

**DETAILED SPECIFICATIONS**  
**LIQUID BITUMINOUS MATERIALS**  
**AWARD# 23389**

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**DETAIL SPECIFICATIONS - LIQUID BITUMINOUS MATERIALS**

**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:

**410.1 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.

**410.2 BASIS OF PAYMENT**

**Payment will be made under:**

Item No.	Item	Pay Unit
410.60	Pick Up Broom or Vacuum Sweeper (optional)	Per Day

**410.3 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 roadside 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)**

**410.4 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 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 – PG BINDER CHIP SEAL

### SECTION 410PG – PG BINDER CHIP SEAL

This work shall consist of the construction of a single course Hot-Oil Chip Seal for pavements and/or shoulders in accordance with the contract documents.

#### 410PG.1 MATERIALS

**A. Bituminous Material:** The bituminous material shall meet the applicable requirements of Section 702.

1. **PG Binder:** Ensure that the bituminous material is compatible with the selected aggregate; use material meeting the requirements of 702-64V22.
2. **Fog Seal:** The Contractor shall provide material meeting the requirements of 702-3002, 702-3601, 702-4002 or 702-4501.

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

1. **Aggregate:** The aggregate shall meet one of the following requirements:
  - a. Limestone or a blend of limestone and dolomite having an acid insoluble residue content not less than 20.0%.
  - b. Dolomite.
  - c. Sandstone, granite, chert, trap rock, ore tailings, or other similar non-carbonate materials.
  - d. Use gravel or blend two or more of: gravel, limestone, dolomite, sandstone, granite, chert, trap rock, ore tailings, or other similar materials to produce a final blend having non-carbonate plus 1/4-inch particles comprising at least 20.0% of the total aggregate by weight with adjustments to equivalent volumes for materials of different specific gravities.
2. **Pre-Coating:** The aggregate shall be pre-coated in an asphalt mixing plant using material meeting the requirements of 702-64S22. Polymer Modified PG Binders may be allowed with the permission of the Regional Material Engineer. The asphalt binder shall have a minimum mixing temperature of 250°F and be applied at a rate of 0.40 to 0.80 percent asphalt cement by weight of aggregate.

#### C. Material Sampling and Testing

##### 1. Aggregate Stockpile.

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

**DETAILED SPECIFICATIONS – PG BINDER CHIP SEAL (Cont'd)**

5. Percent asphalt content of each sample following NY 400-13C or AASHTO T164 Method A or B.

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

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

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

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

2. **Bituminous Material:** Bituminous material is subject to QA testing by the Materials Bureau. The Engineer will evaluate any material failing QA testing to determine if it will be left in place. Material represented by a sample failing QA testing that is left in place will be subject to pay reductions.
- D. Mix Design:** Complete a mix design for pavements and/or shoulders in accordance with Materials Method 410. A shoulder mix design is required when Contractor operations require the shoulder to be treated separately from the mainline. Mix designs shall be submitted to the Engineer a minimum of two weeks prior to the start of the work.

**410PG.2 CONSTRUCTION DETAILS**

**A. General**

1. **Weather and Seasonal Limitations:** Chip Seal shall be placed during the period from May 1st through September 7th. Material shall not be applied to a pavement surface when the:
- Surface has standing water or is saturated.
  - Surface temperature is not less than 60°F and greater than 140°F.
  - Ambient temperature is less than 50°F.
  - Weather conditions would prevent proper construction of the Chip Seal.
2. **Equipment:** All equipment shall be maintained in satisfactory working conditions at all times.
- a. Sweepers**
- Self-propelled Rotary Power Broom:** The self-propelled rotary power broom shall be designed, equipped, maintained, and operated so the pavement surface can be swept clean.
  - Self-propelled Pick-Up Broom or Vacuum Sweeper:** The self-propelled equipment shall be designed, equipped, maintained, and operated so that the pavement can be swept clean. Excess aggregate shall be contained in an onboard hopper and disposed of.

**DETAILED SPECIFICATIONS – PG BINDER CHIP SEAL (Cont'd)**

**b. Bituminous Material Distributor**

1. The distributor shall be equipped, maintained, and operated so that bituminous material can be applied uniformly on variable widths up to 15-feet; and at controlled temperature and rates from 0.05 to 0.55 gallons per square yard. Prior to starting work, the distributor shall be calibrated for transverse and longitudinal application rate by ASTM D 2995, Standard Practice for Estimating Application Rate of Bituminous Distributors, or an equivalent method approved by the Engineer. The Engineer will witness the equipment calibration or require the Contractor to provide documentation certifying the calibration.
2. The distributor shall uniformly apply the bituminous material at the specified rate with a maximum allowable variation of 0.02 gallons per square yard.
3. Distributor equipment shall include accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with full circulation spray bars adjustable laterally and vertically. The distributor shall be equipped with a bituminous material sampling valve.

**c. Aggregate Spreader**

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

**d. Pneumatic Tire Roller**

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

3. **Surface Preparation:** Perform all surface preparations immediately ahead of the Chip Seal operation.
  - a. Thoroughly clean the entire area to be overlaid of dirt, oil, and other foreign materials. Remove all debris and standing water.
  - b. Cover all manhole covers, water boxes, catch basins, and other such utility structures within the area being treated with plastic, building felt, or other material approved by the Engineer. Remove the covers each day.
  - c. The Contractor shall remove pavement markings.
  - d. The Contractor shall place Temporary Road Pavement Markers (Chip Seal Markers) every 100' along the centerline of the roadway. If the roadway has multiple lanes Chip Seal markers shall be placed along the lane lines in addition to the centerline. If markers are damaged or missing prior to the Chip Seal passing the location of the marker, replace the marker.

**DETAILED SPECIFICATIONS – PG BINDER CHIP SEAL (Cont’d)**

**B. Chip Seal**

- 1. Application of PG Binder:** PG binder shall be applied in a uniform, continuous spread over the section to be treated at a minimum temperature of 325°F. The PG binder application rate is 0.25 to 0.50 gallons per square yard. The Contractor shall document and report to the Engineer any field changes in application rates from the mix design submittal.

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

Uncovered PG binder shall not be exposed to traffic. All PG binder shall be covered with aggregate before opening to traffic.

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

- 2. Application of Pre-Coated Cover Aggregate:** Immediately following the application of the bituminous material, pre-coated cover aggregate shall be spread between 20 to 30lbs per square yard.

Temperatures of the pre-coated cover aggregate shall be between 175°F to 225°F. The Contractor shall document and report to the Engineer any field changes in application rates from the mix design submittal. Spreading shall be accomplished in such a manner that construction equipment or other vehicles shall not drive on the uncovered and newly applied PG binder. Any free PG binder on the surface caused by a deficient amount of pre-coated cover aggregate shall be covered by broadcasting additional aggregate over the deficient area.

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

Initial rolling of pre-coated cover aggregate shall occur within 5 minutes after the application of bituminous material. Cover aggregate shall receive a minimum of three roller passes within 30 minutes of bituminous material application. Use Table 410-1 Number of Rollers to determine the minimum number of rollers required:

<b>Table 410-1 Number of Rollers</b>	
<b>Overlay width (feet)</b>	<b>Number of Rollers (minimum)</b>
≤ 6	1
> 6 ≤ 9	2
> 9 ≤ 12	3
> 12	4

**DETAILED SPECIFICATIONS – PG BINDER CHIP SEAL (Cont’d)**

- 3. Sweeping:** Prior to opening the roadway to unguided traffic, sweep loose stone from the newly treated surface. Additional sweeping shall be performed as directed by the Engineer during a 5-day period following placement of the Chip Seal.
- 4. Opening to Traffic:** After Chip Seal application, controlled traffic may be permitted at the Contractor’s option. Traffic shall be maintained at a speed not to exceed 15 mph for a period of 3 hours after placement of the Chip Seal by the use of pilot vehicles or an alternative method approved by the Engineer.

Traffic Advisory Signs - 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 shall 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.

Use Table 410-2 Pilot Vehicles to determine the number of pilot vehicles required:

<b>Table 410-2 Pilot Vehicles</b>	
<b>Lane Miles Surfaced in Previous Three Hours</b>	<b>Number of Pilot Vehicles</b>
< 2	1
≥ 2	2

- 5. Application of Fog Seal:** Prior to applying Fog Seal, the surface shall be swept. Follow the requirements of Application of PG Binder. The Fog Seal application rate is 0.05 to 0.15 gallons per square yard.
- 6. Opening to Traffic After Fog Seal:** The Contractor shall determine when traffic may be permitted on the treated Chip Seal. More time may be required for areas with limited exposure to sunlight.

**410PG.3 METHOD OF MEASUREMENT**

The quantity of Chip Seal to be measured for payment will be square yards of material in place, making no deductions for minor untreated areas such as catch basins and manholes.

The PG Binder for the Chip Seal will be measured by the number of 60°F gallons incorporated in the work.

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

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

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

Where:  $\Delta T$  = Delivered Temperature (°F) – 60 VolumeD = Quantity Delivered (gallons)

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

**DETAILED SPECIFICATIONS – PG BINDER CHIP SEAL (Cont’d)**

**410PG.4 BASIS OF PAYMENT**

The unit price bid per square yard for Chip Seal shall include the cost of all labor, materials, and equipment necessary to perform the work.

PG binder used for Chip Seal will be paid for under a separate item as the number of 60°F gallons of material used.

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

The Engineer will evaluate any bituminous material failing QA testing to determine if it will be left in place. If the material is left in place, the bituminous material will be subject to a reduction in payment according to Table 410-3:

<b>Table 410-3 Bituminous Material Pay Table</b>	
<b>Number of Failing QA Test Results</b>	<b>Pay Reduction of Bituminous Material Item</b>
1	15 %
2	25 %

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
410.20100009	PG Binder Chip Seal (1ST)	Square Yard
410.30100009	PG Binder	Gallons
410.40100009	Fog Seal	Gallons
410.60100009	Pick Up Broome or Vacuum Sweeper	Each

**DETAILED SPECIFICATIONS – PG BINDER CHIP SEAL (Cont'd)**

**410PG.5 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 all provisions of the original contract including among other things the Work Zone Traffic Control provisions.

**DETAILED SPECIFICATIONS – PG BINDER 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:

7. 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.
8. 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.
9. 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 – PG BINDER 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

### SECTION 416 – COLD RECYCLING

#### 416.1 DESCRIPTION

This work shall consist of Cold Recycling (CR) asphalt pavement by either In-Place or Central Plant methods.

**416.1.01 Cold In-Place Recycling (CIPR):** Work for CIPR shall consist of sampling, mix design formulation, materials management plan, milling, recycling, paving, and compacting recycled asphalt pavement in accordance with the contract documents.

**416.1.02 Cold Central Plant Recycling (CCPR):** Work for CCPR shall consist of sampling, mix design formulation, materials management plan, recycling, hauling, paving, and compacting recycled asphalt pavement in accordance with the contract documents.

#### 416.2 MATERIALS

**416.2.01 General:** All materials shall comply with the requirements of the following subsections of Section 700 Materials and Manufacturing, or as established by this section, and the contract documents.

Water	712-01
Portland Cement (Type I, II, or IL)	701-01
Coarse Aggregate (Crushed Bedrock)	703-02

**416.2.02 Bituminous Materials:** Materials shall comply with the requirements of §702.

- A. Performance-Graded (PG) Binder:** Material shall comply with material designation 702-64S22. Other grades of performance-graded binder may be used with the approval of the Materials Bureau Director.
- B. Asphalt Emulsion:** Material shall comply with materials designation 702-3301 or 702-4501.
- C. Polymer-Modified Asphalt Emulsion:** Material shall comply with materials designation 702-3301R or 702-4501R. Other grades of asphalt emulsion having a certified minimum of 65% asphalt residue may be used with the approval of the Materials Bureau Director.
- D. Fog Seal:** Material shall comply with Diluted Tack Coat.

**416.2.03 Reclaimed Asphalt Pavement (RAP):** Existing Stockpiles of RAP material to be used for CCPR shall be sourced from a NYSDOT highway. The Contractor shall provide RAP source documentation to the Engineer. RAP material not sourced from a NYSDOT highway, requires prior approval by the Department and will be subject to physical requirement testing.

#### 416.3 CONSTRUCTION DETAILS.

**416.3.01 Temperature & Seasonal Limitations:** 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. Perform all work between May 1 and October 7.

**416.3.02 Mix Design (MD):** Formulate a MD in accordance with Materials Method 416-1. Submit the mix design to the Engineer, Regional Materials Engineer, and Materials Bureau Director at least 7 days prior to the pre-recycling meeting. Materials Bureau Director shall be emailed at [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov).

**DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**

- 416.3.03 Materials Management Plan (MMP):** Complete a MMP in accordance with Materials Method 416-1. Submit to the Engineer, Regional Materials Engineer, and Materials Bureau Director at least 7 days prior to the pre-recycling meeting. Materials Bureau Director shall be emailed at [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov).
- 416.3.04 Pre-Recycling Meeting:** The Engineer will conduct a pre-recycling meeting at least one week in advance of CR operations. At a minimum, attendance at this meeting will include the Engineer, Regional Materials Engineer, and the Recycling Contractor Paving Foreman. The Contractor and Department will discuss the requirements necessary to complete the work. The Engineer should arrange for written minutes to be taken for the record and then distribute them appropriately. The attendees at the meeting are responsible for relaying the information covered and agreed upon to the paving crew and inspectors.
- 416.3.05 Equipment**
- A. Pilot Vehicle:** 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.
- B. Milling Machine:** Shall comply with §490-2.01.
- C. Recyclers:**
- 1. CIPR:** Place millings, bituminous material, water, and recycling additives as a homogeneous mixture into a paver or windrow.
    - a. Recycler.** Shall be capable of:
      - Processing the reclaimed material to pass a 2-inch sieve.
      - Measuring water usage with a totalizing water meter.
      - Measuring bituminous material usage with a mass flow meter.
      - Mixing the reclaimed material with water, bituminous material, and additives.
    - b. Miller/Recycler.** Shall be capable of:
      - Milling machine to comply with §490-2.01.
      - Processing the reclaimed material to pass a 2-inch sieve.
      - Measuring water usage with a totalizing water meter.
      - Measuring bituminous material usage with a mass flow meter.
      - Mixing the reclaimed material with water, bituminous material, and additives.
  - 2. CCPR:** Recycler shall be capable:
    - Processing the reclaimed material to pass a 2-inch sieve.
    - Weighing RAP, stone, and cement.
    - Measure water usage with a totalizing water meter.
    - Measuring bituminous material usage with a positive displacement meter - a mass flow meter will be required after 1 May 2024.
    - Mixing the reclaimed material with water, bituminous material, and additives.

Meter calibration and validation shall be done annually prior to the start of the CR season, in accordance with Materials Procedure 417-01. Subsequent verifications shall be in accordance with manufacturer's recommendations. At least 7 days prior to the start of season submit the validation results to the Director of Materials Bureau at [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov).

**DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**

Scale checks for CCPR equipment shall comply with NYSDOT Materials Procedure 401, Section II.C.3.

- D. Hauling Equipment:** CCPR only, shall comply with §404.3.03.
- E. Paver:** Shall comply with §404.3.02.
- F. Rollers:** Shall comply with §404-3.04.
- G. Power Broom:** Capable of removing loose material from the recycled pavement surface.
- H. Fog Seal:** Distributor shall comply with §407-3.01.

**416.3.06 Pilot Vehicle:** Maintain traffic using a pilot vehicle to escort traffic through the work zone at a maximum speed of 20 mph.

**416.3.07 Milling:** Mill surfaces to comply with §490. Maintain existing grade and cross slope of the roadway, unless otherwise noted. CIPR milled surfaces will be repaved with recycled material the same day milling is performed.

**416.3.08 Corrective Aggregate:** Shall comply with §623. The maximum amount of aggregate to be added shall be 20% by weight of RAP. Do not adjust aggregate rates from mix design without the Regional Materials Engineer’s approval.

- A. CIPR -** Spread the aggregate in a uniform layer, at least 6-feet in width across the pavement, centered in front of the recycling equipment.
- B. CCPR -** Aggregate shall be added to pugmill via hopper or belt scale.

**416.3.09 Cement:** The maximum amount of cement to be added shall be 1% by weight of RAP.

- A. CIPR -** Dry Portland cement shall be metered and spread in a uniform manner, at least 8-feet in width across the pavement, centered in front of the recycling equipment.

Other methods of delivering cement to the recycled mixture require prior approval from the Director of the Materials Bureau.

Meter calibration and validation shall be done before start of work per the manufacturer’s written recommendations.

- B. CCPR -** Portland cement may be added dry or as a slurry.

Dry cement delivery shall meet the requirements of §501-2.03.B – E and §501-2.03.G

Slurry meter calibration and validation shall be done before start of work per the manufacturer’s written recommendations.

**416.3.10 Recycling:** Maintain bituminous material and water rates to within 10% of the design rates. Make field changes in 0.05% to 0.2% increments. Changes exceeding 10% of the design rates require Regional Materials Engineer’s approval. Meet minimum water rates in Table 416-1.

<b>Table 416-1 – MINIMUM WATER RATE</b>		
<b>Minimum Water Application Rates Gallons / Square Yard Recycled</b>		
<b>Depth of Recycle</b>	<b>Emulsion</b>	<b>PG Binder</b>
3-inch	0.36	0.72
4-inch	0.48	0.96

**DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**

Recycling operations shall progress in the opposite direction of traffic. Change in direction shall have prior approval from the Engineer.

Maximum forward speed of 30-feet per minute.

**A. Sampling and Testing.**

1. **Performance-Grade Binder:** Shall be sampled first day and with any change in lot number. The Contractor shall perform an expansion/half-life test a minimum of once per day and with any change in lot number.
2. **Asphalt Emulsion and Polymer-Modified Asphalt Emulsion:** Shall be sampled first day and with any change in lot number. Samples shall be taken according to MM 702-2, Asphalt Emulsion Quality Assurance.

**416.3.11 Paving:** Use a paver to reestablish grade and cross slope of original surfaces unless otherwise noted. Construct recycled surface to a 3/8-inch tolerance in 15-foot parallel to centerline, and 10-foot perpendicular to centerline.

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

**416.3.12 Quality Control Testing:** Once continuous production has been achieved, take a minimum of two samples from that day’s production of recycled mixture at two different locations. Test each sample for gradation and total asphalt content. Submit the test results to the Engineer, Regional Materials Engineer, and Materials Bureau Director before the end of the next workday.

For each subsequent day of production, take a minimum of one sample from that day’s production of recycled mixture from 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 Materials Bureau Director 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 additional quality control tests as described in Materials Method 416-1.

Materials Bureau Director shall be emailed at [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov).

**416.3.13 Compaction:** Compact the mixture in accordance with §404-3.07 C., 70 Series Compaction Method and Table 416-2 – Rolling Requirements, with the following exception. Reestablish a new Project Target Density (PTD) when two consecutive density readings are less than 96%, or greater than 110% of the previous PTD.

**A. Requirements:** One roller shall be used on each compaction sequence for a minimum of three rollers on the project.

TABLE 416-2 – ROLLING REQUIREMENTS			
Compaction Sequence	Roller Type	Compaction Type	Minimum # of Passes
Initial	Steel or Pneumatic <sup>1</sup>	Vibratory or Static <sup>2</sup>	2
Intermediate	Steel or Pneumatic <sup>1</sup>	Vibratory or Static <sup>2</sup>	2
Finish	Steel	Static	2

<sup>1</sup> Either the initial or intermediate passes will use a pneumatic roller.

<sup>2</sup> Either the initial or intermediate passes will use a vibratory compaction.

**DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**

Complete all turning of the compaction equipment on material which has had a minimum of one roller pass.

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

**B. Reporting:** The rolling pattern to achieve the PTD shall be noted on the back of the BR 340R form. At the end of each production day, the Contractor shall provide the Engineer with a copy of the BR 340R - In-Place Pavement Density Data Sheet # 1 and BR 341R - In-Place Pavement Density Data - Continuation Sheet form(s) relating to that day's work.

Changes to the roller pattern requires approval of the Engineer.

**416.3.14 Longitudinal Joints**

**A. CIPR** - Construct a longitudinal joint at the centerline. Construct other longitudinal joints at the edge of lane whenever possible. Subsequent CIPR passes will reclaim a minimum of 6-inches of the adjacent compacted recycled mat.

**B. CCPR** - Construct longitudinal joints at the edge of the lane whenever possible. 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.

**416.3.15 Transverse Joints CCPR:** At the end of each production day, construct a transverse joint wedge of recycled material at a slope of 1 on 15 or flatter to meet the existing pavement elevation. Prior to commencing additional work, cut this wedge of material back to expose full depth of the paving course.

**416.3.16 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, not to exceed 30 days.

**416.3.17 Brooming:** Broom the pavement and shoulders to remove loose stone or reclaimed material. Brooming requirements apply from the time of placement until the recycled material is overlaid, not to exceed 30 days.

**416.3.18 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. No traffic will be allowed on a Fog Seal surface until it has properly set. Stopped traffic will not be allowed on a Fog Sealed surface for a minimum of 1 hour after application.

**A. Sampling:** Shall be sampled according to MM 702-2, Asphalt Emulsion - Quality Assurance.

**416.3.19 Damaged or Deficient Areas:** Repair all areas 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.

**DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**

**416.3.20 Cure Times:** Recycled mixtures cannot be overlaid until the minimum cure times in Table 416-4 have been met.

TABLE 416-4 – CURE TIME	
Bituminous Material Used	Cure Period
PG Binder	3 Day
Asphalt Emulsion	10 Days

**416.4 METHOD OF MEASUREMENT.**

**416.4.01 Cold In-Place Recycling:** This work will be measured as the number of square yards of recycled pavement surface.

**416.4.02 Cold Central Plant Recycling:** This work will be measured as the number of square yards of recycled pavement surface.

**416.4.03 Fog Seal:** Material will be measured by the number of gallons at 60°F incorporated in the work. The following formula will be used to calculate 60°F gallons:

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

Where:

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

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

**416.4.04 Performance-Grade Binder, Asphalt Emulsion, and Polymer-Modified Asphalt Emulsion:** Material will be measured by the number of gallons at 60°F incorporated in the work. The following formula will be used to calculate gallons:

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

Where:

$$\text{Mass}_D = \text{Quantity Delivered measured by Mass Flow Meter (pounds)}$$

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

**416.4.05 Portland Cement:** Material will be measured by the number of tons incorporated into the work.

**416.5 BASIS OF PAYMENT**

**416.5.01 Cold In-Place Recycling:** The square yard price bid for CIPR asphalt concrete shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work.

**416.5.02 Cold Central Plant Recycling:** The square yard price bid for CCPR asphalt concrete will include the cost of all labor, materials, and equipment necessary to perform the work.

**416.5.03 Performance-Graded Binder, Asphalt Emulsion, or Polymer-Modified Asphalt Emulsion:** The gallon at 60°F price bid for performance-grade binder or asphalt emulsions will include the cost of all labor, materials, and equipment necessary to perform the work.

**416.5.04 Portland Cement:** The ton price bid for dry Portland cement will include the cost of all labor, materials, and equipment necessary to perform the work.

**416.5.05 Fog Seal:** The gallon at 60°F price bid for Fog Seal will include the cost of all labor, materials, and equipment necessary to perform the work.

**DETAILED SPECIFICATIONS – COLD RECYCLING (Cont'd)**

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
416.01	Cold In-Place Recycling Asphalt Pavement	Square Yard
416.02	Cold Central Plant Recycling Asphalt Pavement	Square Yard
416.20	Asphalt Emulsion for Recycling	Gallon
416.21	Polymer Modified Asphalt Emulsion for Recycling	Gallon
416.22	Performance Graded Binder for Recycling	Gallon
416.30	Fog Seal	Gallon
416.40	Portland Cement	Ton

**DETAILED SPECIFICATIONS – HEATER SCARIFICATION**

**SECTION 417 – HEATER SCARIFICATION**

**417.1 DESCRIPTION**

This work shall consist of recycling an existing asphalt pavement surface in a continuous multi-step process of heating the asphalt pavement layer; scarifying into a loose mix; blending the mix with an asphalt recycling agent; spreading, leveling, then compacting the rejuvenated asphalt mixture.

**417.2 MATERIALS**

**417.2.01 Recycling Agent**

The recycling agent shall be 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. The use of any other grade of recycling agent or other product requires prior approval from the Director, Materials Bureau. Requests for this approval shall be submitted to the Department at least 3 weeks prior to the pre-recycling meeting.

**417.2.02 Mixture Design**

The application rate of the asphalt recycling agent shall be determined by analyzing a minimum of three cores per lane mile or a maximum of 20 cores per project from the existing asphalt pavement. These cores shall come from locations that represent the entire project condition.

The design application rate of the recycling agent shall provide an average penetration value of at least 30% or more of the average penetration value of the recovered asphalt binder from the existing pavement cores. The final penetration value shall not exceed 90. All penetration testing shall be performed in accordance with AASHTO T 49, Penetration of Bituminous Materials.

The mix design shall be submitted to the Engineer, Regional Materials Engineer, and Materials Bureau Director at least 7 days prior to the pre-recycling meeting. Submissions to the Materials Bureau Director shall be emailed to [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov).

**417.3 CONSTRUCTION DETAILS**

**417.3.01 Equipment**

**A. Preheating or Heating Unit**

This unit shall generate sufficient radiant heat, with no open flame exposed to the pavement surface, to soften the asphalt pavement to the depth specified in the contract documents. The burner assembly shall be adjustable up to 14-feet wide. The entire heating unit shall be enclosed and vented to contain the heat and prevent damage to adjacent properties and landscape.

**B. Heater Scarification Unit**

The scarification unit shall be a self-contained, self-propelled machine capable of operating at speeds of between 8 and 26-feet per minute while uniformly heating and scarifying the existing asphalt pavement to the minimum loose mix depth specified in the contract documents. The unit shall spray the loose mix with the required recycling agent; thoroughly blend the recycling agent and the loose mix asphalt into a homogenous mixture, and uniformly redistribute the resultant rejuvenated asphalt mixture onto the mat.

**DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)**

**1. Scarifier**

The scarifying unit shall contain at least 2 rows of spring-loaded tines that are adjustable to scarify up to 14-feet wide. The tines shall be arranged such that the lateral spacing between tines on immediately adjacent rows does not exceed 1-inch. The unit shall be capable of conforming to the pavement contours to ensure a uniform penetration from the tines and prevent damage to utility structures.

**2. Sprayer**

This unit shall be immediately behind the scarifying unit and capable of uniformly applying the recycling agent to the scarified asphalt pavement at the approved rate. The size of the nozzles located on the spray bar and pump shall be selected based upon the rate of application and the forward speed of the Heater Scarification unit. This unit shall be equipped with a mass flow meter and measuring system which is capable of maintaining the required application rate of the recycling agent within a tolerance of  $\pm 5\%$  of the mix design. The measuring system shall continuously verify and display the application rate of recycling agent and cumulative total with respect to the volume of scarified material.

**3. Mixer/Miller**

Immediately following the application of the recycling agent, an enclosed unit shall mill the asphalt pavement to the loose mix depth specified in the contract documents and thoroughly mix the recycling agent with the scarified and milled pavement. If a loose mix depth is not specified, the loose mix depth shall be 1.5-inches. The unit shall be located between the spray unit and the screed. This unit shall be operated hydraulically, be capable to maintain depth control, and capable of working at variable speeds up to 120 revolutions per minute. The unit shall be adjustable up to 14-feet wide.

**4. Screed**

The screed shall be an attached heated, augured vibratory screed capable of uniformly distributing the rejuvenated asphalt to the desired longitudinal and transverse section. The screed shall be adjustable up to 14-feet wide, equipped with an adjustable crown control and each end of the screed shall have hand wheel adjusting screws for providing the desired longitudinal grade and transverse slope.

**C. Rollers**

Rollers shall be in good mechanical condition, capable of reversing without backlash and operated at speeds slow enough to avoid displacement of the newly placed mixture. The weight of the rollers shall be sufficient to compact the mixture without crushing aggregate. Rollers shall be equipped with tanks and spray bars for wetting the drums or tires.

**D. 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 shall 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.

**DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)**

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 shall 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.

If 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 shall be performed only when the existing pavement surface temperature is 45°F or above.

**417.3.04 Surface Preparation**

**A. Pavement Markings**

Remove epoxy or thermoplastic pavement markings, and other markings in accordance with §635-3.01 and 3.04.

**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 process.

**C. Mastic Repair Material**

All mastic patches greater than 5 square feet shall be removed. Other mastic patches shall be removed at the discretion of the Engineer.

**DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)**

**417.3.05 Recycling and Placement**

Asphalt pavement to be recycled shall be heated in a manner such that the underlying asphalt layers not to be recycled, are not disturbed or overheated. When operating the heating unit(s), care shall be taken not to damage adjacent property and vegetation. All adjacent property and vegetation that becomes heat-damaged shall be repaired immediately, at no additional cost to the State.

The Heater Scarification equipment shall maintain the temperature of the scarified material, 5-feet beyond the screed, between 275°F and 325°F during recycling.

The speed of the equipment shall be controlled 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 shall be consistent and free from segregation.

The width of each pass shall be set to provide proper placement of longitudinal joints, including a 3-inch overlap onto adjacent lane passes.

The final recycled pavement shall conform to the requirements of §404-3.10, Surface Tolerance and §404-3.11, Thickness Tolerance. The depth of the loose scarified mix behind the screed unit shall be measured 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 shall determine any required repairs. Repair all designated areas, as approved by the Engineer, at no additional cost to the State.

**417.3.06 Compaction**

The recycled mixture shall be compacted in accordance with 404-3.07, D., 80 Series Compaction Method.

**417.3.07 Quality Control and Quality Assurance**

At the start of and during production, provide the AECTA and documented quantities to the Engineer for each shipment of recycling agent. Samples for every shipment shall be taken in accordance with NYSDOT Materials Method 702-2 Asphalt Emulsion – Quality Assurance.

**A. First day**

Prior to the start of work, the Engineer shall select two coring locations within one lane mile of each other. Two cores shall be extracted from each location. The Contractor shall extract asphalt binder from the surface layer of one core at each location and test it for penetration. The second core at each location shall be provided to the Engineer for companion testing by the Department. If approved by the Engineer, the Contractor may sample dry loose mix of the scarified pavement, prior to rejuvenation, in the locations indicated by the Engineer in lieu of coring. The same testing requirements as noted above apply to dry loose samples.

**DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)**

During the scarification process, four loose mix samples shall be taken prior to compaction at each location where cores, or dry loose mix samples, were taken. These samples shall represent the day's production. The samples shall be taken either behind the screed or in any place after the spraying and mixing units. All samples shall be identified by their locations at the project site. Two of the loose mix samples from each location shall be tested for penetration. The remaining rejuvenated loose mix companion samples shall be provided to the Engineer. Take all the required core and loose mix samples after the first 500-feet of the day's production.

Penetration test results shall be submitted 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. Penetration of the PG binder recovered from the recycled mixture shall be determined in accordance with AASHTO T 49. The average penetration value of the loose mix samples shall be a minimum of 30% or more of the penetration of the samples taken from the existing pavement (either cores or dry loose mix.)

Failing penetration results from the rejuvenated loose mix samples shall be addressed as follows: A new application rate shall be determined and submitted to the Engineer for approval. The sampling and testing procedure in this section shall be repeated. New penetration test results shall be submitted to the Engineer by end of the next day's production. This process shall be repeated until the average penetration value of the rejuvenated loose mix is 30% or more of the penetration of the samples from existing pavement (either from cores or dry loose mix.)

**B. Routine Day**

The sampling and testing procedures in section 417-3.07 A shall be repeated every third day of production.

The average penetration value of the rejuvenated loose mix shall not exceed 90. Any pavement sections where average penetration of samples from rejuvenated mix exceed 90 shall be subject to evaluation by the Engineer. Additional testing as ordered by the Engineer in this evaluation shall be completed by the Contractor at no additional cost to the State.

**417.4 METHOD OF MEASUREMENT**

**417.4.01 Heater Scarification (HS)**

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

**417.4.02 Recycling Agent**

This material will be measured by the number of pounds incorporated in the work.

**417.5 BASIS OF PAYMENT**

**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.

**DETAILED SPECIFICATIONS – HEATER SCARIFICATION (Cont'd)**

**417.5.02 Recycling Agent**

The unit price bid per gallon of recycling agent shall include the cost of all labor, materials, and equipment necessary to complete the work satisfactorily. The Regional Materials Engineer will evaluate the material represented by any failing sample of recycling agent.

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Unit</b>
417.01	Heater Scarification	Square Yards
417.0101	Recycling Agent	Pounds

**DETAILED SPECIFICATIONS – JOINT & CRACK FILLER/SEALER**

**SECTION 412 – CLEANING AND SEALING CRACKS AND JOINTS USING HOT APPLIED  
SEALANT IN ASPHALT PAVEMENT (LANE MILES)**

**412.1 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.

**412.2 MATERIAL REQUIREMENTS**

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

**412.3 CONSTRUCTION DETAILS**

**412.3.01 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 with §640 Reflectorized Pavement Markings at no additional cost to the State.

**412.3.02 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 in the wheel path 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.

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.

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

**412.3.03 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  $40^{\circ}\text{F}$ . 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)**

**412.4 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.

**412.5 BASIS OF PAYMENT**

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

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

**DETAILED SPECIFICATIONS – MASTIC JOINT & CRACK FILLER**

**SECTION 412M – CLEANING AND FILING WIDE CRACKS AND JOINTS USING HOT APPLIED AGGREGATE REINFORCED MASTIC MATERIALS IN ASPHALT PAVEMENT (LANE MILES)**

**412M.1 DESCRIPTION**

The intent of this item is to clean and repair cracks in asphalt pavement that have deteriorated beyond the typical scope for cleaning, and overband filling. Clean and fill cracks or joints (cracks  $\geq$  1 inch,  $\leq$  6-inch maximum width) using an approved aggregate reinforced, hot applied mastic material. The Engineer shall mark all such cracks to be cleaned and repaired.

**412M.2 MATERIALS**

Deliver mastic 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.
- 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 mastic as well as the material MSDS, 7 days prior to commencing work.

**Mastic Material:** Hot-applied, prepackaged, pourable, aggregate reinforced, Polymer Modified Asphalt Mastic as approved by the Materials Bureau or an approved equal.

Approved Products	Suppliers/Manufacturers	Location
Crafco MasticOne	Crafco, Inc.	Allentown, PA Chandler (Phoenix), AZ Cheyenne, WY Halls, TN Northumberland, PA Youngstown, OH
Deery Level and GoRepair Mastic	Crafco, Inc.	Allentown, PA Chandler (Phoenix), AZ Cheyenne, WY Halls, TN Northumberland, PA Youngstown, OH
GAP Mastic MOD201 GAP Mastic MOD202	Maxwell Products	Salt Lake City, UT
SAMIscreed	FPT Infrastructure	Mount Airy, NC

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

**412M.3 CONSTRUCTION DETAILS**

**412M.3.01 Technical Assistance**

A manufacturer's representative shall be on-site at the beginning of the work until the Engineer determines the assistance is no longer required.

**412M.3.02 General**

Complete all pavement repairs other than mastic contained in the contract documents bordering pavement cracks prior to commencing work (if any).

Furnish all equipment that is necessary for cleaning and mastic application. Use equipment meeting the description and/or performance requirements described herein and approved by the Engineer.

Only apply material to clean, dry surfaces and only when the ambient air and pavement temperature is at or above 40°F or as per manufacture's recommendation. Prepare cracks and joints for treatment on the same day that they are to be filled.

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.

Use a high-pressure air lance or hot air lance to thoroughly clean and dry cracks and joints of dust, dirt, foreign material, sand, and any other extraneous materials, including existing cold patch material, according to the manufacturer's recommendations immediately prior to filling cracks and joints.

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 mastic. Replace with the appropriate items in accordance with §640 Reflectorized Pavement Markings, cost for this item will be paid for under appropriate items.

**412M.3.03 Crack and Joint Preparation**

Prepare cracks and joints for mastic application on the same day that they are to be filled.

Clean all cracks and joints 1.0-inch to 6.0-inches in width. These cracks and joints should not exceed 2.0-inches in depth, however cracks exceeding 2.0-inches in depth should be filled using mastic and Bulking Stone as per manufacture's methods.

**412M.3.04 Material Melting**

Use a melter recommended by the material manufacturer and meeting the requirements of this specification.

Melter Requirements:

- Double boiler filled with a heat-transfer medium between the inner and outer shells. Do not use direct fire heating.
- Capable of maintaining the application temperature.
- Equipped with positive temperature controls, and with mechanical horizontal agitation.
- Equipped with separate thermometers to indicate the temperature of the heat transfer medium and the mastic material in the hopper.

Check the discharge temperature of the mastic with a non-contact infrared thermometer.

Discharge the material at a temperature between the manufacturer's recommended pouring and safe heating temperatures indicated on the material packaging.

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

**412M.3.05 Crack and Joint Filling 1.0-inch to 6.0-inches wide.**

Handle, mix, heat, prime, place, and finish the material in accordance with the manufacturer's instructions and this specification.

Apply material in an overband of 2-inches on all sides, beyond the edges of the deteriorated area, to structurally sound pavement.

Apply material so that the finished installation is smooth, level and does not impact traveling public safety.

**412M.3.06 Final Surface Treatment Cracks and Joints 1.0-inch to 6.0-inches wide.**

Heat and melt the edges of the repair area with a torch immediately after material application, to ensure adherence and a watertight seal only if recommended by the manufacturer. Do not burn, scorch, or ignite the material or adjoining pavement when heating.

Broadcast a Topping Stone, as recommended by the manufacture, over the repair area immediately after installation.

A low pressure, volume of water may be used to accelerate cooling of the material.

Check temperature of mastic (as per manufacture's recommendation) prior to allowing traffic access.

Do not allow traffic on the repaired areas until the material has cooled, to prevent tracking.

Before opening to traffic, sweep away or collect any excess fine aggregate off the pavement, if any was applied. Remove and dispose of material applied in excess of the specified thickness over the pavement surface or any material that has not bonded around the repair.

**412M.4 METHOD OF MEASUREMENT**

The Engineer will measure the number of lane miles of pavement that has been cleaned and filled with mastic in accordance with this specification. Shoulders less than 6-ft. wide will be included in the adjacent lane. The cost to clean and fill cracks in shoulders greater than 6-ft. wide will be paid as a separate travel lane. Full width ramps and turn lanes are considered separate travel lanes.

**412M.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.

## DETAILED SPECIFICATIONS – MICRO-SURFACING

- 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

### 413.1 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.

### 413.2 MATERIALS

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

**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% acidinsoluble residue in the plus and minus No. 30 size fractions.
- 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 Bedrock, Gravel, and Slag for Micro-Surfacing and Slurry Surfacing.

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.

**DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont’d)**

<b>TABLE 1 - MAXIMUM STOCKPILE TOLERANCE</b>								
Sieve (in)	3/8	No. 4	No. 8	No. 16	N. 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.

**413.3 CONSTRUCTION DETAILS**

**413.3.01 Weather and Seasonal Limitations:** The requirements of §404-3.01 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.

**413.3.02 Mix Design:** Employ a Department approved laboratory to develop a job mix formula, following the procedure outlined in AASHTO PP 83, Standard Practices for Micro-Surfacing Design, 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 Materials Bureau Director. Materials Bureau Director shall be emailed at [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov). Mixture designs are valid until 3rd Saturday in September of the year in which they are submitted if the mixture materials sources have not changed.

<b>TABLE 2 - PROPORTIONAL REQUIREMENTS</b>	
<b>Constituent</b>	<b>Proportional Requirement</b>
Residual Asphalt	5.5 to 10.5% (by dry weight of aggregate).
Mineral Filler	0.0 to 3.0% by dry weight 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.

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

<b>TABLE 3 - PHYSICAL REQUIREMENTS</b>		
<b>Property</b>	<b>Test Method</b>	<b>Requirement</b>
Wet Cohesion	ISSA TB 139; 30 minutes ISSA TB 139; 60 minutes	12 kg-cm, minimum 20 kg-cm, minimum
Wet Track Abrasion Loss	ISSA TB 100; 1 hour soak ISSA TB 100; 6-day soak	538 g/m <sup>2</sup> , maximum 807 g/m <sup>2</sup> , maximum
Mix Time @ 25°C	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 <sup>2</sup> , maximum
Lateral Displacement	ISSA TB 147A	5.0% maximum
Specific Gravity after 1000 cycles of 125 lbs.	ISSA TB 147A	2.10 maximum

<b>TABLE 4 - GRADATION REQUIREMENTS</b>	
<b>Mixture Type</b>	<b>Aggregate Gradation</b>
Type II	2MS <sup>(1)</sup>
Type III	3MS <sup>(1)</sup>

<sup>(1)</sup> § 703-02 Material Requirements, Table 703-5 Sizes of Crushed Bedrock, Gravel, and Slag for Micro-Surfacing and Slurry Surfacing.

**413.3.03 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 Table 4 – Sampling and Testing of Materials Procedure 401. Each sample must contain material from each face of the stockpile.

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

- b. Test samples in accordance with AASHTO T 11, Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing, and AASHTO T 27, Sieve Analysis of Fine and Coarse Aggregates. Test results shall be based on the average of three tests.
  - c. Sample and test the aggregate in accordance with Materials Method 28, “Friction Aggregate Control and Test Procedures,” Appendix B, Table B1 – Minimum Testing Frequencies for Slurry Surfacing Aggregates.
2. **Department Testing and Approval:** The Regional Materials Engineer will review the Contractor's submission for specification compliance. The Regional Materials Engineer will base final approval of the stockpile on the Contractor's submission or Department sampling and testing. Re-approval is required if additional material is added to the stockpile.
- a. Gradation - Test results shall be the average of three tests. If the percent passing is outside the gradation limits for any sieve, the stockpile will be rejected.
  - b. Friction Requirements - Samples shall meet appropriate friction values. All Micro-Surfacing previously placed with material from a stockpile rejected for non-carbonate or acid insoluble residue content will be rejected.

**B. Emulsion:** Asphalt emulsion shall be sampled according to Materials Method 702-2, “Asphalt Emulsion – Quality Assurance.”

**413.3.04 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 in Charge, the Regional Materials Engineer, and the Materials Bureau Director at [DOT.sm.Pavement.Preservation.Friction@dot.ny.gov](mailto:DOT.sm.Pavement.Preservation.Friction@dot.ny.gov) 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 §404, shall be used.

**413.3.05 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.

**DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont’d)**

**413.3.06 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.

**413.3.07 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.

<b>TABLE 5 - APPLICATION LIMITS</b>		
<b>Gradation</b>	<b>Course</b>	<b>Application Rate (lbs./yd<sup>2</sup>)</b>
Type II	Scratch Finish	15 maximum 15-20
Type III	Scratch Finish	20 maximum 20-30

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

**DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont’d)**

- 413.3.08 Coverage:** Do not use hand tools to expand the width of application wider than the spreader box, except as described under *Hand Finishing* below.
- 413.3.09 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

- 413.3.10 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.
- 413.3.11 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.
- 413.3.12 Excess Material:** Remove all excess material in areas such as driveways, gutters, intersections, etc. each day.
- 413.3.13 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.
- 413.3.14 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.
- 413.3.15 Milling for Pavement Markings:** Mill recesses for pavement markings as required by contract documents.

**DETAILED SPECIFICATIONS – MICRO-SURFACING (Cont’d)**

**413.3.16 Quality Control Reports:** The Contractor shall submit a signed report daily with the following information:

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

<sup>1</sup> 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.

<sup>2</sup> These parameters may change throughout the day. Record the amount and location of any change on the report.

<sup>3</sup> Water content will be determined by taking a sample of mixed material and drying to a constant weight.

**413.4 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.”

**413.5 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:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
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

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

**413.6 BONDING REQUIREMENTS**

Within 10 calendar days of receipt of a purchase order from the State, the Contractor shall provide the State agency the following:

**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.

**Amount of Bond:** The amount of the Maintenance Material Bond shall be 100% of the amount of the project's cost.

**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.

The procedure of the Maintenance Material Bond shall be as follows:

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.

The Contractor 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. 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.

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.

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 all provisions of the original contract including among other things the Work Zone Traffic Control provisions.

**DETAILED SPECIFICATIONS – MICRO-SURFACING (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 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:

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.

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.

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.

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 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.

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

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**

**415C.1 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 asphalt wearing course.

**415C.2 MATERIALS**

**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** – Non-carbonate 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 non-carbonate.

**Type B Mixes** – Non-carbonate 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 non-carbonate.

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

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

**3. Coarse Aggregate Type F3 Conditions**

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

**Type A Mixes** – Non-carbonate 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 non-carbonate.

**Type B Mixes** – Non-carbonate 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 non-carbonate.

**Type C Mixes** – Non-carbonate 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 non-carbonate.

- 4. **Additional Coarse Aggregate Requirements:** Coarse aggregate must also meet the requirements listed in Table 1 – Coarse Aggregate Properties.

<b>TABLE 1 - COARSE AGGREGATE PROPERTIES</b>		
<b>Property</b>	<b>Method</b>	<b>Requirement</b>
Maximum Flakiness Index	NFP 18-561	20
Maximum Flakiness Coefficient (G/E) <sup>(1)</sup>	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.”
- 6. **Mineral Filler:** § 703-08, Mineral Filler.

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

7. **Asphalt Binder:** The Performance-Graded Binder (PG Binder) grades are listed in Table 2, *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).

<b>Table 2 - PG Binder Selection</b>		
<b>Location</b>	<b>Location by Counties</b>	<b>PG Binder Grades<sup>1</sup> (Material Designation)</b>
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)

<sup>1</sup> Use these grades unless directed otherwise by the contract documents.

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 prior approval by the Director of the Materials Bureau.

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

**415C.3 CONSTRUCTION DETAILS**

**415C.3.01 Equipment**

1. **Paving:** Use a self-priming paver capable of spraying the polymer modified asphalt emulsion, applying the 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 § 404-3.03, Hauling Equipment, to transport the asphalt mixture wearing course.
4. **Paver and Equipment Cleaning:** The requirement of § 404-3.12, Paver and Equipment Cleaning apply.

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

**415C.3.02 Asphalt Mixture 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 Asphalt Mixture.

**415C.3.03 Mix Designs:** Formulate a job mix formula that satisfies the design limits listed in Table 3- Mixture Requirements and submit it to the Regional Materials Engineer for approval. The use of recycled asphalt pavement in these mixes is prohibited.

<b>TABLE 3 - MIXTURE REQUIREMENTS<sup>(1)</sup></b>						
	<b>Type A</b>		<b>Type B</b>		<b>Type C</b>	
<b>Sieve Sizes (in)</b>	<b>Design Limits (% Passing)</b>	<b>Production Tolerance (%)</b>	<b>Design Limits (% Passing)</b>	<b>Production Tolerance (%)</b>	<b>Design Limits (% Passing)</b>	<b>Production Tolerance (%)</b>
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 - 60	± 3	24 - 45	± 3	24 - 45	± 3
No. 8	21 - 37	± 3	21 - 37	± 3	21 - 37	± 3
No. 16	16 - 26	± 3	16 - 26	± 3	16 - 26	± 3
No. 30	12 - 20	± 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 - 5.3		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)**

**415C.3.04 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.

**415C.3.05 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.

**415C.3.06 Application:** The requirements of § 404-3.01, Weather and Seasonal Limitations apply, except as modified herein. Placement may begin if the surface temperature is at least 45°F and rising.

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 asphalt wearing course is applied.
3. Immediately after applying the polymer modified asphalt emulsion, apply the asphalt overlay across the full width of the emulsion at a temperature of 290-325°F.
4. Apply the asphalt mixture 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.

<b>TABLE 4 - WEARING COURSE APPLICATION RANGES</b>		
<b>Type</b>	<b>Minimum (lbs./yd<sup>2</sup>)</b>	<b>Maximum (lbs./yd<sup>2</sup>)</b>
A	55	65
B	60	70
C	65	75

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

**415C.3.07 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.

**415C.3.08 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.

**415C.4 METHOD OF MEASUREMENT**

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

**415C.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. 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.

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

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
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**

**415M.1 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 asphalt wearing course.

**415M.2 MATERIALS**

**415M.2.01 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.

**415M.2.02 Coarse Aggregate Type F1 Conditions**

1. Sandstone, granite, chert, traprock, ore tailings, slag, or other similar non-carbonate materials.
2. 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** – Non-carbonate 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 non-carbonate.

**Type B Mixes** – Non-carbonate 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 non-carbonate.

**Type C Mixes** – Non-carbonate 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 non-carbonate.

**415M.2.03 Coarse Aggregate Type F2 Conditions**

1. Limestone, dolomite, or a blend of the two having an acid insoluble residue content of not less than 20.0%.
2. Sandstone, granite, chert, traprock, ore tailings, slag, or other similar non-carbonate materials.
3. 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** – Non-carbonate 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 non-carbonate.

**Type B Mixes** – Non-carbonate 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 non-carbonate.

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

**Type C Mixes** – Non-carbonate 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 non-carbonate.

**415M.2.04 Coarse Aggregate Type F3 Conditions**

1. Limestone or a blend of limestone and dolomite having an acid insoluble residue content of not less than 20.0%.
2. Dolomite.
3. Sandstone, granite, chert, traprock, ore tailings, slag, or other similar non-carbonate materials.
4. 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** – Non-carbonate 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 non-carbonate.

**Type B Mixes** – Non-carbonate 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 non-carbonate.

**Type C Mixes** – Non-carbonate 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 non-carbonate.

**415M.2.05 Additional Coarse Aggregate Requirements:** Coarse aggregate must also meet the requirements listed in Table 1 - Coarse Aggregate Properties.

<b>TABLE 1 - COARSE AGGREGATE PROPERTIES</b>		
<b>Property</b>	<b>Method</b>	<b>Requirement</b>
Maximum Flakiness Index	NFP 18-561	20
Maximum Flakiness Coefficient (G/E) <sup>(1)</sup>	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.

**415M.2.06 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.”

**415M.2.07 Mineral Filler:** § 703-08, Mineral Filler.

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

**415M.2.08 Performance Graded Binder:** The Performance Graded Binder (PG Binder) grades are listed in Table 2, *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 asphalt 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 2 - PG Binder Selection		
Location	Location by Counties	PG Binder Grades (Material Designation)
Upstate <sup>1</sup>	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)

<sup>1</sup> 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 prior approval by the Director of the Materials Bureau.

**415M.2.09 Polymer Modified Asphalt Polymer Modified Asphalt Emulsion:** §702 - Bituminous Materials, 702- 4001P.

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

**415M.3 CONSTRUCTION DETAILS**

**Mix Designs:** Formulate a job mix formula that satisfies the design limits listed in Table 3- Mixture Requirements and submit it to the Regional Materials Engineer for approval. The use of recycled asphalt pavement in these mixes is prohibited.

TABLE 3 - MIXTURE REQUIREMENTS <sup>(1)</sup>						
	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 - 60	± 3	24 - 45	± 3	24 - 45	± 3
No. 8	21 - 37	± 3	21 - 37	± 3	21 - 37	± 3
No. 16	16 - 26	± 3	16 - 26	± 3	16 - 26	± 3
No. 30	12 - 20	± 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 - 5.3		4.8 - 5.2		4.8 - 5.2	

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

**415M.4 EQUIPMENT**

- 415M.4.01 Paving:** Use a self-priming paver capable of spraying the polymer modified asphalt emulsion, applying the asphalt mixture 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.
- 415M.4.02 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.
- 415M.4.03 Hauling:** Use vehicles that meet § 404-3.03, Hauling Equipment, to transport the asphalt mixture wearing course.
- 415M.4.04 Asphalt Mixture 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.

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

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

**415M.4.05 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.

**415M.4.06 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.

**415M.4.07 Application:** The requirements of § 404-3.01, 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 asphalt mixture wearing course is applied.

Immediately after applying the polymer modified asphalt emulsion, apply the asphalt mixture overlay across the full width of the emulsion at a temperature of 290-325°F.

3. Apply the asphalt mixture 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.
4. 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.

<b>TABLE 4 - WEARING COURSE APPLICATION RANGES</b>		
<b>Type</b>	<b>Minimum (lbs./yd<sup>2</sup>)</b>	<b>Maximum (lbs./yd<sup>2</sup>)</b>
A	60	70
B	65	75
C	70	80

**415M.4.08 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.

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

**415M.4.09 Paver and Equipment Cleaning:** The requirement of § 404-3.12, Paver and Equipment Cleaning apply.

**415M.4.10 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.

**415M.5 METHOD OF MEASUREMENT**

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

**415M.6 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:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
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