

SECTION 02511

ASPHALTIC CONCRETE PAVING

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SECTION 02511

ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. Reference Appendix A for Superpavement requirements which, if used, replace this and MDOT Section 401 in their entirety.

1.02 REFERENCES

- A. April 1995 MDOT Standard Specifications, Highways & Bridges, including relevant updates, except as modified herein.
- B. April 1997 MDOT Standard Details, Highways & Bridges.
- C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).
- D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
- E. Hot Mix. Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).
- F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).
- G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.
- H. AASHTO M-226/ASTM D3381 Asphalt Cement
- I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat
- J. AASHTO M-117/ASTM D242 Mineral Filler
- K. AASHTO T-245/ASTM D1559 Marshall Mix Design
- L. Approved and released for construction plans.

1.03 RELATED SECTIONS

- A. Section 02223 - Excavation, Backfilling and Compacting for Pavement
- B. Section 02330 – Subbase and Base Gravel
- C. Section 02520 - Portland Cement Concrete for Site Improvements
- D. Section 02525 - Curbs and Side Walks
- E. Section 02584 - Pavement Markings

1.04 SUBMITTALS

- A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.
- B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and contractor, certifying that materials comply with, or exceed, the requirements herein.
- C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including sta/offset of test.
- D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

1.05 JOB CONDITIONS

- A. Weather Limitations:
 - 1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.
 - 2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.
- B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

- C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

- D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.
- E. Asphalt-Aggregate Mixture: Unless otherwise noted on the Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1000 lbs. with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

Square Sieve	Total Percent Passing	Percent Tolerance
3/4"	100	
1/2"	80-100%	5%
3/8"	65-93%	4%
#8	40-55%	4%
#50	12-27%	2%
#200	0-10%	0%

Percent bitumen by weight of total mix: 5.0 - 8.5.

Air voids: 3-6%

Percent aggregate voids filled with asphalt cement: 70-82%

Allowable variance of percent bitumen by weight of total mix=0.4

2.02 EQUIPMENT

Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Remove loose material from compacted base material surface immediately before applying prime coat.
- B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.
- C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.02 APPLICATIONS

- A. Tack Coat:
 1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.
 2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.
 3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.
 4. Apply at minimum rate of 0.05 gallon per square yard of surface.

5. Allow to dry until at proper condition to receive paving.

3.03 ASPHALTIC CONCRETE PLACEMENT

- A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
 1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.
 2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.
 3. When ambient temperature is higher than 60 degrees F: 275 degrees F.
- B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.
- D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.04 WEATHER AND SEASONAL LIMITATIONS

For weather limitations the State of Maine will be considered to be divided into two paving zones:

- (a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.
- (b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bituminous plant mix for use other than traveled way wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

3.05 ROLLING AND COMPACTION

- A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.06 FIELD QUALITY CONTROL

- A. An Independent Testing Laboratory, selected and paid by Owner, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density, composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design.
- B. Grade Control: Establish and maintain required lines and elevations.
- C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.

- D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface: 1/4"
Wearing Course Surface: 3/16"

- E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.
- F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:
1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.
 2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

- G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.

---END OF SECTION 02511---

APPENDIX A SECTION 401 HOT MIX ASPHALT PAVEMENT

Section 401 of MDOT Standard Specifications and the preceding Asphaltic Concrete section are deleted in their entirety and replaced by the following:

401.01 Description. The Contractor shall furnish and place one or more courses of Superpave Hot Mix Asphalt Pavement (SHMA) on an approved base in accordance with the Contract documents and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established. The Owner will accept this Work under Quality Assurance (QA) provisions, in accordance with these specifications and the requirements of Section 106.

For the purposes of this Section, the Owner shall be defined as the developer or their assigned agent in charge of construction supervision and inspection.

MATERIALS

401.02 Composition of Mixtures. The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. SHMA shall be designed and tested according to AASHTO TP-4. The Contractor shall size, uniformly grade, and combine the aggregate fractions in proportions that provide a mixture meeting the grading requirements of the Job Mix Formula (JMF). The Contractor may use a maximum of 20 percent reclaimed asphalt pavement in any base, binder or shim course, and in any wearing course placed on shoulders (excluding Urban areas).

The Contractor shall submit a JMF for approval. A JMF shall be submitted for testing to a laboratory selected by the Owner for each mixture to be supplied at least 15 calendar days prior to production. The JMF shall establish a single percentage of aggregate passing each required sieve size within the limits shown in Table 1, and shall not cross the restricted zone. The general composition limits given in Table 1 indicate the control points of mixtures permissible under this specification. The JMF shall state the source, gradation, and percentage to be used of each portion of the aggregate, and mineral filler if required. It shall also state the proposed PGAB content, the name and location of the refiner and the supplier for the source of PGAB submitted for approval, and the type of PGAB modification if applicable.

In addition, the Contractor shall provide the following information in the proposed JMF.

- Superpave Stockpile Gradation Summary
- Superpave Design Aggregate Structure Consensus Property Summary
- Superpave Design Aggregate Structure Trial Blend Gradation Plots
- Superpave Trial Blend Results (summary)
- PGAB Specific Gravity and temperature/viscosity charts and Recommended mixing and compaction temperatures from supplier
- Material Safety Data Sheets (MSDS) for PGAB

Table 1: COMPOSITION OF MIXTURES – CONTROL POINTS

SIEVE SIZE	GRADING			
	TYPE 25 mm	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm
	PERCENT BY WEIGHT PASSING – COMBINED AGGREGATE			
37.5 mm	100			
25 mm	90-100	100		
19 mm	-90	90-100	100	
12.5 mm	-	-90	90-100	100
9.5 mm	-	-	-90	90-100
4.75 mm	-	-	-	-90
2.36 mm	15-41	23-49	28-58	32-67
1.18 mm	-	-	-	-
0.60 mm	-	-	-	-
0.30 mm	-	-	-	-
0.075 mm	1-7	2-8	2-10	2-10

SIEVE SIZE	RESTRICTED ZONES			
	TYPE 25 mm	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm
	PERCENT BY WEIGHT PASSING – COMBINED AGGREGATE			
37.5 mm	-	-	-	-
25 mm	-	-	-	-
19 mm	-	-	-	-
12.5 mm	-	-	-	-
9.5 mm	-	-	-	-
4.75 mm	39.5	-	-	-
2.36 mm	26.8-30.8	34.6	39.1	47.2
1.18 mm	18.1-24.1	22.3-28.3	25.6-31.6	31.6-37.6
0.60 mm	13.6-17.6	16.7-20.7	19.1-23.1	23.5-27.5
0.30 mm	11.4	13.7	15.5	18.7
0.075 mm	-	-	-	-

At the time of JMF submittal, the Contractor shall identify and make available the stockpiles of all proposed aggregates at the plant site. The Owner shall obtain samples for laboratory testing. The Contractor shall also make available to the Owner the PGAB proposed for use in the mix in sufficient quantity to test the properties of the asphalt and to produce samples for testing of the mixture. Prior to the start of paving, the Contractor and the Owner shall split a production sample for evaluation. The Contractor shall test its split of the sample and determine if the results meet the requirements of the MDOT's written policy for mix design verification (Available at the Central Lab in Bangor). If the results are found to be acceptable, the Contractor will forward their results to the Owner's laboratory, which will test the Owner's split of the sample. The results of the two split samples will be compared and shared between the Owner and the Contractor. If the Owner finds the mixture acceptable, an approved JMF will be forwarded to the Contractor and paving may commence.

The Contractor shall submit a new JMF for approval each time a change in aggregate source, a significant change in proportions, or a change in PGAB is proposed. The same approval process shall be followed.

TABLE 2 – SUPERPAVE Volumetric Design Criteria

Estimated Traffic, million 80 kN ESALs	%G @N _{initial}	Voids in the Mineral Aggregate (VMA)					Voids Filled With Binder (VFB)		Fines to Effective Binder Ratio (P _{0.075} /P _{be})	
		9.5 mm	12.5 mm	19.0 mm	25.0 mm	37.5 mm	Min.	Max.	Min.	Max.
		Minimum								
<0.3	<91.5	15.0%	14.0%	13.0%	12.0%	11.0%	70	80	0.6	1.2
0.3 to <1.0	<90.5						65	78		
1.0 to <3.0	<89.5						65	78		
3.0 to <10	<89						65	75*		
10 to <30							65	75*		
30 to <100							65	75*		
≥100							65	75*		

*For 9.5 mm nominal maximum aggregate size mixtures, the maximum VFB is 76.

As design criteria, Voids @ N_{des} shall be 4.0%, Voids @ N_{max} shall be ≥ 2.0%

401.03 Aggregates. Fine aggregate, that material passing the 2.36 mm sieve, shall not exceed an absorption of 3.0 percent by weight as determined by AASHTO T84. The composite blend, minus any reclaimed asphalt pavement used, shall have a minimum degradation value of 30 as determined by the Washington State Degradation Test of 1967, or a Micro-Deval value of under 18 as determined by the AASHTO Provisional Standard available from the Owner's Central Lab in Bangor. If the Contractor elects to use the Micro-Deval, it shall be indicated in the proposed JMF.

Aggregates shall also meet the following consensus properties. The Owner reserves the right to sample and test the composite aggregate for any of the following properties at any time.

TABLE 3 – SUPERPAVE Aggregate Consensus Properties Criteria

Estimated Traffic, Million 80 kN ESALs	ASTM D 5821 Coarse Aggregate Angularity (Minimum)		AASHTO TP33 Method A Uncompacted Void Content of Fine Aggregate (Minimum)		ASTM D 4791 (8.4) Flat and Elongated Particles (Maximum)	AASHTO T176 Clay Content/ Sand Equivalent (Minimum)
	Depth from Surface					
	<100mm	>100mm	<100mm	>100mm		
<0.3	60/60	60/60	-	-	-	45
0.3 to <1.0	65/60	60/60	40	-	-	45
1.0 to <3.0	75/60	60/60	40	40	10	45
3.0 to <10	85/80	60/60	45	40	10	45
10 to <30	95/90	80/75	45	40	10	45
30 to <100	100/100	95/90	45	45	10	50
≥ 100	100/100	100/100	45	45	10	50

ASTM D 5821 – “85/80” denotes that 85% of the coarse aggregate has one fractured face and 80% has two fractured faces.

AASHTO TP33 – Criteria are presented as percent air voids in loosely compacted fine aggregate, (U).

ASTM 4791 – Criteria are presented as maximum percent by weight of flat and elongated particles. (5:1 ratio).

401.04 – Vacant

401.05 Temperature Requirements. After the JMF is established, the temperatures of the mixture shall conform to the following tolerances:

In the truck at the mixing plant	$\pm 10^{\circ} \text{ C}^*$
At the Paver	$\pm 10^{\circ} \text{ C}^*$

* If noted in the Quality Control Plan, these may be increased or decreased due to extraordinary considerations, but temperature shall in no case vary by more than 15° C .

The JMF and the mix subsequently produced shall meet the requirements of Tables 2 and 3.

401.06 Performance Graded Asphalt Binder. PGAB shall be as specified in Special Provision 403. The PGAB shall meet the applicable requirements of AASHTO Provisional Standard MP1 – Standard Specifications for PGAB, in accordance with Section 702. The Contractor shall provide the Owner with an approved copy of the Quality Control Plan for PGAB in accordance with AASHTO PP-26.

CONSTRUCTION REQUIREMENTS

401.07 Weather and Seasonal Limitations. The State is divided into 2 paving zones as follows:

- (a) Zone 1. Areas north of U.S. Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.
- (b) Zone 2. Areas south of Zone 1 including the U.S. Route 2 and Route 9 boundaries.

The Contractor may place Hot Mix Asphalt Pavement for use other than a traveled way wearing course in either Zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer (placed in the shade at the paving location) is 2° C or higher and the area to be paved is not frozen. The Contractor may place Hot Mix Asphalt Pavement as traveled way wearing course in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th, provided the air temperature determined as above is 10° C or higher. For the purposes of this Subsection, the traveled way includes truck lanes, ramps, approach roads and auxiliary lanes.

Hot Mix Asphalt Pavement used for curb, driveways, sidewalks, islands, or other incidentals is not subject to seasonal limitations, except that conditions shall be satisfactory for proper handling and finishing of the mixture. Unless otherwise specified, the Contractor shall not place Hot Mix Asphalt Pavement on a wet or frozen surface, and the air temperature shall be 2° C or higher.

401.08 Hot Mix Asphalt Plant.

401.081 General Requirements. Mixing plants shall conform to AASHTO M 156. The mixing plant shall include an efficient dust collecting system to prevent loss of fine material. The material collected may be returned to the mixture at a uniform rate and/or be discarded.

- (a) Truck Scales. When the bituminous mixture is to be weighted on scaled meeting the requirements of Section 109 – Measurement and Payment, the scales shall be inspected and sealed by the State Sealer as often as the Owner deems necessary to verify their accuracy.
- (b) Performance Graded Asphalt Binder. The Contractor shall provide a valve for sampling the bituminous material, located in a circulating feed line connecting the storage tank with the mixing plant or in a line of the storage circulation system. The valve shall be in a readily accessible location offering protection from damage. The Contractor shall maintain this valve in a workable condition and provide a drainage receptacle.

401.083 Automation of Batching. Batch plants shall be automated for weighing, recycling and the monitoring system. In the case of a malfunction of the printing system, the requirements of Subsection 109.013(c) will apply.

The batch plant shall accurately proportion the various materials in the proper order by weight. The entire batching and mixing cycle shall be continuous and shall not require any manual operations. The batch plant shall use auxiliary interlock circuits to trigger an audible alarm whenever an error exceeding the acceptable tolerance occurs. Along with the alarm, the printer shall print an asterisk on the delivery slip in the same row containing the out-of-tolerance weight. The automatic proportioning system shall be capable of consistently delivering material within the full range of batch sizes.

Tolerances are based on the total batch weight of the Hot Mix Asphalt Pavement. The batch plant shall be able to automatically or manually adjust for all desired batch sizes. The first or last bin drawn shall be the sand bin. Allowable tolerances are as follows:

Each aggregate component	± 2.5 percent from the cumulative target, each bin
Last Bin Drawn	± 1.5 percent
Mineral Filler	± 0.5 percent
Performance Graded Asphalt Binder	± .25 percent, -.15 percent
Zero Return (aggr.)	± 0.5 percent
Zero Return (bit. Material)	± 0.1 percent

All plants shall be equipped with an approved digital recording device. The delivery slip load ticket shall contain information required under 1 through 4 of Section 109.01(f), and sections (a) and (b) of 109.012.

401.085 Drum Plant Recordation of Proportions. The plant shall utilize an approved recordation system. In the case of a malfunction of this recordation system, the Contractor may continue production for up to two working days while the system is repaired, after which time production shall cease until repairs are completed. The recorder shall simultaneously record the accumulated weights of the dry aggregates, the mineral filler (if added separately) and the Performance Graded Asphalt Binder, all at 5 minute intervals during production and on demand, unless the Owner approves otherwise. The printed record shall include the actual Performance Graded Asphalt Binder content quantity as a percentage of the total mixture weight. The maximum resolution shall be 90 kg of dry aggregate, 9 kg of mineral filler, 9 kg of Performance Graded Asphalt Binder, and 0.1 percent for Performance Graded Asphalt Binder content. The printout shall indicate the amount of moisture programmed into the moisture compensation by total weight. All printed records shall show the day, month, year, and the time to the nearest minute when the printout was generated. The Contractor shall provide the Owner with a clear and legible copy of the recordings at the end of each day.

401.09 Hauling Equipment. Trucks for hauling Hot Mix Asphalt Pavement shall have tight, clean, smooth metal dump bodies which have been thinly coated with a small amount of lime solution or an approved soap solution or detergent to prevent the mixture from adhering to the bodies.

All truck dump bodies shall have a cover of canvas or other water repellent material capable of heat retention which completely covers the mixture. The cover shall be securely fastened on the loaded truck except when unloading.

All truck bodies shall have an opening on both sides which will accommodate a thermometer stem. The opening shall be located near the midpoint of the body, at least 300 mm above the bed.

401.10 Pavers. Pavers shall be self-contained, self-propelled units with an activated screen (heated if necessary) capable of placing courses of Hot Mix Asphalt Pavement in lane widths on the main line, or shoulder width for shoulders and similar construction.

The Contractor shall place Hot Mix Asphalt Pavement on the main line with a paver using an automatic grade and slope controlled screed, unless otherwise authorized by the Owner. The controls shall automatically adjust the screed and increase or decrease the layer thickness to compensate for irregularities in the preceding course. The controls shall maintain the proper transverse slope and be readily adjustable so that transitions and superelevated curves can be properly paved. The controls shall operate from a fixed or moving reference such as a grade wire or ski type device (floating beam) with a minimum length of 9 M, except that a 12 M ski shall be used on Expressway projects.

The Contractor shall operate the paver at speeds which produce a uniform mat. The paver shall have a receiving hopper with sufficient capacity for a uniform spreading operation and a distribution system to place the

mixture uniformly, without segregation in front of the screed. The screed assembly shall produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screeds shall have auger extensions and tunnel extenders as necessary.

The Contractor shall have the paver at the project site sufficiently before the start of paving operations to be inspected and approved by the Owner. The Contractor shall repair or replace any paver found worn or defective, either before or during placement, to the satisfaction of the Owner.

401.11 Rollers. Rollers shall be static steel, pneumatic tire, or approved vibrator type. Rollers shall be in good mechanical condition, capable of starting and stopping smoothly, and be free from backlash when reversing direction. Rollers shall be equipped and operated in such a way as to prevent the picking up of hot mixed material by the roller surface. Use of rollers which result in crushing of the aggregate or displacement of the mixture will not be permitted. Any Hot Mix Asphalt Pavement that becomes loose, broken, contaminated, shows an excess or deficiency of Performance Graded Asphalt Binder, or is in any other way defective shall be removed and replaced at no additional cost with fresh Hot Mix Asphalt Pavement which shall be immediately compacted to conform with the adjacent area.

The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided specification densities are attained and with the following requirements:

- 1) At least one roller shall be pneumatic-tired on bridges and variable depth courses as well as the first lift of pavement over gravel or a reclaimed pavement or other irregular surface.
- 2) Compaction with a vibratory or steel wheel roller shall precede pneumatic-tired rolling, unless otherwise authorized by the Owner.
- 3) Vibratory rollers shall not be operated in the vibratory mode when checking or cracking of the mat occurs, or on bridge decks.
- 4) Any method which results in cracking or checking of the mat will be discontinued, and corrective action taken.

The maximum operating speed for a steel wheel roller shall not exceed the manufacturer's recommendations.

401.111 Surface Tolerances. The Owner will check surface tolerance with a 4.9 m straightedge or string line placed parallel to the centerline of pavement and with a 3 m straightedge or string line placed transverse to the centerline of pavement. The Contractor shall correct variations exceeding 6 mm by removing defective work and replacing it with new material as directed by the Owner. The Contractor shall furnish a 3 m straightedge for the Owner's use.

401.12 Conditioning of Existing Surface. The Contractor shall thoroughly clean the surface upon which Hot Mix Asphalt Pavement is to be placed of all objectionable material. When the surface of the existing base or pavement is irregular, the Contractor shall bring it to uniform grade and cross section.

401.13 Hot Mix Asphalt Material Documentation. The Contractor and the Owner shall agree on the amount of Hot Mix Asphalt Pavement that has been placed each day.

401.14 Preparation of Aggregates. The Contractor shall dry and heat the aggregates for the mixture to the required temperature. The Contractor shall properly adjust flames to avoid physical damage to the aggregate and to avoid depositing soot on the aggregate.

401.15 Mixing. The Contractor shall combine the dried aggregate in the mixer in the amount of each fraction of aggregate required to meet the JMF. The Contractor shall measure the amount of PGAB and introduce it into the mixer in the amount specified by the JMF.

The Contractor shall produce the mixture at the temperature established by the JMF.

The Contractor shall dry the aggregate sufficiently so that the mixture will not flush, foam excessively, or displace excessively under the action of the rollers. The Contractor shall introduce the aggregate into the mixer at a temperature of not more than 14° C above the temperature at which the viscosity of the bituminous material being used is 0.150 Pas.

The Contractor shall store and introduce into the mixer the Performance Graded Asphalt Binder at a uniformly maintained temperature at which the viscosity of the material is between 0.150 Pas and 0.300 Pas. The aggregate shall be completely and uniformly coated with a thorough distribution of the PGAB. The Contractor shall determine the wet mixing time for each plant and for each type of aggregate used.

401.16 Spreading and Finishing. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the Contractor shall spread, rake, and lute the mixture with hand tools to provide the required compacted thickness.

On the roads opened to two way traffic, the Contractor shall place each course over the full width of the traveled way section being paved that day, unless otherwise approved by the Owner.

401.17 Compaction. Immediately after the Hot Mix Asphalt Pavement has been spread, struck off, and any surface irregularities adjusted, the Contractor shall thoroughly and uniformly compact the mixture by rolling.

The Contractor shall roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving. The Contractor shall prevent adhesion of the mixture to the rollers or vibrating compactors without the use of oil.

The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes to the satisfaction of the Owner. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued.

Along forms, curbs, headers, walls, and other places not accessible to the roller, the Contractor shall thoroughly compact the mixture with mechanical vibrating compactors. The Contractor shall only use hand tamping in areas inaccessible to all other compaction equipment. On depressed areas, the Contractor may use a trench roller or cleated compression strips under a roller to transmit compression to the depressed area.

401.18 Joints. The Contractor shall construct wearing course transverse joints in such a manner that minimum tolerances shown in section 401.111 are met when measured with a straightedge.

The paver shall always maintain a uniform head of material during the joint construction. The bituminous mix shall be free of segregation and meet temperature requirements. Transverse joints of the wearing course shall be straight and neatly trimmed. The Contractor may form a vertical face exposing the full depth of the course by inserting a header, by breaking the bond with the underlying course, or by cutting back with hand tools. The Owner may allow feathered or "lap" joints on lower courses or when matching existing low type pavements.

The Contractor shall apply a coating of emulsified asphalt immediately prior to paving all joints, except those formed by pavers operating in echelon. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Owner may approve application by a brush for small surfaces, or in the event of a malfunction of the spray apparatus, but for a period of not more than one working day.

Where pavement under this Contract joins an existing pavement of when the Owner directs, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Owner will not permit broken or raveled edges. The cost of all work necessary for the preparation of joints is incidental to related Contract items.

401.19 Quality Control Method A & B.

The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of 106.031 and these Special Provisions. The Contractor shall not begin paving operations until the QCP is approved in writing by the Owner.

Prior to placing any mix, the Owner and the Contractor shall hold a Pre-paving conference to discuss the paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of

mix supply, and traffic control. All field and plant supervisors including the responsible onsite paving supervisor shall attend this meeting.

The QCP shall address all elements which affect the quality of the Plant Mix Pavement including, but not limited to, the following:

- (a) JMF(s)
- (b) Hot asphalt mix plant details
- (c) Stockpile Management (to include provisions for a minimum 2 day stockpile)
- (d) Make & type of paver(s)
- (e) Make & type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers
- (f) Name of QCP Administrator, and certification number
- (g) Name of Process Control Technician(s), and certification number(s)
- (h) Name of Quality Control Technician(s), and certification number(s)
- (i) Mixing & transportation including process for ensuring that truck bodies are clean and free of debris or contamination that could adversely affect the finished pavement.
- (j) Frequency of and tests for Quality Control pavement
- (k) Laydown operations including longitudinal joint construction, procedures for avoiding paving in inclement weather, tacking of all joints, methods to ensure that segregation is minimized, procedures to determine the maximum rolling and paving speeds based on best engineering practices as well as past experience in achieving the best possible rideability of the pavement.
- (l) Examples of Quality Control Forms
- (m) Process for compacting paved shoulders and traveled way for method B projects
- (n) Silo management and details (can show storage for use on project of up to 36 hours)
- (o) Provisions for varying mix temperature due to extraordinary conditions.
- (p) Name and responsibilities of the Responsible onsite Paving Supervisor

The QCP shall include the following technicians together with these minimum requirements:

- (a) QCP Administrator – A qualified individual shall administer the QCP. The QCP Administrator must be a full-time employee of or a consultant engaged by the Contractor or paving subcontractor. The QCP Administrator shall have full authority to institute any and all actions necessary for the successful operation of the QCP. The QCP Administrator (or its designee in the QCP Administrator's absence) shall be available to communicate with the Owner at all times. The QCP Administrator shall be certified as a Plant Technician or Paving Technician certified by the New England Transportation Technician Certification Program.

- (b) Process Control Technician(s) (PCT) shall utilize test results and other quality control practices to assure the quality of aggregates and other mix components and control proportioning to meet the JMF(s). The PCT shall periodically inspect all equipment used in mixing to assure it is operating properly and that mixing conforms to the mix design(s) and other Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented and whether more than one PCT is required. The Plan shall include the criteria to be utilized by the PCT to correct or reject unsatisfactory materials. The PCT shall be certified as a Plant Technician by the New England Transportation Certification Program.
- (c) Quality Control Technician(s) (QCT) shall perform and utilize quality control tests at the job site to assure that delivered materials meet the requirements of the JMF(s). The QCT shall inspect all equipment utilized in transporting, laydown, and compacting to assure it is operating properly and that all laydown and compaction conform to the Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented, and whether more than one QCT is required. The QCP shall include the criteria utilized by the QCT to correct or reject unsatisfactory materials. The QCT shall be certified as a Paving Technician by the New England Transportation Technician Certification Program.

The QCP shall detail the coordination of the activities of the Plan Administrator, the PCT and the QCT. The project Superintendent shall be named in the QCP, and his responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with the following minimum frequencies:

Table 4: MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Temperature of mix	6 per day at street and plant	-
Temperature of Mat	4 per day	-
% TMD (Surface)	1 per 150 Mg	ASTM D-2950*
% TMD (Base)	1 per 600 Mg	AASHTO T-166
Fines/Effective Binder	1 per 1200 Mg	AASHTO TP-4
Gradation	1 per 600 Mg	AASHTO T-30
PGAB content	1 per 600 Mg	AASHTO T-164, T-287 or TP 53
Voids at N_{design}	1 per 600 Mg	AASHTO TP-4
Voids in Mineral Aggregate at N_{design}	1 per 600 Mg	AASHTO TP-4
Rice Specific Gravity	1 per 600 Mg	AASHTO T-209
Coarse Aggregate Angularity	1 per 6000 Mg	ASTM D 5821
Flat and Elongated Particles	1 per 6000 Mg	ASTM D-4791
Fine Aggregate Angularity	1 per 6000 Mg	AASHTO TP33

* May be modified according to the MDOT's policy on file at the Central Lab in Bangor.

The Contractor may utilize innovative equipment or techniques not addressed by the Contract documents to produce or monitor the production of the mix, subject to approval by the Owner.

The Contractor shall record all Hot Mix Asphalt Pavement plant test results in writing, signed by the appropriate technician and present them to the Owner by 10:00 AM on the next working day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make density test results, including randomly sampled densities, available to, and summaries of each day's results shall be recorded and signed by the QCT and presented to the Owner by 10:00 AM the next working day.

The Contractor shall have a testing lab at the plant site, equipped with all testing equipment necessary to complete the tests in Table 4. The Contractor shall locate an approved SHRP Gyrotory Compactor at the plant testing lab or within 30 minutes of the plant site.

The Contractor shall fill all holes in the pavement resulting from cutting cores by the Contractor or the Owner with an acceptable mixture no later than the following working day. Before filling, the Contractor shall carefully clean the holes and apply a coating of emulsified asphalt. On surface courses, cores shall not be cut except for calibration of the Nuclear Density Gauge, or as directed by QA testing by the Owner. On a daily basis, the Contractor shall perform nuclear density testing across the mat being placed, at 300 mm intervals. If the values vary by more than 2.0% from the mean, the Contractor shall make adjustments until the inconsistencies are remedied.

The Contractor shall monitor plant production using control charts as specified in Section 106. If plotted test results indicate a production problem, the Contractor shall notify the Owner and take corrective action acceptable to the Owner. The Contractor shall keep control charts up to date and available for review by the Owner at any time.

The Contractor may construct a pavement test strip on a given project at the option of the Contractor for each individual JMF. Prior to test strip placement the Contractor shall deliver a written notice to the Owner notifying that a test strip will be scheduled. Prior to placement of the test strip, a passing verification test is required.

The test strip shall not exceed 800 M. The quantity of Hot Mix Asphalt produced for the test strip shall not exceed 700 MG, 4 hours production, or 4% of the total quantity for the project, as determined by the Owner.

The test strip is intended to allow the Contractor to establish rolling patterns to achieve optimum density for the mat being laid. The Owner will not test the first third of the mat, allowing the plant to "balance itself". The Owner will calibrate thin lift densometers against cut cores. For surface mixes, the Owner will select 3 test sites and take 4 shots at each site. For base and binder mixes, 3 cores shall be run for density verification. The Contractor shall not commence full production until the calibrations are complete and the test strip has attained its minimum values for percent voids and percent TMD.

Should the test strip fail to meet an average density of 89% or greater (minimum of 3 tests, maximum of 7 including re-tests) or should the volumetrics, based on QC results, be outside of the 3-6% range, the Owner will reject the test strip. The Contractor shall remove and replace rejected test strips at their expense. The test strip shall be considered part of the project pavement and no separate payment will be made.

The Contractor shall cease paving operations whenever one of the following occurs on a lot in progress:

- (1) The Pay Factor (which will be used for QA purposes only) for VMA, Voids @ N_d , Percent PGAB, composite gradation, VFB, fines to effective binder or density using all available tests is less than 0.90.
- (2) The Coarse Aggregate Angularity or Fine Aggregate Angularity value falls below the requirements of Table 3 for the design traffic level.
- (3) The first 2 control tests for the lot fall outside the upper or lower limits.
- (4) The Flat and Elongated Particles value exceeds 10 percent by ASTM D-4791.
- (5) There is any visible damage to the aggregate due to over-densification other than on variable depth shim courses.
- (6) The Contractor fails to follow the approved QCP.

Paving operations shall not resume until the Contractor and the Owner determine that material meeting the Contract requirements will be produced. The Owner will consider corrective action acceptable if the Pay Factor for the failing property increases. If the Owner determines that the resumption of production involves a significant change to the production process, the current lot will be terminated and a new lot will begin.

401.20 Quality Assurance.

Method A

This method utilizes Quality Level Analysis and Pay Factor specifications. However, the pay factor shall be utilized to evaluate pavement performance only. Payment for all material and labor to place the payment shall be included in the Lump Sum contract. No separate payment will be made.

For asphalt pavement designated for acceptance under Quality Assurance (QA) provisions, the Owner will sample once per subplot on a statistically random basis, test, and evaluate in accordance with the following Acceptance Criteria:

Table 5: ACCEPTANCE CRITERIA

PROPERTIES	POINT OF SAMPLING	LOT SIZE	SUBLOT SIZE	TEST METHOD
Gradation	Paver Hopper	JMF*	1200 Mg	AASHTO T-30
PGAB Content	Paver Hopper	JMF*	1200 Mg	AASHTO TP-53
% TMD (Surface)	Mat behind all Rollers	JMF*	300 Mg	ASTM-2950/ AASHTO T-166
% TMD (Base or Binder)	Mat behind all Rollers	JMF*	600 Mg	AASHTO T-166
Air Voids at N _d	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Voids in Mineral Aggregate at N _d	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Fines to Effective Binder	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Voids Filled with Binder	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4

* Not to exceed 6,000 Mg, unless an unplanned overrun less than 2400 MG, or agreed to at the Pre-Construction Conference.

On the first day of production the Owner will take 3 random samples which will be used to calculate the quality level of the in-place material in the event the lot is terminated prematurely. Only 1 of the 3 will be for tested, the other 2 will be held onsite until at least 3 random samples have been taken, at which time the other 2 will be discarded.

(a) Lot Size. For purposes of evaluating all acceptance test properties, a lot shall consist of the total quantity represented by each item listed under the lot size heading in the table above. Each lot will be divided into at least 3 sublots, 5 where possible.

(b) Sublot size. The quantity represented by each sample will constitute a subplot. The size of each subplot shall be as listed under the subplot size heading in the table above. If there is insufficient quantity in a lot to make up at least three sublots, then the lot quantity will be divided into three equal sublots.

If there is less than one half of a subplot remaining at the end, then it shall be combined with the previous subplot. If there is more than one half subplot remaining at the end, then it shall constitute the last subplot and shall be represented by test results.

(c) Rejection by Contractor. The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material at no expense to the Owner. The Owner will sample, test, and evaluate any such new material for acceptance. The Owner will review any test results for density below 90%, and areas found to be deficient shall be isolated and 3 random tests taken. If the resultant Pay Factor falls at or below 0.75, the Contractor shall remove and replace the material for the full lane width for a length of no less than 50 Meters at no expense to the Owner.

(d) Acceptance Testing. The Owner will obtain samples of Hot Mix Asphalt Pavement in conformance with AASHTO T168 – Sampling Bituminous Paving Mixtures. The Owner will take the sample randomly within each subplot. Target values shall be as specified in the JMF. The Owner will use the following Table for calculating Pay Factors for gradation, PGAB content, air voids at N_d , VMA, Fines to Effective Binder and VFB.

Table 6: GRADATION, VOLUMETRIC AND ASPHALT CEMENT ACCEPTANCE LIMITS

Property	USL and LSL
Passing 4.75 mm and larger sieves	Target \pm 7 percent
Passing 2.36 mm to 1.18 mm sieves	Target \pm 4 percent
Passing 0.60 mm	Target \pm 3 percent
Passing 0.30 mm to .075 mm sieve	Target \pm 2 percent
PGAB Content	Target \pm 0.4 percent
Air Voids	Target \pm 1.5 percent
Fines to Effective Binder	0.6% to 1.4%
Voids in the Mineral Aggregate	JMF Target \pm 1.5% but not more than 0.5% below the table 2 Min. Value
Voids Filled with Binder	Target \pm 5%

Prior to paving, the Contractor shall determine whether testing of the surface for density QA will be done with cores or the Nuclear Density Gauge. If the Owner tests with the Nuclear Method, then the following table shall apply:

Table 7a: Density Acceptance Limits

	TARGET	LSL	USL
% of Maximum Theoretical Density	94.5	92.0	97.0

The Owner will designate a control section of pavement approximately 150 m long at the start of the paving operations. Within the control section at least three locations will be tested at the same offset at approximately a 2 M spacing to calibrate the nuclear density gauge. After placement of pavement, the Contractor shall cool the pavement to be tested by using ice and promptly cut the necessary calibration cores. After cooling to 20° C, the Contractor shall remove the cores using a core removing tool to assure minimum damage to the core. The Owner will adjust the nuclear density gauge to reflect the average of the cores. The Owner reserves the right to designate a new control section at any time. When nuclear testing is performed at locations outside normal paving and traffic control areas, the Contractor shall furnish a flagger and other necessary safety devices to protect personnel and equipment.

For base of binder courses, or for surface course when the nuclear density gauge is not available and the Owner so directs, the Contractor shall cut cores within 24 hours of placement of the pavement, or by the end of the next working day.

If the Owner tests with the Core Method then the following Table shall apply:

Table 7b: Density Acceptance Limits

	TARGET	LSL	USL
% of Maximum Theoretical Density	95.0	92.5	97.5

The Owner will measure pavement density on the compacted wearing surface using core samples tested according to AASHTO T-166. The Owner will randomly determine core locations. The Contractor shall cut cores at no additional cost to the Owner within 24 hours of placement of the pavement, and immediately give them to the Owner. At the time of sampling, the Contractor and the Owner shall mutually determine if a core is damaged. If it is determined that the core(s) is damaged, the Contractor shall cut new core(s) adjacent to the initial sample. In the Owner's presence, the Contractor may saw-cut the bottom of the core onsite without disturbing the layer being tested to remove lower layers of Hot Mix Asphalt Pavement, gravel, or RAP. No recuts are allowed at a test location after the core has been tested.

The minimum acceptable density for shoulders shall be 90.0% unless waived by the Owner due to local conditions that make densification to this point detrimental to the finished pavement.

Method B

Method B utilizes Product Verification testing to determine the quality of the material incorporated into the project. The Hot Mix Asphalt Pavement (other than that placed outside the traveled way and shoulders) shall meet the material properties in Tables 1 through 3. Aggregates and Mix shall meet the Consensus and Volumetric properties in Table 8 and Section 401.03, Aggregates, utilizing the testing methods and sampling procedures in Table 5.

For the traveled way density will be tested with 3 random cores, and statistically evaluated for Pay Factors with a USL of 98.0% and an LSL of 92.0%. If the resultant Pay Factor is 0.75 or below, the Contractor shall remove and replace the material with mix meeting the specifications at no additional cost to the Owner.

Only the Owner shall be allowed to dispute whether the test results reflect the true quality of the mix.

Unless otherwise noted, the Owner will verify density by inspection to ensure that the proper compaction procedures are complied with. The Owner may test for density to ensure that the Contractor's method attains acceptable results. At any time, the Owner may take samples from the source of production to determine the properties shown in Table 8, Section 401.03, Aggregates, or will verify these properties with test results from another project done during the same time period.

Table 8: GRADATION, VOLUMETRIC AND PGAB CONTENT VERIFICATION LIMITS (METHOD B)

	USL and LSL		
	Mainline	Shoulder	Drives & Sidewalks
Percent Passing 4.75 mm and larger sieves	Target + 7	Target + 7	Target + 7
Percent Passing 2.36 mm to 1.18 mm sieves	Target + 5	Target + 5	Target + 5
Percent Passing 0.60 mm	Target + 4	Target + 4	Target + 4
Percent Passing 0.30 mm to 0.75 mm sieve	Target + 3	Target + 3	Target + 3
PGAB Content	Target ± 0.5	Target ± 0.5	Target ± 0.5
Air Voids	4.0% ± 2.0	4.0% ± 2.0	Not Applicable
Fines to Effective Binder	0.6% to 1.6%	0.6% to 1.6%	Not Applicable
Voids in the Mineral Aggregate	JMF Target ± 1.5%*	JMF Target ± 1.5%*	Not Applicable
Voids Filled with Binder	Target ± 5%	Target ± 5%	Not Applicable

* But not more than 0.5% below the Table 2 Min. Value

For PGAB Content, Gradation, and Volumetric properties on items covered under Method B, the Owner may take 3 or more random samples from the material delivered to the project. The Owner may elect to test one or more of these samples to evaluate the quality of the mix. If there is concern about the quality, the Owner will test 3 or more random samples to determine a Pay Factor for each property using Table 8 USLs and LSLs. The Owner may reject material with a 0.75 pay factor or less. If the PF is less than 1.00 but greater than 0.75, price adjustments may be made accordingly. If the PF is 1.00 or greater the Owner will pay the full contract price.

401.21 Method of Measurement and Payment. All material, equipment and labor required to produce, place and test the asphalt pavement shall be included in the Lump Sum contract except testing by the independent testing laboratory hired by the Owner. No quantity measurement will be made for any pavement placed under this contract.

401.22 Basis of Payment. Payment for all paving activity shall be included in the Project Lump Sum contract price.

This Work shall include all labor, equipment, materials, and incidentals necessary to meet all related Contract requirements, including design of the JMF, implementation of the QCP, obtaining core samples, filling

core holes, applying emulsified asphalt to joints, and providing testing facilities and equipment. Cleaning objectionable material from the pavement and furnishing and applying bituminous material to joints and contact surfaces is incidental.

No separate payment will be made for any pavement work under this Contract.

401.222 Pay Factor (PF) (Method A Only). The Owner will use density, Performance Graded Asphalt Binder content, voids @ N_d , VMA, VFB, F/B^e, and the screen sizes listed below (Table 9) for the type of material represented in the JMF. The Owner will evaluate materials using the following price adjustment factors under Subsection 106.033 for QA purposes only and no additional payment will be based on these calculations.

Table 9: Table of Gradation Composite “f” Factors
(Method A)

Constituent		“f” Factor				
		25 mm	19 mm	12.5 mm	9.5 mm Surface	9.5 mm Other
Gradation	25 mm	4	-	-	-	-
	19 mm		4	-	-	-
	12.5 mm			4	-	-
	9.50 mm				4	4
	2.36 mm	6	6	6	6	6
	1.18 mm					
	0.60 mm	2	2	2	2	2
	0.30 mm	2	2	2	2	2
	0.075 mm	6	6	6	6	6

For each lot of material, the Owner will determine a price adjustment as follows:

Gradation. The Owner will determine a composite pay factor (PF) using applicable price adjustment factors “f” from Table 9 and acceptance limits from Table 6. The Owner will not make price adjustments for gradations, but will monitor them as a shutdown criteria.

VFB and Fines to Effective Binder. The Owner will determine a pay factor (PF) using acceptance limits from Table 6. The Owner will not make price adjustments for VFB or Fines to Effective Binder, but will monitor them as a shutdown criteria.

Density. For mixes having a density requirement, the Owner will determine a Pay Factor using acceptance limits from Table 7a or 7b.

PGAB Content, VMA and Air Voids. For mixes having a Volumetric requirement, the Owner will determine a Pay Factor using acceptance limits from Table 6.

If any single Pay Factor for PGAB Content, VMA, Air Voids or Density falls below 0.75, the Owner will reject the material.

401.223 Process for Dispute Resolution (Method A Only).

The Owner will take a split for each QA test random sample, including mix samples for PGAB content, volumetrics and gradation, and label and store them to allow at least 2 working days for the Contractor to notify the Owner in writing of any disputes. At the time of sampling, the Contractor may also take a split sample of the material.

(a) PGAB content. To contest PGAB content within a subplot the Contractor must run its split of the original sample. If the Contractor tests its split and the results are equal to or greater than the allowable tolerances in Table 10, and notifies the Owner in writing within 2 working days of receiving the QA test results, the Owner will retest for PGAB content by the ignition method. If the re-test result is within the allowable tolerance shown in Table 10, the original test result will be used. If the re-test is equal to or greater than the allowable tolerances from Table 10 the new value will be used to calculate PGAB Content, VMA, VFB and Fines to Effective Binder.

(b) Density. To contest a nuclear density reading within a subplot, 1) the Contractor's nuclear gauge must have been calibrated using the same cores as the QA test gauge, and 2) the QC test must have been taken at the same location, and 3) the difference must have been greater than the tolerance allowed in Table 10. If the difference is greater, the Contractor may request a new reading be taken by the QA Technician within 10 meters at the same offset from centerline. If this result is within Table 10 tolerance, the Owner will use the initial QA test. If the resulting density reading differs more than allowed in Table 10, the Owner will use the second reading. If the difference is less than the tolerance allowed in Table 10, the Owner will use the original reading.

If the Contractor and the Owner believe that the mat being tested may be 5 mm less than the designated thickness or thinner, the Contractor may cut a core in the same location as the original test. If the core is found to be 5 mm or more thinner than the designated thickness, then the Owner will test the core. If the density results exceed the tolerances allowed in Table 10, then the Owner will substitute the core value for the nuclear value. Re-testing may only take place after the area is opened to traffic if approved by the Owner. On any pavement thickness found to be less than 30 mm, the Owner will determine density using the core.

Where the Owner tests for density by the core method, no disputes will be allowed unless based on evidence that the results are inaccurate, as reasonably determined by the Owner.

(c) Volumetric. If the Contractor believes that the Owner's test results vary significantly from the Contractor's results, the Contractor may dispute the Owner's results by testing their split of the original sample. If the Contractor's results vary from the Owner's results by more than the tolerance in Table 10, and the Owner is notified in writing within at least 2 working days of the Contractor receiving QA test results, the Owner will re-test the remaining split of the original sample. If the Owner's re-test is within the allowable tolerance shown in Table 10, the original test shall stand. If the re-test is outside the allowable tolerances from Table 10 but is within the Table 10 tolerance of the Contractor's test, the Owner will use the second value.

When the Contractor has initiated 3 disputes that have not been overturned, further disputes resulting in no change will be paid for by the Contractor at the rates established by the Owner.

Table 10. Dispute Resolution Variance Limits

PGAB Content	± 0.3%*
Density	± 1.0%
Voids @ N _d	± 0.8%
VMA	± 0.8%

* 0.4% will be used if the Contractor uses any method other than TP53.