

## ITEM P-209 CRUSHED AGGREGATE BASE COURSE

### DESCRIPTION

**209-1.1** This item consists of a base course composed of crushed aggregate constructed on a prepared course in accordance with these Specifications and to the dimensions and typical cross-sections shown on the Plans.

### MATERIALS

**209-2.1 CRUSHED AGGREGATE BASE.** Crushed aggregate shall consist of clean, sound, durable particles of crushed stone or crushed gravel and shall be free from excess coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone and gravel that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in Table 209-1.

**TABLE 209-1  
CRUSHED AGGREGATE BASE MATERIAL REQUIREMENTS**

Material Test	Requirement	Standard
<b>Coarse Aggregate</b>		
Resistance to Degradation	Loss: 45% maximum	AASHTO T 96
Soundness of Aggregates by Use of Sodium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate	AASHTO T 104
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 100% with at least one fractured face <sup>1</sup>	ATM 305
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles <sup>2</sup>	ATM 306
Micro-Deval	25% maximum	AASHTO T 327
<b>Fine Aggregate</b>		
Liquid limit	Less than or equal to 25	ATM 204
Plasticity Index	Not more than six (6)	ATM 205

<sup>1</sup> The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

<sup>2</sup> A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

**209-2.2 GRADATION REQUIREMENTS.** The gradation of the final aggregate base material shall meet the requirements of the gradation given in Table 209-2 when tested per ATM 304. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa. Use Gradation D-1 unless specified otherwise.

**TABLE 209-2  
REQUIREMENTS FOR GRADATION OF AGGREGATE**

Sieve Size	Design Range Percentage by Weight passing		Contractor's Final Gradation	Job Control Grading Band Tolerances <sup>1</sup> (Percent)
	C-1	D-1		
1-1/2 inch	100			0
1 inch	70-100	100		±5
3/4 inch	60-90	70-100		±8
3/8 inch	45-75	50-80		±8
No. 4	30-60	35-65		±8
No. 8	22-52	20-50		±8
No. 50 <sup>2</sup>	6-30	6-30		±5
No. 200 <sup>2</sup>	0-5	0-5		±3

<sup>1</sup> The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

<sup>2</sup> The fraction of material passing the No. 200 sieve shall not exceed two-thirds the fraction passing the No. 50 sieve.

**209-2.3 SAMPLING AND TESTING.**

- a. **Aggregate base materials.** The Contractor shall take samples of the aggregate base in accordance with ATM 301 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in Subsection 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.
- b. **Gradation requirements.** The Contractor shall take at least two aggregate base samples per day in the presence of the Engineer to check the final gradation. Sampling shall be per ATM 301. Material shall meet the requirements in Subsection 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the Engineer.

**209-2.4 SEPARATION GEOTEXTILE.** Not Used.

**CONSTRUCTION METHODS**

**209-3.1 CONTROL STRIP.** The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the Engineer, that the materials, equipment, and construction processes meet the requirements of the Specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined.

Control strips that do not meet Specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the Engineer. The Contractor shall use the same equipment, materials, construction methods, and sequence and manner of rolling for the remainder of base course construction, unless adjustments made by the Contractor are approved by the Engineer.

**209-3.2 PREPARING UNDERLYING COURSE.** The underlying subgrade and/or subbase shall be checked and accepted, in writing, by the Engineer before base course placing and spreading operations begin. Any ruts or soft, yielding areas shall be corrected and compacted to the required density before the

base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope, or as directed by the Engineer.

**209-3.3 PRODUCTION.** The aggregate shall be uniformly blended and, when at a satisfactory moisture content according to Subsection 209-3.5, the approved material may be transported directly to the spreading equipment. The plant shall blend and mix the materials to meet the Specifications.

**209-3.4 PLACEMENT.**

The crushed aggregate base material shall be placed on the approved subgrade in uniform, equal-depth layers, each not exceeding 6 inches of compacted depth. The aggregate shall meet gradation and moisture requirements prior to compaction. . Crushed aggregate base course shall not be placed on frozen material.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the Specifications at the Contractor's expense.

**209-3.5 COMPACTION.** Immediately after completion of the spreading operations, and within the same day that the aggregate is placed, compact each layer of the base course to the required density.

The field density of each compacted lift of material shall be at least 98% of the maximum density of laboratory specimens prepared from samples of the crushed aggregate base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ATM 207 or ATM 212. The moisture content of the material during placing operations shall be within  $\pm 2$  percentage points of the optimum moisture content as determined by ATM 207 or ATM 212. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

**209-3.6 WEATHER LIMITATIONS.** Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

**209-3.7 MAINTENANCE.** The base course shall be maintained in a condition that will meet all Specification requirements until the work is accepted. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course to avoid rutting or uneven compaction. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

**209-3.8 SURFACE TOLERANCES.** After the course has been compacted, the surface will be tested by the Engineer for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompact to grade until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

- a. **Smoothness.** The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.
- b. **Grade.** The grade and crown shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

**209-3.9 ACCEPTANCE SAMPLING AND TESTING.** Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yards. Sampling locations will be determined on a random basis according to ATM SP 4.

- a. **Density.** The Engineer will perform all density tests. Base course will be accepted for density when the field density is not less than 98% of the maximum density, as determined according to ATM 207 or ATM 212. The in-place field density and moisture content will be determined according to ATM 213. If the specified density is not attained, the material shall be reworked and/or recompacted until the specified density is reached.
- b. **Thickness.** The thickness of the finished base course will be determined by the Engineer by taking before and after elevation measurements, or by depth tests, at random locations. The completed thickness of the base course shall be within 1/2 inch of the design thickness. Where the thickness is deficient by more than 1/2 inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

### METHOD OF MEASUREMENT

**209-4.1** The quantity of crushed aggregate base course will be determined by the ton or measured by the cubic yard of material in final position according to Subsection 90-02.

### BASIS OF PAYMENT

**209-5.1** Payment shall be made at the contract unit price per unit of measurement, accepted in place.

Payment will be made under:

Item P209.010.0000	Crushed Aggregate Base Course - per cubic yard
Item P209.020.0000	Crushed Aggregate Base Course - per ton
Item P209.030.0000	Crushed Aggregate Base Course Stockpile – per ton
Item P209.070.0000	Base Course Reconditioning – per square yard

### REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AASHTO T 96	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T 104	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
ATM 204	WAQTC FOP for AASHTO T 89 Determining the Liquid Limit of Soils
ATM 205	WAQTC FOP for AASHTO T 90 Determining the Plastic Limit and Plasticity Index of Soils
ATM 207	WAQTC FOP for AASHTO T 99/ T 180 Moisture-Density Relations of Soils
ATM 212	Determining the Standard Density of Coarse Granular Materials Using the Vibratory Compactor
ATM 213	WAQTC FOP for AASHTO T 310 In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*
ATM 301	WAQTC FOP for AASHTO T 2 Sampling of Aggregates

ATM 304	WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates *
ATM 305	WAQTC FOP for AASHTO T 335 Determining the Percentage of Fracture in Coarse Aggregate*
ATM 306	Determining the Percentage of Flat and Elongated Particles in Coarse Aggregate
ATM 317	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
ATM SP 4	Random Sampling

## ITEM P-299 AGGREGATE SURFACE COURSE

### DESCRIPTION

**299-1.1** This item consists of an aggregate surface course composed of crushed or uncrushed coarse aggregate bonded with either soil or fine aggregate or both. It shall be constructed on a prepared course according to these Specifications and to the dimensions and typical cross section shown on the Plans.

### MATERIALS

**299-2.1 GENERAL.** Aggregates shall consist of hard, durable particles or fragments of stone or gravel mixed or blended with sand, stone dust, or other similar binding or filler materials produced from approved sources. The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances. The coarse aggregate shall have a maximum Micro-Deval value of % when tested according to AASHTO T 327. The aggregate shall have a percent of wear not more than 50 at 500 revolutions as determined by AASHTO T 96 and shall not show evidence of disintegration nor show loss greater than 12% when subjected to 5 cycles of sodium sulfate accelerated soundness test using AASHTO T 104.

- a. **Crushed Aggregate Surface Course.** The aggregates shall consist of both fine and coarse fragments of crushed stone or crushed gravel mixed or blended with sand, screenings, or other similar approved materials. The material shall consist of hard, durable particles or fragments of stone and shall be free from excess soft or disintegrated pieces, dirt, or other objectionable matter.

The fractured particles in the finished product shall be as uniform as practicable. At least 75% by weight of material retained on the No. 4 sieve shall have one or more fractured faces, when tested according to ATM 305.

If necessary to meet this requirement, or to eliminate an excess of fine, uncrushed particles, the gravel shall be screened before crushing.

The fine, aggregate portion, defined as the portion passing the No. 4 sieve, produced in crushing operations, shall be incorporated in the base material to the extent permitted by the gradation requirements.

- b. **Uncrushed Aggregate Surface Course.** This material may consist of natural pit-run aggregate. However, screening, blending, ripping, washing, and/or necessary mixing of the material or other processing may be necessary to meet the gradation and performance requirements of this specification.

**299-2.2 GRADATION.** The gradation of the uncrushed or crushed material shall meet the requirements of the gradations indicated in Table 1, when tested according to ATM 304.

**TABLE 1  
AGGREGATE GRADATION REQUIREMENTS**

Sieve Designation(Square Openings)	Percentage by weight passing sieves For E-1
1.0 in.	100
3/4 in.	70-100
3/8 in.	50-85
No. 4	35-65
No. 8	20-50
No. 50	15-30
No. 200	8-15

**Commented [JMW1]:** Note to designer:  
 Use 15% for airports with Maximum Gross Takeoff Weight >12,500 pounds.  
 Use 21% for airports with Maximum Gross Takeoff Weight ≤12,500 pounds.

The specified gradations represent the limits of suitability of aggregate for use from the sources of supply. The final gradations decided on, within the specified limits, shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves, or vice versa.

The portion of the material passing the No. 40 sieve shall have a liquid limit not more than 35 and a plasticity index not more than 10, when tested according to ATM 204 and ATM 205.

**299-2.3 FINES FOR BLENDING.** If additional fine material is necessary, it shall be obtained from approved sources and uniformly blended with the aggregate at the crushing plant, the mixing plant, or as approved by the Engineer. Silt, stone dust, or other similar fine material may be used as binder.

## **CONSTRUCTION METHODS**

### **299-3.1 (RESERVED).**

**299-3.2 PREPARING UNDERLYING COURSE.** The underlying course will be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft areas shall be corrected and compacted to the required density before placing aggregate surface course.

To protect the underlying course and to ensure proper drainage, the spreading of the aggregate surface course shall begin along the centerline on a crowned section or on the high side of sections with a one-way slope.

**299-3.3 METHODS OF PRODUCTION.** The aggregate shall be uniformly blended and when at the satisfactory moisture content per paragraph 299-3.5, the approved material may be transported directly to the spreading equipment.

**299-3.4 PLACING.** The surface course shall be constructed without segregation of the aggregate. The material shall be placed in uniform, equal-depth layers, each not exceeding 6 inches of compacted depth. No material shall be placed in snow or on a soft uncompacted, muddy, or frozen course.

During the mixing and spreading process, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the surface course mixture.

**299-3.5 COMPACTION.** Immediately upon completion of the spreading operations, the aggregate shall be thoroughly compacted to the required density. The moisture content of the material shall be  $\pm 2$  percentage points of the optimum moisture content.

**299-3.6 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY.** The surface course will be accepted for density when the field density is not less than 95% of the maximum density, as determined according to ATM 207, ATM 212, or ATM 309. The control strip for ATM 309 shall be compacted by a vibratory compactor with a minimum operating weight of 22,000 pounds. The in-place field density and moisture content will be determined according to ATM 213. If the specified density is not attained, the material shall be reworked and/or recompacted until the specified density is reached.

**299-3.7 FINISHING.** The surface of the aggregate surface course shall be finished by blading or with automated equipment specifically designed for this purpose.

In no case shall thin layers of material be added to the top of surface course to meet grade. If the compacted elevation of the top layer is 0.05 foot or more below grade, it shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be blended and compacted to bring it to grade. If the finished surface is above plan grade, it shall be cut back to grade and recompacted.

**299-3.8 SURFACE TEST.** After the course has been completely compacted, the surface will be tested by the Engineer for smoothness and accuracy of grade and crown. The finished grade elevation shall not vary more than 0.05 foot from the design elevation. The finished surface shall not vary more than 3/8 inch from a 12-foot straightedge when applied to the surface parallel with, and at right angles to, the centerline. Any

portion lacking the required smoothness or failing in accuracy of grade or crown shall be corrected to within the specified tolerances and approved by the Engineer.

**299-3.9 PROTECTION.** Work on the surface course shall not be accomplished during freezing temperatures or when the subgrade is wet. When the aggregates contain frozen materials or when the underlying course is frozen, the construction shall be stopped.

Hauling equipment may be routed over completed portions of the surface course, provided no damage results and provided that such equipment is routed over the full width of the surface course to avoid rutting or uneven compaction. However, the Engineer in charge will have full and specific authority to stop all hauling over completed or partially completed surface course when, in their opinion, such hauling is causing damage. Any damage resulting to the surface course from routing equipment over the surface course shall be repaired by the Contractor at their own expense.

**299-3.10 MAINTENANCE.** Following the completion of the aggregate surface course, the Contractor shall satisfactorily remove all blue tops, fill and compact the voids, and perform all maintenance work on this surface until final acceptance unless otherwise stated in the Specifications. The surface course shall be properly drained at all times.

### METHOD OF MEASUREMENT

**299-4.1** Aggregate Surface Course will be weighed by the ton or measured by the cubic yard in final position according to GCP Subsection 90-02.

### BASIS OF PAYMENT

**299-5.1** Aggregate Surface Course will be paid for at the contract price, per unit of measurement, accepted in place.

Payment will be made under:

Item P299.010.0000	Crushed Aggregate Surface Course – per cubic yard
Item P299.020.0000	Crushed Aggregate Surface Course – per ton
Item P299.030.0000	Crushed Aggregate Surface Course – per contingent sum
Item P299.040.0000	Uncrushed Aggregate Surface Course – per cubic yard

### TESTING REQUIREMENTS

AASHTO T 96	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T 104	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
ATM 212	WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates *
ATM 304	WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates *
ATM 204	WAQTC FOP for AASHTO T 89 Determining the Liquid Limit of Soils
ATM 205	WAQTC FOP for AASHTO T 90 Determining the Plastic Limit and Plasticity Index of Soils
ATM 207	WAQTC FOP for AASHTO T 99/ T 180 Moisture-Density Relations of Soils*
ATM 213	WAQTC FOP for AASHTO T 310 In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*

ATM 305

WAQTC FOP for AASHTO T 335 Determining the Percentage of Fracture  
in Coarse Aggregate\*

ATM 317

Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-  
Deval Apparatus

## ITEM P-401 ASPHALT MIX PAVEMENT

### DESCRIPTION

**401-1.1 ASPHALT MIX PAVEMENT.** Hot Mix Asphalt (HMA) shall consist of pavement courses composed of mineral aggregate and asphalt binder mixed in a central mixing plant and placed on a prepared base or stabilized course in accordance with these Specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the Plans. Each course shall be constructed to the depth, typical section, and elevation required by the Plans and shall be rolled, finished, and approved before the placement of the next course.

### MATERIALS

**401-2.1 AGGREGATE.** Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand, and mineral filler, as required. The aggregates should have no known history of detrimental pavement staining due to ferrous sulfides, such as pyrite. Coarse aggregate is the material retained on the No. 4 sieve. Fine aggregate is the material passing the No. 4 sieve.

Use a minimum of three stockpiles of crushed aggregate of different gradations. Place blend material, if any, in a fourth pile.

- a. **Coarse Aggregate.** Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. Coarse aggregate material shall conform to Table 401-1 Coarse Aggregate Material Requirements.

**TABLE 401-1. COARSE AGGREGATE MATERIAL REQUIREMENTS**

Material Test	Requirement	Standard
Resistance to Degradation	Loss: 40% maximum	AASHTO T 96
Soundness of Aggregates by Use of Sodium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate	AASHTO T 104
Clay lumps and friable particles	1.0% maximum	AASHTO T 112
Micro-Deval	18% maximum	AASHTO T 327
Percentage of Fractured Particles	For pavements designed for aircraft gross weights of 60,000 pounds or more: Minimum 90% by weight of particles with at least two fractured faces, except Type V shall have a minimum of 98% by weight with at least two fractured faces	ATM 305
	For pavements designed for aircraft gross weights less than 60,000 pounds (27200 kg): Minimum 50% by weight of particles with at least two fractured faces and 65% with at least one fractured face <sup>1</sup>	
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 <sup>2</sup>	ATM 306

<sup>1.</sup> The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

<sup>2.</sup> A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

- b. **Fine Aggregate.** Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel and shall be free from coatings of clay, silt, or other objectionable matter, and conform to Table 401-2 Fine Aggregate Material Requirements.

Natural (non-manufactured) sand may be used to obtain the gradation of the fine aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of these Specifications.

**TABLE 401-2. FINE AGGREGATE MATERIAL REQUIREMENTS**

Material Test	Requirement	Standard
Liquid limit	25 maximum	ATM 204
Plasticity Index	4 maximum	ATM 205
Soundness of Aggregates by Use of Sodium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate	AASHTO T 104
Clay Lumps and Friable Particles	1.0% maximum	AASHTO T 112
Sand Equivalent	45 minimum	ATM 307
Natural Sand	15% maximum by weight of total aggregate	ASTM D1073
Uncompacted Void Content <sup>1</sup>	45% minimum	AASHTO T 304, Method A

<sup>1</sup>. Applies to Type V mix designs.

- c. **Sampling.** The Engineer will sample according to ATM 301 for coarse and fine aggregate and according to ASTM D242 for mineral filler.

**401-2.2 MINERAL FILLER.** Mineral filler (baghouse fines) may be added in addition to material naturally present in the aggregate. Mineral filler shall meet the requirements of AASHTO M 17 and Table 401-3.

**TABLE 401-3. MINERAL FILLER REQUIREMENTS**

Material Test	Requirement	Standard
Plasticity Index	4 maximum	ATM 205

**401-2.3 ASPHALT BINDER.** Provide the asphalt binder performance grade as indicated on the Plans. Asphalt binder shall conform to AASHTO M 320 or M 332 for the specified Performance Grade, except as indicated in Table 401-4 Exceptions to Performance-Graded Asphalt Binder Specification.

**TABLE 401-4. EXCEPTIONS TO PERFORMANCE-GRADED ASPHALT BINDER SPECIFICATION**

Performance Grade	AASHTO Spec.	Viscosity AASHTO T 316	MSCR, AASHTO T 350			PAV, Dynamic Shear AASHTO T 315	Direct Tension AASHTO T 314
			JNR <sub>3.2</sub> kPa <sup>-1</sup>	JNR Diff	% Rec <sub>3.2</sub>		
PG 52-28	M320	None	---	---	---	None	Delete
PG 52-40	M320	None	---	---	---	None	Delete
PG 52-40V	M332	None	0.50 max.	Delete	75 min.	None	Delete
PG 58-34E	M332	None	0.25 max.	Delete	85 min.	None	Delete
PG 64-40E	M332	1.0 PaS max.	0.10 max.	Delete	95 min.	5000 max @ 4°C	Delete

The Contractor shall furnish vendor's certificate of compliance and certified test reports for each lot of asphalt binder shipped to the project. The vendor's certified test report for the asphalt binder can be used for acceptance or tested independently by the Engineer.

The following documents shall be furnished at delivery:

- a. Manufacturer's certificate of compliance
- b. Certified test reports for the lot.
- c. Lot number, storage tanks, and shipping containers (if applicable) used.
- d. Date and time of load out for delivery.
- e. Type, grade, temperature, and quality of asphalt binder loaded.
- f. Type and percent of anti-stripping agent added.

All excess asphalt binder shall remain the property of the Contractor. Removal of excess asphalt binder from the project area shall be incidental to the contract and no separate payment will be made.

**401-2.4 ANTI-STRIPPING AGENT.** Any anti-stripping agent or additive (anti-strip) shall be heat stable and shall not change the asphalt binder grade beyond Specifications. Anti-strip shall be approved by the Engineer.

**401-2.5 PRELIMINARY MATERIAL ACCEPTANCE.** Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:

- a. Coarse Aggregate.
  - (1) Percent of wear
  - (2) Soundness
  - (3) Degradation
  - (4) Percent of fracture
  - (5) Percent of flat and elongated particles
  - (6) Clay lumps and friable particles
- b. Fine Aggregate.
  - (1) Liquid limit.
  - (2) Plasticity index
  - (3) Sand equivalent
  - (4) Un-compacted void content for HMA Type V
  - (5) Clay lumps and friable particles
  - (6) Soundness
  - (7) Percent Natural Sand
- c. Mineral Filler.

- (1) Gradation
- (2) Plasticity Index
- (3) Organic content

d. Asphalt Binder. The certification(s) shall show the appropriate test(s) for each material, the test results, and a statement that the material meets the specification requirement. Include temperature/viscosity charts and note recommended mixing and compaction temperatures.

**401-2.6 JOINT ADHESIVE.** The joint adhesive shall conform to Table 401-5 Joint Adhesive Material Requirements.

**TABLE 401-5. JOINT ADHESIVE MATERIAL REQUIREMENTS**

PROPERTY	SPECIFICATION	TEST METHOD
Brookfield Viscosity, 400°F	4,000 – 11,000 cP	ASTM D2669
Core Penetration, 77°F Flow, 140°F Resilience, 77°F Tensile Adhesion, 77°F Asphalt Compatibility	60 – 100 0.2-inch, max. 30%, min. 500%, min. Pass	ASTM D5329
Ductility, 77°F Ductility, 39.2°F	1-foot, min. 1-foot, min.	ASTM D113
Softening Point	170°F	AASHTO T 53

**401-2.7 JOINT SEALANT.** The joint shall be sealed with GSB 88 (manufactured by Asphalt Systems Inc.), Optipave (manufactured by SealMaster), or meet the following:

a. Emulsion concentrate, in the undiluted state, shall have the following properties:

- (1) Saybolt furol viscosity at 77°F, ASTM D244, seconds ..... 20-100
- (2) Residue by distillation or evaporation, ASTM D244, % ..... 57 min
- (3) Sieve test, ASTM D244, % ..... 0.2 max
- (4) 5 day Settlement test, ASTM D244, % ..... 5.0 max
- (5) Particle charge (refer to 401-2.7d), ASTM D244 ..... Positive

b. Ready to Apply:

(1) Emulsion concentrate diluted in the proportion of one part emulsion to one part hot water by volume, shall have the following properties:

- (a) Saybolt furol viscosity at 77°F, ASTM D244, seconds ..... 10-50
- (b) Residue by distillation or evaporation, ASTM D244, % ..... 28.5 min
- (c) Pumping stability test, (refer to 401-2.7e) ..... Pass

(2) Emulsion concentrate diluted in the proportion of two parts emulsion to one part hot water by volume, shall have the following properties:

- (a) Saybolt furol viscosity at 77°F, ASTM D244, seconds ..... 10-50

- (b) Residue by distillation or evaporation, ASTM D244, % ..... 37.5 min
- (c) Pumping stability test, (refer to 401-2.7e) ..... Pass
- c. Tests on residue from distillation or evaporation shall have the following properties:
  - (1) Viscosity at 275°F, ASTM D4402, cubic feet per second (cts)..... 1,750 max
  - (2) Solubility in 1,1,1 Trichloroethylene, ASTM D2042, %..... 97.5 min
  - (3) Penetration ASTM D5, dmm..... 50 max
  - (4) Asphaltenes, ASTM D2007, % ..... 15 min
  - (5) Saturates, ASTM D2007, % ..... 15 max
  - (6) Polar Compounds, ASTM D2007, % ..... 25 min
  - (7) Aromatics, ASTM D2007, % ..... 15 min
- d. pH may be used in lieu of the particle charge test, which is sometimes inconclusive in slow setting, bituminous emulsions.
- e. Pumping stability test is tested by pumping one pint of sealer material diluted one part concentrate to one part water, at 77°F, through a 1/4-inch gear pump operating 1,750 revolutions per minute (rpm) for 10 minutes with no significant separation or coagulation.

The bituminous base residue shall contain not less than 20% gilsonite, and shall not contain any tall oil pitch. Curing time, under recommended application conditions, shall not exceed four hours. The Contractor shall furnish and submit to the Engineer, manufacturer's certification that the material is the type, grade, and quality specified for each load of bituminous material delivered. The certification shall show the shipment number, refinery, consignee, destination, contract number, and date of shipment. The Contractor shall submit to the Engineer, two 1-quart samples of ready-to-apply bituminous material for each batch applied and two 1-quart samples of concentrate for each load delivered. The Contractor shall submit any additional samples requested by the Engineer.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable Specifications.

### **COMPOSITION**

**401-3.1 COMPOSITION OF MIXTURE(S).** The HMA shall be composed of a mixture of well-graded aggregates, filler, if required, and asphalt binder. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix design (JMD).

**401-3.2 JOB MIX DESIGN (JMD) LABORATORY.** The laboratory used to develop the JMD shall possess a current certificate of accreditation, listing ASTM D3666 from a national accrediting authority, and all test methods required for developing the JMD; and be listed on the accrediting authority's website. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the Department prior to start of construction.

**401-3.3 JOB MIX DESIGN (JMD).** No HMA for payment shall be placed until an acceptable JMD has been approved by the Engineer. The Class A and B HMA shall be designed using procedures contained in ATM 417, and shall meet the requirements of Tables 401-6 and 401-8.

The HMA, Type V, Class S will be designed using procedures contained in AASHTO R 35 and shall meet the requirements of Table 401-7 and Table 401-8. Upon completion of the JMD, determine the Marshall

stability and Marshall air voids at the design asphalt binder content using a 75-Blow Marshall from procedures contained in ATM 417. The Department will furnish all JMDs for HMA, Type V.

The JMD and subsequent production targets should be based on a stability greater than shown in Table 401-6 and 401-7, and the flow and air voids should be targeted close to the mid-range of the criteria in order to meet the acceptance requirements.

Anti-stripping agent shall be added to the asphalt binder in the amount determined by ATM 414. A minimum of 0.30% anti-stripping agent by weight of asphalt binder is required.

At the discretion of the Engineer, the JMD may be designed by the Department. The Department designed JMDs will be based on the Contractor's submitted target gradation. The Contractor shall submit material samples to the Engineer, upon request, for JMD. The Department will bear the cost of the initial JMD evaluation for each Type and Class of HMA specified. If subsequent evaluations are required, the Engineer will assess a fee of \$5,000.00 under Hot Mix Asphalt Price Adjustment, for each additional evaluation.

- a. DEPARTMENT FURNISHED JMD.** Submit the following, or as directed, in writing to the Engineer at least 30 calendar days prior to the start of paving operations and shall include as a minimum:
- (1) Manufacturer's Certificate of Analysis (COA) for the asphalt binder used in the JMD according to subsection 401-2.3. Certificate of asphalt Performance Grade must include added modifier, if used, and also indicate compliance of asphalt binder with AASHTO M 320 or AASHTO M 332. Furnish five (5) separate 1-gallon samples of the asphalt binder proposed for use in the HMA, and Safety Data Sheet.
  - (2) Manufacturer's Certificate of Analysis (COA) for the anti-stripping agent if used in the JMD according to subsection 401-2.4.
  - (3) Certified material test reports for the course and fine aggregate and mineral filler according to subsection 401-2.1.
  - (4) Percent natural sand.
  - (5) Percent fractured faces.
  - (6) Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).
  - (7) Laboratory mixing and compaction temperatures.
  - (8) Supplier-recommended field mixing and compaction temperatures.
  - (9) Plot of the combined gradation on a 0.45 power gradation curve. Provide curve and testing results for each aggregate type proposed for use.
  - (10) Type and amount of anti-strip agent when used. Furnish a minimum of 1/2-pint of the proposed anti-strip additive, if anti-strip is not incorporated into asphalt binder by the manufacturer.
  - (11) Temperature-viscosity relationship of the asphalt binder.
  - (12) Uncompacted void content for HMA Type V.
  - (13) Percentage and properties (asphalt content, asphalt binder properties, and aggregate properties) of RAP in accordance with subsection 401-3.4. Furnish 200-pound, minimum, sample of proposed RAP.

- b. CONTRACTOR FURNISHED JMD.** When the Contractor is directed to prepare the JMD for approval, the Contractor must submit the JMD sealed by the responsible Professional Engineer of the laboratory.

In addition to the items listed in subsection 401-3.3a, submit the following, or as directed, in writing to the Engineer at least 15 calendar days prior to the start of paving operations:

- (1) Date the JMD was developed. Mix designs that are not dated or which are from a prior construction season will not be accepted.
- (2) Percent passing each sieve size for individual gradation of each aggregate cold feed and/or hot bin; percent by weight of each cold feed and/or hot bin used; and the total combined gradation in the JMD. Furnish representative samples totaling 500 pounds of aggregate material in proportional amounts to the proposed JMD.
- (3) A letter stating the location, size, and type of mixing plant. The letter shall include gradations for individual stockpiles, and the blend ratio of each aggregate stockpile.
- (4) Specific Gravity and absorption of each coarse and fine aggregate.
- (5) Percent of asphalt.
- (6) Number of blows or gyrations.
- (7) Asphalt Pavement Analyzer (APA), or Hamburg test results; or stability and flow test results, as appropriate for the mix design method.
- (8) Sand Equivalent value for fine aggregate.
- (9) Theoretical Maximum Specific Gravity at the optimum asphalt binder content.

All Contractor furnished JMDs must be sealed by a professional Engineer registered in the State of Alaska. The Professional Engineer must certify that the JMD was performed according to the specified procedures, and meets these Specifications.

The Engineer has authority to review and reject submitted JMDs that do not meet these Specifications. The Contractor shall submit samples to the Engineer, upon request, for JMD verification testing.

The JMD for each mixture shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new JMD must be approved by the Engineer before the new material is used.

**TABLE 401-6. MARSHALL MIX DESIGN REQUIREMENTS**

<b>Test Property</b>	<b>Class A: Pavements Designed for Aircraft Gross Weights of 60,000 lbs or More or Tire Pressures of 100 psi or More</b>	<b>Class B: Pavements Designed for Aircraft Gross Weight Less Than 60,000 lbs or Tire Pressure Less Than 100 psi</b>
Number of blows	75	50
Stability, pounds	2150	1350
Flow, 0.01 inch <sup>1</sup>	10-16	10-18
Air voids % (design target 3.5%)	2.8 – 4.2	2.8 – 4.2
Voids in mineral aggregate, %, min.	See Table 401-8	See Table 401-8

Test Property	Class A: Pavements Designed for Aircraft Gross Weights of 60,000 lbs or More or Tire Pressures of 100 psi or More	Class B: Pavements Designed for Aircraft Gross Weight Less Than 60,000 lbs or Tire Pressure Less Than 100 psi
Asphalt Binder Content, %, min.	5.0	5.0
Antistrip Requirement, % coverage, min <sup>2</sup>	70	70
Asphalt Pavement Analyzer (APA) <sup>3</sup>	Less than 10mm @ 4,000 passes	N/A

<sup>1</sup>. The flow requirement is not applicable for Polymer Modified Asphalts.

<sup>2</sup>. ATM 414 <sup>3</sup>. ATM 419 at 250 psi hose pressure at 64°C test temperature

**TABLE 401-7. GYRATORY HOT MIX ASPHALT TYPE V MIX DESIGN REQUIREMENTS**

<b>Mix Design Class S</b>	
Pavements for gross aircraft weights of 60,000 lbs or more.	
Test Property	Design Criteria <sup>3/4</sup> " Nominal Maximum Aggregate Size
Initial Number of Gyration (N <sub>ini</sub> )	7
Design Number of Gyration (N <sub>des</sub> )	75
Maximum Number of Gyration (N <sub>max</sub> )	115
Air voids @ N <sub>des</sub> (Design Target 3.5), %	2.8-4.2
Voids in Mineral Aggregate @ N <sub>des</sub> , %	Table 401-8
Voids filled with Asphalt @ N <sub>des</sub> , %	65-78
Dust to effective asphalt ratio	0.6 -1.2
Uncompacted Void Content	45 min.
% G <sub>mm</sub> @ N <sub>ini</sub>	≤ 90.50
% G <sub>mm</sub> @ N <sub>max</sub>	≤ 98.00
Asphalt Binder Content, %, min.	5.0
Antistrip Requirement, %, min. <sup>1</sup>	70
Marshall Stability 75 blow (average of 3 specimens)	Report
Marshall Air Voids – 75 blow (average of 3 specimens)	Report
Rut Index, Max., mm, ATM 419 <sup>2</sup>	Less than 10 mm @ 4,000 passes

<sup>1</sup>. ATM 414

<sup>2</sup>. ATM 419 at 250 psi hose pressure at 64°C test temperature

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 401-8 Aggregate-Asphalt Pavements when tested according to ATM 304. The maximum size aggregate used shall not be more than one-fourth of the thickness of the course being constructed.

The gradations in Table 401-8 represent the limits that shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in the JMD), shall have a gradation within the limits designated in Table 401-8 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine when tested according to ATM 304.

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

**TABLE 401-8. AGGREGATE – ASPHALT PAVEMENTS**

Sieve Size	Percentage by Weight Passing Sieves			Type V
	Type I	Type II	Type III <sup>1</sup>	
1 inch	100	--	--	--
3/4 inch	90-100	100	--	100
1/2 inch	68-88	90-100	100	65-90
3/8 inch	60-82	72-88	90-100	55-80
No. 4	45-67	53-73	58-78	40-60
No. 8	32-54	38-60	40-60	≤ 45
No. 16	22-44	26-48	28-48	≤ 35
No. 30	15-35	18-38	18-38	≤ 25
No. 50	9-25	11-27	11-27	≤ 20
No. 100	6-18	6-18	6-18	≤ 12
No. 200	3-6	3-6	3-6	4-7
<b>Minimum Voids in Mineral Aggregate (VMA)</b>	13	14	15	14
<b>Asphalt percent by total weight of mixture:</b>				
<b>Stone or gravel</b>	4.5-7.0	5.0-7.5	5.5-8.0	5.0 – 7.5
<b>Recommended Minimum Construction Lift Thickness</b>	3 inches	2 inches	1-1/2 inches	2 inches

<sup>1</sup> Type III gradation is intended for leveling courses.

**401-3.4 RECYCLED HOT MIX ASPHALT PAVEMENT.** Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, asphalt binder, and recycling agent, if necessary. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP size shall not exceed one inch. The recycled HMA shall be designed using procedures contained in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition, in conjunction with ATM 417. The percentage of asphalt in the RAP shall be established for the mix design according to ASTM D2172 using the appropriate dust correction procedure. The JMD shall meet the requirements subsection 401-3.3. Recycled HMA shall only be used for shoulder surface course mixes and for any intermediate courses. The amount of RAP shall be limited to 20 percent. In addition to the requirements of subsection 401-3.3, the JMD shall indicate the percent of RAP, the percent and grade of new asphalt binder, the percent and grade of hot mix recycling agent (if used), and the properties (including viscosity and penetration) of the asphalt blend. The resulting composite mixture of RAP and virgin components shall meet all requirements specified for mixes without RAP. No RAP shall be used in Type V, Class S HMA.

RAP containing Coal Tar shall not be used. Coal Tar surface treatments must be removed prior to recycling underlying asphalt material. Recycled asphalt shingles (RAS) shall not be used.

All new aggregates used in the recycled mix shall meet the requirements of subsection 401-2.1. New asphalt binder shall meet the requirements of subsection 401-2.3. Recycling agents shall meet the requirements of ASTM D4552. The Contractor shall submit documentation to the Engineer, indicating that the mixing equipment proposed for use is adequate to mix the percent of RAP shown in the JMD.

**401-3.5 CONTROL STRIP.** Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the Engineer. The Contractor shall prepare and place a quantity of asphalt according to the JMD. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor Quality Control Program (CQCP), showing conformance with the requirements of subsection 401-5.1, has been accepted, in writing, by the Engineer.

The control strip will consist of at least 250 tons. The control strip shall be placed in two lanes of the same width and depth to be used in production with a longitudinal cold joint. The cold joint must be cut back in accordance with subsection 401-4.14 using the same procedure that will be used during production. The cold joint for the control strip will be an exposed construction joint at least four (4) hours old or when the mat has cooled to less than 160°F. The equipment used in construction of the control strip shall be the same type, configuration, and weight, to be used on the project.

The control strip shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in subsection 401-6.1 for aggregate gradation and asphalt binder content. The control strip shall be divided into three separate equal sub-lots. If the Composite Pay Factor is less than 1.000, the control strip is unacceptable.

Three 6-inch diameter core samples shall be cut from the finished hot mix asphalt by the Contractor, at the locations marked by the Engineer. The core samples will be tested by the Department for density according to subsection 401-5.1. The Target Value for mat density is 94.0% of the theoretical maximum specific gravity (MSG) of the JMD. The three samples will be evaluated according to subsection 401-8.1.a. If the Density Pay Factor is less than 1.000, the control strip is unacceptable.

Three longitudinal joint cores centered on the longitudinal joint shall be cut by the Contractor, at the locations marked by the Engineer. The core samples will be tested by the Department according to subsection 401-5.1. The Target Value for joint density is 92.0% of the JMD MSG. If the average density of the three joint cores is below 91.0%, the control strip is unacceptable.

After completion of control strip compaction, the Department will accept or reject the control strip within 48 hours.

If the control strip is unacceptable, necessary adjustments to the JMD, plant operation, placing procedures, and/or rolling procedures shall be made and another control strip shall be placed. Unacceptable control strips shall be removed at the Contractor's expense. For small projects, less than 3,000 tons, a control strip is not required.

**401-3.6 PRE-PAVING CONFERENCE.** Meet with the Engineer for a pre-paving meeting in the presence of project superintendent and paving foreman at least five working days before beginning paving operations. Submit a paving plan and pavement inspection plan per 401-3.7, 24 hours before the pre-paving conference.

Include the following elements in the paving plan and address these elements at the meeting:

- a. Safety Plan procedures to be implemented prior to and during paving.
- b. Sequence of operations and Laydown Plan per subsection 401-4.11.
- c. List of equipment that will be used for production, transport, pick-up (if applicable), laydown, and compaction.
- d. Summary of plant modifications (if applicable) for production of HMA.
- e. Procedures to produce consistent HMA.
- f. Procedures to minimize material and thermal segregation.
- g. Procedures to minimize premature cooling.
- h. Procedures to achieve HMA density.

- i. Procedures for joint construction including corrective action for joints that do not meet surface tolerance requirements.
- j. Quality control sampling and testing methods, frequencies and sample locations for gradation, asphalt binder content, and density.
- k. Any other information or procedures necessary to provide completed HMA construction that meets the contract requirements.

Include the following elements in the pavement inspection plan and address these elements at the meeting:

- l. Process for daily inspections
- m. Means and methods to remove and dispose of project materials

**401-3.7 PROJECT MAINTENANCE.** Inspect daily according to pavement inspection plan. Remove, and dispose of project materials incorrectly deposited on existing and new pavement surface(s) inside and outside the project area including haul routes.

The Contractor is responsible for damage caused by not removing these materials and any damage to the roadway from the removal method(s).

Repair damage to the existing paved surfaces that results from fugitive materials or their removal.

### CONSTRUCTION METHODS

**401-4.1 WEATHER LIMITATIONS.** The HMA shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 401-9. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.

**Table 401-9. Surface Temperature Limitations of Underlying Course**

Mat Thickness	Base Temperature (°F Minimum)
3 inches or greater	40
Greater than 2 inches but less than 3 inches	45

**401-4.2 ASPHALT MIXING PLANT.** Meet American Association of State Highway and Transportation Officials (AASHTO) M 156. Use an HMA plant capable of producing at least 250 tons of HMA per hour noted on posted DEC air quality permit, designed to dry aggregates, maintain consistent and accurate temperature control, and accurately proportion asphalt binder and aggregates. HMA plant capacity to support echelon paving shall be a minimum of 400 tons per hour produced by a maximum of 2 plants. Both plants shall produce the same mix design. Calibrate the HMA plant and furnish copies of the calibration data to the Engineer at least 24 hours before HMA production.

Provide a scalping screen at the asphalt plant to prevent oversize material or debris from being incorporated into the HMA.

Provide a tap on the asphalt binder supply line just before it enters the plant (after the 3-way valve) for sampling asphalt binder. Provide aggregate and asphalt binder sampling locations meeting OSHA safety requirements.

Plants may not be placed on Airport property unless a specific location is noted on the Plans. Requirements for all plants include:

- a. **Inspection of Plant.** The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.
- b. **Storage Bins and Surge Bins.** Use of surge bins or storage bins for temporary storage of HMA will be permitted as follows:
  - (1) The HMA may be stored in surge bins for not longer than 3 hours.
  - (2) The HMA may be stored in insulated storage bins for not longer than 8 hours.

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the Engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no temporary storage will be allowed.

**401-4.3 AGGREGATE STOCKPILE MANAGEMENT.** Aggregate stockpiles shall be constructed in a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the asphalt batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. A continuous supply of materials shall be provided to the work to ensure continuous placement.

**401-4.4 HAULING EQUIPMENT.** Trucks used for hauling HMA shall have tight, clean, and smooth metal beds. To prevent the mixture from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the RPR. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

**401-4.4.1 MATERIAL TRANSFER VEHICLE (MTV).** MTVs used to transfer the material from the hauling equipment to the paver shall be self-propelled, with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The MTV will have remixing and storage capability of at least 15 tons to prevent physical and thermal segregation.

**401-4.5 ASPHALT PAVERS.** HMA pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of bituminous plant mix material that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface. The asphalt paver shall be equipped with a control system capable of automatically maintaining the specified screed grade and elevation.

If the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued.

The paver shall be capable of paving to a minimum width specified in subsection 401-4.12. Place auger extensions within 20 inches of the screed extensions or per written manufacturer's recommendations.

**401-4.6 ROLLERS.** The number, type, and weight of rollers shall be sufficient to compact the asphalt to the required density while it is still in a workable condition without crushing of the aggregate, depressions or other damage to the pavement surface. Rollers shall be in good condition, clean, and capable of operating at slow speeds to avoid displacement of the asphalt. All rollers shall be specifically designed and

suitable for compacting asphalt concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used.

**401-4.7 DENSITY DEVICE.** The Contractor shall have on site a density gauge during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall supply a qualified technician during all paving operations to calibrate the gauge and obtain accurate density readings for all new asphalt. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

**401-4.8 PREPARATION OF ASPHALT BINDER.** The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. The temperature of unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325°F when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

**401-4.9 PREPARATION OF MINERAL AGGREGATE.** The aggregate for the HMA shall be heated and dried. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350°F when the asphalt binder is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

**401-4.10 PREPARATION OF HMA.** The aggregates and the asphalt binder shall be weighed or metered and mixed in the amount specified by the JMD.

The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants.

The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in AASHTO T 195, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles.

For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

The moisture content of all HMA upon discharge shall not exceed 0.5% of the total weight of mix, as determined by ATM 407.

**401-4.11 APPLICATION OF PRIME AND TACK COAT.** Immediately before placing the HMA, the underlying course shall be cleaned of all dust and debris.

If required, a prime coat in accordance with Item P-602 Emulsified Asphalt Prime Coat shall be applied to aggregate base prior to placing HMA.

A tack coat shall be applied in accordance with Item P-603 Emulsified Asphalt Tack Coat to all vertical and horizontal asphalt and concrete surfaces prior to placement of the first and each subsequent lift of HMA.

**401-4.12 LAYDOWN PLAN, TRANSPORTING, PLACING, AND FINISHING.** Prior to the placement of the HMA, the Contractor shall prepare a laydown plan with the sequence of paving lanes and width to minimize the number of cold joints; the location of any temporary ramps; laydown temperature; and estimated time of completion for each portion of the work (milling, paving, rolling, cooling, etc.). The laydown plan and any modifications shall be approved by the Engineer.

The Contractor shall use an MTV conforming to the requirements of subsection 401-4.4.1 to deliver mix to the paver.

Deliveries shall be scheduled so that placing and compacting of asphalt is uniform with minimum stopping and starting of the paver. Supply echelon paving operations with hot mix asphalt at a minimum rate of 400 tons per hour. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to approximately ambient temperature. The Contractor, at their expense, shall be responsible for repair of any damage to the pavement caused by hauling operations.

Contractor shall survey each lift of HMA surface course and certify to the Engineer that every lot of each lift meets the grade tolerances of subsection 401-6.2f before the next lift can be placed.

Edges of existing asphalt pavement abutting the new work shall be saw cut and the cut off material and laitance removed. Apply a tack coat in accordance with P-603 before new asphalt material is placed against it.

The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Placement of the HMA shall begin along the centerline of a crowned section or on the high side of areas with a one way slope unless shown otherwise on the laydown plan as accepted by the Engineer. The HMA shall be placed in consecutive adjacent lanes having a minimum width of 20 feet except where edge lanes require less width to complete the area. Additional screed sections attached to widen the paver to meet the minimum lane width requirements must include additional auger sections to move the HMA uniformly along the screed extension.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least one foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the asphalt may be spread and luted by hand tools.

The Engineer may at any time, reject any batch of asphalt, on the truck or placed in the mat, which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or overheated HMA. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the Department's laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

Areas of segregation in the surface course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness for the approved mix design. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

Echelon paving shall be used for the final lift of HMA pavement. Pave the final lift of HMA with two pavers operating in echelon in adjacent lanes with a breakdown roller behind each paver operating with intelligent compaction equipment. The pavers shall be spaced no more than 50 feet apart. The distance between the pavers shall be reduced as required to ensure the HMA placed by the lead paver is greater than 230°F when the second paver places material against it. Two paving crews are required.

**401-4.13 COMPACTION OF HMA.** After placing, the HMA shall be thoroughly and uniformly compacted by self-propelled rollers. The surface shall be compacted as soon as possible when the asphalt has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any surface defects and/or displacement occurring as a result of the roller, or from any other cause, shall be corrected at the Contractor's expense.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent

adhesion of the asphalt to the roller, the wheels shall be equipped with a scraper and kept moistened with water as necessary.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with power tampers approved by the Engineer.

Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding pavement. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

**401-4.14 JOINTS.** The formation of all joints shall be made to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid asphalt except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. Any longitudinal joint should also have the use of a bulkhead for any traffic that may also cause a rolled edge. In both methods, all contact surfaces shall have a tack coat or joint adhesive applied, dependent on top/bottom asphalt lift, before placing any fresh mix against the joint.

Longitudinal joints shall be formed in such a manner that the joint meets density requirements of subsection 401-6.2c. Longitudinal joints which have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F; or are irregular, damaged, uncompacted or otherwise defective shall be cut back with a cutting wheel or pavement saw a minimum of 3 inches and a maximum of 6 inches to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material and any laitance produced from cutting joints shall be removed from the project. Asphalt tack coat in accordance with P-603 shall be applied to the clean, dry joint prior to placing any additional fresh asphalt against the joint. The cost of this work shall be considered incidental to the cost of the asphalt.

For all joints below the top lift, uniformly coat joint surfaces with tack coat material meeting P-603.

When joint adhesive is required, follow joint adhesive manufacturer's recommendations for temperatures and application method. Otherwise, use tack coat material meeting Item P-603. Remove joint adhesive applied to the top of pavement surface. When forming a longitudinal joint in the final lift, apply a 1/8 inch thick band joint adhesive to the full height of the joint surface prior to placing any fresh hot mix asphalt against the joint. Joint edge preparation, and joint adhesive application temperature, thickness, and method shall be per the manufacturer's recommendations. Joint adhesive is not required between mats placed while echelon paving.

Joint sealant shall be applied in a 12-inch wide strip centered over joints in the final lift layer of HMA while the asphalt is still clean, free of moisture, and before striping. Joint sealant shall be applied over joints in the final lift formed by two panels of HMA composed of different type or class of mix; or of new against existing HMA pavement. Joint surface preparation, and joint sealant application temperature, thickness, and method shall be per the manufacturer's recommendations.

Joints between existing and new HMA shall be saw cut. Cut a neat, straight line along the existing HMA to expose the full depth of the layer where new HMA is to be placed against existing asphalt. Use a power saw or other method approved by the Engineer.

Cut back of all cold joints is required as specified above.

The Contractor may provide additional joint density quality control by use of joint heaters at the Contractor's expense. The heaters shall be operated so they do not produce excessive heat when the units pass over new or previously paved material. When used, heaters will be required to be in operation at all times.

Electrically powered infrared heating equipment should consist of one or more low-level radiant energy heaters to uniformly heat and soften the pavement joints. The heaters should be configured to uniformly heat an area up to 18 inches in width and 3 inches in depth. Infrared equipment shall be thermostatically controlled to provide a uniform, consistent temperature increase throughout the layer being heated up to a maximum temperature range of 200°F to 300°F.

Propane powered infrared heating equipment shall be attached to the paving machine and the output of infrared energy shall be in the one to six-micron range. Converters shall be arranged end to end directly over the joint to be heated in sufficient numbers to continuously produce, when in operation, a minimum of 240,000 BTU per hour. The joint heater shall be positioned not more than one inch above the pavement to be heated and in front of the paver screed and shall be fully adjustable.

**401-4.15 SAW-CUT GROOVING.** If shown on the Plans, saw-cut grooves shall be provided as specified in Item P-621 Saw Cut Grooves. Do not perform saw-cut grooving until smoothness testing has been performed, as described in subsection 401-5.3.

**401-4.16 DIAMOND GRINDING.** Diamond grinding shall be completed prior to pavement grooving. Diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive.

Diamond grinding shall be performed with a machine designed specifically for diamond grinding capable of cutting a path at least 3 feet wide. The saw blades shall be 1/8-inch wide with a sufficient number of blades to create grooves between 0.090 and 0.130 inches wide; and peaks and ridges approximately 1/32-inch higher than the bottom of the grinding cut. The actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate.

Equipment or grinding procedures that cause ravels, aggregate fractures, spalls or disturbance to the pavement will not be permitted. The Contractor shall demonstrate to the Engineer that the grinding equipment will produce satisfactory results prior to making corrections to surfaces. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. The Contractor shall apply a surface treatment per Item P-608 Emulsified Asphalt Seal Coat to all areas that have been subject to grinding.

**401-4.17 NIGHTTIME PAVING REQUIREMENTS.** Paving during nighttime construction shall require the following:

- a. All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations shall be equipped with artificial illumination sufficient to safely complete the work.
- b. Minimum illumination level shall be twenty horizontal foot-candles and maintained in the following areas:
  - (1) An area of 30 feet wide by 30 feet long immediately behind the paving machines during the operations of the machines.
  - (2) An area 15 feet wide by 30 feet long immediately in front and back of all rolling equipment, during operation of the equipment.
  - (3) An area 15 feet wide by 15 feet long at any point where an area is being tack coated prior to the placement of pavement.
- c. As partial fulfillment of the above requirements, the Contractor shall furnish and use, complete artificial lighting units with a minimum capacity of 3,000 watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.
- d. A lighting plan must be submitted by the Contractor and approved by the Engineer prior to the start of any nighttime work.

Lighting for nighttime construction is required for work occurring between end civil twilight and begin civil twilight as posted the United States Naval Observatory on all days except the “No Lighting Required” period shown in Table 401-10.

**TABLE 401-10. NIGHTTIME ILLUMINATION EXCLUSIONS**

Latitude (degrees)	No Lighting Required		Nearby
	Start	End	Cities
South of 61	Lighting Required All Year		Everything South of Hope
61	June 11	July 1	Anchorage, Valdez, Girdwood
62	June 2	July 13	Wasilla, Palmer, Glennallen, Talkeetna
63	May 27	July 17	Cantwell, Paxson, McGrath
64	May 22	July 21	Tok, Delta, Nome
65	May 18	July 25	Fairbanks
66	May 14	July 29	Circle City
67	May 10	August 2	Coldfoot, Kotzebue
68	May 7	August 6	Galbraith Lake
69	May 3	August 9	Happy Valley
70	April 30	August 12	Deadhorse
71	April 27	August 15	Utqiagvik (Barrow)
72	April 24	August 19	

**CONTRACTOR QUALITY CONTROL (CQC)**

**401-5.1 GENERAL.** The Contractor shall develop a CQC Program (CQCP) according to the GCP Section 100. No partial payment will be made for materials that are subject to specific QC requirements without an approved CQCP.

**401-5.2 CONTRACTOR QUALITY CONTROL (QC) FACILITIES.** The Contractor shall provide or contract for testing facilities in accordance with GCP Section 100. The Engineer shall be permitted unrestricted access to inspect the Contractor’s QC facilities and witness QC activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

**401-5.3 QUALITY CONTROL (QC) TESTING.** The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to these Specifications, and as set forth in the approved CQCP. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A QC Testing Plan shall be developed as part of the CQCP.

- a. **Asphalt Content.** A minimum of two tests shall be performed per day in accordance with ATM 405 or ATM 406, by total weight of mix for determination of asphalt content. When using ATM 406, the correction factor shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter. The asphalt content for the day will be determined by averaging the test results.
- b. **Gradation.** Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ATM 304 and ATM 408.

- c. **Moisture Content of Aggregate.** The moisture content of aggregate used for production shall be determined a minimum of once per day in accordance with ATM 202.
- d. **Moisture Content of Asphalt.** The moisture content shall be determined once per day in accordance with ATM 407.
- e. **Temperatures.** Temperatures shall be checked, at least four times per day, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the asphalt at the plant, and the asphalt at the job site.
- f. **In-place Density Monitoring.** The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ATM 411.
- g. **Smoothness for Contractor Quality Control.** The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than 1/4-inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues.

The Contractor may use a 12-foot straightedge, a rolling inclinometer meeting the requirements of ASTM E2133, or rolling external reference device that can simulate a 12-foot straightedge approved by the Engineer. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement.

Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using the FAA profile program, ProFAA, or FHWA ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the Plans.

- (1) **Transverse Measurements.** Transverse measurements shall be taken for each day's production placed. Transverse measurements shall be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the Engineer. The joint between lanes shall be tested separately to facilitate smoothness between lanes.
- (2) **Longitudinal Measurements.** Longitudinal measurements shall be taken for each day's production placed. Longitudinal tests shall be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 feet or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4-inch shall be corrected with diamond grinding per subsection 401-4.16 or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding.

All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in subsection 401-6.2d. Areas that have been ground shall be

sealed with a surface treatment in accordance with Item P-608. To avoid the surface treatment creating any conflict with runway or taxiway markings, it may be necessary to seal a larger area.

Control charts shall be kept to show area of each day's placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor's machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day's production, production shall be stopped until corrective measures are implemented by the Contractor.

- h. Grade.** Grade shall be evaluated daily to allow adjustments to paving operations when grade measurements do not meet Specifications. As a minimum, grade shall be evaluated prior to and after the placement of the first lift and after placement of the surface lift.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and Plans. The final surface of the pavement will not vary from the grade line elevations and cross-sections shown on the Plans by more than 1/2-inch vertically and 0.1 feet laterally. The documentation will be provided by the Contractor to the Engineer within 24 hours.

Areas with humps or depressions that exceed grade or smoothness criteria and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2-inch less than the thickness specified on the Plans. Grinding shall be in accordance with subsection 401-4.16.

The Contractor shall repair low areas or areas that cannot be corrected by grinding by removal of deficient areas to the depth of the final course plus 1/2-inch and replacing with new material. Skin patching is not allowed.

**401-5.4 SAMPLING.** When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

**401-5.5 CONTROL CHARTS.** The Contractor shall maintain linear control charts for both individual measurements and range (i.e. difference between highest and lowest measurements) for aggregate gradation, asphalt binder content, and density.

Control charts shall be posted in a location satisfactory to the Engineer and kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

- a. Individual Measurements.** Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt binder content, and density. The control charts shall use the JMD target values as indicators of central tendency for the test parameters with associated Action and Suspension Limits in Table 401-11.

**Table 401-11. CONTROL CHART LIMITS FOR INDIVIDUAL MEASUREMENTS**

<b>Sieve</b>	<b>Action Limit</b>	<b>Suspension Limit</b>
3/4-inch	±6%	±9%
1/2-inch	±6%	±9%

3/8-inch	±6%	±9%
No. 4	±6%	±9%
No. 16	±5%	±7.5%
No. 50	±3%	±4.5%
No. 200	±2%	±3%
<b>Asphalt Binder Content</b>	±0.45%	±0.70%
<b>Minimum VMA</b>	-0.5%	-1.0%

- b. **Range.** Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed in Table 401-12. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of  $n = 2$ . Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for  $n = 3$  and by 1.27 for  $n = 4$ .

**Table 401-12. CONTROL CHART LIMITS BASED ON RANGE (n = 2)**

<b>Sieve</b>	<b>Suspension Limit</b>
1/2-inch	11%
3/8-inch	11%
No. 4	11%
No. 16	9%
No. 50	6%
No. 200	3.5%
<b>Asphalt Content</b>	0.8%

- c. **Corrective Action.** The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

- (1) One point falls outside the Suspension Limit line for individual measurements or range; or
- (2) Two points in a row fall outside the Action Limit line for individual measurements.

**401-5.6 QUALITY CONTROL (QC) REPORTS.** The Contractor shall maintain records and shall submit reports of QC activities daily, in accordance with the CQCP described in GCP Section 100.

### **MATERIAL ACCEPTANCE**

**401-6.1 ACCEPTANCE SAMPLING AND TESTING.** All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor. Selection of sampling and testing methods used for Acceptance are at the discretion of the Engineer.

- a. Lot size.

- (1) **Hot Mix Asphalt Lots.** The bid quantity of each type of HMA produced and placed will be divided into lots and the lots evaluated individually for acceptance. The Department has the exclusive right and responsibility for determining the acceptability of all materials incorporated

into the project. The results of the acceptance testing performed by the Engineer will be made available to the Contractor.

Where more than one plant is simultaneously producing asphalt for the job, the lot sizes will apply separately for each plant

- (2) **5,000 Ton Lot Size.** A lot will normally be 5,000 tons. The lot will be divided into sub-lots of 500 tons, each randomly sampled and tested for asphalt binder content, density and gradation according to this subsection. The lot is evaluated for price adjustment according to subsection 401-6.2. Seasonal startup or a new JMD requires starting a new lot.

If the project has more than one lot and if less than eight sub-lots have been sampled at the time a lot is terminated, the material in the shortened lot will be included as part of the prior lot and the price adjustment computed for the prior lot will include the samples from the shortened lot. Density test results from material in the shortened lot will be based on the MSG of the shortened lot. If there is no prior lot, and there are at least three sub-lots, the material in the shortened lot will be considered as a lot and the price adjustment will be based on the actual number of test results in the shortened lot. If there are less than three sub-lots, the HMA will be accepted for payment based on the Engineer's approval of the JMD, and placement and compaction of the HMA to the specified depth, finished surface requirements and tolerances. The Engineer reserves the right to perform any testing required in order to determine acceptance.

If eight or nine sub-lots have been placed at the time a lot is terminated, they will be considered as a lot and the price adjustment will be based on the actual number of test results in the shortened lot.

- (3) **1,500 to 4,999 Ton Lot Size.** If the total contract bid quantity is between 1,500 tons and 4,999 tons, the total project quantity will be considered one lot. The lot will be divided into sub-lots of 500 tons and randomly sampled for asphalt binder content, density and gradation according to this subsection. The lot will be evaluated for price adjustment according to subsection 401-6.2 except as noted.
- (4) **Under 1,500 Ton Lot Size.** If the total contract bid quantity is less than 1,500 tons, asphalt concrete pavement will be accepted for payment based on the Engineer's approval of a Job Mix design and the placement and compaction of the HMA to the specified depth and finished surface requirements and tolerances, and material testing. The Engineer reserves the right to perform any testing required in order to determine acceptance.

Any area of finished surfacing that is segregated, fails to meet surface tolerance requirements, cools to below 175°F prior to completing compaction, or is any other way defective shall be removed and replaced with new asphalt concrete pavement. Removal and replacement of defective pavement shall be at no additional cost to the Department.

- (5) **Joint Density Lot Size.** Longitudinal joints include joints internal to a lot and joints created when paving adjacent to previously placed lots. Joints constructed by echelon paving will not be evaluated for density, unless required by the Engineer.
- (6) **Asphalt Binder Grade Lot Size.** The lot size for asphalt binder is 200 tons of the same grade asphalt binder. If a project has more than one lot and the remaining asphalt binder quantity of the same grade is less than 150 tons, it is added to the previous lot and that total quantity will be evaluated as one lot. If the remaining asphalt binder quantity is 150 tons or greater, it is sampled, tested and evaluated as a separate lot.

If the bid quantity of asphalt binder is between 85 and 200 tons, the contract quantity is considered as one lot and sampled, tested, and evaluated according to this subsection.

Quantities of asphalt binder less than 85 tons will be accepted based on manufacturer's certified test reports and certification of compliance.

**b. Sampling.**

- (1) **Asphalt Binder Content.** Samples taken for the determination of asphalt binder content will be taken from behind the screed prior to initial compaction, or from the windrow, according to ATM 402 and ATM 403.

If sampling is from behind the screed prior to initial compaction, then provide a WAQTC certified technician and equipment to take plate samples. Sample in locations determined by the Engineer. Sample in the presence of the Engineer and immediately transfer possession of the sample to the Engineer.

Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if applicable.

- (2) **Gradation.** Samples taken for the determination of aggregate gradation will be from the same location as specified for the determination of asphalt binder content. Two separate samples will be taken, one for acceptance testing and one held in reserve for retesting if applicable.

- (3) **Mat Density.** The location(s) for taking core samples is determined using a set of random numbers (independent of asphalt binder and aggregate sampling set of random numbers) and the Engineer's judgment. The Contractor shall cut full depth core samples with a diameter of 6 inches from each sub-lot, within 24 hours of final rolling for density acceptance testing. The samples shall be neatly cut by a core drill at the randomly selected location designated by the Engineer according to the procedures contained in ATM 413.

All voids left by sampling shall be backfilled with new asphalt concrete material and compacted within 24 hours of sampling. All core holes on final lift will be sealed with GSB-88, after being backfilled and compacted, or have Craftco Joint adhesive applied prior to backfill and compaction.

Cores for mat density shall not be taken closer than one foot from a transverse or longitudinal joint.

- (4) **Joint Density.** Longitudinal joint density cores shall be taken directly on the joint, at locations adjacent to cores taken from the mat completing the joint. Cores shall be taken by the Contractor in the presence of the Engineer. The Engineer will take immediate possession of the samples.

- (5) **Asphalt Binder Grade.** Sample asphalt binder at the plant from the supply line in the presence of the Engineer according to ATM 401. The Engineer will take immediate possession of the samples. Take three samples from each lot, one for acceptance testing, one for Contractor requested retesting, and one held in reserve for referee testing if requested.

**c. Testing.**

- (1) **Asphalt Binder Content.** Asphalt binder content will be determined by ATM 405 or ATM 406, by total weight of mix.

- (2) **Gradation.** Cold feed or dry batched aggregate gradations will be tested according to ATM 304 and evaluated for acceptance according to subsection 401-6.2. Asphalt concrete mix and core sample gradations will be determined according to ATM 408 from extracted aggregate, or aggregate remaining after the ignition oven ATM 406 has burned off the asphalt binder.

- (3) **Density.** Mat density will be based on theoretical maximum specific gravity (MSG) as determined by ATM 409. For the first lot of HMA, the MSG will be determined by the JMD. For

additional lots, the MSG will be determined from the randomly selected sample from the first sub-lot.

For the top lift longitudinal joint density, use the MSG of the panel completing the joint. No adjustment will be made to the MSG or any other material property, due to application of joint adhesive, in evaluating joint density.

Core samples will be tested according to ATM 410, and evaluated for acceptance according to subsection 401-6.2.

- (4) Asphalt Binder Grade.** Asphalt binder will be tested for conformance to the requirements specified in subsection 401-2.3 and evaluated for acceptance according to subsection 401-6.2.

#### **401-6.2 ACCEPTANCE CRITERIA.**

- a. General.** Acceptance will be based on the following characteristics of the HMA and completed pavement as well as the implementation of the Contractor's Quality Control Plan (CQCP) and test results:

- (1)** Aggregate Gradation
- (2)** Asphalt Binder Content
- (3)** Mat Density
- (4)** Joint Density
- (5)** Thickness
- (6)** Smoothness
- (7)** Grade
- (8)** Asphalt Binder Quality

The Engineer may at any time reject and require the Contractor to dispose of any batch of HMA which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and, if it can be demonstrated in a certified laboratory, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

- b. Mat Density, Aggregate Gradation, and Asphalt Binder Content.** Evaluation for acceptance of each lot of plant-produced material for mat density, aggregate gradation, and asphalt binder content will be based on percentage of material within specification limits (PWL). Acceptance and payment for the lot will be according to subsection 401-8.1.

- (1) Percentage of Material within Specification Limits (PWL).** Acceptance of test results for HMA asphalt binder content, gradation and mat density are used in HMA price adjustment. These test results for a lot are analyzed collectively and statistically by the Quality Level Analysis (QLA) method as specified in GCP Section 110 to determine the total estimated percentage of the lot that is within specification limits.

HMA pay factors are computed as follows:

- (a)** All statistical Quality Level Analysis (QLA) is computed using the Engineer's Price Adjustment programs.

- (b) The USL and LSL are equal to the Target Value (TV) plus and minus the allowable tolerances. The specification tolerance limits (L) and (U) are contained in Table 401-13. The values for percent passing the No. 200 sieve, asphalt binder content and density test results are reported to the nearest 0.1%. All other sieves used in QLA are reported to the nearest whole number. The TV is the specification value shown on the approved JMD.

**TABLE 401-13. LOWER SPECIFICATION TOLERANCE LIMIT (L)  
AND UPPER SPECIFICATION TOLERANCE LIMIT (U)**

Measured Characteristics	L	U
3/4 in.	99	100
1/2 in.	TV -6	TV +6
3/8 in.	TV -6	TV +6
No. 4	TV -6	TV +6
No. 8	TV -6	TV +6
No. 16	TV -5	TV +5
No. 30	TV -4	TV +4
No. 50	TV -4	TV +4
No. 100	TV -3	TV +3
No. 200 *	TV -2.0 *	TV +2.0
Asphalt %	TV -0.4	TV +0.4
Mat Density	93.0%	100.0%

TV (Target Value) = Job Mix Design value for gradation and asphalt binder content

\* L for the No. 200 sieve is restricted by the broadband limits Table 401-8.

- c. **Longitudinal Joint Density.** The minimum density for top lift longitudinal joint density is 92.0% of the MSG of the panel completing the joint. MSG will be determined according to ATM 409. Top lift longitudinal joints will be evaluated for acceptance according to 401-8.1b.

For a joint core that is less than 92.0% of the MSG perform corrective action on the subplot containing the joint core. Perform Corrective Action by heating the longitudinal joint to compaction temperatures with an infrared heater and compact to at least 92.0% of the MSG. Do not exceed mixing temperatures as indicated on the mix design. Material may be added to the joint to meet surface tolerances, but do not skin patch. Perform corrective action prior to grooving or striping. After corrective action is performed and joint is acceptable, seal the joints in the sub-lot per 401-4.14.

- d. **Thickness.** Thickness of each lift will be evaluated by the Engineer to the requirements shown on the Plans. Measurements of thickness will be made by the Engineer using the cores extracted from the mat for each sub-lot for density measurement. The maximum allowable deficiency at any point will not be more than 1/4-inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, will not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sub-lot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Engineer to circumscribe the deficient area.

- e. **Smoothness.**

- (1) **Non-runway HMA.** The finished surfaces of the HMA shall not vary more than 1/4 inch for the surface layer when tested with a 12-foot straightedge. Straightedge testing will be performed in accordance with subsection 401-6.2e(2)(a).

(2) **Runway HMA.** The final surface shall be free from roller marks and will be subject to the following smoothness testing.

(a) **Straight Edge Testing.** After the final rolling, the surface of each lot shall be tested in both transverse and longitudinal directions for smoothness. The finished surface course of the pavement shall not vary more than 1/4-inch when evaluated with a 12-foot straightedge. Measurements will include joints.

1. **Transverse Measurements.** Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline every 50 feet or more often as determined by the Engineer.

2. **Longitudinal Measurements.** Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center.

(b) **Profilograph Smoothness for QA Acceptance.** The final profilograph shall be the full length of the project to facilitate testing of roughness between lots. The Engineer will perform a profilograph roughness test on the completed project with a profilograph meeting the requirements of ASTM E1274 or a Class I inertial profiler meeting ASTM E950. Data and results shall be provided within 48 hours of profilograph roughness tests.

The pavement shall have an average profile index less than 15 inches per mile per 1/10-mile. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must grind" bumps and the Profile Index for the pavement using a 0.2-inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or Department approved, trained operator.

Profilograms shall be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. Profilograph shall be performed one foot right and left of project centerline and 15 feet right and left of project centerline.

(c) **Corrective Action.** Areas of unacceptable smoothness on final surface course shall be corrected with diamond grinding per subsection 401-4.16 or by removing and replacing full depth of surface course.

Where corrections are necessary, a second profilograph run shall be performed to verify that the corrections produced an average profile index of 15 inches per mile per 1/10-mile or less.

f. **Grade.** Grade shall be evaluated after the first day of placement and then as a minimum, prior to the placement of the surface lift and after the placement of the surface lift to allow adjustments to paving operations if measurements do not meet specification requirements. The Contractor shall provide the survey data/results to the Engineer by the following day after the measurements have been taken. Measurements shall be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and 50-foot longitudinal spacing on cross sections verifying that the surface is in conformance with project Plans and cross sections. Data shall include the difference between the measured surface and plan grades.

The finished surface of the pavement shall not vary from the gradeline elevations and cross sections shown on the Plans by more than 0.05-foot. The finished grade of each lot will be determined by running levels at intervals of 50 feet or less longitudinally and transversely to determine the elevation of the completed pavement. The lot size will be 2,000 square yards. When more than 15% of all the measurements within a lot are outside the specified tolerance, the Contractor shall remove the deficient area and replace with new material. Removal depth shall be a minimum of 2 inches. Skin patching for correcting low areas will not be permitted. High points may be ground off.

- g. Asphalt Binder Quality.** Acceptance and payment for the lot shall be determined according to subsection 401-8.1c. If three consecutive samples are out of specification, stop HMA production immediately and submit a corrective action plan to the Engineer for approval.

#### **401-6.3 RETESTS.**

- a. General.** When test results have failed to meet specification tolerance limits, retest of acceptance test results for asphalt binder content, gradation, and density may be requested provided the quality control requirements of subsection 401-6.3 are met. Deliver this request in writing to the Engineer within seven days of receipt of the final test of the lot.

The Engineer will mark the sample location for the density retest within a 2-foot radius of the original core. The original test results are discarded and the retest result is used in the price adjustment calculation regardless of whether the retest result gives a higher or lower pay factor.

Only one retest per sample is allowed. Except for the first lot, when gradation and asphalt binder content are determined from the same sample, retesting for gradation or asphalt binder from the first sub-lot of a lot will include retesting for the MSG; when separate samples are used, retesting for asphalt binder content will include retesting for MSG.

When gradation and asphalt binder content are determined from the same sample, a request for a retest of either gradation or asphalt binder content results in a retest of both. Both gradation and asphalt binder content retest results are used in the price adjustment calculation. Retesting will be performed by a department laboratory.

- (1) A redefined PWL will be calculated for the lot.
- (2) The cost for resampling shall be borne by the Contractor.
- (3) Asphalt Binder Grade Retest. Retest of acceptance test results may be requested provided the quality control requirements of subsection 401-6.3 are met.

The assigned test value (ATV) will be determined using ASTM D3244. Testing will be by AASHTO accredited independent laboratories. Each test will be completed by a different laboratory.

Submit a written request, for a retest, no more than seven days from receiving notice of the failed acceptance test. In the request, identify the retest laboratory. The Engineer will send the second sample (retest sample) to the laboratory. Provide the retest results to the Engineer. Contractor pays for the retest costs.

If the average of the combined test results ( $[\text{acceptance} + \text{retest}]/2$ ) passes the specification requirement, the average value becomes the ATV. If this ATV fails the specification requirement, the Engineer or Contractor may request the third sample (referee sample) be tested.

The Engineer will send the third sample (referee sample) to an agreed upon laboratory. The average of the combined test results ( $[\text{acceptance} + \text{retest} + \text{referee}]/3$ ) equals the ATV. If the ATV fails to meet Specifications, the Contractor pays for the referee test.

- b. Payment for Resampled Lots.** The redefined PWL for a resampled lot will be used to calculate the payment for that lot according to GCP Section 110.

#### **401-6.4 RESAMPLING PAVEMENT FOR MAT DENSITY.** (Subsection Not Used)

**401-6.5 LEVELING COURSE.** The leveling course is the first variable thickness lift placed to correct surface irregularities prior to placement of subsequent courses. The leveling course shall meet the aggregate gradation in Table 401-8, subsection 401-3.3. The leveling course shall meet the requirements

of subsection 401-3.3 and 401-6.2, but shall not be subject to the mat density or joint density requirements. The leveling course shall be compacted with the same effort used to achieve density of the control strip. The leveling course shall not exceed the lift thickness associated with each gradation in Table 401-8, subsection 401-3.3.

## METHOD OF MEASUREMENT

**401-7.1 MEASUREMENT.** HMA will be measured by the number of tons used in the accepted work, based on recorded truck scale weights. No deduction will be made for the weight of asphalt binder in the mixture.

Asphalt binder will be measured by the number of tons of asphalt binder used in the accepted pavement determined as follows:

The method of measurement to be used will be based on one of the following procedures listed in subsections a, b, and c.

- a. Supplier's invoices minus waste, diversion and excess left over. This method may be used on projects where deliveries are made in sealed tankers and the plant is producing material for one project only. Method b. will be used to compute left over. Waste and diversion will be computed in a manner to be determined by the Engineer.
- b. Volume measure (tank stickings) of actual daily uses. It is the Contractor's responsibility to notify the Engineer whenever material is to be added to the calibrated volume measure or whenever material from the volume measure is to be used for work other than that specified in this contract.
- c. Percent of asphalt binder content for each sub-lot as determined by ATM 405 or ATM 406 multiplied by the weight represented by that sub-lot.

Method c. will be used for determining asphalt binder quantity unless otherwise directed in writing by the Engineer. Whichever method is used must be used for the duration of the project. Another method may be used and computed as a check, but only one method will be used for payment computation.

Longitudinal Joint Density Price Adjustment will be measured by the linear foot of top lift longitudinal joint under subsection 401-8.1(b).

Joint Adhesive will be measured by the linear foot of longitudinal and transverse joint.

**401-7.2 ASPHALT MATERIAL PRICE ADJUSTMENT.** Asphalt Material Price Adjustment. This subsection provides a price adjustment for asphalt material by: (1) additional compensation to the Contractor or (2) a deduction from the contract amount.

- a. This provision shall apply:
  - (1) To asphalt binder material meeting the criteria of section P-401-2.3, and is included in items listed in the bid schedule of section P-602, P-603, P-609, and P-626.
  - (2) When there is more than 500 tons of asphalt material in the bid schedule of section described in 401-7.2.a(1).
  - (3) To cost changes in asphalt material that occur between the date of bid and the date on the certified bill of lading from the asphalt material refiner/producer.
  - (4) When there is more than a seven and one half percent (7.5%) increase or decrease in the Alaska Asphalt Material Price Index (AAMPI) from the date of bid opening to the date on the certified bill of lading from the asphalt refiner/producer.
- b. Provide the certified bill of lading from the asphalt material refiner/producer.

- c. The AAMPI is calculated bimonthly on the first and third Friday of each month, and will remain in effect from the day of calculation until the next bimonthly calculation. The AAMPI is posted on the Department's Statewide Materials website at and calculated according to the formula posted there. [http://www.dot.state.ak.us/stwddes/desmaterials/aprice\\_index.shtml](http://www.dot.state.ak.us/stwddes/desmaterials/aprice_index.shtml)
- d. Price adjustment will be cumulative and calculated with each progress payment. Use the AAMPI in effect in the date of the certified bill of lading from the asphalt material refiner/producer, to calculate the price adjustment for asphalt material. The Department will increase or decrease payment under this contract by the amount determined with the following asphalt material price adjustment formula:

(1) For an increase exceeding 7.5 percent, additional compensation =  $[(IPP - IB) - (0.075 \times IB)] \times Q$

(2) For a decrease exceeding 7.5 percent, deduction from contract =  $[(IB - IPP) - (0.075 \times IB)] \times Q$

Where:

Q = Quantity of asphalt material incorporated into the project during the pay period, in tons as measured by the Engineer

IB = Index at Bid: The bimonthly AAMPI in effect on the date of bid, in dollars per ton

IPP = Index at Pay Period: the bimonthly AAMPI in effect on the date shown on the certified bill of lading from the asphalt refiner/producer, in dollars per ton

- e. Method of measurement for determining Q (quantity) is the weight of asphalt material that meets criteria of this subsection and is incorporated into the project. The quantity does not include aggregate, mineral filler, blotter material, thinning agents added after material qualification, or water for emulsified asphalt. The quantity for emulsified asphalts will be based on the asphalt residue material only and will be calculated using the percent residue from testing, or if not tested, from the manufacturers certificate of compliance.

**BASIS OF PAYMENT**

**401-8.1 PAYMENT.** Payment for an accepted lot of HMA will be made at the contract unit price per ton for HMA and asphalt binder adjusted according to subsection 401-8.1a. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

- a. HMA Price Adjustment.** The HMA price adjustment will be the sum of the HMA price adjustments for each lot. Acceptance test results for HMA asphalt binder content, gradation, and mat density are used in the HMA price adjustment. These tests results for a lot are analyzed collectively and statistically by the Quality Level Analysis (QLA) method as specified in GCP subsection 110-01 to determine the total estimated percentage of the lot that is within specification limits.

The price adjustment will be based on the Composite Pay Factor (CPF) for asphalt binder content and aggregate gradation or the Density Pay Factor (DPF) whichever is the lowest value. Table 401-14 is used to determine the weight factor (f) for each sieve size and asphalt binder content. The HMA Composite Pay Factor (CPF) is computed for asphalt binder content and all sieves using the following formula:

$$CPF = \frac{[f_{3/4in} (PF_{3/4in}) + f_{1/2in} (PF_{1/2in}) + \dots + f_{ac} (PF_{ac})]}{\sum f}$$

**TABLE 401-14. WEIGHT FACTORS**

	<b>Type I Factor "f"</b>	<b>Type II and V Factor "f"</b>	<b>Type III Factor "f"</b>
1 in.	4	-	-
3/4 in.	4	4	-
1/2 in.	4	5	4
3/8 in.	4	5	5
No. 4	4	4	5
No. 8	4	4	5
No. 16	4	4	5
No. 30	4	5	6
No. 50	4	5	6
No. 100	4	4	4
No. 200	20	20	20
Asphalt %	40	40	40

The Density Pay Factor (DPF) is computed using HMA mat core compaction acceptance test results.

The CPF and DPF are rounded to the nearest 0.001. The price adjustment for each individual lot is calculated as follows:

$$\text{HMA Price Adjustment} = [(CPF \text{ or } DPF)^{-1}] \times (\text{tons in lot}) \times (\text{PAB})$$

PAB = Price Adjustment Base per ton (for mix including asphalt binder)

\*Composite Pay Factor (CPF) or Density Pay Factor (DPF) whichever is lower value.

Price Adjustment Base shall be the lessor of:

- (1) Dollars per ton as follows:

$$PAB = [\text{\$ } \quad ] \text{ per ton Hot Mix Asphalt [Type } \quad ], [\text{Class } \quad ];$$

or,

(2) The value in dollars per ton calculated as follows: [Contractor's Bid/ton for Hot Mix Asphalt [Type ], [Class ]] +

[Contractor's Bid/ton for Asphalt Binder, PG [ ]] x (% JMD Optimum Oil Content / 100)]

A lot containing material with less than a 1.000 pay factor is accepted at an adjusted price, provided that pay factor is at least 0.800 and there are no isolated defects identified by the Engineer. A lot containing material that fails to obtain the minimum pay factor is considered unacceptable and rejected under GCP Section 110.

Hot Mix Asphalt Price Adjustment also includes fees assessed for additional JMDs as identified in 401-3.2.

- b. **Longitudinal Joint Density Price Adjustment.** The longitudinal joint density price adjustment will be based on top lift cold joint densities greater than 93.0%. Add \$1.50 per lineal foot for one-half the distance to each prior and subsequent passing joint density greater than 93.0%.
- c. **Asphalt Binder Price Adjustment.** A lot quantity of asphalt binder, with a quality pay factor less than 1.000 is accepted or rejected according to Table 401-15, Asphalt Binder Quality Pay Factors.

**Table 401-15. ASPHALT BINDER QUALITY PAY FACTORS**

Pay Factor			1.01	1.00	0.95	0.90	0.75	Reject
<b>RTFO (Rolling Thin Film Oven)</b>								
<b>DSR<sup>(1)</sup></b>	All Grades	G*/Sinδ, kPa <sup>-1</sup>	≥2.69	2.68-2.20	2.19-1.96	1.95-1.43	1.42-1.10	< 1.10
	PG 52-40V	JNR 3.2	≤ 0.39	0.40-0.50	0.51-0.59	0.60-0.69	0.70-1.00	> 1.00
% Rec <sub>3.2</sub>		≥ 86	85-75	74-68	67-60	59-55	< 55	
<b>MSCR<sup>(2)</sup></b>	PG 58-34E	JNR 3.2	≤0.19	0.20-0.25	0.26-0.29	0.30-0.39	0.40-0.50	> 0.50
		% Rec <sub>3.2</sub>	≥90	89-85	84-80	79-75	74-70	< 70
	PG 64-40E	JNR 3.2	≤ 0.05	0.05-0.10	0.11-0.15	0.16-0.20	0.21-0.25	> 0.25
		% Rec <sub>3.2</sub>	≥97	96-95	94-91	90-85	84-80	< 80
<b>PAV (Pressure Aging Vessel)</b>								
<b>DSR<sup>(3)</sup></b>	PG 64-40E And all other Grades	G*Sinδ, kPa	≤4711	4712 - 5000	5001-5289	5290-5578	5579-5867	> 5867
	PG 52-40V, PG 58-34E	G*Sinδ, kPa	≤5700	5701-6000	6001-6300	6301-6600	6601-7000	> 7000
<b>CS<sup>(4,5)</sup></b>	All Grades <sup>(4)</sup>	BBR, "S" MPa	≤247	248-300	301-338	339-388	389-449	≥ 450
	All Grades <sup>(5)</sup>	BBR, "M"	≥0.320	0.319-0.300	0.299-0.294	0.293-0.278	0.277-0.261	<0.261

Creep Stiffness (CS)      Dynamic Shear Rheometer (DSR)      Multiple Stress Creep Recovery (MSCR)  
 Asphalt Binder Price Adjustment = (Lowest Pay Factor – 1.00) x (Binder Quantity) x PAB x 5

Select the lowest pay factor from:

**RTFO** (test at Performance Grade Temperature)

(1) DSR, All Grades, G\*/Sinδ, kPa-1

(2) MSCR: PG, Select the highest pay factor, either JNR 3.2 or % Rec3.2

## PAV

(3) Intermediate DSR, PG,  $G^* \sin \delta$ , kPa

(4) CS, All Grades, BBR, S MPa

(5) CS, All Grades, BBR, M

If Pay Item P401.130.0000 HMA Combined Price Adjustment is in the Bid Schedule, the Price Adjustment Pay Items (P401.080.0000 Hot Mix Asphalt Price Adjustment, Method 1, P401.110.0000 Longitudinal Joint Density Price Adjustment, and P401.120.0000 Asphalt Binder Quality Price Adjustment) will be paid under P401.130.0000 HMA Combined Price Adjustment.

Payment will be made under:

Item P401.010.____	Hot Mix Asphalt Type __, Class __ - per ton
Item P401.020.____	Asphalt Binder, PG __-per ton
Item P401.070.0000	Joint Adhesive -per linear foot
Item P401.080.0000	Hot Mix Asphalt Price Adjustment -per contingent sum
Item P401.090.0000	Asphalt Material Price Adjustment -per contingent sum

## REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

### Alaska Test Methods (ATM) Manual

ATM 202	Moisture Content of Aggregate and Soils
ATM 204	Liquid Limit of Soils
ATM 205	Plastic Limit and Plasticity Index of Soils
ATM 301	Sampling Aggregates
ATM 304	Sieve Analysis of Aggregate and Soils
ATM 305	Determining the Percentage of Fracture in Coarse Aggregate.
ATM 306	Flat and Elongated
ATM 307	Sand Equivalent
ATM 317	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
ATM 401	Sampling Bituminous Materials
ATM 402	Sampling Bituminous Mixes
ATM 403	Sampling Hot Mix Asphalt
ATM 405	Asphalt Binder Content of Asphalt Concrete Mixtures by the Nuclear Method
ATM 406	Asphalt Binder Content of Bituminous Mixes by Ignition Method
ATM 407	Moisture Content of Hot-Mix Asphalt (HMA) by Oven Method

ATM 408	Mechanical Analysis of Extracted Aggregate
ATM 409	Maximum Specific Gravity of Bituminous Mixes
ATM 410	Bulk Specific Gravity and Percent Compaction of Bituminous Mixes
ATM 411	In-Place Density of Asphalt Mixtures by Nuclear Method
ATM 413	Sampling Hot Mix Asphalt (HMA) after Compaction (Obtaining Cores)
ATM 414	Anti-Strip Requirements of Hot Mix Asphalt
ATM 417	Hot Mix Asphalt Design by the Marshall Method
ATM 419	Rutting Susceptibility using an Asphalt Pavement Analyzer

ASTM International (ASTM)

ASTM D5	Penetration of Bituminous Materials
ASTM D113	Ductility of Asphalt Materials
ASTM D242	Mineral Filler for Bituminous Paving Mixtures
ASTM D244	Practices for Emulsified Asphalts
ASTM D1073	Fine Aggregate for Asphalt Paving Mixtures
ASTM D2007	Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method
ASTM D2042	Solubility of Asphalt Materials in Trichloroethylene
ASTM D2172	Quantitative Extraction of Bitumen from Asphalt Paving Mixtures
ASTM D2669	Apparent Viscosity of Petroleum Waxes Compounded with Additives (Hot Melts)
ASTM D3244	Utilization of Test Data to Determine Conformance with Specifications
ASTM D3666	Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4402	Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D4552	Classifying Hot-Mix Recycling Agents
ASTM D5329	Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Concrete Pavements
ASTM E1274	Measuring Pavement Roughness Using a Profilograph
ASTM E950	Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference
ASTM E2133	Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface

American Association of State Highway and Transportation Officials (AASHTO)

- AASHTO M 17 Mineral Filler for Bituminous Paving Mixtures
- AASHTO M 156 Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
- AASHTO M 320 Performance-Graded Asphalt Binder
- AASHTO M 332 Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test
- AASHTO R 35 Superpave Volumetric Design for Asphalt Mixtures
- AASHTO T 96 Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- AASHTO T 104 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- AASHTO T 195 Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures
- AASHTO T 304 Uncompacted Void Content of Fine Aggregate
- AASHTO T 314 Determining the Fracture Properties of Asphalt Binder in Direct Tension (DT)
- AASHTO T 315 Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
- AASHTO T 316 Viscosity Determination of Asphalt Binder Using Rotational Viscometer
- AASHTO T 350 Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

Asphalt Institute (AI)

Asphalt Institute MS-2 Mix Design Manual, 7th Edition

## ITEM P-609 CHIP SEAL COAT

### DESCRIPTION

**609-1.1** This item shall consist of a chip seal coat as a wearing course composed of a single or multiple application of liquid asphalt material and aggregate cover placed on the prepared primed base or properly cured wearing surface, according to these Specifications, and shall conform to the dimensions and typical cross section shown on the Plans.

**609-1.2 QUANTITIES OF MATERIALS.** The approximate amounts of materials per square yard for the chip seal shall be as provided in Table 609-1 for the treatment specified on the Plans. The exact amounts shall be provided to the Engineer for review and approval.

**TABLE 609-1. QUANTITIES OF MATERIALS**

Application No	Aggregate lbs/yd <sup>2</sup>	Asphalt gal/yd <sup>2</sup>	Type of Asphalt <sup>1\1</sup>
1	40-50	0.35-0.45	Asphalt Cement
		0.40-0.50	Emulsified Asphalt
2	20-25	0.15-0.25	Asphalt Cement
		0.20-0.35	Emulsified Asphalt
3	15-20	0.15-0.20	Emulsified Asphalt

<sup>1\1</sup> See Table 609-4 for grades of asphalt and spraying temperatures.

### MATERIALS

**609-2.1 AGGREGATE MATERIALS.** The aggregate material shall be either crushed stone or crushed gravel. The cover material shall be screenings; sand may be used when specified.

If the material is to be crushed stone, it shall be manufactured from sound, hard, durable rock of accepted quality and crushed to specification size. All strata, streaks, and pockets of clay, dirt, sandstone, soft rock, or other unsuitable material accompanying the sound rock shall be discarded and not allowed to enter the crusher.

If the material is to be crushed gravel, it shall consist of hard, durable, fragments of stone or gravel of accepted quality and crushed to specification size. All strata, streaks, and pockets of sand, excessively fine gravel, clay, or other unsuitable material including all stones, rocks, and boulders of inferior quality shall be discarded and not allowed to enter the crusher. When tested according to ATM 305, the crushing of the gravel shall result in a product in which the material retained on the separate No. 4, 3/8-inch, and 1/2-inch sieves shall have at least 90% of particles with at least one fractured face.

**TABLE 609-2. AGGREGATE MATERIAL REQUIREMENTS**

Material Test	Requirement	Standard
L.A. Wear	Loss: 40% maximum	AASHTO T 96
Soundness of Aggregates by Use of Sodium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate	AASHTO T 104
Micro-Deval	15% maximum	AASHTO T 327
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least one fractured faces <sup>1</sup>	ATM 305
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 3:1	ATM 306

<sup>1</sup> The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be achieved by crushing.

The crushed aggregate for the applications shall meet the requirements for gradation given in Table 609-3 when tested according to ATM 304.

**TABLE 609-3. REQUIREMENTS FOR GRADATION OF AGGREGATE<sup>1</sup>**

Sieve Designation (square openings)	Percentage by Weight Passing Sieves		
	Aggregate No. 1	Aggregate No. 2	Aggregate No. 3
1 inch	100		
3/4 inch	90-100		
1/2 inch	20-55	100	
3/8 inch	0-15	85-100	100
No. 4	0-5	10-30	60-85
No. 8		0-10	0-25
No. 16		0-5	0-5
No. 200	0-1	0-1	0-2

<sup>1</sup> Locally available aggregate used for chip seals with similar gradations may be used provided the maximum aggregate size is the same; and the aggregate meets all other quality requirements in these specifications.

The gradations in the table represent the limits which shall determine suitability of aggregate for use for the specified applications from the sources of supply. The final gradations decided on, within the limits designated in the table, shall be uniformly graded from coarse to fine.

The aggregate to be used shall show no evidence of stripping or swell when tested according to ATM 414. The use of antistripping agents for the control of stripping shall be used if necessary.

**609-2.2 ASPHALT MATERIAL.** The types, grades, controlling specifications, and application temperatures for the asphalt materials are shown in Table 609-4. Provide the specific liquid asphalt material designated in the Plans.

**TABLE 609-4. ASPHALT MATERIALS**

Type and Grade	Specification	Spraying Temperature \1\Deg. F
Asphalt Cement		
PG 52-28	AASHTO M 320	275+
Emulsified Asphalt		
RS-1	AASHTO M 140	70-140
RS-2	AASHTO M 140	125-175
MS-1, HFMS-1	AASHTO M 140	70-160
CRS-1	AASHTO M 208	125-175
CRS-2	AASHTO M 208	125-175
CRS-2P	AASHTO M 316	140-170

\1\ The maximum temperature for asphalt cements shall be below that at which fogging occurs.

The Contractor shall provide samples of the asphalt material and a copy of the manufacturer's Certificate of Analysis (COA) for each carload or equivalent of the asphalt material to the Engineer for review and

acceptance before the asphalt material is applied. If the asphalt emulsion is diluted at other than the manufacturer's facility, the Contractor shall provide a supplemental COA from an independent laboratory verifying the asphalt emulsion properties. The furnishing of COA for the asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

**609-2.3 SAMPLING AND TESTING** Sampling and testing is the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor, subject to approval by the Engineer. Sampling shall be according to ATM 301 for aggregates and ATM 401 for asphalt material, unless otherwise directed. Perform aggregate gradation tests on each sample according to ATM 304. Perform all other aggregate tests on the initial source samples and repeat tests when there is a change of source. Perform sieve analyses daily from material samples. The tests shall include an analysis of each gradation of material. Submit copies of test results to the engineer, within 24 hours after completion of each test.

## **CONSTRUCTION METHODS**

**609-3.1 WEATHER LIMITATIONS.** Asphalt material shall be applied only when the existing surface is dry and the atmospheric temperature is above 60°F. No material shall be applied when rain is imminent or when dust or sand is blowing.

**609-3.2 EQUIPMENT AND TOOLS.** The Contractor shall furnish all equipment, tools, and machines necessary for the performance of the work.

- a. **Asphalt Distributor.** The distributor shall be designed, equipped, maintained, calibrated according to ASTM D2995, and operated so that asphalt material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 5%. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.
- b. **Aggregate Spreader.** The aggregate spreader shall be a self-propelled mechanical spreader or truck-attached mechanical spreader capable of uniformly distributing aggregate at the specified rates.
- c. **Power Rollers.** Power rollers shall be steel-wheeled or pneumatic-tired type, conforming to the following requirements:
  - (1) Steel-wheeled rollers shall have at least one steel drum and weigh a minimum of 5 tons. Steel wheels of the rollers shall be equipped with adjustable scrapers.
  - (2) Pneumatic-tired rollers shall be self-propelled and have wheels mounted on two axles in such manner that the rear tires will not follow in the tracks of the forward group. Tires shall be uniformly inflated to not less than 60 psi nor more than 80 psi pressure. The pneumatic-tired rollers shall be equipped with boxes or platforms for ballast loading and shall be loaded so that the tire print width of each wheel is not less than the clear distance between tire prints.
- d. **Power Broom.** A power broom and/or blower shall be provided for removing loose material from the surface to be treated.

**609-3.3 PREPARING UNDERLYING COURSE.** The surface of the underlying course shall be prepared, shaped, and conditioned to a uniform grade and section, as shown on the Plans and as specified. Loose dirt and other objectionable material shall be removed from the surface.

On those type of bases where a prime coat is required and specified, the prime shall be applied and satisfactorily cured before starting the asphalt surface treatment.

When specified, the Contractor shall be required to patch, with premixed material, any holes or other malformations deviating from the true cross section and grade. The premixed material shall be made of the asphalt material specified and prepared by the method directed by the Engineer. All small patches shall be thoroughly hand tamped while the large patches shall be rolled with a power or pneumatic roller.

**609-3.4 CONTROL STRIP.** Prior to providing a complete chip seal coat and in the presence of the Engineer, treat three lengths of at least 100-feet for the full width of the distributor bar. Use the appropriate typical application rates shown in Table 609-1 for one surface treatment trial. Make other chip seal coat trials using various amounts of materials, as required by the Engineer.

**609-3.5 APPLICATION OF ASPHALT MATERIAL.** Asphalt material shall be applied on the properly prepared surface at the rate and temperature specified using a pressure distributor to obtain uniform distribution at all points. To insure proper drainage, the strips shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope. During all applications, the surfaces of adjacent structures shall be protected in such manner as to prevent their being spattered or marred. Asphalt materials shall not be discharged into borrow pits or gutters or upon the airport area.

**609-3.6 APPLICATION OF AGGREGATE MATERIAL.** Immediately after the application of the asphalt material, or as directed by the Engineer, uniformly spread the aggregates over the asphalt material at the rate specified for each designated application. Trucks spreading aggregate shall be operated backward so that the asphalt material will be covered before the truck wheels pass over it. The aggregate shall be spread in the same width of application as the asphalt material and shall not be applied in such thickness as to cause blanketing. Back-spotting or sprinkling of additional aggregate material, and pouring additional asphalt material over areas that show up having insufficient cover or asphalt, shall be done by hand whenever necessary. Additional spreading of aggregate material shall be done with a motor-patrol grader equipped with broom moldboard, a broom drag, kick broom, or a power broom, as directed by the Engineer.

Immediately after spreading each application, the aggregate shall be rolled. The rolling shall be continued until no more aggregate can be worked into the surface. In the construction of the second and third application, blading with the wire-broom moldboard attachment, kick broom, or broom dragging shall begin as soon as possible after the rolling has started and after the surface has set sufficiently to prevent excessive marking. Further blading and rolling on the strip being placed and on adjacent strips previously placed, shall be done as often as necessary to keep the aggregate material uniformly distributed. These operations shall be continued until the surface is evenly covered and cured to the satisfaction of the Engineer.

Succeeding applications shall not be applied until the preceding application has set and in no case until at least 24 hours have elapsed. If dust, dirt, or other foreign matter accumulates on the surface between the applications, the Contractor shall sweep and clean the surface as specified herein. The asphalt material and the aggregate shall be spread upon the clean and properly cured surface and handled as required. Avoid brooming or tracking dirt or any foreign matter on any portion of the pavement surface under construction.

All surplus aggregate from the final application shall be swept off the surface and removed prior to final acceptance of the work.

**609-3.7 CORRECTION OF DEFECTS.** Any defects, such as raveling, low centers, lack of uniformity, or other imperfections, shall be corrected to the satisfaction of the Engineer.

All defective materials resulting from over-heating, improper handling, or improper application shall be removed by the contractor and replaced with approved materials according to these specifications.

**609-3.8 FREIGHT AND WAYBILLS.** Before the final estimate is allowed the Contractor shall file with the Engineer receipted bills where railroad shipments are made, and certified waybills when materials are received in any other manner, of the asphalt and covering materials actually used in the construction covered by the contract. The Contractor shall not remove asphalt material from the tank car or storage tank

until the initial outage and temperature measurements have been taken by the Engineer, nor shall the car or tank be released until the final outage has been taken by the Engineer. Copies of all freight bills and waybills shall be furnished to the Engineer during the progress of the work.

### METHOD OF MEASUREMENT

**609-4.1** The asphalt material will be measured by the ton. Water added to emulsified asphalt will not be measured for payment.

**609-4.2** The quantity of aggregate material for the first, second, and third application to be paid for will be the number of tons of aggregate used for the accepted work.

**609-4.3** Chip Seal Coat, [number of aggregate] Applications. Section 90, by square yard of chip seal coat. Chip seal coat will be measured by the square yard, all preparation, materials, and application, completed and accepted. Liquid asphalt material, aggregate, blotter material, water used for aggregate and preparation, sweeping and dust control are subsidiary to P-609 items. Any areas of asphalt surface treatment found unacceptable by the Engineer shall be removed and reconstructed at the Contractor's expense. The pay unit/payment is for all layers/full depth of the surface treatment.

### BASIS OF PAYMENT

**609-5.1** Payment will be made at the contract unit price per ton for asphalt material for surface treatment and per ton for the first, second, and third aggregate application, or by the square yard for the completed chip seal coat application, as shown in the Bid Schedule.

Payment will be made under:

Item P609.010.0000	Asphalt Material – per ton
Item P609.020.0000	First Application Aggregate – per ton
Item P609.030.0000	Second Application Aggregate – per ton
Item P609.040.0000	Third Application Aggregate – per ton
Item P609.050.0000	Chip Seal Coat, ____ Applications – square yard.

### TESTING REQUIREMENTS

ATM 301	Sampling of Aggregates
ATM 304	Sieve Analysis of Aggregates & Soils
ATM 305	Percentage of Fracture in Coarse Aggregate
ATM 306	Percentage of Flat and Elongated Particles in Coarse Aggregate
ATM 317	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
ATM 401	Sampling Asphalt Materials
ATM 414	Anti-Strip Requirements of Hot Mix Asphalt
AASHTO T 96	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T 104	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

## **MATERIAL REQUIREMENTS**

AASHTO M 140

Emulsified Asphalt

AASHTO M 208

Cationic Emulsified Asphalt

AASHTO M 320

Performance Graded Asphalt Binder

## ITEM P-626 EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT

### DESCRIPTION

**626-1.1** This item shall consist of a mixture of emulsified asphalt, polymer, mineral aggregate, and water properly proportioned, mixed, and spread on an asphalt pavement surface, including airport pavements serving airplanes of 12,500 lbs or less, roads, and other general applications. The application of the surface treatment shall be according to these Specifications and shall conform to the dimensions shown on the Plans or as directed by the Engineer.

**626-1.2 ACRONYMS.** Also see Subsection GCP-10-02.

ISSA International Slurry Surfacing Association, Washington, DC

### MATERIALS

**626-2.1 AGGREGATE.** The aggregate shall consist of sound and durable manufactured sand, slag, crusher fines, crushed stone, or a combination thereof. The aggregate shall be clean and free from vegetable matter, dirt, and other deleterious substances. The aggregate shall have a sand equivalent of not less than 45 percent when tested according to ATM 307. The aggregate shall show a loss of not more than 35 percent when tested according to AASHTO T 96. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles when tested according to AASHTO T 104. Aggregates shall have a maximum Micro-Deval value of 15% when tested according to AASHTO T 327. Aggregate shall be 100% crushed.

The combined aggregate shall conform to the gradation shown in Table 626-1 when tested according to ATM 304. The specific aggregate gradation type will be designated in the Plans.

**TABLE 626-1. GRADATION OF AGGREGATES**

Sieve Size	Percent by Weight Passing Sieve		
	Type I	Type II	Type III
3/8 in.	100	100	100
No. 4	100	90 - 100	70 - 90
No. 8	90 - 100	65 - 90	45 - 70
No. 16	65 - 90	45 - 70	28 - 50
No. 30	40 - 65	30 - 50	19 - 34
No. 50	25 - 42	18 - 30	12 - 25
No. 100	15 - 30	10 - 21	7 - 18
No. 200	10 - 20	5 - 15	5 - 15
Residual asphalt content, percent dry weight of aggregate	10% - 16%	7.5% - 13.5%	6.5% - 12%

The job mix design (JMD) shall be run using aggregate within the gradation band for the desired type shown in Table 626-1. Once the JMD has been submitted and approved by the Engineer, the aggregate used on the project shall not vary by more than the tolerances shown in Table 626-2. At no time shall the aggregate used go out of the gradation bands in Table 626-1.

The aggregate will be accepted at the job location or stockpile. The aggregate will be accepted based on five gradation test samples according to ATM 301. If the average of the five tests is within the gradation tolerances, the materials will be accepted by the Engineer. If the tests show the material to be out of tolerance, the Contractor has the choice either to remove the material or blend other aggregates with the stockpile material to bring it into specification. Materials used in blending shall meet the quality tests before blending and shall be blended in a manner to produce a consistent gradation. This blending may require a new JMD.

Screening shall be required at the project stockpile site if there are oversize materials in the mix. Precautions shall be taken to prevent segregation of the aggregate in storing and handling. The stockpile shall be kept in areas that drain readily.

- a. **Aggregate Tolerance.** Once the JMD has been accepted, the aggregate gradation used on the project may vary from the aggregate gradation used in the JMD on each sieve by the percentages shown in Table 626-2. If the project aggregate fails to remain within this tolerance, a new JMD will be required by the Engineer at the expense of the Contractor.

**TABLE 626-2. AGGREGATE TOLERANCE**

Sieve Size	Tolerance, percent passing by weight
3/8 in.	± 5
No. 4	± 5
No. 8	± 5
No. 16	± 5
No. 30	± 5
No. 50	± 4
No. 100	± 3
No. 200	± 2
Residual Asphalt, percent dry weight of aggregate	± 1

**626-2.2 MINERAL FILLER.** If mineral filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of AASHTO M 17 and shall be used in the amounts required by the JMD. The mineral filler shall be considered as part of the aggregate.

**626-2.3 EMULSIFIED ASPHALT.** The specific emulsified asphalt is designated in the Plans, and shall conform to the requirements of AASHTO R 5. The cement mixing test is waived for these slurry type emulsions. The type of emulsified asphalt shall be either anionic or cationic, whichever is best suited to the aggregate and job conditions to be encountered.

The Contractor shall provide samples of the emulsified material and a copy of the manufacturer's Certificate of Analysis (COA) for each carload or equivalent of the asphalt material to the Engineer for review and acceptance before the emulsified asphalt material is applied. The furnishing of COA for the emulsified asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

**626-2.4 POLYMER.** The Contractor shall submit manufacturer's technical data, the manufacturer's certification indicating that the polymer meets the requirements of the specification, and the asphalt material manufacturer's approval of its use to the Engineer.

**626-2.4 WATER.** All water used in mixing or curing the slurry shall be from potable sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

**COMPOSITION AND APPLICATION**

**626-3.1 COMPOSITION.** The slurry seal shall consist of a mixture of emulsified asphalt, mineral aggregate, a minimum of 1% polymer (when specified), additives as necessary, and water.

**626-3.2 JOB MIX DESIGN.** No slurry seal for payment shall be placed until a JMD has been approved by the Engineer. The JMD shall be developed by a laboratory with experience in designing slurry seal mixes and a signed copy shall be submitted in writing by the Contractor to the Engineer at least 10 days prior to the start of operations.

The laboratory report JMD shall indicate the proportions of aggregates, mineral filler (min. and max.), water (min. and max.), polymer (%), and asphalt emulsion based on the dry aggregate weight. It shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effects). The JMD shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new JMD shall be established before the new material is used.

The Contractor shall submit to the Engineer for approval a complete JMD on the materials proposed for use, prepared and certified by an approved laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the JMD. The JMD shall be made with the same aggregate and grade of emulsified asphalt that the Contractor will provide on the project. At a minimum the required tests and values needed are shown in Table 626-3:

**TABLE 626-3. SLURRY MIX TESTS**

TEST	DESCRIPTION	SPECIFICATION
ISSA TB-100	Wet Track Abrasion of Slurry Surfacing Systems, One Hour Soak	50 g/ft <sup>2</sup> Max
ISSA TB-115	Determination of Slurry Seal Compatibility	Pass

**626-3.3 APPLICATION RATE.** Unless otherwise specified, the slurry seal shall be applied to at the application rates shown in Table 626-4 for that gradation of material used. The rate of application shall not vary more than  $\pm 2$  lb/yd<sup>2</sup>.

**TABLE 626-4. SLURRY APPLICATION RATES**  
(Pounds of mixture per square yard)

Type I	Type II	Type III
8 - 12	12 - 20	18 - 30

**626-3.4 CONTROL STRIPS.** Control Strips, of 60 yd<sup>2</sup> each, shall be placed prior to the start of the slurry seal work in the presence of the Engineer. The test area will be designated by the Engineer and will be located on the existing pavement. Control strips shall be made by each machine after calibration. Samples of the slurry seal may be taken and the mix consistency verified by using ISSA TB-106 Slurry Seal Consistency test. In addition, the proportions of the individual materials may be verified by the Engineer by using the calibration information provided after machine calibration. If any test does not meet specification requirements, additional tests shall be made at the expense of the Contractor, until an acceptable control strip is placed.

## CONSTRUCTION METHODS

**626-4.1 WEATHER LIMITATIONS.** The slurry seal shall not be applied if the pavement or air temperature is below 50°F and falling but may be applied when both pavement and air temperature are above 45°F and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. Do not apply slurry seal during rain or other adverse weather conditions. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

**626-4.2 EQUIPMENT AND TOOLS.** The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of this work.

- a. **Slurry Mixing Equipment.** The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled slurry seal mixing machine of either truck mounted or continuous run design. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, and water to a revolving mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for materials to maintain an adequate supply to the proportioning controls.

If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speed of the machine during application of the slurry seal,

with a self-loading device, with opposite side driver stations, all part of original equipment manufacturer design.

The aggregate shall be pre-wetted immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients. No excessive mixing shall be permitted. The mixing machine shall be equipped with a fines feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed into the mixer.

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for complete fogging of the surface with an application of 0.05 to 0.10 gal/yd<sup>2</sup> preceding the spreading equipment.

Sufficient machine storage capacity to mix properly and apply a minimum of 5 tons of the slurry shall be provided. Proportioning devices shall be calibrated prior to placing the slurry seal.

- b. Slurry Spreading Equipment.** The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to ensure no loss of the mixture at the surface contact point. The rear seal shall act as the final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated to produce a free flow of material of uniform consistency to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform mat.

A continuous spreading operation shall be maintained by means of a continuous charging operation so that a minimum of construction joints occur. Continuous operating is defined as one in which the spreading operation progresses prior to initial setting or breaking of the slurry mix, which starts within approximately 15 minutes.

Provide suitable storage facilities for the asphalt emulsion, using containers equipped to prevent water from entering the emulsion. If necessary, suitable heat shall be provided to prevent freezing.

- c. Auxiliary Equipment.** Other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushers, power blowers, barricades, etc., shall be provided as required.
- d. Roller.** The roller shall be a self-propelled pneumatic-tired roller capable of exerting a contact pressure during rolling of 50 psi. It shall be equipped with a water spray system, to be used if the slurry is picking up on the tires during rolling.
- e. Tack Coat and Distributor.** Normally a tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt and three parts water. The emulsified asphalt may be the same as that used in the mix. Pressure distributors used for application of the diluted asphalt emulsion tack coat shall be self-propelled, equipped with pneumatic tires, and capable of uniformly applying 0.05 to 0.15 gal/yd<sup>2</sup> of the diluted emulsion over the required width of application. Distributors shall be equipped with tachometers, pressure gages, and volume-measuring devices. The tack coat shall be applied at least 2 hours before the slurry seal but within the same day.

**626-4.3 EQUIPMENT CALIBRATION.** Each slurry mixing unit to be used on the project shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted by the Engineer provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until either the calibration has been completed or a previous calibration is accepted by the Engineer.

**626-4.4 PREPARATION OF EXISTING SURFACE.** Clean pavement surface immediately prior to placing the tack coat and slurry seal coat by sweeping, flushing well with water leaving no standing water, or a combination of both, so that the pavement surface is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film. Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. Water flushing will not be permitted in areas where considerable cracks are present in the pavement surface. After cleaning, treat these areas with an oil spot primer.

All painted stripes or markings on the surface to be treated, shall be removed according to Subsection P-620-3.3. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt pavement similar to that of the existing pavement. Materials and methods of construction shall comply with the applicable sections of these specifications. Remove all vegetation and debris from cracks to a minimum depth of 1-inch. If extensive vegetation exists, treat the specific area with a concentrated solution of a water-based herbicide approved by the Engineer. Fill all cracks greater than 1/4-inch (wide) with a crack sealant meeting ASTM D6690, Type IV. The crack sealant, preparation, and application shall be compatible with the surface treatment/overlay to be used. To minimize contamination of the asphalt with the crack sealant, underfill the crack sealant a minimum of 1/8-inch, not to exceed 1/4-inch. Any excess joint or crack sealant shall be removed from the pavement surface.

**626-4.5 APPLICATION OF SLURRY SEAL COAT.** Charge the mixture in the following order:

- a. Water
- b. Aggregate
- c. Asphalt Emulsion

No violent mixing will be permitted. Maintain temperature range at the mixer between 90 and 120 °F. Mix until a uniform coating of the aggregate is obtained. Continue mixing until the mixture is discharged into the spreader box. Discard the entire batch if there is evidence that the emulsion has broken.

The surface shall be pre-wet by fogging ahead of the slurry spreader box. Water used in pre-wetting the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total time of mixing shall not exceed 2 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Care shall be taken not to overload the spreader box which shall be towed at a slow and uniform rate not to exceed 5 mph. No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry shall be removed from the pavement surface. A sufficient amount of slurry shall be fed into the box to keep a full supply against the full width of the spreader box. The mixture shall not be permitted to overflow the sides of the spreader box. No breaking of the emulsion will be allowed in the spreader box.

Apply the slurry seal to form a film with a maximum thickness of 3/8 inch. Isolated depressions and cracks may have a thickness greater than 3/8 inch in order to obtain a smooth surface.

The finished surface shall have no more than 4 tear or drag marks greater than 1/2 inch wide and 4 inches long in any 12 foot by 22 foot section. It shall have no tear or drag marks greater than 1 inch wide and 3 inches long.

The finished surface shall have no transverse ripples of 1/4 inch or more in depth, as measured with a 12-foot straight edge laid upon the surface.

Adjacent lanes shall be lapped at the edges a minimum of 2 inches with a maximum of 4 inches to provide complete sealing at the overlap. Construction longitudinal and transverse joints shall be neat and uniform

without buildup, uncovered areas, or unsightly appearance. All joints shall have no more than 1/4 inch difference in elevation when measured across with a 12-foot straight edge.

After application of the slurry seal, the surface shall be rolled with a pneumatic-tired roller a minimum of 2 complete passes. The roller shall be operated at a tire pressure of approximately 50 psi.

The fresh slurry seal application shall be protected by barricades and markers and permitted to dry for 4 to 24 hours, depending on weather conditions. Any damage to uncured slurry shall be repaired at the expense of the Contractor.

In areas where the spreader box cannot be used, the slurry shall be applied by means of a hand squeegee. Upon completion of the work, the seal coat shall have no holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform and skid resistant texture satisfactory to the Engineer. All wasted and unused material and all debris shall be removed from the site prior to final acceptance.

Upon completion of the project, the Contractor shall sweep the finished surface with a conventional power rotary broom, to remove any potential loose material from the surface. The material removed by sweeping shall be disposed of in a manner satisfactory to the Engineer.

**626-4.6 CERTIFICATION.** Samples of the emulsion that the Contractor proposes to use, together with a statement as to its source, shall be submitted, and approval shall be obtained before using such material. The Contractor shall submit to the Engineer a manufacturer's certified report for each consignment of the emulsion. The manufacturer's certified report shall not be interpreted as a basis for final acceptance. All such reports shall be subject to verification by testing samples of the emulsion as received for use on the project.

#### **METHOD OF MEASUREMENT**

**626-5.1** The emulsified asphalt for slurry coat will be measured by the square yard.

**626-5.2** Aggregate will be measured by the ton of dry aggregate.

**626-5.3** Tack coat will be measured by the ton.

**626-5.4** Emulsified Asphalt Slurry Seal Surface Treatment will be measured according to Section 90 by the square yard, all preparation, materials, and application, completed and accepted. Liquid asphalt material, aggregate, blotter material, water used for emulsion and preparation, sweeping and dust control are subsidiary to the work. Any areas of emulsified asphalt slurry seal surface treatment found unacceptable by the Engineer shall be removed and reconstructed at the Contractor's expense. The pay unit/payment is for all layers/full depth of slurry seal surface treatment.

#### **BASIS OF PAYMENT**

**626-6.1** Payment will be made at the contract unit price per square yard for the slurry coat and at the contract price per ton for aggregate and tack coat.

Payment will be made under:

Item P626.010.0000	Emulsified Asphalt for Slurry Coat - per square yard
Item P626.020.0000	Aggregate - per ton
Item P626.030.0000	Emulsified Asphalt for Tack Coat - per ton
Item P626.040.0000	Emulsified Asphalt Slurry Seal Surface Treatment – per square yard

#### **TESTING REQUIREMENTS**

AASHTO T 96	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
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AASHTO T 104	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
ATM 313	Degradation Value of Aggregates
ISSA TB-100	Wet Track Abrasion of Slurry Surfacing Systems
ISSA TB-106	Measurement of Slurry Seal Consistency
ISSA TB-115	Determination of Slurry System Compatibility
ASTM C1602	Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D6690	Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ATM 301	WAQTC FOP for AASHTO T 2 Sampling of Aggregates
ATM 304	WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates
ATM 307	WAQTC FOP for AASHTO T 176 Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
ATM 317	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

**MATERIAL REQUIREMENTS**

AASHTO M 17	Mineral Filler for Bituminous Paving Mixtures
AASHTO R 5	Selection and Use of Emulsified Asphalts

## ITEM P-636 HIGH FLOAT SURFACE TREATMENT

### DESCRIPTION

**636-1.1** Construct a single course asphalt surface treatment (HFST).

### MATERIALS

**636-2.1 EMULSIFIED ASPHALT.** Use HFMS-2s high float asphalt emulsion material that conforms to AASHTO M 140.

**636-2.2 AGGREGATES.** Use crushed stone or crushed gravel for cover coat material (cover aggregate) consisting of sound, tough, durable pebbles or rock fragments of uniform quality. Use material free from clay balls, vegetable matter, adherent films or coatings of dirt, clay, dust, or other deleterious matter that could impede adherence of the asphalt material. Wash the aggregate if necessary. Meet the following requirements:

L.A. Wear,%	AASHTO T 96	50, max.
Micro-Deval, %	AASHTO T 327	15, max.
Sodium Sulfate Loss,%	AASHTO T 104	9, max. (5 cycles)
Fracture,%	ATM 305	50, min. (single face)
Thin-Elongated Pieces	ATM 306	8, max.
Plasticity Index*	AASHTO T 90	3 max.

\*Prepare material for AASHTO T 90 according to the wet preparation method, AASHTO T 146.

The test sampling locations(s) will be determined by the Engineer, before crushing operations begin. Cover stockpiles of cover coat material to exclude precipitation.

**a. Gradation testing:**

- (1) **Acceptance Testing:** Determine the gradation by AASHTO T 27. Testing will be done upon notification by the Contractor that the crusher is ready for production.
- (2) **Assurance Testing:** Determine the gradation by AASHTO T 27 and AASHTO T 88 except dry the material for the T 88 test within a temperature range of 90° to 100° F.

At least 15 days before beginning work, submit a representative 30-pound sample of the aggregate and 1-quart sample of the asphalt material proposed for use in the work. The Department will test the materials using ATM 414 as submitted (that is, without addition of anti-stripping additives). The Department will reject materials failing to meet or exceed 70% retention of the asphalt, unless you provide approved anti-stripping additives or employ other approved measures which correct this deficiency.

**TABLE 636-1  
REQUIREMENTS FOR GRADING OF COVER AGGREGATE  
FOR HIGH FLOAT SURFACE TREATMENT**

Sieve	Percent Passing by Weight
1 in.	100
3/4 in.	75-95
3/8 in.	50-80
No. 4	35-65
No. 8	20-50
No. 40	8-30
No. 200	0-5
0.005 mm	0-3*

*\* Special Note on Gradation Testing: For acceptance testing, verify compliance with the minus 0.005 mm size fraction at least once for each source used. For assurance testing, use the entire gradation with each test.*

**636-2.3 SURFACE TREATMENT BLOTTER MATERIAL.** Use suitable, clean sand. Unless otherwise required by the Engineer, use sand passing the 8 mesh sieve, and having no more than 0.5% material passing the 200 mesh sieve. The material may be accepted in stockpile at the source. Gradation will be determined by AASHTO T-27.

**636-2.4 DETERMINE HFST DESIGN COMPOSITION.** Within two days after the start of cover aggregate crushing, submit a representative 70 lb sample of the cover aggregate and a 1 gallon sample of the high float asphalt emulsion proposed for use on the project. Fill the asphalt container to the brim so that it contains no air.

Submit changes in application rates warranted by changes in aggregate gradation, source of cover aggregate, or high float emulsion supplier in the same manner as the-original submittal.

**636-2.5 COMPOSITION OF SURFACE TREATMENT.** The initial application rates of asphalt and cover aggregate materials will be as determined by the Engineer per subsection 636-2.4. The Engineer may adjust application rates as required by field conditions.

The following table provides the pre HFST Design estimating factors, and specifies the tolerance allowed the Contractor for applying surface treatment material above or below the application rates determined by the Engineer.

Material	Pre-HFST Design Estimating Factor	Specified Tolerance
HFMS-2S Asphalt	0.75 gallon per sq. yard	±0.04 gallon per sq. yard
Cover Aggregate	75 lb per sq. yard	±3 lb per sq. yard

### CONSTRUCTION REQUIREMENTS

**636-3.1 GENERAL.** Longitudinal joints are allowed only at the centerline. Accomplish work in a manner such that asphalt and cover aggregate applications are completed full width by the end of each shift.

**636-3.2 WEATHER LIMITATIONS.** Proceed only if ambient air temperature is 60°F or above. Measure temperatures in the shade away from any heat source.

Do not apply HFST during periods of rain, fog, mist or imminent rain or when weather conditions prevent the proper penetration of the asphalt material and/or adhesion of the cover aggregate.

Ensure that weather conditions allow for proper construction of the HFST and adequate curing time prior to inclement weather or freeze-up. Do not apply HFST before May 15 or after August 15.

#### 636-3.3 EQUIPMENT.

- a. **Distributor.** Use a distributor that is designed, equipped, maintained and operated so that asphalt material at even heat is applied uniformly on variable widths of surface up to half the roadway, runway, or taxiway width plus 6 inches, at the specified rate, from 0.38 to 0.75 gallons per square yard, with uniform pressure and within specified tolerances.

Provide distributor equipment that meets the following:

- (1) Computerized control of liquid asphalt spread rates to automatically deliver specified delivery rates and capable of changing rates when so directed. Computer monitoring of spread rate, truck speed and distance traveled.

- (2) A thermometer for measuring temperatures of the tank's contents, readily visible from outside the truck cab.
- (3) Each nozzle in the spray bar is turned to make the constant angle with the longitudinal axis of the spray bar that is recommended by the manufacturer of the distributor. All nozzles in the spray bar are of the same manufacture, type and size. The spray bar height provides triple overlap of the asphalt emulsion being applied by the spray nozzles.

Before the application of asphalt, ensure that the distributor meets the following requirements:

- (1) The spray bar can be maintained at a constant height throughout the entire operation.
- (2) Spray bar nozzles are clean and in good working condition.
- (3) The spray bar is provided with a positive shutoff to prevent dribbling.
- (4) The distributor is capable of maintaining a uniform speed.

Calibration and adjustment requirements include:

- (1) The distributor will be inspected by the Engineer prior to the commencement of the operation. Perform any adjustments, maintenance and other requirements prior to use.
  - (2) Calibrate the distributor in accordance with the manufacturer's recommendations. The Engineer may require the Contractor to prove the accuracy of the distributor prior to commencing the asphalt application and any time thereafter if deemed necessary by the Engineer. Any change in settings on the distributor after calibrating will require that the distributor be recalibrated.
  - (3) Should any of the nozzles on the spray bar fail to provide a constant, uniform flow during the application of asphalt material, immediately cease application of the asphalt material. Do not allow the distributor to resume application of the asphalt material until all of the nozzles are in good working order. Nozzle adjustments and/or repairs must be approved by the Engineer.
- b. **Aggregate Spreader.** Provide an aggregate spreader that is capable of evenly applying cover aggregate material to the specified roadway, runway, or taxiway width in a maximum of two passes. Provide an aggregate spreader that is computer controlled to automatically maintain the specified delivery rate of cover aggregate regardless of variations in machine speed. Provide a spreader with sufficient size feed system to maintain cover aggregate in the spread hopper at all times. Provide a spread hopper that is equipped with augers or other approved equipment to prevent segregation of the cover aggregate materials.

Stopping the aggregate spreader to refill the receiving hopper will be permitted provided that the spreader is backed up at least 20 feet from the last cover aggregate application. The aggregate spreader will be permitted to slow down to allow trucks to backup and discharge loads into the receiving hopper. Provide an aggregate spreader that is constructed to eliminate material segregation in the various hoppers.

Immediately before using the aggregate spreader on the project, calibrate the aggregate spreader for the cover aggregate to be applied. Control the forward speed of the aggregate spreader during calibration to approximate the speed required to apply the cover aggregate over the asphalt material and maintain a continuous operation with the distributor. Calibrate the aggregate spreader in accordance with the manufacturer's recommendations. The Engineer may require the Contractor to prove the accuracy of the aggregate spreader.

Calibrate the aggregate spreader whenever directed by the Engineer and allow the Engineer to observe the procedure.

- c. **Rollers.** Utilize a minimum of three self-propelled pneumatic rollers weighing not less than 20,000 lbs, equipped with not less than nine tires staggered back and front, inflated to 60 psi. Inflate all tires to equal pressure, and equip each roller with a suitable tire pressure gauge for checking tire inflation pressure.

**636-3.4 PREPARATION OF SURFACE.** Apply HFST on sections of fully shaped and compacted grade. Allow the Engineer to approve grade prior to application of HFST. Apply HFST within 72 hours of approval of the grade. Areas of grade not surfaced within the 72 hour period are subject to reapproval by the Engineer. Roll the surface with a steel wheeled soil compactor immediately prior to application of asphalt materials. Do not leave windrows of materials that may impede drainage on or adjacent to the surface treatment area.

Apply HFST when the prepared surface is damp. Prior to the asphalt application, the Engineer may require dampening the surface by applying a fine spray of water to the prepared surface. Do not apply HFST to a wet surface or when rain or fog is present or imminent.

**636-3.5 APPLYING HIGH FLOAT ASPHALT EMULSION MATERIAL.** Ensure that the length of spread of high float asphalt emulsion (hereafter referred to as asphalt) material does not exceed that which trucks loaded with cover aggregate can immediately cover.

For the first pass over the segment of roadway, runway, or taxiway being surfaced, follow a string line, set either on the shoulder or on the centerline, whichever is on the driver's side of the distributor. Accomplish the second pass with the centerline joint on the driver's side of the distributor.

Do not allow any equipment or vehicles on sprayed asphalt at any time prior to cover aggregate application.

Do not spread asphalt material more than 6 inches wider than the width covered by the cover aggregate from the spreader. Do not allow operations to proceed in a manner that allows asphalt material to chill, set up, dry, or otherwise impair retention of the cover aggregate.

Park the distributor, when not spreading, so that the spray bar or mechanism will not drip asphalt material on the surface of the roadway, runway, or taxiway.

Apply asphalt material at temperatures between 150°F and 180°F.

Correct any skipped areas or deficiencies. Prevent an excess of asphalt material at junctions of spreads.

**636-3.6 APPLICATION OF COVER AGGREGATE MATERIAL.** Provide cover aggregate that has a temperature of no less than 40°F and a 3%-5% moisture content (by dry weight) at the time of application. If necessary, the cover aggregate shall be moistened or dried to achieve the specified moisture content.

Apply cover aggregate within 1.5 minutes after application of the asphalt material or as directed by the Engineer. Keep the increment as constant as possible, and adjust as needed to meet changing conditions. Whenever it is apparent that the time limit above will be exceeded, make a transverse joint by placing construction paper (roofing felt or similar product) on the prepared surface and ending the HFST operations on the paper. Remove the paper and dispose of properly. Touch up the edges of the applied HFST prior to restarting HFST operations.

Immediately after cover aggregate is spread, cover deficient areas with additional material. Begin pneumatic tire rolling for the full width of the aggregate immediately after placement of cover aggregate and continue until at least six complete coverages are obtained or until cover aggregate is bound tightly, to the satisfaction of the Engineer. Accomplish the rolling operation within 500 feet of the cover aggregate application. Slow the high float application operation if the rolling cannot be completed within this distance. Do not exceed 5 miles per hour with the pneumatic tire roller. Maintain a spare pneumatic tired roller on the project during high float application, in addition to those rollers necessary to accomplish this specification.

Accomplish spreading in such a manner that the tires of the trucks or aggregate spreader do not contact the uncovered and newly applied asphalt material.

Sweeping to remove excess cover aggregate is required. Sweep between two and three weeks following the application of cover coat material as directed by the Engineer. Remove ridges of loose aggregate created by traffic prior to sweeping, or uniformly spread ridges over the surface as they develop as directed by the Engineer.

**636-3.7 APPLICATION OF BLOTTER MATERIAL.** Due to weather, construction and/or materials problems, it is possible that the finished surface treatment may become unstable. To minimize development of damage to the surface, blotter material may be required. Apply blotter material as directed by the Engineer and immediately roll with a pneumatic-tired roller (as described above) with tire pressures adjusted to 90-100 psi.

**636-3.8 TRAFFIC CONTROL.** Do not operate construction equipment at speeds exceeding 15 miles per hour on a freshly applied surface treatment, for a period of up to 24 hours, as directed by the Engineer. Unless otherwise specified, keep public corridors open to traffic at all times. Do not allow traffic on freshly sprayed asphalt or cover aggregate material that is not fully compacted. As soon as final rolling of the HFST layer is accomplished, controlled traffic may be permitted to operate on the HFST surface. Control public traffic on the HFST so that speeds do not exceeding 15 miles per hour for a period of 12 hours or as directed by the Engineer.

### **METHOD OF MEASUREMENT**

**636-4.1** See Section 90.

Surface Treatment Blotter Material and water used for aggregate and surface preparation are not measured for payment; these items are considered subsidiary obligations.

If sweeping and/or blading of excess cover aggregate is required, this work is not measured or paid for directly, but is considered a subsidiary obligation.

### **BASIS OF PAYMENT**

**636-5.1** Water for emulsified asphalt is subsidiary.

Payment will be made under:

Item P636.010.0000	Asphalt for High Float Surface Treatment, Type HFMS-2s – per ton
Item P636.020.0000	Aggregate for High Float Surface Treatment, Grading B – per ton
Item P636.030.0000	High Float Surface Treatment – per square yard
Item P636.040.0000	Aggregate for High Float Surface Treatment – per cubic yard

### **TESTING REQUIREMENTS**

ATM 305	Percentage of Fracture in Coarse Aggregate
ATM 306	Determining the Percentage of Flat and Elongated Particles in Coarse Aggregate (Alaska FOP for ASTM D 4791)
ATM 317	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
ATM 414	Anti-Strip Requirements of Hot Mix Asphalt
AASHTO T 27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 88	Particle Size Analysis of Soils
AASHTO T 90	Plastic Limit and Plasticity Index of Soils
AASHTO T 96	Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

AASHTO T 104

Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

AASHTO T 146

Wet Preparation of Disturbed Soil Samples for Test

**MATERIAL REQUIREMENTS**

AASHTO M 140

Emulsified Asphalt