

DIVISION 400 - PAVEMENTS

SECTION 401 - HOT MIX ASPHALT PAVEMENT

401.01 Description The Contractor shall furnish and place one or more courses of Hot Mix Asphalt Pavement (HMA) on an approved base in accordance with the contract documents and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Resident. The Department will accept this work under Quality Assurance provisions, in accordance with these specifications and the requirements of Section 106 - Quality.

401.02 Materials Materials shall meet the requirements specified in Section 700 - Materials:

Asphalt Cement	702.01
Aggregates for HMA Pavement	703.07
HMA Mixture Composition	703.09
Mineral Filler	703.15

401.03 Composition of Mixtures The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. HMA shall be designed and tested according to AASHTO T312 and the volumetric criteria in Table 1. 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 15% reclaimed asphalt pavement (RAP) in any base, binder, surface, or shim course. The Contractor may be allowed to use more than 15% RAP, up to a maximum of 25% RAP, in a base, binder, or shim course provided that PG 58-34 asphalt binder is used in the mixture.

The Contractor shall submit for Department approval a JMF to the Central Laboratory in Bangor for each mixture to be supplied. The Department may approve 1 active design per nominal maximum size, per traffic level, per plant, plus a 9.5mm “fine” mix @ 50 gyrations for shimming. The Department shall then have 15 calendar days in which to process a new design before approval. The JMF shall establish a single percentage of aggregate passing each required sieve size within the limits shown in Table 1. 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, the supplier, the source of PGAB submitted for approval, the type of PGAB modification if applicable, and the location of the terminal if applicable.

In addition, the Contractor shall provide the following information with the proposed JMF:

- Properly completed JMF indicating all mix properties (Gmm, VMA, VFB, etc.)
- Stockpile Gradation Summary
- Design Aggregate Structure Consensus Property Summary
- Design Aggregate Structure Trial Blend Gradation Plots (0.45 power chart)
- Trial Blend Test Results for at least three different asphalt contents
- Specific Gravity and temperature/viscosity charts for the PGAB to be used

Recommended mixing and compaction temperatures from the PGAB supplier
Material Safety Data Sheets (MSDS) For PGAB
Asphalt Content vs. Air Voids trial blend curve
Test report for Contractor's Verification sample

At the time of JMF submittal, the Contractor shall identify and make available the stockpiles of all proposed aggregates at the plant site. There must be a minimum of 150 Mg [165 ton] for stone stockpiles, 75 Mg [80 ton] for sand stockpiles, and 50 Mg [55 ton] of blend sand before the Department will sample. The Department shall obtain samples for laboratory testing. The Contractor shall also make available to the Department 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. Before the start of paving, the Contractor and the Department 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 Department's written policy for mix design verification (Available at the Central Laboratory in Bangor). If the results are found to be acceptable, the Contractor will forward their results to the Department's Lab, which will test the Department's split of the sample. The results of the two split samples will be compared and shared between the Department and the Contractor. If the Department finds the mixture acceptable, an approved JMF will be forwarded to the Contractor and paving may commence. The first day's production shall be monitored, and the approval may be withdrawn if the mixture exhibits undesirable characteristics such as checking, shoving or displacement. The Contractor shall be allowed to submit aim changes within 24 hours of receipt of the first Acceptance test result. Adjustments will be allowed of up to 2% on the percent passing the 2.36 mm [No. 8] sieve through the 0.075 mm [No. 200] and 3% on the percent passing the 4.75 mm [No. 4] or larger sieves. Adjustments will be allowed on the %PGAB of up to 0.2%. Adjustments will be allowed on GMM of up to 0.010. Pay factors on in-place material shall be based on the original JMF. The revised JMF shall be used for all subsequent mix.

The Contractor shall submit a new JMF for approval each time a change in material source or materials properties is proposed. The same approval process shall be followed. The cold feed percentage of any aggregate may be adjusted up to 10 percentage points from the amount listed on the JMF, however no aggregate listed on the JMF shall be eliminated. The cold feed percentage for RAP may be adjusted up to 5 percentage points from the amount listed on the JMF but shall not exceed the maximum allowable percentage for RAP for the specific application.

TABLE 1: VOLUMETRIC DESIGN CRITERIA

Design ESAL's (Millions)	Required Density (Percent of G _{mm})			Voids in the Mineral Aggregate (VMA)(Minimum Percent)					Voids Filled with Binder (VFB) (Minimum %)	Fines/Eff. Binder Ratio
				Nominal Maximum Aggregate Size (mm)						
	N _{initial}	N _{design}	N _{max}	25 [1 inch]	19 [¾ inch]	12.5 [½ inch]	9.5 [⅝ inch]	4.75 [#4]		
<0.3	≤91.5	96.0	≤98.0	12.0	13.0	14.0	15.0	16.0	70-80	0.6-1.2
0.3 to <3	≤90.5								65-78	
3 to <10	≤89.0								65-75*	
10 to <30										
> 30										

*For 9.5 mm [¾ in] nominal maximum aggregate size mixtures, the maximum VFB is 76.

*For 4.75 mm [#4] nominal maximum aggregate size mixtures, the maximum VFB is 80.

401.04 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	+/-10°C [20°F]
At the Paver	+/-10°C [20°F]

The JMF and the mix subsequently produced shall meet the requirements of Tables 1 and Section 703.07. Under no circumstances will the Department accept HMA (unless the binder has been modified) that has been heated to temperatures over 179°C [340°F].

401.05 Performance Graded Asphalt Binder Unless otherwise noted in Special Provision 403 - Hot Bituminous Pavement, PGAB shall be 64-28, except that for mixtures containing greater than 15% but no more than 25% RAP the PGAB shall be PG 58-34. The PGAB shall meet the applicable requirements of AASHTO M320 - Standard Specification for PGAB. The Contractor shall provide the Department with an approved copy of the Quality Control Plan for PGAB in accordance with AASHTO R 26-01 Certifying Suppliers of PGAB.

401.06 Weather and Seasonal Limitations The State is divided into two paving zones as follows:

- a. Zone 1 Areas north of US 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 US 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 4°C [40°F] 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 [50°F] or higher. For the purposes of this Section, 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 4°C [40°F] or higher.

401.07 Hot Mix Asphalt Plant

401.071 General Requirements HMA plants shall conform to AASHTO M156. The HMA 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 hot mix asphalt is to be weighed on scales meeting the requirements of Section 108 - Payment, the scales shall be inspected and sealed by the State Sealer as often as the Department deems necessary to verify their accuracy.

b. Performance Graded Asphalt Binder The Contractor shall provide a valve for sampling the PGAB, located in a circulating feed line connecting the storage tank with the HMA 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.

c. Plant Scales Plant scales shall meet the following requirements:

Aggregate Scales

Minimum Graduations	= (Batch Size) x 0.0025
Sensitivity	= (Batch Size) x 0.00125
Accuracy	= (Batch Size) x 0.005

Asphalt Scales

Minimum Graduations	= (Batch Size) x 0.0005
Sensitivity	= (Batch Size) x 0.00025
Accuracy	= (Batch Size) x 0.001

Poises shall be designed to lock in any position to prevent unauthorized change of position.

Plant scales shall be checked prior to the start of the paving season. Subsequent check will be made as determined by the Resident. The Contractor will have at least ten 23 kg [50 lb] masses for scale testing.

401.072 Automation of Batching Batch plants shall be automated for weighing, recycling, and monitoring the system. In the case of a malfunction of the printing system, the requirements of Section 401.074 c. of this specification 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. When RAP is being used, the plant must be capable of automatically compensating for the moisture content of the RAP.

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	+/-1.5% from the cumulative target, each bin
Last Bin Drawn	+/-1.5%
Mineral Filler	+/-0.5%
Performance Graded Asphalt Binder	+0.25%, -0.15%
Zero Return (aggregate)	+/-0.5%
Zero Return (bituminous material)	+/-0.1%

All plants shall be equipped with an approved digital recording device. The delivery slip load ticket shall contain information required under Section 108.1.3 - Provisions Relating to Certain Measurements, Mass and paragraphs a, b, and c of Section 401.073

401.073 Automatic Ticket Printer System on Automatic HMA Plant An approved automatic ticket printer system shall be used with all approved automatic HMA plants. The requirements for delivery slips for payment of materials measured by weight, as given in the following Sections, shall be waived: 108.1.3 a., 108.1.3 b., 108.1.3 c., and 108.1.3 d. The automatic printed ticket will be considered as the Weight Certificate.

The requirements of Section 108.1.3 f. - Delivery Slips, shall be met by the weigh slip or ticket, printed by the automatic system, which accompanies each truckload, except for the following changes:

- a. The quantity information required shall be individual weights of each batch or total net weight of each truckload.
- b. Signatures (legible initials acceptable) of Weighmaster (required only in the event of a malfunction below).
- c. The MDOT designation for the JMF.

Automatic HMA plants shall have the scales sealed by the State Sealer of Weights and Measures within a period of 12 months preceding the date of any weighing and after each change of location. The Contractor shall make checks on the accuracy and sensitivity of the aggregate and asphalt plant scales as specified in Section 401.074 in the presence of a representative of the Department, at intervals not exceeding 60 days.

401.074 Weight Checks on Automatic HMA Plant At least twice during each 5 days of production either of the following checks will be performed:

- a. A loaded truck may be intercepted and weighed on a platform scale that has been sealed by the State Sealer of Weights and Measures within the past 12 months. Whenever the discrepancy in net weights is greater than 1.0%, but does not exceed 1.5%, the plant

inspector will notify the producer to take corrective action; payment will still be governed by the printed ticket. The producer will be allowed a period of two days to make any needed repairs to the plant and/or platform scales so that the discrepancy in net weights between the two is less than 1.0%. If the discrepancy exceeds 1.5%, the plant will be allowed to operate as long as payment is determined by truck platform scale net weight. Effective corrective action shall be taken within two working days.

b. Where platform scales are not readily available, a check will be made to verify the accuracy and sensitivity of each scale within the normal weighing range and to assure that the interlocking devices and automatic printer system are functioning properly.

c. In the event of a malfunction of the automatic printer system, production may be continued without the use of platform truck scales for a period not to exceed the next two working days, providing total weights of each batch are recorded on weight tickets and certified by a Licensed Public Weighmaster.

401.08 Hauling Equipment Trucks for hauling Hot Mix Asphalt Pavement shall have tight, clean, and 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 [12 in] above the bed.

401.09 Pavers Pavers shall be a Highway Class, self-contained, self-propelled unit with an activated screed (heated if necessary) capable of placing courses of Hot Mix Asphalt Pavement in full lane widths on the main line, shoulder or similar construction.

On projects with no price adjustment for smoothness, pavers shall be of sufficient class and size to place Hot Mix Asphalt Pavement over the full width of the mainline travel way with a 3000 mm [10 ft] minimum main screed with activated extensions.

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 Department. 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 [30 ft], a non-contact grade control with a minimum span of 8 m [24 ft], except that a 12 m [40 ft] reference shall be used on Expressway projects.

The Contractor shall operate the paver in such a manner as to produce a visually uniform surface texture and a thickness within the requirements of Section 401.101 - Surface Tolerances. 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 Department. The Contractor shall repair or replace any paver found worn or defective, either before or during placement, to the satisfaction of the Department. Pavers that produce an unevenly textured or non-uniform mat will be repaired or replaced before continuing to place HMA on MDOT projects. On a daily basis, the Contractor shall perform nuclear density testing across the mat being placed, at 300 mm [12 in] intervals. If the values vary by more than 2.0% from the mean, the Contractor shall make adjustments until the inconsistencies are remedied.

Failure to replace or repair defective placement equipment may result in a letter of suspension of work and notification of quality control violation resulting in possible monetary penalties as governed by section 106 - Quality

401.10 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. The use of rollers, which result in crushing of the aggregate, or in displacement of the HMA 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 to 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:

- a. At least one roller shall be a 14.5 Mg [16 ton] pneumatic-tired on bridges and variable depth courses as well as the first lift of pavement over gravel, a reclaimed pavement, or other irregular surface. When required by the Resident, the roller shall be ballasted to 18.1 Mg [20 ton].
- b. Compaction with a vibratory or steel wheel roller shall precede pneumatic-tired rolling, unless otherwise authorized by the Department.
- c. Vibratory rollers shall not be operated in the vibratory mode when checking or cracking of the mat occurs, or on bridge decks.

d. 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 or pneumatic roller shall not exceed the manufacturer's recommendations, a copy of which shall be available if requested.

401.101 Surface Tolerances The Department will check surface tolerance with a 4.9 m [16 ft] straightedge or string line placed parallel to the centerline of pavement and with a 3 m [10 ft] straightedge or string line placed transverse to the centerline of pavement. The Contractor shall correct variations exceeding 6 mm [$\frac{1}{4}$ in] by removing defective work and replacing it with new material as directed by the Department. The Contractor shall furnish a 3 m [10 ft] straightedge for the Departments use.

401.11 Preparation 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.

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

401.13 Preparation of Aggregates The Contractor shall dry and heat the aggregates for the HMA 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.

401.14 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 HMA at the temperature established by the JMF.

The Contractor shall dry the aggregate sufficiently so that the HMA 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 [25°F] above the temperature at which the viscosity of the PGAB being used is 0.150 Pa·s [0.1008 Lbm/sec·ft].

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 PGAB is between 0.150 Pa·s [0.1008 Lbm/sec·ft] and 0.300 Pa·s [0.2016 Lbm/sec·ft]. The aggregate shall be coated completely and uniformly 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.

401.15 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 HMA with hand tools to provide the required compacted thickness.

On 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 noted by the Department in Section 403 - Hot Bituminous Pavement.

401.16 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 HMA 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 HMA to the rollers or vibrating compactors without the use of fuel oil or other petroleum based release agents.

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 Department. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued. Any new pavement that shows obvious cracking, checking, or displacement shall be removed and replaced for the full lane width as directed by the Resident at no cost to the Department.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the Contractor shall thoroughly compact the HMA 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.

Any HMA that becomes unacceptable due to cooling, cracking, checking, segregation or deformation as a result of an interruption in mix delivery shall be removed and replaced, with material that meets contract specifications at no cost to the Department.

401.17 Joints The Contractor shall construct wearing course transverse joints in such a manner that minimum tolerances shown in Section 401.101 - Surface Tolerances are met when measured with a straightedge.

The paver shall always maintain a uniform head of HMA during the joint construction. The HMA 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 Department may allow feathered or "lap" joints on lower courses or when matching existing low type pavements.

Longitudinal joints shall be constructed in a manner that will best ensure joint integrity. Methods or activities that prove detrimental to the construction of sound longitudinal joints will be discontinued.

The Contractor shall apply a coating of emulsified asphalt immediately before paving all joints to the vertical face and 75mm [3 in] of the adjacent portion of any pavement being overlaid except those formed by pavers operating in echelon. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Department 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 or when the Department directs, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Department will not permit broken or raveled edges. The cost of all work necessary for the preparation of joints is incidental to related contract pay items.

401.18 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 Section 106.6 - Acceptance and this Section. The Contractor shall not begin paving operations until the Department approves the QCP in writing.

Prior to placing any mix, the Department 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, random sampling, project lots and sublots and traffic control. A copy of the QC random numbers to be used on the project shall be provided to The Resident. The Departments' random numbers for Acceptance testing shall be generated and on file with the Resident and the Project Manager. All field and plant supervisors including the responsible onsite paving supervisor shall attend this meeting.

The QCP shall address any items that affect the quality of the Hot Mix Asphalt Pavement including, but not limited to, the following:

- a. JMF(s)
- b. Hot mix asphalt plant details
- c. Stockpile Management (to include provisions for a minimum 2 day stockpile)
- d. Make and type of paver(s)
- e. Make and 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 Technicians(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. Testing Plan
- k. Laydown operations including longitudinal joint construction, procedures for avoiding paving in inclement weather, type of release agent to be used on trucks tools and rollers, compaction of shoulders, 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 smoothness of the pavement

- l. Examples of Quality Control forms including a daily plant report and a daily paving report
- m. Silo management and details (can show storage for use on project of up to 36 hours)
- n. Provisions for varying mix temperature due to extraordinary conditions
- o. Name and responsibilities of the Responsible onsite Paving Supervisor
- p. Method for calibration/verification of Density Gauge
- q. A note that all testing will be done in accordance with AASHTO and MDOT/ACM procedures
- r. A note detailing conditions under which the percent of RAP will vary from that specified on the JMF.

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 Department at all times. The QCP Administrator shall be certified as a Plant Technician or Paving Inspector certified by the New England Transportation Technician Certification Program (NETTCP).

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 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 NETTCP.

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 Inspector by the NETTCP.

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 the 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 2 : 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 125 Mg [135 ton] (As noted in QC Plan)	ASTM D2950
%TMD (Base)	1 per 250 Mg [275 ton] (As noted in QC Plan)	AASHTO T269
Fines / Effective Binder	1 per 500 Mg [550 ton]	AASHTO T 312
Gradation	1 per 500 Mg [550 ton]	AASHTO T30
PGAB content	1 per 500 Mg [550 ton]	AASHTO T164 or T308
Voids at N_{design}	1 per 500 Mg [550 ton]	AASHTO T 312
Voids in Mineral Aggregate at N_{design}	1 per 500 Mg [550 ton]	AASHTO T 312
Rice Specific Gravity	1 per 500 Mg [550 ton]	AASHTO T209
Coarse Aggregate Angularity	1 per 6000 Mg [6600 ton]	ASTM D5821
Flat and Elongated Particles	1 Per 6000 Mg [6600 ton]	ASTM D4791
Fine Aggregate Angularity	1 Per 6000 Mg [6600 ton]	AASHTO T304

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 Department.

The Contractor shall submit all Hot Mix Asphalt Pavement plant test reports, inspection reports and updated pay factors in writing, signed by the appropriate technician and present them to the Department by 1:00 P.M. on the next working day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall also retain splits of the previous 5 QC tests, with QC results enclosed for random selection and testing by The Department during QA inspections of the HMA production facility. Test results of splits that do not meet the Dispute Resolution Variance Limits in Table 9 shall trigger an investigation by the MDOT Independent Assurance Unit, and may result in that lab losing NETTCP certification and the ability to request a dispute [Section 401.223 - Process for Dispute Resolution (Methods A and B only)].

The Contractor shall make density test results, including randomly sampled densities, available to the Department onsite. Summaries of each day's results, including a daily paving report, shall be recorded and signed by the QCT and presented to the Department by 1:00 p.m. 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 2. The Contractor shall locate an approved SHRP Gyratory 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 Department 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 Verification of the Nuclear Density Gauge, at a rate not to exceed 3 per day or 2 per 1000 Mg [1100 ton] placed.

The Contractor shall monitor plant production using running average of three control charts as specified in Section 106 - Quality. Control limits shall be as noted in Table 3 below.

TABLE 3: Control Limits

Property	UCL and LCL
Passing 4.75 mm [#4] and Nominal Max sieves	Target +/-4.0
Passing 2.36 mm [#8] sieve	Target +/-2.5
Passing .075 mm [#200] sieve	Target +/-1.2
PGAB Content*	Target +/-0.2
Voids in the Mineral Aggregate	JMF Target +/-0.9
% Voids at N_{design}	JMF Target +/-0.9

*Based on AASHTO T 308

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

- a. The Pay Factor for VMA, Voids @ N_d , Percent PGAB, composite gradation, VFB, fines to effective binder or density using all Acceptance or all Quality Control tests for the current lot is less than 0.85.
- b. The Coarse Aggregate Angularity or Fine Aggregate Angularity value falls below the requirements of Table 3: Aggregate Consensus Properties Criteria for the design traffic level.
- c. Each of the first 2 control tests for the lot fall outside the upper or lower limits for VMA, Voids @ N_d , or Percent PGAB. This includes any case where both tests are out on the same, or different properties.
- d. The Flat and Elongated Particles value exceeds 10% by ASTM D4791.
- e. There is any visible damage to the aggregate due to over-densification other than on variable depth shim courses.
- f. The Contractor fails to follow the approved QCP.
- g. The Contractors control chart shows the process to be out of control on any property listed in Table 3: Control Limits.

Paving operations shall not resume until the Contactor and the Department determines that material meeting the Contract requirements will be produced. The Department will consider corrective action acceptable if the pay factor for the failing property increases, based on samples already in transit, or a verification sample is tested and the property falls within the upper and lower specification limits.

The Department retains the exclusive right, with the exception of the first day's production of a new JMF, to determine whether the resumption of production involves a significant change to the production process. If the Department so determines, then the current lot will be terminated, a pay factor established, and a new lot will begin.

401.19 Quality Control Method C For Items covered under Method C, the Contractor shall submit a modified QC Plan detailing, how the mix is to be placed, what equipment is to be used, and what HMA plant is to be used. All mix designs (JMF) shall be approved and verified by MDOT prior to use. Certified QC personnel shall not be required. The Contractor shall certify the mix and the test results for each item by a Certificate of Compliance.

401.20 Acceptance

401.201 Method A This method utilizes Quality Level Analysis and pay factor specifications. For Hot Mix Asphalt Pavement designated for acceptance under Quality Assurance provisions, the Department will sample once per subplot on a statistically random basis, test, and evaluate in accordance with the following Acceptance Criteria:

TABLE 4: ACCEPTANCE CRITERIA

PROPERTIES	POINT OF SAMPLING	LOT SIZE	SUBLOT SIZE	TEST METHOD
Gradation	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T30
PGAB Content	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T308
%TMD (Surface)	Mat behind all Rollers	JMF*	250 Mg ** [275 ton]	AASHTO T269
%TMD (Base or Binder)	Mat behind all Rollers	JMF*	500 Mg ** [550 ton]	AASHTO T269
Air Voids at N _d	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312
%VMA at N _d	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312
Fines to Effective Binder	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312
%VFB	Paver Hopper	JMF*	1000 Mg [1100 ton]	AASHTO T 312

* Not to exceed 6,000 Mg [6,600 ton], unless an unplanned overrun less than 3,000 Mg [3,300 ton], or agreed to at the Pre-Construction Conference.

** Minimum of five tests are required (a minimum of three tests required for a terminated LOT).

On the first day of production in the current calendar year, or the first day of production of a new JMF the Department will take three 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 one of the three will be tested, the other two will be held onsite until at least three random samples have been taken, at which time the other two 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 a minimum of four sublots for mix properties and five sublots for percent TMD.

In the event that the Department decides to terminate a lot prematurely, the samples from the first days production will be used to calculate a volumetric pay factor, and a minimum of three cores will be used for a density pay factor, if applicable, for quantities placed to date.

b. Sublot size The quantity represented by each sample will constitute a sublot. The size of each sublot shall be as listed under the sublot size heading in the table above. If there is insufficient quantity in a lot to make up at least four sublots, then the lot quantity will be divided into four equal sublots for mix properties and five sublots for percent TMD.

If there is less than one-half of a sublot remaining at the end, then it shall be combined with the previous sublot. If there is more than one-half sublot remaining at the end, then it shall constitute the last sublot and shall be represented by test results. If it becomes apparent partway through a Lot that, due to an underrun, there will be insufficient mix quantity to obtain the minimum number of sublots needed, the Resident may adjust the size of the remaining sublots and select new sample locations based on the estimated quantity of material remaining in the Lot.

c. Acceptance Testing The Department will obtain samples of Hot Mix Asphalt Pavement in conformance with AASHTO T168 Sampling Bituminous Paving Mixtures, and the MDOT/ACM Sampling Policy, which will then be transported by the Contractor to the designated MDOT Laboratory, as directed by MDOT in approved transport containers to be provided by the Department, unless otherwise directed by the Resident. The Department will take the sample randomly within each sublot. Target values shall be as specified in the JMF. The Department will use Table 5 for calculating pay factors for gradation, PGAB Content, Air Voids at N_{design} , VMA, Fines to Effective Binder and VFB. Upon conclusion of each lot, where there is a minimum of four sublots, results shall be examined for statistical outliers, as stated in Section 106.7.2 - Statistical Outliers.

d. Isolated Areas During the course of inspection, should it appear that there is an isolated area that is not representative of the lot based on a lack of observed compactive effort, excessive segregation or any other questionable practice, that area may be isolated and tested separately. An area so isolated that has a calculated pay factor below 0.80, based on three random tests shall be removed and replaced at the expense of the Contractor for the full lane width and a length not to be less than 50 m [150 ft].

TABLE 5: METHOD A ACCEPTANCE LIMITS

Property	USL and LSL
Passing 4.75 mm [No. 4] and larger sieves	Target +/-7%
Passing 2.36 mm [No. 8] to 1.18 mm [No. 16] sieves	Target +/-4%
Passing 0.60 mm [No. 30]	Target +/-3%
Passing 0.30 mm [No. 50] to 0.075 mm [No. 200] sieve	Target +/-2%
PGAB Content	Target +/-0.4%
Air Voids	4.0% +/-1.5%
Fines to Effective Binder	0.6 to 1.2
Voids in the Mineral Aggregate	LSL Only from Table 1
Voids Filled with Binder	Table 1 values plus a 4% production tolerance for USL only

e. Pavement Density The Department will measure pavement density using core samples tested according to AASHTO T-166. The Department will randomly determine core locations. The Contractor shall cut 150 mm [6 in] diameter cores at no additional cost to the Department by the end of the working day following the day the pavement is placed, and immediately give them to the Department. The cores will be placed in a transport container provided by the Department and transported by the Contractor to the designated MDOT Lab as directed by the Department. Pre-testing of the cores will not be allowed. At the time of sampling, the Contractor and the Department 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) at the same offset and within 1 m [3 ft] of the initial sample. At the time the core is cut, the Contractor and the Department will mutually determine if saw cutting of the core is needed, and will mark the core at the point where sawing is needed. The core may be saw cut by the Contractor in the Department's presence onsite, or in an MDOT Lab by The Department, 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. Upon conclusion of each lot, density results shall be examined for statistical outliers as stated in Section 106.7.2.

TABLE 6: METHOD A DENSITY ACCEPTANCE LIMITS
75 Gyration or more Design

	TARGET	LSL	USL
Percent of Maximum Theoretical Density	95.0	92.5	97.5

50 Gyration Design

	TARGET	LSL	USL
Percent of Maximum Theoretical Density	95.5	93.0	98.0

Cores for acceptance testing shall be cut such that the nearest edge is never within 0.225 m [9 in] of any joint.

There shall be no bonus for density on shoulders unless otherwise noted in Section 403 - Hot Bituminous Pavement. Density for shoulders shall be obtained by the same rolling train and methods as used on mainline travelway, unless otherwise directed by the Department. Efforts to obtain optimum compaction will not be waived by the Department unless it is apparent during construction that local conditions make densification to this point detrimental to the finished pavement surface course.

401.202 Method B Note: Paragraphs c., d., and e. from Section 401.201 - Method A, also apply to Method B, except that Table 5: Method A Acceptance Limits is replaced by Table 7: Method B and C Acceptance Limits and the results will not be examined for outliers.

This method utilizes Quality Level Analysis and pay factor specifications. Aggregates and mix shall meet the gradation ranges and Volumetric Properties in Table 7: Method B and C

Acceptance Limits, utilizing the testing methods and sampling procedures in Table 4: Acceptance Criteria.

Density testing: Unless waived in Section 403 - Hot Bituminous Pavement, density shall be tested by cutting three 150 mm [6 in] diameter cores at random locations. The cores will be tested and statistically evaluated for pay factors as described in Section 106.7 - Quality Level Analysis, using the density requirements listed in Table 7: Method B and C Acceptance Limits. The Department will pay the Contractor the price calculated as described in Section 401.22 - Basis of Payment.

PGAB Content, Gradation, and Volumetric properties testing: Unless waived in Section 403 - Hot Bituminous Pavement, the Department shall take three random samples. The samples will be tested and statistically evaluated for pay factors as described in Section 106.7 - Quality Level Analysis, using the specification limits shown in Table 7: Method B and C Acceptance Limits. The Department will pay the Contractor the price calculated as described in Section 401.22 - Basis of Payment.

TABLE 7: METHOD B AND C ACCEPTANCE LIMITS

Property	USL and LSL	
	Method B	Method C
Percent Passing 4.75 mm [No. 4] and larger sieves	Target +/-7	Target +/-7
Percent Passing 2.36 mm [No. 8] to 1.18 mm [No. 16] sieves	Target +/-5	Target +/-5
Percent Passing 0.60 mm [No. 30]	Target +/-4	Target +/-4
Percent Passing 0.30 mm [No. 50] to 0.075 mm [No. 200] sieve	Target +/-3	Target +/-3
PGAB Content	Target +/-0.5	Target +/-0.5
Air Voids	4.0% +/-2.0	Not Applicable
Fines to Effective Binder	0.6 to 1.4	Not Applicable
Voids in the Mineral Aggregate	LSL from Table 2	Not Applicable
Voids Filled with Binder	Table 1 plus a 4% production tolerance for USL.	Not Applicable
In-place Density	92.0 to 98.0	92.0 Minimum

401.203 Method C Note: Paragraphs c., d., and e. from Section 401.201 - Method A, also apply to Method C, except that Table 5: Method A Acceptance Limits is replaced by Table 7: Method B and C Acceptance Limits and the results will not be examined for outliers.

For hot mix asphalt items designated as Method C in Section 403 - Hot Bituminous Pavement, one sample will be taken from the paver hopper or the truck body per 250 Mg [275 ton] per pay item. The mix will be tested for gradation and PGAB content. Disputes will not be allowed. If the mix is within the tolerances listed in Table 7: Method B and C Acceptance Limits, Method C the Department will pay the contract unit price. If the test results for each 250 Mg [275 ton] increment are outside these limits, the following deductions (Table 7b) shall

apply to the HMA quantity represented by the test. A second consecutive failing test shall result in cessation of production.

TABLE 7b

PGAB Content	-5%
2.36 mm [#8] sieve	-2%
0.30 mm [#50] sieve	-1%
0.075 mm [#200] sieve	-2%
Density	-10%*

*Only applies when called for in Section 403 - Hot Bituminous Pavement. Contractor shall cut two 150 mm [6 in] cores, which shall be tested for percent TMD per AASHTO T-269. If the average for the two tests falls below 92.0% the disincentive shall apply.

401.21 Method of Measurement The Department will measure Hot Mix Asphalt Pavement by the Mg [megagram] in accordance with Section 108.1 - Measurement of Quantities for Payment.

401.22 Basis of Payment The Department will pay for the work, in place and accepted, in accordance with the applicable sections of this Section, for each type of HMA specified.

The Department will pay for the work specified in Section 401.11, for the HMA used, except that cleaning objectionable material from the pavement and furnishing and applying bituminous material to joints and contact surfaces is incidental.

Payment for this work under the appropriate pay items shall be full compensation for 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, transporting cores and samples, filling core holes, applying emulsified asphalt to joints, and providing testing facilities and equipment.

When work is to be accepted under Method A provisions, the Department will make a pay adjustment for quality above (or below) the minimum acceptable level, as specified below.

When work is to be accepted under Method B provisions, the Department will make a pay adjustment for quality below the minimum acceptable level, as specified below. When work is to be accepted under Method C provisions, the Department will make a pay adjustment for quality below the minimum acceptable level, as specified on Table 7b.

The maximum composite pay factor for mixes evaluated under Method B or C testing shall be 1.00. If price adjustments apply to both Density and Volumetric Properties, they shall be cumulative and they shall be based upon the original Contract unit price.

401.221 Price Adjustment for the Quality of Hot Bituminous Pavement (Methods A & B) The Department will sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with Section 106 - Quality and Section 401.20 - Acceptance, of this Specification.

401.222 Pay Factor (PF) (Methods A and B) The Department will use density, Performance Graded Asphalt Binder content, voids @N_d, VMA, VFB, F/B^e, and the screen sizes listed in Table 8 for the type of HMA represented in the JMF. The Department will evaluate materials using the following price adjustment factors under Section 106.7 - Quality Level Analysis.

The Department will apply price adjustments to the appropriate Hot Mix Asphalt Pavement pay items. Price adjustments shall be applied based on test results for each lot. If any pay factor for any single property (or composite gradation) falls below 0.85, the Contractor shall shut down the HMA plant. If any single pay factor for PGAB Content, VMA, or Air Voids falls below 0.80 for Method A or 0.83 for Method B, the composite pay factor for PGAB Content, VMA, and Air Voids shall be 0.55 for Method A or 0.70 for Method B.

If the pay factor for Density falls below 0.80 for Method A or 0.83 for Method B, all of the cores will be randomly recut by Sublot. A new pay factor will be calculated that combines all initial and retest results. If the resulting pay factor is below 0.80 for Method A or below 0.83 for Method B, the entire Lot shall be removed and replaced with material meeting the specifications at no additional cost to the Department. Pay factors equal to or greater than the reject level will be paid accordingly.

TABLE 8: TABLE OF GRADATION COMPOSITE "F" FACTORS
(Methods A and B)

Constituent		"F" Factor			
		19 mm [¾ inch]	12.5 mm [½ inch]	9.5 mm [⅜ inch]	4.75 mm [#4]
Gradation	25 mm [1 inch]	-	-	-	-
	19 mm [¾ inch]	4	-	-	-
	12.5 mm [½ inch]		4	4	-
	9.50 mm [⅜ inch]				4
	2.36 mm [No. 8]	6	6	6	8
	1.18 mm [No. 16]				
	0.60 mm [No. 30]	2	2	2	2
	0.30 mm [No. 50]	2	2	2	2
	0.075 mm [No. 200]	6	6	6	8

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

Gradation The Department will determine a composite pay factor (CPF) using applicable price adjustment factors "F" from Table 8: Table of Gradation Composite "F" Factors, and acceptance limits from Table 5: Method A Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will not make price adjustments for gradations, but will monitor them as shutdown criteria.

VFB and Fines to Effective Binder The Department will determine a pay factor (PF) using acceptance limits from Table 5: Method A Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will not make price adjustments for VFB or Fines to Effective Binder, but will monitor them as shutdown criteria.

Density For mixes having a density requirement, the Department will determine a pay factor using acceptance limits from Table 6: Method A Density Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will calculate the price adjustment for density as follows:

$$PA = (\text{density PF} - 1.0)(Q)(P) \times 0.50$$

Where

PA = Price Adjustment

Q = Quantity represented by PF in Mg [ton]

P = Contract price per Mg [ton]

PF = Pay Factor

The maximum pay factor for Density shall be 1.025.

PGAB Content, VMA and Air Voids For mixes having a Volumetric Properties requirement, the Department will determine a pay factor using acceptance limits from Table 5: Method A Acceptance Limits, for Method A or Table 7: Method B and C Acceptance Limits, for Method B. The Department will calculate the price adjustment for Volumetric Properties as follows:

$$PA = (\text{voids @ } N_d \text{ PF} - 1.0)(Q)(P) \times 0.20 + (\text{VMA @ } N_d \text{ PF} - 1.0)(Q)(P) \times 0.20 + (\text{PGAB PF} - 1.0)(Q)(P) \times 0.10,$$

Where

PA = Price Adjustment

Q = Quantity represented by PF in Mg [ton]

P = Contract price per Mg [ton]

PF = Pay Factor

The maximum Composite Pay Factor for mixes having only a Volumetric requirement shall be 1.025.

401.223 Process for Dispute Resolution (Methods A & B only)

a. Dispute Resolution sampling At the time of Hot-Mix Asphalt sampling, the Department will obtain a split sample of each Acceptance test random sample for possible dispute resolution testing. The Contractor may also obtain a split sample of the HMA at this same time if The Contractor wishes to retain the option of requesting dispute testing of the initial Acceptance sample. The Department's dispute resolution split sample will be properly labeled and stored for a period of not more than two weeks, or until the sample is tested.

b. Disputing Acceptance results The Contractor may dispute the Department's Acceptance results and request (Method A or Method B) that the dispute resolution split sample be tested by notifying the Department's Resident and the QA Engineer at the Central Laboratory in Bangor in writing within two working days after receiving the results of the Acceptance test. The following shall be provided in the request:

- Acceptance sample reference number
- The specific test result(s) or property(ies) being disputed, and
- The complete, signed report of the Contractor's testing (In a lab certified by the NETTCP and MDOT) of their split of the Acceptance sample indicating that the variances in Table 9: Dispute Resolution Variance Limits, for the specific test result(s) or property(ies) were exceeded.

c. Disputable items The Contractor may dispute any or all of the following test results when the difference between the Department's value and the Contractor's value for that test equals or exceeds the corresponding allowable variation in Table 9: Dispute Resolution Variance Limits, PGAB content, G_{mb} , and G_{mm} . In addition, if the allowable variation for these tests is not met or exceeded, the Contractor may dispute either or both of the following material properties provided the difference between results for them equals or exceeds the corresponding allowable variation in Table 9: Voids at N_{design} , and VMA.

d. Outcome The value of any disputed result or property reported for the initial Acceptance sample shall stand if the value reported for the dispute resolution sample is not closer to the value the Contractor reported for their split sample than to the value reported for the initial Acceptance sample. Otherwise, the value reported for the dispute resolution sample will replace the value reported for the initial Acceptance sample, and will be used to re-calculate any other affected results or properties.

TABLE 9: DISPUTE RESOLUTION VARIANCE LIMITS

PGAB Content	+/-0.4%
G_{mb}	+/-0.030
G_{mm}	+/-0.020
Voids @ N_d	+/-0.8%
VMA	+/-0.8%

SECTION 402 - PAVEMENT SMOOTHNESS

402.01 Pavement Smoothness The final pavement surface shall be evaluated for smoothness using a Class I or Class II profiler as defined by ASTM E950 (94). Smoothness measurements will be expressed in terms of the International Roughness Index (IRI) as defined by the World Bank, in units of meters/kilometer (inches/mile).

402.02 Lot Size Lot size for smoothness will be 1000 lane-meters [3000 lane-feet]. A subplot will consist of 20 lane-meters [50 lane-feet]. Partial lots will be included in the previous lot if less than one-half the size of a normal lot. If greater than one-half the normal lot size, it will be tested as a separate lot.

402.03 Acceptance Testing The Department will conduct Acceptance testing following completion of the surface course. Sections to be excluded from testing include the following:

- Bridge decks and joints (no smoothness measurements will be taken within 60 meters (200 ft) of bridge joints)
- Acceleration and deceleration lanes
- Shoulders and ramps
- Side streets and roads
- Within 60 m [200 ft] of transverse joints at the beginning and end of the project
- Within 60 m [200 ft] of railroad crossings
- Urban areas with speed limits of 30 mph or lower

Each lot shall have 2 measurements made in each wheel path. The average of the 4 measurements will determine the smoothness for that lot.

The smoothness measurements will be statistically evaluated for pay factors as described in Subsection 106.7 - Quality Level Analysis, using the specification limits shown below.

ACCEPTANCE LIMITS	
Roadway Type	USL
Interstate Highways	1.25 m/km (79.15 in/mile)
Other Highways	1.40 m/km (88.65 in/mile)

Computation of Smoothness Pay Adjustment:

$$PA = (PF-1.0)(Q)(P)$$

where:

Q = Quantity of surface course in the Lot (excluding shoulders, side streets, bridge decks, ramps, acceleration and deceleration lanes)

PF = smoothness pay factor for the Lot

P = Contract unit price for surface pavement

PA = pay adjustment

402.04 Unacceptable Work In the event that any Lot is found to have a pay factor less than 0.75, the Contractor shall take whatever remedial action is required to correct the pavement surface in that Lot at no additional expense to the Department. Such remedial action may include but is not limited to removal and replacement of the unacceptable pavement. In the event remedial action is necessary, the Contractor shall submit a written plan to the Resident outlining the scope of the remedial work. The Resident must approve this plan before the remedial work can begin. Following remedial work, the Lot shall be retested, and will be subject to the specification limits listed above. The resulting pay factor, if within the acceptable range, will be used in the final pay adjustment. The Contractor shall pay the cost of retesting the pavement following corrective action.

Localized surface tolerance defects will be subject to the provisions outlined in Section 401.111 Surface Tolerances.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
402.10 Incentive/Disincentive - Pavement Smoothness	Lump Sum

SECTION 403 - HOT BITUMINOUS PAVEMENT

403.01 Description This work shall consist of constructing one or more courses of bituminous pavement on an approved base in accordance with these specifications, and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established.

The bituminous pavement shall be composed of a mixture of aggregate, filler if required, and bituminous material.

403.02 General The materials and their use shall conform to the requirements of Section 401 - Hot Mix Asphalt Pavement.

403.03 Construction The construction requirements shall be as specified in Section 401 - Hot Mix Asphalt Pavement.

In addition, hot bituminous pavement placed on bridges shall also conform to the following requirements.

- a. The mixture shall be placed in courses as specified in the Special Provisions.
- b. The bottom course shall be placed with an approved rubber mounted bituminous paver of such type and operated in such a manner that the membrane waterproofing will not be damaged in any way.
- c. The top course shall not be placed until the bottom course has cooled sufficiently to provide stability.
- d. The Contractor will not be required to cut sample cores from the compacted pavement on the bridge deck.
- e. After the top course has been placed, the shoulder areas shall be sealed 1 m [3 ft] wide with two applications of an emulsified bituminous sealer meeting the requirements of Section 702.12 - Emulsified Bituminous Sealing Compound. The first application shall be pre-mixed with fine, sharp sand, similar to mortar sand, as needed to fill all voids in the mix in the area being sealed. The second application may be applied without sand. The sealer shall be carried to the curb at the gutter line in sufficient quantity to leave a bead or fillet of material at the face of the curb. The area to be sealed shall be clean, dry and the surface shall be at ambient temperature.

- f. The furnishing and applying of the required quantity of sealer for the bridge shoulder areas shall be incidental to placing the hot bituminous pavement.
- g. The atmospheric temperature for all courses on bridge decks shall be 10°C [50°F] or higher.

403.04 Method of Measurement Hot bituminous pavement will be measured as specified in Section 401.21- Method of Measurement.

403.05 Basis of Payment The accepted quantities of hot bituminous pavement will be paid for at the contract unit price per megagram [ton] for the bituminous mixtures, including bituminous material complete in place.

Method A, Method B, and Method C shall be used for acceptance as specified in Section 401 - Hot Mix Asphalt Pavements. (See Complementary Notes, Section 403 - Hot Bituminous Pavement, for Method location).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
403.102 Hot Mix Asphalt Pavement for Special Areas	Megagram [Ton]
403.206 Hot Mix Asphalt, 25 mm Nominal Maximum Size	Megagram [Ton]
403.207 Hot Mix Asphalt, 19.0 mm Nominal Maximum Size	Megagram [Ton]
403.208 Hot Mix Asphalt, 12.5 mm Nominal Maximum Size, Surface	Megagram [Ton]
403.209 Hot Mix Asphalt, 9.5 mm Nominal Maximum Size (sidewalks, drives, islands & incidentals)	Megagram [Ton]
403.210 Hot Mix Asphalt, 9.5 mm Nominal Maximum Size	Megagram [Ton]
403.211 Hot Mix Asphalt (shimming)	Megagram [Ton]
403.212 Hot Mix Asphalt, 4.75 mm Nominal Maximum Size	Megagram [Ton]
403.213 Hot Mix Asphalt, 12.5 mm Nominal Maximum Size, Base	Megagram [Ton]

SECTION 404 - 408 VACANT

SECTION 409 - BITUMINOUS TACK COAT

409.01 Description This work consists of furnishing and applying one application of liquid bituminous material on an approved surface in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established.

409.02 Bituminous Material The type and grade of bituminous material will be specified in the contract.

The bituminous material shall meet the applicable requirements of Section 702 - Bituminous Materials. The bituminous material may be conditionally accepted at the source.

409.04 Weather Limitation Bituminous material shall not be applied on a wet surface, after sunset or before sunrise, or when the atmospheric temperature is below 10°C [50°F] in a shaded area at the job site, or when weather conditions are otherwise unfavorable to proper construction procedures.

409.05 Equipment The Contractor shall provide necessary equipment to properly apply the bituminous material.

The distributor shall be designed, equipped, maintained and operated so that bituminous material at constant temperature may be applied uniformly on variable widths of surface up to 4.5 m [15 ft] at readily determined and controlled rates from 0.05 to 2.0 L/m² [0.01 to 0.5 gal/yd²], with uniform pressure and with an allowable variation from any specified rate not to exceed 0.05 L/m² [0.01 gal/yd²]. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices, or a calibrated tank and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically. Approved fog type nozzles will be required.

All liquid and cement bituminous material bulk delivery vehicles and distributors shall be equipped with an acceptable sampling valve.

On bulk delivery vehicles the valve shall be located in an accessible area in the lower half of the front or rear bulkhead. The valve shall be similarly located on distributors except that it may be installed in a circulating line having a rising flow.

409.06 Preparation of Surface before application of the bituminous tack coat the surface shall be thoroughly cleaned of all loose and objectionable material. Preparation of the surface shall be considered incidental to the contract.

409.07 Application of Bituminous Material Bituminous material shall be applied by a pressure distributor in a uniform, continuous spread over the area to be treated and within the temperature range specified in Section 702.05 - Application Temperatures. The rate of application and areas to be treated will be specified in the contract.

When traffic is maintained, one-way passage of vehicles will be maintained on the untreated portion of the roadway. Bituminous tack coat shall not be placed on any surface where traffic will be forced to travel upon the uncovered tack coat. All tack coat shall be covered on the day it is applied.

Care shall be taken so that the application of the bituminous tack coat at the junction of spreads is not in excess of the specified amount. Skipped areas and deficiencies shall be corrected as directed.

409.08 Method of Measurement Unless otherwise specified, bituminous tack coat will be measured by the liter [gallon]. All quantity determinations will be made in accordance with Section 108 - Payment.

409.09 Basis of Payment The accepted quantity of bituminous tack coat will be paid for at the contract unit price per liter [gallon] for the designated type of material complete in place.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
409.15 Bituminous Tack Coat, Applied	liter [gallon]

SECTION 410 - BITUMINOUS SURFACE TREATMENT

Reserved

SECTION 411 - UNTREATED AGGREGATE SURFACE COURSE

411.01 Description This work shall consist of constructing a surface course or leveling course of untreated aggregate or crushed stone on an approved base in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established.

411.02 Aggregate Aggregates for untreated aggregate surface course shall conform to the requirements of Section 703.10 - Aggregate for Untreated Surface Course and Leveling Course.

Aggregates for crushed stone surface shall conform to the requirements of Section 703.12 - Aggregate for Crushed Stone Surface.

411.03 Placing The surface course material shall be spread evenly in one layer upon the prepared base course to a depth that will insure the required depth after being compacted. The aggregate, when spread, shall be well graded with no pockets of fine or coarse material and shall be bladed and shaped with a power grader.

411.04 Compaction Compacting shall be done with rollers, heavy construction equipment or any combination capable of satisfactorily compacting the course. The Contractor shall maintain the moisture content of the material to attain the required compaction.

When the aggregate surface material lacks sufficient fines to obtain compaction, binder material of an approved quality shall be added. The binder material shall be uniformly incorporated into the surface material by means of harrowing or by other methods capable of obtaining satisfactory results. The amount added shall not increase the total fines in the mixture to exceed the limits specified.

411.05 Surface Tolerance The entire surface shall be shaped and maintained to a tolerance of 10 mm [$\frac{3}{8}$ in] above or 10 mm [$\frac{3}{8}$ in] below the required cross sectional shape.

411.06 Leveling Course When Aggregate Leveling Course for fine grading aggregate base and subbase course is called for, it shall be placed, measured and paid for under the contract item for Untreated Aggregate Surface Course.

411.07 Method of Measurement Untreated aggregate surface course will be measured by the cubic meter [cubic yard] in place unless designated by pay item to be measured by truck measure. When measured in place, the width and thickness for measurement will be the width and thickness of aggregate surface as shown on the plans or as modified. The length will be along the centerline. All measurements will be in accordance with Section 108 - Payment. When designated by pay item to be measured by truck measure, the measurement will be in vehicles at the point of delivery as shown on delivery slips in accordance with Section 108.1.3 f.

Aggregate surface course, designated by pay item to be measured in place and used for driveways and other locations difficult to accurately measure in place, may be measured in vehicles at 80% of the number of cubic meters [cubic yards] accepted and used, at the point of delivery as shown by delivery slips in accordance with Section 108.1.3 f. The quantity so measured shall not exceed 300 m³ [400 yd³] per contract.

Aggregate for crushed stone, surface will be measured by the Mg [ton] in accordance with Section 108 Payment

411.08 Basis of Payment The accepted quantities of untreated aggregate surface course of the type specified will be paid for at the respective contract price per cubic meter [cubic yard]. Payment shall include purchasing material, stripping pits, excavating, crushing and screening when necessary, hauling, placing, compacting and other necessary processes which are required to furnish acceptable material under this item.

Water added or fines added or both added to the material to aid compaction and to prevent raveling will be at the Contractor's expense.

Payment will be made under:

	<u>Pay Item</u>	<u>Pay Unit</u>
411.09	Untreated Aggregate Surface Course	cubic meter [cubic Yard]
411.10	Untreated Aggregate Surface Course, Truck Measure	cubic meter [cubic Yard]
411.12	Crushed Stone Surface	Megagram [Ton]

SECTIONS 412 - 418 VACANT

SECTION 419 - SAWING AND SEALING JOINTS IN BITUMINOUS PAVEMENT

Reserved

SECTION 420 - PORTLAND CEMENT CONCRETE PAVEMENT

Reserved

SECTIONS 421 THROUGH 423 - VACANT

SECTION 424 - CRACK SEAL

Reserved

SECTION 425 - RECYCLED BITUMINOUS PAVEMENT

Reserved

SECTIONS 426 THROUGH 459 - VACANT

SECTION 460 - HOT BITUMINOUS PAVEMENT FOR SPECIAL AREAS

Reserved

SECTION 461 - VACANT

SECTION 462 - MICROSURFACING

Reserved