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DEPARTMENT OF TRANSPORTATION

STATE OF GEORGIA

SPECIAL PROVISION

Project No._____

P.I. No._____

Section 404—Paver Laid Surface Treatment

404.1 General Description

The work consists of constructing a surface treatment composed of a polymer-modified asphalt emulsion application followed immediately with a thin placement of hot-plant-mixed paving mixture, according to the details shown on the Plans and the requirements herein.

Work will be accepted on a Lot basis according to the applicable requirements of Section 106 and this Specification.

404.1.01 Definitions

Comparison sample: Opposite quarter of material sampled by the Contractor.

Quality assurance sample: Independent sample taken by the Department.

Referee sample: A sample of the material remaining after quartering which is used for evaluation if a comparison of Contractor and Departmental test results is outside allowable tolerances.

404.1.02 Related References

A. Standard Specifications

Section 106—Control of Materials

Section 109—Measurement and Payment

Section 152—Field Laboratory Building

Section 400—Hot Mix Asphaltic Concrete Construction

Section 424—Bituminous Surface Treatment

Section 800—Coarse Aggregate

Section 802—Coarse Aggregate for Asphaltic Concrete

Section 820—Asphalt Cement

Section 883—Mineral Filler

B. Referenced Documents

AASHTO T 176

AASHTO T 200-79

ASTM D 5546

Laboratory Standard Operating Procedure (SOP) 27, "Quality Assurance for Hot Mix Asphaltic Concrete Plants in Georgia"

GDT 38

GDT 56

GDT 66

GDT 73

GDT 78

GDT 83

GDT 125

GDT 126

GSP 15

GSP 21

QPL 1

QPL 2

QPL 45

404.1.03 Submittals

A. Paving Plan

Before starting asphaltic concrete construction, submit a written paving plan to the Engineer for approval. Include the following on the paving plan:

- Proposed starting date
- Location of plant(s)
- Rate of production
- Average haul distance(s)

- Number of haul trucks
- Paver speed feet (meter)/minute for each placement operation
- Mat width for each placement operation
- Number and type of rollers for each placement operation
- Sketch of the typical section showing the paving sequence for each placement operation
- Electronic controls used for each placement operation
- Temporary pavement marking plan

If staged construction is designated in the Plans or contract, provide a paving plan for each construction stage.

B. Mixture Design

Supply a mix design for approval by the Engineer. Proportion the aggregate so that the job-mix formula percentages fall within the master gradation limits in Table 1, below.

Table 1
Aggregate Gradations – For Paver Laid Surface Treatment

Sieve Size		Type A (1/4")	Type B (3/8")	Type C (1/2")	Mixture Control Tolerance %
ASTM	mm	% Passing by Weight	% Passing by Weight	% Passing by Weight	
3/4"	19 mm	-	100	100	-
1/2"	12.5 mm	-	90-100	85 – 100	±5
3/8"	9.5 mm	100	75 – 100	60 – 80	±5
No. 4	4.75 mm	40 – 55	28 – 42	28 – 38	±4
No. 8	2.36 mm	22 – 32	25 – 32	25 – 32	±4
No. 50	300 μm	8 – 13	8 – 13	8 – 13	±3
No. 200	75 μm	4 – 7	4 – 7	4 – 7	±2
Asphalt Content %		5.0 – 5.8	4.8 – 5.6	4.6 – 5.6	±0.4

C. Job Mix Formula

After the Contract has been awarded, submit to the Engineer a written job mix formula proposed for each mixture type to be used based on an approved mix design. Furnish the following information for each mix:

- Specific project for which the mixture will be used
- Source and description of the materials to be used
- Proportions of the raw materials to be combined in the paving mixture
- Single percentage of the combined mineral aggregates passing each specified sieve
- Single percentage of asphalt by weight of the total mix to be incorporated in the completed mixture
- Single temperature at which to discharge the mixture from the plant
- Name of the person or agency responsible for quality control of the mixture during production
- The results of a design study providing the necessary information to conform to the appropriate requirements of this Specification. Allow two weeks from the date batched materials are received by the Office of Materials and Research (OMR) for verification of the mix design by OMR.

Submit job mix formulas for approval at least two weeks prior to beginning mixing operations. Do not start any Paver-Laid Surface Treatment work until the Engineer has approved a job mix formula for the mixture to be used. The Engineer will not accept any mixture placed without an approved job mix formula.

D. Quality Control Program

Submit a Quality Control Plan to the Engineer for approval. The Quality Control Program will be included as part of the certification in the annual plant inspection report.

404.2 Materials

Furnish materials meeting the following requirements:

A. Aggregate

1. General

   Ensure that the aggregate is composed of a coarse aggregate, a fine aggregate and, if required, a mineral filler, meeting the requirements below, and that the gradation of the blend of these components meets the master gradation requirements for the paving mixture.

   Do not use Recycled asphalt pavement (RAP) as a component in the paving mixture.

   Ensure that all fine and coarse aggregate comes from an approved source listed in the Department's current QPL 2 and that it consists of Class A, Group II stone as described in Section 800 of the Specifications.

2. Fine Aggregate

   Ensure that the fine aggregate meets the requirements of Subsection 802.2.01 except that the sand equivalent measured on the No. 4 sieve, as determined by AASHTO T 176, shall be greater than 60.0.

3. Coarse Aggregate

   Ensure that Coarse aggregate meets the requirements of Subsection 802.2.02 and that the aggregate is of uniform quality throughout, and consists of 100% virgin crushed material.

   Use Class A aggregate only with percent wear of each individual size not to exceed 45 percent based on the B grading of AASHTO T 96.

   Use aggregate which contains no more than 20 percent flat and elongated pieces (length greater than three times the average thickness) for that portion of the blend of all aggregate retained on the No.4 (4.75 mm) sieve.

4. Mineral Filler

   Ensure that mineral filler, if required, meets the requirements of Subsection 883.2.01.

B. Liquid Binder Material

1. Paving Mixture

   Use the type liquid binder material specified on the Mix Design and ensure that it meets the requirements of Subsection 820.2.01 Superpave Asphalt Binder.

2. Tack Coat

   Ensure that the polymer modified asphalt emulsion tack coat is co-milled at the manufacturer's facility using polymer modified binder or polymer injected into the binder line before it enters the emulsion mill. Use only Styrene Butadiene Rubber (SBR), Styrene Butadiene Styrene (SBS), or Styrene Butadiene (SB) polymer modifiers. Ensure the emulsion is CQS-Special, smooth and homogeneous and meets the requirements shown in the following Table 2.

Table 2

CQS-Special Modified Asphalt Emulsion

Test Of Emulsion			
Parameter	**Test Method**	**Value**	
Viscosity @ 77 °F (25 °C), SF	AASHTO T 59-96	20 Min.	100 Max.
Sieve Test, %	AASHTO T 59-96	-	0.1 Max.
24-Hour Storage Stability, %[1]	AASHTO T 59-96	-	1.0 Max.
Residue by Distillation	AASHTO T 59-96	63 Min.	-
Oil Distillate, by Volume of Emulsion, %	AASHTO T 59-96	-	2.0 Max.
Particle Charge	AASHTO T 59-96	Positive[2]	
Test Of Residue From Emulsion			
Solubility in TCE, %	AASHTO T 44-96[3]	97.5 Min.	-
Elastic Recovery @ 50 °F (10 °C)[4]	ASTM D 5892	20.0 Min.	-
Penetration @ 77 °F (25 °C)	AASHTO T 49-96	60 Min.	200 Max.
Ductility @ 39.2 °F (4 °C)[5]	ASTM P 226	40 Min.	-

Note 1: After standing undisturbed for 24 hours ensure that the surface is a smooth homogeneous color throughout the sample with no evidence of any white, milky-colored substance.

Note 2: If the Particle Charge Test is inconclusive, use a pH test (AASHTO T 200-79). The maximum allowable pH is 6.7.

Note 3: ASTM D 5546 may be used when polymers block the filter during the test.

Note 4: Test temperature changed from 77 °F (25 °C).

Note 5: Test temperature changed from 77° F (25 °C) and minimum elongation changed to 11.8 in (30 cm+).

C. Additives

Use additives to facilitate mixing and/or improve the quality of the paving mixture when shown on the Plans; or, with written authorization from the Engineer.

Use hydrated lime meeting the requirements of Subsection 883.2.03 to reduce the moisture susceptibility of the aggregate. Add hydrated lime at the rate of 1.0 percent by weight of the total dry aggregate. Design the mix to ensure that the mixture properties have a minimum of 95% retained coating and a minimum of 80% retained tensile strength ratio when tested accordance with GDT 56 and GDT 66, respectively.

404.2.01 Delivery, Storage, and Handling

All stockpiling and storage of materials shall be in accordance with Section 106 and Section 400.

Ensure that vehicles for the transportation and delivery of Paver-Laid Surface Treatment mixtures meet the requirements of Subsection 400.2.01.A

Ensure that the containers used in transporting, conveying, and storing bituminous material are free from foreign material and are equipped with sample valves. Bituminous material will not be accepted from any conveying vehicles indicating leakage or spillage of bituminous material.

404.3 Construction Requirements

404.3. 01 Personnel

General Provisions 101 through 150.

404.3.02 Equipment

Hot mix asphaltic concrete plants producing mix for the Department's use will be governed by the requirements as outlined in Laboratory Standard Operating procedure No. 27, "Quality Assurance for Hot mix Asphaltic Concrete Plants in Georgia".

The Engineer will approve the equipment used to transport and construct Paver-Laid Surface Treatment. Ensure that the equipment is in satisfactory mechanical condition and can function properly during production and placement operations.

Place the following equipment at the plant or project site:

A. Field Laboratory

Provide a field laboratory according to Section 152.

B. Plant Equipment

Ensure that hot mix asphaltic concrete mixing plants used to produce Paver-Laid Surface Treatment meet the requirements of Subsection 400.3.02.B and are listed in the Department's current QPL 45.

C. Equipment at Project Site

1. Cleaning Equipment

   Provide sufficient hand tools and power equipment to clean the roadway surface before placing the modified emulsion tack coat. Use power equipment that complies with Subsection 424.3.02.F, "Power Broom and Power Blower."

2. Surface Treatment Paving Machine

   Provide a self-priming machine that is capable of spraying the modified emulsion, applying the hot mix asphalt concrete overlay and smoothing the surface of the mat in one pass at the rate of 30 to 90 feet (9 to 27 m) per minute.

   Ensure the self-priming paving machine incorporates a receiving hopper, feed conveyor, insulated storage tank for modified emulsion, a single variable width spray bar, and a variable width, heated, ironing type screed.

   Ensure the screed has the ability to have crown adjusted at the center, both positively and negatively, and have vertically adjustable fixed extensions to accommodate the desired pavement profile. The machine must be approved by the Engineer and meet the following requirements:

a. Screed Unit

Ensure the machine is equipped with a heated screed and produces a finished surface meeting the requirements of the typical cross sections.

- Provide extensions added to the screed with the same heating capability as the main screed unit, except for use on variable depth tapered areas and/or as approved by the Engineer.
- Ensure the screed, with extensions if necessary, is wide enough to pave an entire lane in a single pass.

b. Asphalt Distribution System

- Provide a metered mechanical pressure sprayer on the machine to accurately apply and monitor the rate of application of the modified emulsion.
- Use the target rate of application for the modified emulsion tack coat as specified on the Mix Design.
- Apply the rate uniformly across the entire paving width at a temperature of 140 – 180 °F (60 – 82 °C).
- Apply the material behind the rear tires and in front of the screed unit.
- Use the first 500 linear feet (150 m) of tack application as a test strip to determine the proper rate of application and to establish a uniform rate of coverage. Minor adjustments to these rates may be ordered by the Engineer to fit the physical properties of the existing pavement and aggregates furnished for use.
- Maintain the application rate within $\pm$0.02 gal/yd^2 (0.09 L/m^2) of the rate specified on the Mix Design or approved by the Engineer. At the end of each workday, use the calibrated load cells on the machine to determine the quantities of seal/tack coat used.

3. Tractor Unit

Ensure that the tractor unit meets the following:

- Is equipped with a hydraulic hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher rollers of the finishing machine while the paving mixture is being unloaded.
- No portion of the mass of hauling equipment, other than the connection, is supported by the machine.
- No vibrations or other motions of the loading equipment, which could have a detrimental effect on the riding quality of the completed pavement, are transmitted to the machine.

Ensure that the hauling vehicles that dump material into the finishing machine are capable of being pushed or propelled by the finishing machine so that the desired lines and grades can be achieved without resorting to hand finishing. Hand finishing is not permitted.

4. Compaction Equipment

The compaction equipment must be in good mechanical condition and capable of compacting the mixture to the required density. Obtain the Engineer's approval for the number, type, size, operation, and condition of the compaction equipment.

5. Straightedges and Templates

   Provide acceptable 10 ft (3 m) straightedges as directed by the Engineer for surface testing.

404.3.03 Preparation

A. Prepare Existing Surface

Prepare the existing surface as follows:

1. Clean the Existing Surface.

   Before applying hot mix asphaltic concrete pavement, clean the existing surface to the Engineer's satisfaction.

2. Patch and Repair Minor Defects

   Repair all spalls as directed by the Engineer

B. Apply Bituminous Tack Coat

Apply the modified emulsion tack coat to the entire area to be paved. When spall repairs are being covered, give the surface of the spall repair a uniform application of modified emulsion tack coat using asphaltic materials of this specification approximately two seconds prior to placement of the paving mixture. Apply the modified emulsion tack coat using the paving machine asphalt distributor. Apply the tack coat at the rate specified in the job mix formula and within the limitations shown in Table 3.

Table 3
Application Rates for Bituminous Tack Coat – Gal/yd^2 (L/m^2)

Type Application	Minimum	Maximum
Paver-Laid Surface Treatment	0.l5 (0.68)	0.25 (1.13)

Maintain the application rate within ± 0.02 gal/yd^2 (± 0.09 L/m^2) of the rate specified on the Mix Design or approved by the Engineer.

Field adjustments to the application rate shown on the Mix Design may be made with the approval of the Engineer.

Use care in applying the emulsion tack coat to prevent splattering of adjacent pavement, curb and gutter and structures during paving operations.

404.3.04 Fabrication

General Provisions 101 through 150.

404.3.05 Construction

Produce, transport, and place the specified materials according to these specifications and as approved by the Engineer. Ensure that the finished surface adheres fully to the underlying surface.

Based upon a visual examination, the Engineer may reject any work due to poor workmanship, raveling, or apparent instability.

A. Observe Composition of Mixtures

Ensure the paving mixture consists of a uniform mixture of aggregates, hot liquid binder, and additives. Obtain approval from the Engineer for the intended mix design and job mix formula.

B. Prepare Bituminous Material

Uniformly heat the bituminous material to the temperature specified in the job mix formula with a tolerance of ± 20 °F (± 10 °C).

C. Prepare the Aggregate

Prepare the aggregate as follows:

1. Heat the aggregate for the mixture, and ensure a mix temperature within the limits of the job mix formula.
2. Do not contaminate the aggregate with fuel during heating.
3. Reduce the absorbed moisture in the aggregate until the asphalt does not separate from the aggregate in the prepared mixture. If this problem occurs, the Engineer will establish a maximum limit for moisture content in the aggregates. When this limit is established, maintain the moisture content below this limit.

D. Prepare the Mixture

Proportion the mixture ingredients as necessary to meet the required job mix formula. Mix until a homogenous mixture is produced.

1. Add Mineral Filler

   When mineral filler is used, introduce it in the proper proportions and as specified in Subsection 400.3.02.B.5, "Mineral Filler Supply System."

2. Add Hydrated Lime

   When hydrated lime is included in the mixture, add it at a rate specified in Section 828 and the job mix formula. Use methods and equipment for adding hydrated lime according to Subsection 400.3.02.B.6, "Hydrated Lime Treatment System."

   Add hydrated lime to the aggregate by using Method A or B as follows:

   Method A—Dry Form—Add hydrated lime in its dry form to the mixture as follows, according to the type of plant:

   a. Batch Type Asphalt Plant: Add hydrated lime to the mixture in the weigh hopper or as approved and directed by the Engineer.

b. Continuous Plant Using Pugmill Mixer: Feed hydrated lime into the hot aggregate before it is introduced into the mixer so that dry mixing is complete before the bituminous material is added.

c. Continuous Plant Using Drier-Drum Mixer: Add hydrated lime so that the lime will not become entrained into the air stream of the drier and so that thorough dry mixing will be complete before the bituminous material is added.

Method B—Lime/Water Slurry—Add the required quantity of hydrated lime (based on dry weight) in lime/water slurry form to the aggregate. This solution consists of lime and water in concentrations as directed by the Engineer.

Equip the plant to blend and maintain the hydrated lime in suspension and to mix it with the aggregates uniformly in the proportions specified.

3. Add Stabilizing Fiber

When stabilizing fiber is included in the mixture, add it at a rate specified in Section 819 and the Job Mix Formula. Introduce it as specified in Subsection 400.3.02.B.8, "Fiber Supply System."

4. Add Gilsonite Modifier

When required, add the Gilsonite modifier to the mixture at a rate such that eight percent by weight of the asphalt cement is replaced by Gilsonite. Use either PG 64-22 or PG 67-22 asphalt cement as specified in Subsection 820.2.01. Provide suitable means to calibrate and check the rate of Gilsonite being added. Introduce Gilsonite modifier by either of the following methods.

a. For batch type plants, incorporate Gilsonite into the pugmill at the beginning of the dry mixing cycle. Increase the dry mix cycle by a minimum of 10 seconds after the Gilsonite is added and prior to introduction of the asphalt cement. For this method, supply Gilsonite in plastic bags to protect the material during shipment and handling and store the modifier in a waterproof environment. The bags shall be capable of being completely melted and uniformly blended into the combined mixture.

Gilsonite may also be added through a mineral filler supply system as described in Subsection 400.3.02.B.5, "Mineral Filler Supply System." The system shall be capable of injecting the modifier into the weigh hopper near the center of the aggregate batching cycle so the material can be accurately weighed.

b. For drum drier plants, add Gilsonite through the recycle ring or through an acceptable means which will introduce the Gilsonite prior to the asphalt cement injection point. The modifier shall be proportionately fed into the drum mixer at the required rate by a proportioning device which shall be accurate within ± 10 percent of the amount required. The entry point shall be away from flames and ensure the Gilsonite will not be caught up in the air stream and exhaust system.

5. Avoid Materials from Different Sources

Do not use mixtures prepared from aggregates from different sources intermittently. This will cause the color of the finished pavement to vary.

E. Observe Weather Limitations

Place the modified emulsion or paving mixture only when the humidity, general weather conditions and moisture condition of the pavement surface, in the opinion of the Engineer, are suitable.

Construction for counties or portions of a county that lie along or above the Fall line, which is an imaginary line that stretches from Augusta to Macon to Columbus, is limited to the period from April 15 through October 15. Construction for counties that lie completely below the Fall line is limited to the period of April 1 through October 31.

Modified emulsion and paving mixture may be placed only when both the pavement surface and the ambient temperature is at least 50 °F (10 °C) and rising, and the air temperature is above 50 °F (10 °C) and rising. Do not place the material when the air temperature is below 60 °F (16 °C) and falling.

Take the air temperature in the shade away from artificial heat. Supply a surface temperature thermometer for the work.

F. Perform Spreading and Finishing

Spread and finish the course as follows:

- Apply the paving mixture at a temperature within $\pm$ 20 °F ($\pm$ 11 °C) of the job mix formula.
- Dump the paving mixture directly into the specified machine and spread on the modified emulsion surface in such a manner that, when properly compacted, the finished surface will have a minimum thickness of 3/4 inch, be smooth, and of uniform texture and density.
- Operate the paving machine at a speed that is satisfactory to the Engineer and maintains continuity of operations. If, in the opinion of the Engineer, sporadic delivery of the paving mixture adversely affects the quality of the work or unduly lengthens the time the traffic is restricted from full use of the through lanes, cease paving operations and restore traffic fully to the through lanes until consistent delivery of the paving mixture can be provided.

G. Continuity of Operations

Coordinate plant production, transportation, and paving operations so that a uniform continuity of operation is maintained. If spreading operations are interrupted, the Engineer may require that a transverse joint be constructed any time the mixture immediately behind the paver screed cools to less than 250 °F (121 °C).

H. Thickness of Layers

Control the rate of spread per Lot within plus 10, minus 5 lbs/yd^2 (plus 5.4, minus 2.7 kg/m^2) of the designated rate of spread. These spread rate tolerances are provided to allow normal variations within a given Lot. Continuous operation at a spread rate other than specified will not be allowed.

I. Compaction

Immediately following placement of the paving mixture, roll the surface with a tandem or three-wheel static roller weighing a minimum of 10 tons (9 Mg).

A minimum of three passes will be required unless otherwise directed by the Engineer. Ensure these passes are accomplished prior to the paving mixture cooling to less than 240 °F (115° C) and that the speed and motion of the rollers avoid displacement of the paving mixture. If any displacement occurs, correct it to the satisfaction of the Engineer.

To prevent adhesion of the paving mixture to the roller, keep the wheels thoroughly moistened with a soap-water solution. Take the necessary precautions to prevent the dropping of diesel fuel, gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing.

404.3.06 Quality Acceptance

A. Acceptance Plans

1. Contractor Accreditation of Materials Sampling and Testing of Paver-Laid Surface Treatment

   a. General

      The Contractor or Contractor's representative will randomly sample and test Paver-Laid Surface Treatment. These test results may be used for acceptance on a lot basis. Failure to comply with the requirements listed herein may subject the plant facility to removal from the List of Aproved Hotmix Asphaltic Concrete Plants (QPL 45).

   b. Determine Lot Amount

      A lot consists of the tons (megagrams) of Paver-Laid Surface Treatment produced and placed each production day. If this production is less than 500 tons (500 Mg), or its square yard (meter) equivalent, production may be incorporated into the next working day. The Engineer may terminate a lot when a pay adjustment is imminent if a plant or materials adjustment resulting in a probable correction has been made.

      If the final day’s production does not constitute a lot, the production may be included in the lot for the previous day’s run; or, the Engineer may treat the production as a separate lot with a corresponding lower number of tests.

   c. Determine Lot Acceptance

      1) Lot acceptance of the mixture will be based upon the mean of the deviations from the Job Mix Formula of the specified number of test results per Lot in accordance with the Mixture Acceptance Schedule. This mean will be determined by averaging the actual numeric value of the individual deviations from the Job Mix Formula, disregarding whether the deviations are positive or negative amounts. Use Table 5 to determine acceptance of all Paver-Laid Surface Treatment mixes.

      2) The samples for Lot acceptance of the mixture will be taken randomly in accordance with GDT 73. In the event less than the specified number of samples are taken, take at least two representative 6 in (150 mm) cores from the roadway for each portion of mix that was not sampled. Acceptance will be based on the mean of the deviations from the Job Mix Formula of the total number of tests run, using the appropriate column in the Mixture Acceptance Schedule.

3) When any one of the Pay Factors for a specific acceptance Lot is less than 1.0, the payment for the Lot will be determined by multiplying the Contract Unit Price by the appropriate adjusted Pay Factor. When two or more Pay Factors for a specific acceptance Lot are less than 1.0, the adjusted payment will be determined by multiplying the Contract Unit Price by the lowest Pay Factor.

4) If the mean of the deviations from the Job Mix Formula of the Lot Acceptance tests for a particular sieve or for asphalt cement content exceeds the tolerances established in the appropriate Mixture Acceptance Schedule and if the Engineer determines that the material need not be removed and replaced, the Lot may be accepted at an adjusted Unit Price as determined by the Engineer. If the Engineer determines that the material is not acceptable to leave in place, the materials shall be removed and replaced at the Contractor's expense.

5) The Pay Factor will be determined using the mean of the deviations from the Job Mix Formula of the individual tests in each Lot and applied to the digital printout table in the Mixture Acceptance Schedule. Do not include any test results for materials not used in the Work in the calculations for Lot Acceptance.

6) Any Pay Factor adjustment will be based on control sieves and asphalt cement content. The control sieves used in the Mixture Acceptance Schedule for the various types of mix are as indicated in Table 4, below:

Table 4
Control Sieves

Mix Type	Mixture Control
Type A	No. 4 (4.75 mm), No. 8 (2.36 mm) Sieves and Asphalt Cement
Type B	No. 4 (4.75 mm), No. 8 (2.36 mm) Sieves and Asphalt Cement
Type C	3/8 in (9.5 mm), No. 8 (2.36 mm) Sieves and Asphalt Cement

7) On contracts involving 1000 tons (1000 Mg) or less of Asphaltic Concrete of all types, the mixture will be accepted for 100 percent payment of the Concrete Unit Price provided it meets the minimum requirements for a 1.00 Pay Factor for Asphalt Cement Content and a 0.90 Pay Factor for gradation in Table 5.

8) If the material placed on contracts involving 1000 tons (1000 Mg) or less of Asphaltic Concrete of all type fails to meet the above requirements, it will be paid for using the applicable Acceptance Schedule.

2. Provide Quality Control Program

This quality control program allows the Department to accept the contractor's quality control tests as Acceptance Tests for Paver-Laid Surface Treatment mixtures.

Provide a Quality Control Program as established in SOP 27 which includes:

- Assignment of quality control responsibilities to specifically named individuals who have been certified by the Office of Materials and Research.
- Provisions for prompt implementation of control and corrective measures.
- Provisions for communication with Project Manager, Bituminous Technical Services Engineer, and Testing Management Operations Supervisor at all times. Provide at least one day's notice before beginning production, or before resuming production if operations have been temporarily suspended.
- Provisions for reporting all test results daily through the Office of Materials and Research computer Bulletin Board Service the test results for extractions, lime checks and stripping tests. Other checks, calibrations and records will be reported on a form developed by the Contractor and will be included as part of the project records.
- Notification in writing of any change in quality control personnel

3. Certification Requirements
   a. Use laboratory and testing equipment certified by the Department. (Laboratories which participate in and maintain AASHTO accreditation for testing asphaltic concrete mixtures will be acceptable in lieu of Departmental certification).
   b. Provide quality control personnel that have been certified by the Office of Materials and Research to perform the sampling and testing. A Quality Control Technician (QCT) may be certified at two levels:
      - Level 1 – must demonstrate they are competent in performing the process control and acceptance tests and procedures related to hot mix asphalt production.
      - Level 2 – must meet Level 1 requirements and must be capable of and responsible for making process control adjustments.
   c. Technician certification is valid for 3 years from the date on the technician’s certificate unless revoked or suspended. Eligible technicians may become certified through special training and testing approved by the Office of Materials and Research. The Technician may become re-certified up to 6 months before the expiration date of the current certification.

TABLE 5
Mixture Acceptance Schedule
Asphalt Cement Content and Aggregate Gradation for
Paver-Laid Surface Treatment Mixes

Mixture Characteristics	Pay Factor	Mean Of The Deviations From The Job Mix Formula							
		1 Test	2 Tests	3 Tests	4 Tests	5 Tests	6 Tests	7 Tests	8 Tests
Asphalt Cement Content (Extraction, Ignition)	1.00	0.00 - 0.70	0.00 - 0.54	0.00 - 0.46	0.00 - 0.41	0.00 - 0.38	0.00 - 0.35	0.00 - 0.32	0.00 - 0.30
	0.95	0.71 - 0.80	0.55 - 0.61	0.47 - 0.52	0.42 - 0.46	0.39 - 0.43	0.36 - 0.39	0.33 - 0.36	0.31 - 0.34
	0.90	0.81 - 0.90	0.62 - 0.68	0.53 - 0.58	0.47 - 0.51	0.44 - 0.47	0.40 - 0.45	0.37 - 0.40	0.36 - 0.37
	0.80	0.91 - 1.00	0.69 - 0.75	0.59 - 0.64	0.52 - 0.56	0.48 - 0.52	0.44 - 0.47	0.41 - 0.44	0.38 - 0.41
	0.70	1.01 - 1.19	0.76 - 0.82	0.65 - 0.69	0.57 - 0.61	0.53 - 0.56	0.48 - 0.51	0.45 - 0.47	0.42 - 0.44
	0.50	1.20 - 1.40	0.83 - 0.85	0.70 - 0.72	0.62 - 0.64	0.57 - 0.59	0.52 - 0.55	0.48 - 0.51	0.45 - 0.48
3/8 in (9.5 mm) Sieve Type C	1.00	0.00 - 9.00	0.00 - 6.60	0.00 - 5.60	0.00 - 5.00	0.00 - 4.60	0.00 - 4.20	0.00 - 3.90	0.00 - 3.60
	0.98	9.10 - 10.0	6.70 - 7.50	5.70 - 6.30	5.10 - 5.60	4.70 - 5.20	4.30 - 4.70	4.00 - 4.40	3.70 - 4.10
	0.95	10.1 - 11.9	7.60 - 8.40	6.40 - 7.00	5.70 - 6.30	5.30 - 5.80	4.80 - 5.30	4.50 - 5.00	4.20 - 4.60
	0.90	12.0 - 13.0	8.50 - 9.30	7.10 - 7.70	6.40 - 6.90	5.90 - 6.30	5.40 - 5.80	5.10 - 5.40	4.70 - 5.00
	0.85	13.1 - 14.0	9.40 - 10.2	7.80 - 8.60	7.00 - 7.60	6.40 - 6.90	5.90 - 6.30	5.50 - 5.90	5.10 - 5.50
	0.80	14.1 - 14.5	10.3 - 10.5	8.70 - 8.90	7.70 - 8.00	7.00 - 7.50	6.40 - 6.80	6.00 - 6.40	5.60 - 6.00
No. 4 (4.75 mm) Sieve Type A, Type B	1.00	0.00 - 9.00	0.00 - 6.70	0.00 - 5.70	0.00 - 5.20	0.00 - 4.80	0.00 - 4.40	0.00 - 4.10	0.00 - 3.80
	0.98	9.10 - 10.0	6.80 - 7.60	5.80 - 6.30	5.30 - 5.80	4.90 - 5.40	4.50 - 4.90	4.20 - 4.60	3.90 - 4.30
	0.95	10.1 - 11.9	7.70 - 8.50	6.40 - 6.90	5.90 - 6.40	5.50 - 5.90	5.00 - 5.40	4.70 - 5.00	4.40 - 4.70
	0.90	12.0 - 13.0	8.60 - 9.40	7.00 - 7.50	6.50 - 7.00	6.00 - 6.50	5.50 - 5.90	5.10 - 5.50	4.80 - 5.10
	0.85	13.1 - 14.0	9.50 - 10.2	7.60 - 8.00	7.10 - 7.60	6.60 - 7.00	6.00 - 6.40	5.60 - 5.90	5.20 - 5.50
	0.80	14.1 - 14.5	10.3 - 10.5	8.10 - 8.30	7.70 - 8.00	7.10 - 7.50	6.50 - 6.90	6.00 - 6.40	5.60 - 5.90
No. 8 (2.36 mm) Sieve (All mixes)	1.00	0.00 - 7.00	0.00 - 5.60	0.00 - 4.80	0.00 - 4.30	0.00 - 4.00	0.00 - 3.60	0.00 - 3.40	0.00 - 3.20
	0.98	7.10 - 8.00	5.70 - 6.30	4.90 - 5.40	4.40 - 4.80	4.10 - 4.50	3.70 - 4.10	3.50 - 3.80	3.30 - 3.60
	0.95	8.10 - 9.00	6.40 - 7.00	5.50 - 6.00	4.90 - 5.30	4.60 - 4.90	4.20 - 4.50	3.90 - 4.20	3.70 - 3.90
	0.90	9.10 - 10.9	7.10 - 7.70	6.10 - 6.60	5.40 - 5.80	5.00 - 5.40	4.60 - 4.90	4.30 - 4.60	4.00 - 4.30
	0.85	11.0 - 12.0	7.80 - 8.50	6.70 - 7.20	5.90 - 6.40	5.50 - 5.80	5.00 - 5.30	4.70 - 5.00	4.40 - 4.60
	0.75	12.1 - 12.5	8.60 - 8.80	7.30 - 7.50	6.50 - 6.80	5.90 - 6.30	5.40 - 5.70	5.10 - 5.30	4.70 - 4.90

4. Quality Control Management
   a. Designate at least one Level 2 QCT as manager of the quality control operation. The Quality Control Manager shall meet the following requirements:
      - Be accountable for actions of other QCT personnel
      - Ensure that all applicable sampling requirements and frequencies, test procedures, and Standard Operating Procedures are adhered to
      - Ensure that all reports, charts, and other documentation is completed as required

      Quality Control Managers who do not insure that specification requirements, sampling and testing frequencies and requirements, and Standard Operating Procedures are adhered to may have their certification withdrawn.

      Notify the Engineer in writing of any change in Quality Control personnel.
   b. Provide QCT personnel at the plant as follows:
      - If daily production for all mix types is to be greater than 250 tons (megagrams), have a QCT person at the plant at all times during production and shipment of mixture until all required acceptance tests have been completed

- If daily production for all mix types will not be greater than 250 tons (megagrams) a QCT may be responsible for conducting tests at up to two plants, subject to random number sample selection
- Have available at the plant or within immediate contact by phone or radio a Level 2 QCT responsible for making prompt process control adjustments as necessary to correct the mix

c. Sampling, Testing, and Inspection Requirements.

Provide all sample containers, extractants, forms, diaries, and other supplies subject to approval of the Engineer.

Perform daily sampling, testing, and inspection of mixture production that meets the following requirements:

1) Randomly sample mixtures according to GSP 15, and GDT 73 (Method C) and test on a lot basis. Maintain a printed copy of the computer generated random sampling data as a part of the project records.
2) In the event less than the specified number of samples are taken, obtain representative 6 in (150 mm) cores from the roadway at a location where the load not sampled was placed. Take enough cores to ensure minimum sample size requirements are met for each sample needed.
3) Perform sampling, testing, and inspection duties according to GSP 21.
4) Perform extraction or ignition test (GDT 83 or GDT 125) and gradation analysis (GDT 38). If the ignition oven is used, ensure that a printout of the sample weights becomes a part of the Project records.

   For asphalt cement content only, on plants with digital recorders, digital printouts of liquid asphalt cement weights may be substituted in lieu of an extraction test in accordance with the appropriate table in the Mixture Acceptance Schedule. Calculate the asphalt cement content from the ticket representing the mixture tested for gradation. The asphalt cement content calculated from each ticket will be considered a test.
5) Save extracted aggregate and process as follows:
   - Store in properly labeled, suitable containers
   - Secure in a protected environment
   - Store for three working days. If not obtained by the Department, within three days they may be discarded.
6) Maintain a process control flow chart daily for each sieve specified on the job mix formula and including the percent asphalt cement. The flow chart shall include:
   - Allowable ranges based on the Mixture Control Tolerance in Table 1.
   - A graph plot of the deviations from the job mix formula for each test per mix type
7) If Acceptance test results are outside Mixture Control Tolerances specified in Table 1, the Level 2-QCT shall determine if a plant adjustment is needed and immediately run a Process Control

sample. If the Process Control sample is also out of Mixture Control Tolerances, an immediate plant adjustment will be required. Take additional Process Control samples as necessary to assure the corrective action taken was appropriate to control the mix.

8) If two consecutive acceptance samples are out of the Mixture Control Tolerances specified in Table 1, stop production stop immediately. Mixture already in storage which deviates no more than 10% in gradation and no more than 0.7% in asphalt cement content from the Job Mix Formula may be transported to and placed on the project subject to visual inspection and density and smoothness requirements.

9) If a sample of the mixture deviates more than 10% in gradation or more than 0.7% in asphalt cement content from the Job Mix Formula, any mixture remaining in surge bins or silos will be rejected and disposed of at the Contractor's expense.

10) Make a plant correction prior to resuming production. Do not send any mixture to the project before test results of a process control sample meets Mixture Control Tolerances. Reject any mixture produced at initial restarting that does not meet Mixture Control Tolerances

11) Measure the temperature of the mixture and record the results on the load ticket each time a sample is taken. Ensure the respective load ticket is signed by the QCT for each load from which a sample or temperature check is taken.

12) Check the calibration of the hydrated lime system for accuracy a minimum of twice weekly during production and post the results of these calibration checks at the plant for review.

13) Provide records of materials invoices upon request (including asphalt cement, aggregate, hydrated lime, etc.)

d. Comparison Testing and Quality Assurance Program

Periodic comparison testing by the Department will be required of each QCT to monitor consistency of equipment and test procedures. The Department will take independent samples to monitor the Contractor's quality control program. Department samples taken from opposite quarters of material sampled by the Contractor are defined as Comparison samples. Other independent samples taken by the Department from material produced during the same Lot are defined as Quality Assurance samples.

1) Comparison Sampling and Testing

- Retain and label opposite quarters of hot mix samples for Department comparison testing.
- Label and retain the remainder of the material from the sample for referee testing.
- Store the samples in a suitable container in a protected environment.
- Discard these samples only if the Contractor's acceptance test results meet a 1.00 pay factor and the Department does not procure the samples within three working days.

- The Department will test comparison samples on a random basis. Results will be compared to the respective contractor acceptance tests. The maximum allowable tolerance will be as follows:

Table 6
Allowable Percent Tolerance Between
Department and Contractor Acceptance Tests

Sieve Size	Tolerance
1/2 in. (12.5 mm)	4.0%
3/8 in. (9.5 mm)	4.0%
No. 4 (4.75 mm)	3.5%
No. 8 (2.36 mm)	3.0%
No. 200 (75 μm)	2.0%
A.C.	0.5%

- If test comparisons are within these tolerances, continue production. With the Engineer's approval, use the Contractor's tests for acceptance of the lot
- If test comparisons are not within these tolerances, another Departmental technician will test the corresponding referee sample. The results of the referee sample will be compared to the respective contractor and Departmental tests using the tolerance for comparison samples given above.

If referee test results are within the above tolerances when compared to the Contractor acceptance test, use the Contractor's test for acceptance of the affected lot.

If referee test results are not within the above tolerances when compared to the Contractor acceptance test, the Department will review the Contractor's quality control methods and determine if a thorough investigation is needed.

e. Quality Assurance Sampling and Testing

The Department will take samples for the purpose of monitoring the effectiveness of the Contractor's Quality Control Program. These samples may be obtained from the same load as QCT samples were taken or other loads at the plant or roadway. Samples may also be obtained immediately behind the spreader and prior to compaction. The samples will be tested and analyzed by the Department in accordance with standard procedures.

1) Randomly take a minimum of two quality assurance samples from the lesser of five days or five lots of production regardless of mix type or number of projects to assure that the mixture is being adequately controlled and accurately sampled and tested.

2) The maximum tolerance for QA samples as defined above, when compared to the Job Mix Formula, shall be the same as the Mixture Control Tolerances as outlined in Table 1. If test results are not within these tolerances, the Department may take another sample from the respective mix.
3) If test results of the additional sample are within these tolerances, production may continue.
4) If test results of the additional sample are not within these tolerances, the Department will take the following action:
    - Take random samples from throughout the lot as in Subsection 400.3.06.A.3.b.3) and use these test results for acceptance and in calculations for the monthly plant rating. Applicable pay factors will apply and the contractor QCT test results will not be included in pay factor calculations nor in the monthly plant rating.
    - Determine if the Contractor's quality control program is satisfactory and require prompt corrective action by the Contractor if specification requirements are not being met. Failure to take prompt corrective action will be cause for the Engineer to discontinue acceptance of the mix.
    - Determine if the QCT has not followed Departmental procedures specified in GSP 21 or has provided erroneous information. If the QCT has not followed procedures or has provided erroneous information, his or her certification may be withdrawn and the Contractor subject to punitive or legal action.
    - Technicians who lose their certification due to falsification of test data will not be eligible for re-certification in the future unless approved by the State Materials and Research Engineer.
    - In-place material represented by unacceptable tests will be evaluated by cores in accordance with Subsection 404.3.06.C. These samples will be used for acceptance and applicable Pay Factors will apply and the Contractor QCT test results for the respective Lots will not be included in the Pay Factor calculations.

B. Surface Tolerance

1. Acceptance Testing

   Acceptance testing for surface course tolerance will be conducted using the Laser Road Profiler according to GDT 126.

    - This test will be performed only on surface courses and only on the mainline of the roadway and on ramps more than 0.5 mile (800 m) in length. Pavement courses to be overlaid with a friction course are considered surface courses.
    - The acceptance testing of the surface courses will be on individual test sections, normally one mile (1600 m) in length, and performed only when the pavement is cleared of any debris or obstructions deemed hazardous by the Profiler operator.

- When requested by the Engineer, provide traffic control to conduct the smoothness testing at no cost to the Department.
- Other asphalt paving shall be subject to straightedge and visual inspection and correction of irregularities as set forth below.

2. Visual and Straightedge Inspection

   Paving is subject to visual and straightedge inspection during and after construction operations until Final Acceptance. Locate surface irregularities as follows:

   a. Keep a 10 ft (3 m) straightedge near the paving operation to measure surface irregularities on courses. Provide the straightedge and the labor for its use.

   b. Inspect the base, intermediate, and surface course surfaces with the straightedge to detect irregularities.

   c. Correct irregularities that exceed 1/8 in. in 10 ft (3 mm in 3 m) for surface courses.

   d. Mixture or operating techniques will be stopped if irregularities such as rippling, tearing, or pulling occur and the Engineer suspects a continuing equipment problem. Stop the paving operation and correct the problem.

3. Target Surface Smoothness

   Achieve the smoothest possible ride during construction. Do not exceed the target Laser Road Profiler smoothness index as shown in Table 7.

Table 7

Pavement Smoothness Requirements—New Construction

Construction Description	Smoothness Index
Paver-Laid Surface Treatment on Interstates	825
Paver-Laid Surface Treatment on all other State Routes	900

If the target values are not achieved, immediately adjust the operations to meet the target values.

Corrective work is required if the surface smoothness exceeds the Laser Road Profiler smoothness index shown in Table 8.

Table 8

Pavement Smoothness Requirements—Corrective Work

Construction Description	Smoothness Index
Paver-Laid Surface Treatment on Interstates	900
Paver-Laid Surface Treatment on all other State Routes	1025

If surface tolerance deficiencies need correction, obtain the Engineer's approval of the methods and type mix used.

4. Bridge Approach Ride Quality

The following are subject to a ride quality test by the Department for 100 ft. (30 m) of roadway approaching each end of a bridge using the Rainhart Profilograph:

- A state road with 4 lanes or more
- A 2-lane state road with a current traffic count of 2000 vpd or more
- Locations designated on the Plans

All other bridge approaches shall meet the 1/8 in. in 10 ft (3 mm in 3 m) straightedge requirement.

Test ride quality as follows:

a. The Department will determine a profile index value according to test method GDT 78.

b. The Department will average the profile index value from the right and left wheelpath for each 100 ft (30 m) section for each lane. Keep the profile index value under 30.

c. Meet the profile index value for the 100 ft (30 m) section of roadway up to the joint with the approach slab.

d. Schedule the profilograph testing 5 days before needed. Clean and clear obstructions from the test area.

e. Correct the sections that do not meet the ride quality criteria of this Specification. After correction, these sections are subject to retesting with the Rainhart Profilograph. The Engineer will direct the type of correction method, which may include:

- Milling
- Grinding
- Removing and replacing the roadway

No additional compensation will be made for corrective work.

The Department will perform Profilograph testing up to two times on the bridge approaches at no cost to the Contractor. Additional profilograph testing will cost the Contractor $500 per test.

C. Reevaluation of Lots

Reevaluation of Lots and payment will be based on Department evaluations. All costs of these evaluations will be at the Contractor's expense.

1. When lots are reevaluated as shown in Subsection 106.03, "Samples, Tests, Cited Specifications," sampling and testing is according to GDT73. Make requests for reevaluation immediately upon notification of the lot results. The following procedures apply:

a. The Department will take the same number of new tests on cores taken from the same sub-lots. These tests will be combined with the original Lot tests, resulting in 2, 4, 6, or 8 tests.

b. The Department will use the mean of the deviations from the job mix formula for these tests to determine acceptance based on the appropriate column in Table 5.

404.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

404.4 Measurement

Paver-Laid Surface Treatment, which includes the pavement mixture and modified emulsion tack coat, will be measured by the square yard, complete, in-place and accepted. To compute the square yards (meters), use the lengths and widths as specified in Section 109, "Measurement and Payment".

404.4.01 Limits

General Provisions 101 through 150.

404.5 Payment

Paver-Laid Surface Treatment will be paid for at the Contract Unit Price per square yard (meter). Payment is full compensation for furnishing all designs, submittals, materials, equipment, and labor required to place the surface treatment.

Any mix placed in excess of the upper tolerance shown in Subsection 404.3.05.H will not be paid for. If the spread rate is less than the lower tolerance limit, correct the deficient course by overlaying the entire Lot for the full width of the course. The mix used for correcting deficient areas will be paid for at the Contract Unit Price of the course being corrected and will be subject to the Mixture Acceptance Schedule. However, after the deficient course has been corrected, the total rate of spread will be recalculated and all mix in excess of the upper tolerance limit will not be paid for.

Payment will be made under:

Item No. 404	Paver-Laid surface treatment, Type B	Per square yard (meter)

404.5.01 Adjustments

General Provisions 101 through 150.