion core from each location to the Engineer for testing by the Department for verification purposes.

During the scarification process, take four loose mix samples prior to compaction at each location 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 two of the loose mix samples from each core location for penetration and provide the other two loose mix samples to the Engineer, which may be evaluated by the Department's Lab to verify test results. Take all the required core and loose mix samples after the first 500 feet of the day's production.

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 shut down the scarification process until the results are submitted. Determine the penetration of the PG binder recovered from the recycled mixture in accordance with AASHTO T 49. The average penetration value of the loose mix samples must be at least 30% or more than the penetration of the core samples taken 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 for taking and testing samples. Submit the penetration test results to the Engineer by end of the next day's production. Continue adjusting the application rate and taking samples until average penetration values of the loose mix samples meet the specification requirement of at least 30% or more than the penetration values of the core samples.

- C. Routine Day:** 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. Samples of the scarified pavement prior to rejuvenation can be taken as an option instead of the core samples. When sample results do not meet the specification requirements, make adjustment to the application rate and take samples as described above.

If, at any time, 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 core samples are required for this evaluation, take them at no additional cost to the State and submit them to the Department for testing. Also, if the recycled pavement is not satisfactory to the Engineer, additional tests may be required at no cost to the State.

DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont’d)

417-4 METHOD OF MEASUREMENT

417-4.01 Heater Scarification (HS). This work will be measured as the number of square yards of pavement surface recycled as detailed in this specification.

417-4.02 Recycling Agent. The quantity of recycling agent to be measured for payment will be the number of gallons incorporated in the work, measured at a temperature of 60°F. The following formula will be used to calculate material quantity at 60°F:

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

Where,

$$\Delta T = \text{Delivered Temperature (°F)} - 60$$

$$\text{Volume}_D = \text{Quantity at Delivered Temperature (gallons)}$$

417-5 BASIS OF PAYMENT. Removal of pavement markings and cleaning of the existing pavement will be paid under separate items in the contract documents.

417-5.01 Heater Scarification (HS). The unit price bid per square yard for this item shall include the cost of all labor, materials and equipment necessary to satisfactorily complete the work, including heating, scarifying, mixing, paving, compacting, 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.

417-5.02 Recycling Agent. 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 a pay reduction of 75% of the bid price of the recycling agent for the pavement section represented by the failing sample.

Payment will be made under:

Item No.	Item	Unit
417.01	Heater Scarification	Square Yards
417.0101	Recycling Agent	Gallons

DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER

CLEANING AND SEALING CRACKS AND JOINTS USING HOT APPLIED SEALANT IN HOT MIX ASPHALT PAVEMENT (LANE MILES)

1. DESCRIPTION

Clean and seal cracks 1/8” to 1” wide. Clean and seal in locations shown in the contract documents or where directed by the Engineer along the entire length of the crack or joint.

2. MATERIAL REQUIREMENTS

Deliver the sealant in the manufacturer's original sealed containers legibly marked with the following information:

- Manufacturer's name.
- Trade name of sealant.
- Manufacturer's batch or lot number.
- Sealer only: ASTM D6690, Type II.
- Minimum application temperature.
- Maximum (or Safe) heating temperature.

Provide the Engineer with a copy of the manufacturer's recommendations pertaining to heating and application of the sealant as well as the material MSDS, prior to commencing work.

3. CONSTRUCTION DETAILS

A. General

Furnish all equipment that is necessary for cleaning and sealing the pavement cracks and joints. Use equipment meeting the description and/or performance requirements described herein and approved by the Engineer.

Do not burn, scorch or ignite the adjoining pavement when using a hot air lance.

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

Replace pavement markings, in kind, that become covered and/ or obliterated more than 25% of their width with sealant. Replace with the appropriate items in accordance to §640 Reflectorized Pavement Markings at no additional cost to the State.

B. Crack and Joint Preparation

Prepare cracks and joints for sealing on the same day that they are to be sealed or filled.

The following cracks should not be sealed:

- Multiple nearby cracks which have raveled
- Multiple cracks that include broken asphalt
- Multiple longitudinal cracks within a 10-foot segment, which are separated by less than 10 inches.

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

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

Use a high-pressure air lance or hot air lance to thoroughly clean and dry primary cracks and joints of dust, dirt, foreign material, sand and any other extraneous materials immediately prior to sealing or filling cracks and joints.

C. Sealant Melting

Heat and melt the sealant in a kettle constructed as a double boiler filled with a heat-transfer medium between the inner and outer shells. The kettle will be equipped with separate thermometers to indicate the temperature of the heat transfer medium and the sealant material, positive temperature controls and with a mechanical agitator. Maintain the sealant at the pouring temperature $\pm 10^{\circ}\text{F}$ 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 kettle and discharge temperatures do not meet with 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 kettle if it is not thermostatically heat controlled. Circulate the sealant from the discharge hose and the kettle 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 kettle with fresh material amounting to at least 20 percent of the volume of the material remaining in the kettle.

Apply material to clean, dry surfaces and only when the ambient air and pavement temperature is at or above 40°F . Prepare cracks and joints for treatment on the same day that they are to be sealed or filled.

Seal the 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. Sealant application should produce a film approximately $1/16$ inch thick. The total width of the sealant cannot exceed 2 inches. If the sealant sinks into the reservoir more than $3/8$ inch below the pavement surface, clean it with high pressure air and seal it to meet the specified thin film amount.

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 in excess of the specified thin "film" dimensions or that has not bonded to both sides of the reservoir.

Do not allow traffic on the sealed cracks until the seal has cured so as not to track. Clean sealed cracks damaged from traffic with high pressure air and reseal them to meet the specified thin film amount at no additional cost to the State.

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

4. METHOD OF MEASUREMENT

The Engineer will measure the number of lane miles of pavement that has been cleaned and sealed in accordance with this specification. The cost to clean and seal cracks in shoulders and tapers are included in the adjacent travel lane. Full width ramps and turn lanes are considered separate travel lanes. All measurements will be made to the nearest 0.01 miles.

5. BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

Item No.	Item	Pay Unit
412.XXXXXX	Cleaning and Sealing Cracks and Joints Using Hot Applied Sealant in Hot Mix Asphalt Pavement (Lane Miles)	LN MILES

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.

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.

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.
 - 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.

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

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 Contractors 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.
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.

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont’d)

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

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

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

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.

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.

DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont'd)

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)

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:

Item No.	Item	Pay Unit
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 Micro-surfacing	Gallon

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.

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.

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 _____

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE
TREATMENT - CONVENTIONAL**

415.0X0F0218 PAVER PLACED SURFACE TREATMENT - CONVENTIONAL

DESCRIPTION

This work shall consist of providing and placing ITEM 415.0X0F0218 - PAVER PLACED SURFACE TREATMENT - CONVENTIONAL 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.

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT -
CONVENTIONAL (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.

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.

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:

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT - CONVENTIONAL (Cont’d)

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.

4. Additional Coarse Aggregate Requirements. Coarse aggregate must also meet the requirements listed in Table 2 – Coarse Aggregate Properties.

TABLE 2 - COARSE AGGREGATE PROPERTIES

Property	Method	Requirement
Maximum Flakiness Index	NFP 18-561	20
Maximum Flakiness Coefficient (G/E) ⁽¹⁾	NFP 18-561	1.58
Maximum percent passing No. 30, %	AASHTO T 11, T 27	2

(1) Where G is the smallest square opening the particle can pass through and E is the smallest slot the particle can pass through.

5. 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: The Performance-Graded Binder (PG Binder) grades are listed in Table 3, *PG Binder Selection*. Appropriate binder grade shall be selected based on the project location. The PG Binder shall meet the requirements of the AASHTO M 332, Standard Specification for Performance Graded Asphalt Binder using Multiple Stress Creep Recovery (MSCR).

Table 3 - PG Binder Selection		
Location	Location by Counties	PG Binder Grades ¹ (Material Designation)
Upstate	All Other Counties Not Listed Under Downstate	64S-22 (702-64S22)
Downstate	Orange, Putnam, Rockland, Westchester, Nassau, Suffolk Counties and City of New York	64H-22 (702-64H22)

Notes:

1. Use these grades unless directed otherwise by the contract documents.

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT - CONVENTIONAL (Cont'd)

In addition, the PG Binder shall meet the following requirements:

Upstate. Use of polyphosphoric acid (PPA) to modify PG binder properties is prohibited. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.

Downstate. Polyphosphoric (PPA) is the only type of acid allowed when PG binders are modified using acid. The use of PPA modified PG binder is prohibited for mixtures containing limestone, limestone as an aggregate blend component, limestone as a constituent in crushed gravel aggregate, or recycled asphalt pavement (RAP) that includes any limestone. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.

Other PG Binder grades may be used with a prior approval by the Director of the Materials Bureau.

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.
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.

Joint Adhesive. Apply joint adhesive to all pavement edges in accordance with Section 418*Asphalt Pavement Joint Adhesive* prior to placing the asphalt mixture in order to provide bonding with the newly laid pavement.

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT - CONVENTIONAL (Cont'd)

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 4 – 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 4 - 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 4. 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 4, 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 4 - Wearing Course Application Ranges.

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT - CONVENTIONAL (Cont'd)

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.

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
415.01010218	Paver Placed Surface Treatment – Conventional Type A, F1	Tons
415.01020218	Paver Placed Surface Treatment – Conventional Type A, F2	Tons
415.01030218	Paver Placed Surface Treatment – Conventional Type A, F3	Tons
415.02010218	Paver Placed Surface Treatment – Conventional Type B, F1	Tons
415.02020218	Paver Placed Surface Treatment – Conventional Type B, F2	Tons
415.02030218	Paver Placed Surface Treatment – Conventional Type B, F3	Tons
415.03010218	Paver Placed Surface Treatment – Conventional Type C, F1	Tons
415.03020218	Paver Placed Surface Treatment – Conventional Type C, F2	Tons
415.03030218	Paver Placed Surface Treatment – Conventional Type C, F3	Tons

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT - MODIFIED

415.1X0F0218 PAVER PLACED SURFACE TREATMENT - MODIFIED

DESCRIPTION

This work shall consist of providing and placing ITEM 415.1X0F0218 – PAVER PLACED SURFACE TREATMENT – MODIFIED in accordance with the contract documents and as directed by the Engineer.

Paver Placed Surface Treatment – Modified 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.

**DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT -
MODIFIED (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.

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.

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.

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

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.

4. Additional Coarse Aggregate Requirements. Coarse aggregate must also meet the requirements listed in Table 2 - Coarse Aggregate Properties.

TABLE 2 - COARSE AGGREGATE PROPERTIES

Property	Method	Requirement
Maximum Flakiness Index	NFP 18-561	20
Maximum Flakiness Coefficient (G/E) ⁽¹⁾	NFP 18-561	1.58
Maximum percent passing No. 30, %	AASHTO T 11, T 27	2

(1) Where G is the smallest square opening the particle can pass through and E is the smallest slot the particle can pass through.

5. 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.

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

Performance Graded Binder: The Performance Graded Binder (PG Binder) grades are listed in Table 3, *PG Binder Selection*. Appropriate binder grade shall be selected based on the project location. The PG binder shall be modified with either elastomeric polymer or terminal blend crumb rubber for the production of HMA mixture. The modified PG Binder shall meet the requirements of AASHTO M 332, Standard Specification for Performance Graded Asphalt Binder using Multiple Stress Creep Recovery (MSCR). In addition, the binder grade must also meet the **elastomeric** properties as indicated by one of the following:

For $J_{nr3.2} \geq 0.1$, $Z = \%R_{3.2} - 29.371 * J_{nr3.2}^{-0.2633}$
 And Z must be greater than 0

For $J_{nr3.2} < 0.1$, $\%R_{3.2}$ must be greater than 55%

Table 3 - PG Binder Selection		
Location	Location by Counties	PG Binder Grades (Material Designation)
Upstate ¹	All Other Counties Not Listed Under Downstate	64V-22 (702-64V22)
Downstate	Orange, Putnam, Rockland, Westchester, Nassau, Suffolk Counties and City of New York	64E-22 (702-64E22)

- NOTES:
- For high volume roadways in Upstate Counties, PG 64E-22 may be specified with the concurrence of the Regional Materials Engineer. "High Volume" is defined as 2 or 3 lane highways with design year two-way AADT over 8,000, or for more than three lanes, with two-way AADT over 13,000.

When terminal blend CRM PG binder is used, the following shall apply:

- Crumb rubber particles shall be finer than #30 sieve size.
- The CRM PG binder shall be storage-stable and homogeneous.
- The Dynamic Shear Rheometer (DSR) shall be set at 2-mm gap.
- The CRM PG binder shall be 99% free of particles retained on the 600µm sieve as tested in accordance with Section 5.4 of MP 19.

In addition, the PG Binder shall meet the following requirements:

Upstate. Use of polyphosphoric acid (PPA) to modify PG binder properties is prohibited. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.

Downstate. Polyphosphoric (PPA) is the only type of acid allowed when PG binders are modified using acid. The use of PPA modified PG binder is prohibited for mixtures containing limestone, limestone as an aggregate blend component, limestone as a constituent in crushed gravel aggregate, or recycled asphalt pavement (RAP) that includes any limestone. This prohibition also applies to the use of PPA as a cross-linking agent for polymer modification.

Other modified PG Binder grades may be used with a prior approval by the Director of the Materials Bureau.

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

Polymer Modified Asphalt 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.
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.

Joint Adhesive. Apply joint adhesive to all pavement edges in accordance with Section 418 *Asphalt Pavement Joint Adhesive* prior to placing the asphalt mixture in order to provide bonding with the newly laid pavement.

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

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

- 4. overlay across the full width of the emulsion at a temperature of 290 - 325°F.
- 5. Apply the hot mix asphalt at a rate within the appropriate application range, listed in Table 4 – 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.
- 6. 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.

TABLE 4 - 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 4. 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 4, 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 4 - 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 - Modified satisfactorily placed.

DETAILED SPECIFICATIONS – PAVER PLACED SURFACE TREATMENT - MODIFIED (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, including the application of Asphalt Pavement Joint Adhesive. 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
415.11010218	Paver Placed Surface Treatment – Modified Type A, F1	Tons
415.11020218	Paver Placed Surface Treatment – Modified Type A, F2	Tons
415.11030218	Paver Placed Surface Treatment – Modified Type A, F3	Tons
415.12010218	Paver Placed Surface Treatment – Modified Type B, F1	Tons
415.12020218	Paver Placed Surface Treatment – Modified Type B, F2	Tons
415.12030218	Paver Placed Surface Treatment – Modified Type B, F3	Tons
415.13010218	Paver Placed Surface Treatment – Modified Type C, F1	Tons
415.13020218	Paver Placed Surface Treatment – Modified Type C, F2	Tons
415.13030218	Paver Placed Surface Treatment – Modified Type C, F3	Tons