

## PART V -- ASPHALTIC PAVEMENTS

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## **Section 501 (Reserved)**

## **Section 502**

### **Superpave Asphaltic Concrete Mixtures**

#### **502.01 DESCRIPTION.**

**(a) General:** These specifications are applicable to Superpave asphaltic concrete wearing, binder and base course mixtures of the plant mix type.

This work consists of furnishing and constructing one or more courses of asphaltic concrete mixture applied hot in conformance with these specifications and in conformity with the lines, grades, thicknesses and typical sections shown on the plans or established. The mixture shall consist of aggregates and asphalt with additives combined in proportions which meet the requirements of this section. Equipment and processes shall conform to Section 503.

**(b) Quality Assurance:** Quality assurance requirements and design procedures shall be as specified herein elsewhere and in the latest edition of the Department's publication entitled "Application of Quality Assurance Specifications for Asphaltic Concrete Mixtures" which is hereby made a part of this contract by reference.

It is the intent of these specifications that the mixtures produced and placed meet the requirements for 100 percent payment. Work shall meet the requirements of this section and be subject to acceptance by the Department.

The contractor shall be responsible for and shall exercise quality control over materials and their assembly, design, processing, production, hauling, laydown and associated equipment. Quality control is defined as the constant monitoring of equipment, materials and processes to ensure that mixtures produced and placed are uniform, within control limits, and meet specification requirements. When these specifications are not being met and satisfactory control adjustments are not being made, operations shall be discontinued until proper adjustments and uniform operations are established. Control shall be accomplished by a program independent of the Department's testing and shall ensure that the requirements of the job mix are being achieved and that necessary adjustments provide the specified results.

The quality of mixtures will be evaluated during two phases, mixture produced at the plant, and mixture hauled, placed and compacted. Quality of both phases will be evaluated continuously as stated herein elsewhere.

## 502.01

Plant quality control testing shall be conducted continuously throughout production independent of delivery points. Project site quality control testing shall be conducted on each project for the mix placed on that project.

When the plant is in operation, the contractor shall have a Certified Asphaltic Concrete Plant Technician at the plant or jobsite who is capable of designing asphaltic concrete mixes, conducting any test or analysis necessary to put the plant into operation and producing a mixture meeting specifications. Daily plant operations shall not begin unless the Certified Asphaltic Concrete Plant Technician is at the plant. The Asphaltic Concrete Plant Technician certification will be awarded by the Department upon satisfactory completion of the Department's requirements.

**(c) Mixture Substitutions:** Changes in design level will not be allowed on the roadway. Substitutions will be allowed for mixes without requiring a change order as follows. Wearing course [0.75 inch (19 mm)] may be substituted for binder course but not substituted for base course. Binder course [1 inch (25 mm)] may be substituted for base course. Wearing Course, 0.5 inch (12.5 mm) may be substituted for Incidental Paving, Level A. Shoulders may be any mixture type shown in Table 502-5 regardless of design level.

When any substitution is made, all specification requirements for the mixture used shall apply with the following exceptions. When wearing course is substituted for binder course, RAP will be allowed in accordance with binder course requirements in Table 502-5. The lift thickness placed shall be as specified in Subsection 502.08 and Table 502-5 for the mix type used.

**502.02 MATERIALS.** All materials must be sampled in accordance with the Materials Sampling Manual and shall be tested in accordance with the test procedures in Table 502-1. The contractor shall keep accurate records, including proof of deliveries of materials for use in asphaltic concrete mixtures. Copies of these records shall be furnished to the engineer upon request. Materials shall comply with the following Subsections:

|                                    |                   |
|------------------------------------|-------------------|
| Asphalt                            | 1002              |
| Silicone and Anti-Strip Additives  | 1002.02           |
| Aggregates                         | 1003.01 & 1003.06 |
| Reclaimed Asphaltic Pavement (RAP) | 1003.01 & 1003.06 |
| Hydrated Lime                      | 1018.03(a)        |
| Mix Release Agent                  | 1018.25           |

**Table 502-1  
Test Procedures for Superpave Asphalt Concrete**

| Description   | Test Method       |
|---|-------------------|
| Specific Gravity and Density of Compressed Asphaltic Mixtures | DOTD TR 304       |
| Theoretical Maximum Specific Gravity, $G_{mm}$                | DOTD TR 327       |
| Asphalt Cement Content, $P_b$                                 | DOTD TR 323       |
| Mechanical Analysis of Extracted Aggregate                    | DOTD TR 309       |
| Moisture Content of Loose HMA                                 | DOTD TR 319       |
| Degree of Particle Coating (plant requirement)                | DOTD TR 328       |
| Moisture Sensitivity (Lottman)<br>(Tensile Strength Ratio)    | DOTD TR 322       |
| Bulk Specific Gravity and Absorption                          | AASHTO T 84, T 85 |
| Coarse Aggregate Angularity, % Crushed<br>(Double Faced)      | DOTD TR 306       |
| Fine Aggregate Angularity                                     | DOTD TR 121       |
| Flat and Elongated Particles                                  | ASTM D 4791       |
| Sand Equivalent   | DOTD TR 120       |
| Mixture Conditioning (Aging) of HMA Mixtures                  | AASHTO R 30       |
| Superpave Volumetric Mix Design                               | AASHTO M 323      |
| Preparing Gyrotory Samples                                    | AASHTO T 312      |
| Asphalt Cement Draindown                                      | ASTM D 6390       |
| Longitudinal Profile Using Automated Profilers                | DOTD TR 644       |
| Thickness and Width of Base and Subbase                       | DOTD TR 602       |

**(a) Asphalt Cement:** The asphalt cement grades used shall be as specified in Table 502-2 using the design traffic load levels shown on the plans.

If the asphalt cement does not comply with the requirements of Section 1002, mix production shall cease until proper asphalt material is supplied.

**Table 502-2  
Superpave Asphalt Cement Usage**

| Current Traffic Load Level | Mixture Type      | Grade of Asphalt Cement |
|----------------------------|-------------------|-------------------------|
| Level 1                    | Wearing Course    | PG 70-22m               |
|                            | Binder Course     | PG 70-22m               |
|                            | Base Course       | PG 64-22                |
| Level 2                    | Wearing Course    | PG 76-22m               |
|                            | Binder Course     | PG 76-22m               |
| Level A                    | Incidental Paving | PG 70-22m               |

## 502.02

Base course mixtures containing 20 to 30 percent RAP shall use PG 58-28 asphalt cement.

When mixtures are used for bike paths, curbs, detour roads, driveways, guardrail widening, islands, joint repair, leveling, parking lots, patching, or widening, PG 64-22 asphalt cement may be used in lieu of the modified asphalts. Unless otherwise noted on the plans, PG 64-22 asphalt cement may also be used on shoulders in lieu of the modified asphalts.

PG 76-22m asphalt cement may be substituted for PG 70-22m or PG 64-22 asphalt cements at no increase in price. PG 70-22m asphalt cement may be substituted for PG 64-22 at no increase in price. When average daily traffic (ADT) is less than 2500, PG 70-22m Alternate asphalt cement may be substituted for PG 70-22m asphalt cement for Level 1 and Level A mixes at no increase in price.

### **(b) Additives:**

**(1) Silicone:** Silicone additives, when needed, shall be dispersed into the asphalt cement by methods and in concentrations given in QPL 22.

**(2) Anti-Strip (AS):** An anti-strip additive shall be added at the minimum rate of 0.5 percent by weight (mass) of asphalt cement and thoroughly mixed in-line with the asphalt cement at the plant. Additional anti-strip shall be added up to 1.2 percent by weight (mass) of asphalt in accordance with Subsection 502.03.

When the amount of anti-strip additive is not in accordance with the approved job mix formula, production shall be discontinued until satisfactory adjustments are made.

**(3) Hydrated Lime:** Hydrated lime additive may be incorporated into all asphaltic concrete mixtures at the rate specified in the approved job mix formula. The minimum rate shall not be less than 1.5 percent by weight (mass) of the total mixture. Hydrated lime additive shall be added to and thoroughly mixed with aggregates in conformance with Subsection 503.05(c). Hydrated lime may be added as a mineral filler in accordance with Heading (c)(3).

**(c) Aggregates:** Aggregates shall meet the requirements of Table 502-5 and Section 1003.

**(1) Friction Ratings:** Friction ratings for aggregates shall be determined in accordance with Subsection 1003.06. The friction ratings and allowable usage of aggregates shall be as shown in Table 502-3. Friction rating requirements shall apply only to the final lift of the travel lane wearing course. Bike paths, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, patching, shoulders, widening and incidental paving uses, and roadway binder and base courses may use

any combination of Friction Rating I, II, III, and IV aggregates, in combination with the allowable RAP percentages.

**Table 502-3  
Aggregate Friction Rating**

| Friction Rating | Allowable Usage   |
|-----------------|---|
| I               | All mixtures  |
| II              | All mixtures  |
| III             | All mixtures, except travel lane wearing courses with plan ADT greater than 7000 <sup>1</sup> |
| IV              | All mixtures, except travel lane wearing courses <sup>2</sup>                                 |

**(2) Reclaimed Asphaltic Pavement (RAP):** Reclaimed asphaltic pavement shall be stockpiled separate from other materials at the plant and will be subject to approval prior to use. Such stockpiles shall be uniform and free of soil, debris, foreign matter and other contaminants. Reclaimed materials that cannot be broken down during mixing or that adversely affect paving operations shall be screened or crushed to pass a 2 inch (50 mm) sieve prior to use.

**(3) Mineral Filler:** Mineral filler complying with the requirements of Subsection 1003.06(a)(6) may be used in all mixtures.

**(4) Natural Sand:** Natural sand shall meet the requirements of Table 502-5 and Subsection 1003.06(a)(3).

**502.03 DESIGN OF ASPHALTIC MIXTURES, JOB MIX FORMULA (JMF).** The contractor shall design the mixtures for optimum asphalt content and comply with requirements of the Superpave Mix Design for the level of mixture in Table 502-5 in accordance with AASHTO M 323. The job mix formula shall include the recommended formula, extracted gradation, and supporting design data. The recommended formula shall be submitted for approval to the District Laboratory Engineer on a properly completed Superpave Asphaltic Concrete Job Mix Formula form with all supporting design data. No mixture shall be produced until the proposed job mix formula has been approved.

The contractor's proposed job mix formula shall indicate a single anti-strip additive rate which is 0.1 percent greater than the percentage which will yield a minimum Tensile Strength Ratio (TSR) of 80 percent up to a

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maximum of 1.2 percent anti-strip additive when tested in accordance with DOTD TR 322.

The job mix formula shall indicate a single rate of hydrated lime additive, when used. The job mix formula rate of hydrated lime additive shall not be less than 1.5 percent by weight (mass) of total mixture.

The job mix formula shall indicate the optimum mixing temperature. The job mix formula limits for mix temperature will be  $\pm 25^{\circ}\text{F}$  ( $\pm 14^{\circ}\text{C}$ ) from the optimum mixing temperature.

The job mix formula is to be inside the control points as detailed in Table 502-4. Blending of aggregates, i.e., gravel and stone, will be allowed provided the final composite mixture and final product meets or exceeds all specifications requirements.

The plant shall be operated to produce, on a continuing basis, a mixture uniformly conforming to the approved job mix formula. When this is not the case, the contractor shall make satisfactory adjustments or cease operations. The District Laboratory Engineer may permit the contractor to submit a new Asphaltic Concrete Job Mix Formula form for approval. The contractor shall submit a new job mix formula whenever a plant begins initial operations for the Department in a specific location or whenever a plant experiences a change in materials or source of materials. A new job mix formula will also be required whenever there are significant changes in equipment, such as the introduction of a new crusher, drum mixer, burner, etc.

When reclaimed asphaltic pavement (RAP) is used in a roadway mix, the quantity of RAP shall be designated in the job mix formula and meet the requirements of Table 502-5. The engineer may require the contractor to reduce the percentage of RAP to meet acceptance requirements.

When the contractor changes a source of RAP, the new mix design shall be submitted, validated and approved if the type of aggregate changes (e.g. gravel to limestone) or the source change causes a change in acceptance tolerances. If the contractor determines that the source change will not cause a change in acceptance tolerances, the contractor may elect to integrate the new RAP source into the existing approved mix design provided the contractor submits a revised job mix formula cover sheet which shows the new source of RAP and other changes. A new validation will not be required. If subsequent acceptance tests indicate that the mix is out of tolerance, a new design will be required and appropriate payment adjustments will apply.



**502.04 JOB MIX FORMULA VALIDATION.** The first day's production or a maximum of 2000 tons (2000 Mg) of mix shall be used to validate a new JMF. The contractor and the Department, using the stratified random sampling approach, shall jointly take five (5) samples, one per validation subplot, during the validation lot. The contractor may elect to exclude test results representing the first 250 tons (250 Mg) from the validation analysis in order to make slight adjustments to the mix. The remaining validation lot, up to 1750 tons (1750 Mg), shall be divided into five (5) equal validation sublots and tested for validation analysis. If excluded from validation, the 250 tons (250 Mg) will be paid in accordance with Table 502-9.

Minimum testing shall include one theoretical maximum specific gravity ( $G_{mm}$ ), one gyratory specimen compacted to  $N_{design}$ , one gyratory specimen compacted to  $N_{max}$ , and one oven extraction. As approved by the district laboratory engineer, the contractor and the Department shall jointly analyze the test results for the following parameters:

- (1) Extracted Gradation
- (2) Percent Extracted Asphalt Cement
- (3) Percent Crushed Aggregate, (from cold feed blends)
- (4) Theoretical Maximum Specific Gravity ( $G_{mm}$ ) (aged for one hour)

The following parameters apply to samples aged for one hour in an oven at gyratory compaction temperature and compacted to  $N_{design}$ .

- (5) Bulk Specific Gravity ( $G_{mb}$ ) at  $N_{design}$
- (6) Percent  $G_{mm}$  at  $N_{initial}$
- (7) Percent Air Voids, VMA and VFA

The following parameters apply to samples aged for one hour in an oven at gyratory compaction temperature and compacted to  $N_{max}$

- (8) Bulk Specific Gravity ( $G_{mb}$ ) at  $N_{max}$  measured and estimated
- (9) Percent  $G_{mm}$  at  $N_{max}$  and Corrected percent  $G_{mm}$  at  $N_{design}$
- (10) Slope of the Gyratory Compaction Curve

The mean, standard deviation, Quality Index and percent within limits (PWL) of the test results shall be calculated in accordance with Subsection 502.13, Quality Level Analysis. The test data will be used to validate the JMF.

A JMF is considered validated if the following parameters are 90 percent within limits of the JMF and meet the specifications requirements.

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(1) Extracted Gradations for the No. 8 and No. 200 (2.36 mm and 75  $\mu\text{m}$ ) sieves

(2) Theoretical Maximum Specific Gravity ( $G_{\text{mm}}$ )

(3) Percent  $G_{\text{mm}}$  at  $N_{\text{initial}}$

(4) Percent Air Voids at  $N_{\text{design}}$

Additionally, the average of all validation tests for the other parameters shall be within the specifications limits.

Should the JMF validate on all but one parameter, the contractor may make adjustments and repeat the validation testing using the next day's production or a maximum of 2000 tons (2000 Mg). Should the JMF fail to validate on more than one parameter, the JMF will be considered non-valid, and the contractor will be required to submit a new JMF for approval. Upon validation of the JMF, the validation averages will be used for JMF target values. Payment for validation lots will be in accordance with acceptance pay parameters, except that five cores shall be obtained to determine density pay. After validating the JMF for mix properties, the contractor, witnessed by the Department, shall sample the next day's production and perform validation testing at the plant for DOTD TR 322 and AASHTO T 312 specimens. When the validation results are less than 80 percent, no further production for that job mix formula or any proposed job mix formula substituted for that mix type will be accepted on any DOTD project having DOTD TR 322 requirements until a passing plant-produced Tensile Strength Ratio (TSR) value is verified by the Department. A previously validated and approved JMF may be produced in lieu of the disapproved JMF.

Validation is not required for mixture designs used solely for bike paths, crossovers, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, patching, shoulders, turnouts, widening, and miscellaneous handwork, but the mixture must meet specifications requirements.

**502.05 PLANT QUALITY CONTROL.** For quality control purposes, the contractor shall obtain a minimum of two (2) samples of mixture from each subplot using a stratified random sampling approach. Test results for theoretical maximum specific gravity ( $G_{\text{mm}}$ ) and measured bulk specific gravity ( $G_{\text{mb}}$ ) at  $N_{\text{max}}$  and percent  $G_{\text{mm}}$  at  $N_{\text{initial}}$ , on samples of each subplot shall be reported. Control charts may be requested by the engineer if mixture problems develop. Quality control gyratory samples may be aged or unaged at the contractor's option, but the method chosen shall be used consistently throughout the project. If aged samples are used, report the

measured  $G_{mb}$  at  $N_{max}$ . If unaged samples are used, report the estimated  $G_{mb}$  at  $N_{max}$ . One loose mix sample shall be taken from each subplot after placement of the mix in the truck. The mix shall be tested by the contractor at the plant for aggregate gradation, asphalt content and percent crushed aggregate. The mix shall be tested in accordance with DOTD TR 309, TR 323 and TR 306. The lot average and standard deviation shall be determined for aggregate gradation and asphalt content. The percent within limits (PWL) shall be determined on the Nos. 8 and 200 (2.36 mm and 75  $\mu$ m) sieves and for  $G_{mm}$ . Corrective action shall be taken if these parameters fall below 90 PWL. For each lot, the contractor shall report all quality control data to the DOTD Certified Plant Technician. The full range of gradation mix tolerances will be allowed even if they fall outside the control points. The District Laboratory Engineer may require re-validation of the mix when the average of the Quality Control data indicates non-compliance with the specified limits or tolerances.

The moisture content of the final mixture shall be minimized and uniformly controlled to ensure that placement and density requirements are met. The percent moisture in loose mix shall be reported once per lot and shall not exceed 0.3 percent by weight (mass) when tested in accordance with DOTD TR 319.

**502.06 PLANT ACCEPTANCE.** All Department inspection procedures, including sampling and testing, form the basis for acceptance of the asphaltic concrete. Sampling and testing shall be accomplished following a stratified sampling plan in accordance with the Materials Sampling Manual and specified test procedures. Times and locations shall be established by the engineer.

The Department will take samples or perform tests as outlined in these specifications, to ensure that the asphaltic concrete conforms to Department standards, which include job mix limits, typical sections, material properties, and surface deviations. Plant acceptance tests will be performed for VFA and air voids in the specimen compacted to  $N_{design}$  to determine the acceptability of the asphaltic concrete at the plant unless directed otherwise by the engineer. If the average VFA for 5 samples is outside the specifications limits, satisfactory adjustments must be made or production shall be discontinued. The plant acceptance tests for air voids shall be subject to payment adjustments and sampling and testing in accordance with the requirements specified herein.

Testing for percent air voids will be conducted by the Department. Test results of mixture specimens compacted to  $N_{design}$  shall comply with Table

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502-5 when tested in accordance with AASHTO T 312 and DOTD TR 304. One sample will be taken from each of five (5) sublots. The data will be used to determine if the lot is outside acceptance limits shown in Table 502-5. If the lot is outside the acceptance limits, an adjustment in unit price for the lot will be made in accordance with Tables 502-7 or 502-9.

Acceptance testing for air voids will be conducted on the total lot quantity.

## 502.07 ROADWAY OPERATIONS.

**(a) Weather Limitations:** Asphaltic concrete mixtures shall not be applied on a wet surface or when the ambient temperature is below 50°F (10°C) for wearing courses and 40°F (5°C) for base and binder courses, except that material in transit, or a maximum of 50 tons (45 Mg) in a surge bin or silo used as a surge bin at the time plant operation is discontinued may be placed; however, mixture placed shall perform satisfactorily and meet specification requirements. Inclement weather will be sufficient reason to terminate or not begin production.

When base course materials are placed in plan thicknesses of 2 3/4 inches (70 mm) or greater, these temperature limitations shall not apply provided all other specification requirements are met. When a wearing course is substituted for a binder course mixture the temperature limitation for binder course shall apply.

**(b) Surface Preparation:** The surface to be covered shall be approved prior to placing mixtures. The contractor shall maintain the surface until it is covered.

**(1) Cleaning:** The surface to be covered shall be swept clean of dust, dirt, caked clay, caked material, vegetation, and loose material by revolving brooms or other mechanical sweepers supplemented with hand equipment as directed. When mixtures are to be placed on portland cement concrete pavement or overlaid portland cement concrete, the contractor shall remove excess joint filler from the surface by an approved burning method. The contractor shall remove any existing raised pavement markers prior to asphaltic concrete overlay operations.

When brooming does not adequately clean the surface, the contractor shall wash the surface with water in addition to brooming to clean the surface.

When liquid asphalt is exposed to traffic for more than 1 calendar day, becomes contaminated, or degrades due to inclement weather, the liquid asphalt shall be reapplied at the initial recommended rate at no direct pay.

**(2) Applying Liquid Asphalt Materials:**

**a. Existing Pavement Surfaces:** Before constructing each course, an approved asphalt tack coat shall be applied in accordance with Section 504. The contractor shall protect the tack coat and spot patch as required.

**b. Raw Aggregate Base Course and Raw Embankment Surfaces:** The contractor shall apply an approved asphalt prime coat to unprimed surfaces, or protect in-place prime coat and spot patch as required with asphalt prime coat, in accordance with Section 505.

**c. Cement and Lime Stabilized or Treated Embankment and Base Course Surfaces:** The contractor shall apply an approved asphalt curing membrane when none is in place, or protect the in-place curing membrane and spot patch, as required, with asphalt material in accordance with Section 506.

**d. Other Surfaces:** Contact surfaces of curbs, gutters, manholes, edges of longitudinal and transverse joints, and other structures shall be covered with a uniform coating of an approved asphalt tack coat complying with Section 504 before placing asphaltic mixtures.

**(c) Joint Construction:**

**(1) Longitudinal Joints:** Longitudinal joints shall be constructed by setting the screed to allow approximately 25 percent fluff and also overlapping the paver approximately 2 inches (50 mm) onto the adjacent pass. Prior to rolling, the overlapped mix shall be pushed back to the uncompacted side, without scattering loose material over the uncompacted mat, to form a vertical edge above the joint. The vertical edge shall then be compacted by rolling to form a smooth, sealed joint. Longitudinal joints in one layer shall offset those in the layer below by a minimum of 3 inches (75 mm); however, the joint in the top layer shall be offset 3 inches (75 mm) to 6 inches (150 mm) from the centerline of pavement when the roadway comprises two lanes of width, or offset 3 inches (75 mm) to 6 inches (150 mm) from lane lines when the roadway is more than two lanes. The narrow strip shall be constructed first.

Where adjacent paving strips are to be placed, the longitudinal edge joint of the existing strip shall be tacked.

**(2) Transverse Joints:** Transverse joints shall be butt joints formed by cutting back on the previously placed mixture to expose the full depth of the lift. An approved 10 foot (3.0 m) static straightedge shall be used to identify the location at which the previously placed mixture is to be cut back to maintain no greater than a 1/8 inch (3 mm) deviation in grade. The cut face of the previously placed mat shall be lightly tacked before fresh material is placed. The screed shall rest on shims that are

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approximately 25 percent of plan thickness placed on the compacted mat. Transverse joints shall be formed by an adequate crew. Transverse joints shall be checked by the engineer for surface tolerance using a stringline extended from a point 10 feet (3 m) before the joint to a point approximately 40 feet (12 m) beyond the joint. Any deviation in grade from the stringline in excess of 3/16 inch (5 mm) for roadway wearing courses and 1/4 inch (6 mm) for other courses shall be immediately corrected prior to the paving operation continuing beyond 100 feet (30 m) of the transverse joint. Additionally, the transverse joint shall meet the surface tolerance requirements of Table 502-4. The contractor shall make necessary corrections to the joint before continuing placement operations.

Transverse joints in succeeding lifts shall be offset at least 3 feet (1.0 m).

**502.08 HAULING, PAVING AND FINISHING.** Mixtures shall be transported from the plant and delivered to the paver at a temperature no cooler than 25°F (14°C) below the lower limit of the approved job mix formula. The temperature of the mix going through the paver shall not be cooler than 250°F (120°C).

No loads shall be sent out so late in the day that completion of spreading and compaction of the mixture cannot be completed during daylight, unless artificial lighting has been approved.

When segregation occurs, haul trucks shall be loaded with a minimum of three drops of mix, the last of which shall be in the middle.

Each course of asphaltic mixture shall be placed in accordance with the specified lift thickness. When no lift thickness is specified, or when substitute mixtures are utilized as specified in Subsection 502.01(c), mixtures shall be placed in accordance with Table 502-5

With the engineer's approval, motor patrols may be used to fill isolated depressions in the initial layer, provided this construction does not result in unsatisfactory subsequent lifts.

**(a) Coordination of Production:** The contractor shall coordinate and manage plant production, transportation of mix and placement operations to achieve a high quality pavement and shall have sufficient hauling vehicles to ensure continuous plant and roadway operations. The engineer will order a halt to operations when sufficient hauling vehicles are not available.

On final wearing course construction under traffic with pavement layers of 2 inches (50 mm) compacted thickness or less, the contractor will be permitted to pave one travel lane for a full day. The contractor shall pave

the adjacent travel lane the next work day. When the adjacent travel lane is not paved the next calendar day and the longitudinal joint is exposed to traffic for more than 3 calendar days, and it has been determined that the subsequent roadway edge is not true to line and grade as previously constructed, the entire length of exposed longitudinal joint shall be cut back to plan thickness to a vertical edge and heavily tacked. When pavement layers are greater than 2 inches (50 mm) compacted thickness, the contractor shall place approximately 1/2 of each day's production in one lane and the remainder in the adjacent lane.

Pavement shall be protected from traffic until it has sufficiently hardened to the extent the surface is not damaged.

**(b) Paving Operations:** When placing the final two lifts of asphaltic concrete on the roadway travel lanes, a material transfer vehicle (MTV), as described in Subsection 503.15, will be required to deliver mixtures from the hauling equipment to the paving equipment, and to prevent segregation of the asphaltic concrete hot mix. The MTV is required regardless of ADT. All mixtures shall flow through the paver hopper. Mixtures dropped in front of the paver shall be either lifted into the hopper or rejected and cast aside. Delivery of material to the paver shall be at a uniform rate and in an amount within the capacity of paving and compacting equipment. The paver speed and number of trucks shall be adjusted to have one truck waiting in addition to the one at the paver in order to maintain continuous paving operations. The height of material in front of the screed shall remain uniform.

During mixture transfer, the paver shall not be jarred or moved out of alignment. The level of mix in the paver hopper shall not drop so low as to expose the hopper feed slats.

Pavers shall be designed and operated to place mixtures to required line, grade and surface tolerance without resorting to hand finishing.

Longitudinal joints and edges shall be constructed along lines established. Stringlines or other forms of longitudinal control shall be placed by the contractor for the paver to follow. The paver shall be positioned and operated to closely follow the established line. Irregularities in alignment shall be corrected by trimming or filling directly behind the paver.

After each load of material has been placed, the texture of the unrolled surface shall be checked to determine its uniformity. The adjustment of screed, tamping bars, feed screws, hopper feed, etc., shall be checked frequently and adjusted as required to assure uniform spreading of the mix to proper line and grade and adequate compaction. When segregation of

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materials or other deficiencies occur, paving operations shall be suspended until the cause is determined and corrected.

Surface irregularities shall be corrected directly behind the paver. Excess material forming high spots shall be removed. Indented areas shall be filled and finished smooth. Hand placement in accordance with Heading (c) for surface repair will be permitted. Material shall not be cast over the surface.

When a screed control device malfunctions during binder or wearing course operations, paving operations shall be immediately discontinued and shall not be resumed until the screed malfunction has been remedied. Material in transit may be placed. Material placed shall perform satisfactorily and meet specification requirements. Any cost overrun resulting from placing material without the automatic screed control device shall be borne by the contractor.

When paving and finishing operations are interrupted so that the mixture remaining in trucks, paver, paver hopper or on the pavement cools to such extent that it cannot be placed, finished or compacted to the same degree of smoothness and with the same texture and density as the uncooled mixture, the cooled mixture shall be removed and replaced at no direct pay.

When additional mix is required to increase superelevation in curves, the use of automatic slope control will be optional with the contractor.

The traveling reference plane method of construction will be required for airport runways unless designated otherwise on the plans. Unless the erected stringline is required or directed, the 30-foot (minimum) traveling reference plane method of construction shall be used for roadway travel lanes. The following requirements shall apply for mechanical pavers:

**(1) Traveling Reference Plane:** The traveling reference plane method shall be approved before use. After the initial paving strip of each lift is finished and compacted, adjacent paving strips shall be placed to the grade of the initial paving strip using the traveling reference plane or shoe device to control grade and a slope control device to control cross slope.

On multilane pavements, the initial paving strip and the sequence of lane construction will be subject to approval.

When both outside edges of the paving strip being placed are flush with previously placed material, the slope control device shall not be used. A grade sensor is required for each side of the paver.

In superelevated curves, the cross slope shall be changed from that specified for tangents to that specified for superelevation in gradual increments while the paver is in motion so a smooth transition in grade is



obtained. This change in cross slope shall be accomplished within the transition distance specified.

This is the minimum acceptable method and the contractor must meet or exceed current surface tolerance specifications.

**(2) Erected Stringline:** The erected stringline method shall be used as directed by the engineer. This method may be used on the first lift of asphalt when the underlying new or reconstructed bases do not have grade control requirements. Pavers for roadway travel lanes shall be equipped with automatic screed and slope control devices when used with an erected stringline.

An erected stringline shall consist of a piano wire or approved equal stretched between stakes set at no greater than 25 foot (7.5 m) intervals tensioned between supports so that there is less than 1/8 inch (3 mm) variance between supports when the sensor is in place. The stringline elevation will be verified by the Department using standard surveying practices.

If required, the initial paving strip of the first lift shall be constructed using an erected stringline referenced to established grade. When permitted, mixtures required to level isolated depressions may be placed without automatic screed control. Subsequent lifts may be constructed by use of the traveling reference plane, provided surface and grade tolerances are met on the previous lift.

Only one grade sensor and the slope control device are necessary for roadways with a normal crown on tangent alignment. Superelevated curves will require the use of two grade sensors and two erected stringlines to obtain proper grade and slope; however, when the automatic screed control device is equipped with a dial or other device which can be conveniently used to change the cross slope in small increments, superelevated curves may be constructed using this device and one erected stringline.

After the initial paving strip of the first lift is finished and compacted, adjacent paving strips shall be laid using an approved traveling reference plane.

**(3) Without Automatic Screed Control:** When permitted, pavers without automatic screed control may be used for pavement patching, pavement widening, paved drives and turnouts.

**(c) Hand Placement:** When the use of mechanical finishing equipment is not practical, the mix may be placed and finished by hand to the satisfaction of the engineer. No casting will be allowed including casting the mixture from the truck to the grade. During paving operations

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material shall be thoroughly loosened and uniformly distributed. Material that has formed into lumps and does not break down readily will be rejected. The surface shall be checked before rolling and irregularities corrected.

## 502.09 COMPACTION.

**(a) General:** After placement, mixtures shall be uniformly compacted, by rolling while still hot, to at least the density specified in Table 502-4. If continuous roller operation is discontinued, rollers shall be removed to cooler areas of the mat, where they will not leave surface indentations. The use of steel wheel rollers which result in excessive crushing of aggregate will not be permitted.

The rolling pattern established by the contractor shall be conducted by experienced operators in consistent sequences and by uniform methods that will obtain specified density and smoothness. Individual roller passes shall uniformly overlap preceding passes to ensure complete coverage of the paving area. The speed and operation of rollers shall not displace, tear or crack the mat. Nonvibrating steel wheel rollers shall be operated with drive wheels toward the paver. Any operations causing displacement, tearing or cracking of the mat shall be immediately corrected.

Equipment which leaves tracks or indented areas which cannot be corrected in normal operations or fails to produce a satisfactory surface shall not be used. Operation of equipment resulting in accumulation of material and subsequent shedding of accumulated material into the mixture or onto the mat will not be permitted.

To prevent adhesion of mixture, wheels of steel wheel rollers shall be kept properly moistened, but excess water will not be permitted.

Pneumatic tire rollers shall be operated so that tires will retain adequate heat to prevent mix from adhering to tires. The pneumatic tire roller shall be operated at a contact pressure which will result in a uniform, tightly knit surface. The pneumatic tire roller shall be kept approximately 6 inches (150 mm) from unsupported edges of the paving strip; however, when an adjacent paving strip is down, the roller shall overlap the adjacent paving strip approximately 6 inches (150 mm).

Vibratory rollers may be used provided they do not impair the stability of the pavement structure or underlying layers. Vibratory rollers shall not be used on the first lift of asphaltic concrete placed over the asphalt treated drainage blanket. When mix is placed on newly constructed cement or lime stabilized or treated layers, vibratory rollers shall not be used for at least 7 days after such stabilization or treatment.

It is the responsibility of the contractor to determine the number, size, and type of rollers to sufficiently compact the mixture to the specified density and surface smoothness. The rolling equipment shall be capable of maintaining the pace of the paver and shall conform to Subsection 503.17.

The surface of mixtures after compaction shall be smooth and true to cross slope and grade within the tolerances specified. Mixtures that become loose, broken, contaminated or otherwise defective shall be removed and replaced with fresh hot mixture compacted to conform with the surrounding mixture.

Excessive rippling of the mat surface will not be accepted. Ripples are small bumps in the pavement surface which usually appear in groups in a frequent and regular manner. There shall be no more than 12 ripples or peaks in any 100-foot (30 m) section. Rippling indicates a problem with the paving operation or mix that requires immediate corrective action by the contractor; otherwise operations shall cease. Unacceptable areas shall be corrected at no direct pay. A profilograph trace may be required to define these areas.

**(b) Rolling:** After rolling, newly finished pavements shall have a uniform, tightly knit surface free of cracks, tears, roller marks or other deficiencies. Deficiencies shall be corrected at no direct pay and the contractor shall adjust operations to correct the problem. This may require the contractor to adjust the mix or furnish additional or different equipment.

**(c) Hand Compaction:** Along forms, curbs, headers, walls and at other places inaccessible to rollers, mixture shall be uniformly compacted to the satisfaction of the engineer with approved hand tampers or mechanical tampers, conforming to Subsection 503.18.

## **502.10 ROADWAY QUALITY CONTROL.**

**(a) Density:** The contractor shall constantly monitor equipment, materials, and processes to ensure that density requirements are met.

**(b) Surface Tolerance:** The contractor shall constantly monitor equipment, materials, and processes to ensure that surface tolerance requirements are met. The contractor shall test the pavement during the first work day following placement, but in no case any later than 7 calendar days.

Surface tolerance testing will be required on wearing and binder courses for roadway travel lanes. It will be required on the wearing course only for shoulders, parking areas and airport runways and taxiways. For surface

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tolerance purposes, the wearing course is defined as the final lift placed. The binder course is defined as the last lift placed prior to the final lift.

Other lifts on which additional asphaltic concrete is to be placed shall be finished so that succeeding courses will meet the requirements of this subsection. Base courses on which portland cement concrete pavement is to be placed shall be finished so that the portland cement concrete pavement will meet the requirements of Section 601.

**(1) Equipment:** The contractor shall furnish an approved 10 foot (3.0 m) metal static straightedge for quality control and acceptance testing for transverse, cross slope and grade

The contractor shall also furnish a DOTD certified inertial profiler, for quality control and acceptance, to measure both wheelpaths simultaneously with laser or infrared height sensing equipment. Inertial profilers shall be capable of testing the finished surface in the longitudinal direction for conformance to the surface tolerance requirements listed in this subsection. Longitudinal surface profile shall be measured in inches per mile (mm per km) in accordance with DOTD TR 644 and reported as the International Roughness Index (IRI).

The Department will evaluate and verify the accuracy of the inertial profiler annually using static and dynamic tests in accordance with DOTD TR 644. Approved profilers will have a DOTD decal indicating the date of profiler verification and profiler system parameter settings. These settings shall be verified by the inspector before the first day of binder course paving and randomly thereafter.

For each project, a Department representative will observe the daily set up procedure and pre-operation tests, which shall be performed by the contractor in accordance with the manufacturer's procedures and DOTD TR 644. A copy of the manufacturer's setup procedure, pre-operation procedures, and operating procedure for measuring surface tolerance shall be available at all times during measurement.

### **(2) Transverse, Cross Slope and Grade:**

**a. Transverse:** The contractor shall monitor and test the roadway for conformance to the requirements of Table 502-4. For turnouts, crossovers, detour roads, parking areas, and roadway or shoulder sections less than 500 feet (150 m) in length, the wearing course shall be tested and the surface deviations shall not exceed 1/2 inch (15 mm). Areas with surface deviations in excess of specification limits shall be isolated and corrected by the contractor in accordance with Heading (4). The contractor shall control the transverse surface finish.

**b. Cross Slope:** When the plans require the section to be constructed to a specified cross slope, the contractor shall take measurements at selected locations, using a stringline, slope board or other comparable method. The contractor shall control the cross slope so that the values shown in Table 502-4 are not exceeded for each lane constructed. The contractor shall make corrections in accordance with Heading (4) of this subsection.

**c. Grade:** When the plans require the pavement to be constructed to a grade, the contractor shall perform tests for conformance at selected locations, using a stringline or other comparable method. The contractor shall control grade variations so that the tolerances shown in Table 502-4 are not exceeded. Grade tolerances shall apply to only one longitudinal line, such as the centerline or outside edge of pavement. The contractor shall make corrections in accordance with Heading (4) of this subsection.

**(3) Longitudinal:** The contractor shall report an average IRI number in inches per mile (mm per km) and shall measure and report the average IRI value for each wheelpath on every 0.05-mile (0.08 km) segment of highway. Isolated rough areas will not be allowed. Any 0.05-mile (0.08 km) individual wheelpath segment measurement of the binder and wearing courses shall meet the requirements of Table 502-8B. The contractor shall make corrections in accordance with Heading (4) of this subsection.

**(4) Correction of Deficient Areas:** The contractor shall correct areas not meeting Table 502-8B requirements for individual wheelpath measurements in a 0.05-mile (0.08 km) segment.

**a. Deficiencies in Wearing Course:** The contractor shall correct deficiencies in the final wearing course by diamond grinding and applying a light tack coat, removing and replacing, or furnishing and placing a supplemental layer of wearing course mixture at least 1 1/2 inches (40 mm) compacted thickness for the full width of the roadway meeting specification requirements at no direct pay. If the supplemental layer does not meet specification requirements to the satisfaction of the engineer, the contractor shall remove and replace or correct it by other methods approved by the engineer.

**b. Deficiencies in Binder Courses:** The contractor shall correct deficiencies in binder course, transverse, cross slope, and grade measurements to meet specification requirements at no direct pay. Corrections shall be made before subsequent courses are constructed.

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**c. Deficiencies in Shoulder Transverse, Cross Slope and Grade:** The contractor shall correct deficiencies in these areas by grinding at the project engineer's direction.

**502.11 ROADWAY ACCEPTANCE.** Acceptance testing for pavement density, surface tolerance and dimensional tolerances will be conducted on that portion of the lot placed on each contract.

Hot mix exhibiting deficiencies before placement such as segregation, contamination, lumps, nonuniform coating, excessive temperature variations or other deficiencies, apparent on visual inspection, shall not be placed.

Hot mix exhibiting deficiencies, such as segregation, contamination, alignment deviations, variations in surface texture and appearance or other deficiencies, apparent on visual inspection, will not be accepted and shall be satisfactorily corrected and/or replaced at no direct pay. Poor construction practices such as handwork, improper truck exchanges, improper joint construction, or other deficiencies, apparent on visual inspection, will not be accepted.

**(a) Density:** Acceptance testing for pavement density will be conducted by the Department. Three pavement samples for each mix use shall be obtained from each subplot within 24 hours after placement. When this falls on a day the contractor is not working, sampling shall be done within 3 calendar days. Sampling shall be performed using the random number tables shown in DOTD S605. If there are different mix uses within the same subplot, i.e. shoulder and roadway, then an additional core may be taken to ensure that there is at least one core per mix use. The density requirement for each lot will be as shown in Table 502-4 determined in accordance with DOTD TR 304. Payment will be made in accordance with Table 502-7B using the total number of cores for the lot in accordance with Subsection 502.13. Payment for small quantity lots will be made in accordance with Table 502-9.

When the sampling location determined by random sampling falls within areas that are to be replaced or within 1 foot (0.3 m) of the unsupported pavement edge, another random sampling location will be used.

Samples shall be cores approximately 4 inches (100 mm) or 6 inches (150 mm) in diameter taken by an approved core drill. The contractor shall furnish samples cut from the completed work. The removed pavement shall be replaced with hot or cold mixture and refinished during the work day coring is performed. No additional compensation will be allowed for

furnishing test samples and replacing the areas with new pavement. Samples shall be taken by the contractor in the presence of the engineer's representative from areas selected by the Department in accordance with this subsection. Cores less than 1 3/8 inches (35 mm) thick shall not be used as pavement samples for payment determination.

Cores shall be transported to the plant in approved transport containers. Transportation containers will be sealed, signed, and dated by the inspector using an approved method. The individually wrapped core will also be sealed, signed, and dated by the inspector using an approved method. Any evidence of tampering with the core wrappings, sticker, or of opening the container or friction top can will result in the cores being rejected. Additional pavement samples will be required.

**(b) Surface Tolerance:** The contractor shall measure the top two lifts of the roadway travel lanes. Final acceptance will be based on the last measurement taken on the final wearing course of the travel lanes. Measurement of the center two lanes will be required for airports. The contractor shall test the pavement during the first work day following placement, but in no case any later than 7 calendar days.

**(1) Equipment:** For longitudinal surface tolerance testing, equipment and daily set-up and pre-operation procedures shall be in accordance with Subsection 502.10(b)(1). For transverse, cross slope and grade testing, the contractor shall furnish a 10-foot metal static straightedge for Department use.

**(2) Transverse, Cross Slope and Grade:** The Department will test the surface of the binder and wearing courses at selected locations for conformance to the surface tolerance requirements of Subsection 502.10(b)(2) and Table 502-4, which shall not be exceeded. The contractor shall make corrections as directed in accordance with Subsection 502.10(b)(4).

**(3) Longitudinal Surface Tolerance:**

**a. Acceptance:** The contractor shall report an average IRI number in inches per mile (mm per km) and shall measure and report the average IRI value for each wheelpath on every 0.05-mile (0.08 km) segment of highway. The IRI values for the inside and outside wheelpaths shall be averaged and reported as the segment average and the mean of each segment average shall be reported as the subplot average. The individual wheelpath IRI values shall conform to the requirements of Table 502-8B. The average subplot values shall conform to the requirements listed in Tables 502-8A. A DOTD inspector will be present for the final test run

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and will immediately receive a copy of the IRI results via USB flash drive. The contractor shall provide the engineer a copy of the IRI report. Acceptance of each subplot will be in accordance with Tables 502-8A and 502-8B, based on the IRI profile report. The Department may elect to perform and utilize independent ride quality test results for acceptance at any time.

### **b. Exceptions and Exclusions:**

**1. Excluded Areas:** The Department will review the profile report obtained for each binder and wearing course on a subplot basis. In special cases or extenuating circumstances, the engineer may isolate or exclude sections of the profile. These special cases or extenuating circumstances may be curb and gutter sections that require the adjustment of cross-slope in order to maintain adequate drainage, manholes, catch basins, valve and junction boxes, street intersections, or other structures located in the roadway which cause abrupt deviations in the profile. This specification exclusion will not be used to simply isolate sections of road that are in poor condition when the project is let.

**2. Secondary Areas:** Ramps less than 1500 feet (460 m), tapers, shoulders and medians, or sections of pavement surfaces as directed by the engineer such as 300 feet (90 m) from bridge ends, will not be included in the ride quality index for payment purposes, but shall have a maximum IRI average of 110 or less in a subplot.

**502.12 DIMENSIONAL REQUIREMENTS.** Mixtures that are specified for payment on a cubic yard (cu m) or square yard (sq m) basis shall conform to the following dimensional requirements. Overthickness and overwidth will be accepted at no direct pay.

**(a) Thickness:** Thickness of mixtures will be determined in accordance with DOTD TR 602. Underthickness shall not exceed 1/4 inch (6 mm).

When grade adjustments are permitted for all mixtures except the final wearing course, areas with underthickness in excess of 1/4 inch (6 mm) shall be corrected to plan thickness at no direct pay by furnishing and placing additional mixture in accordance with Subsection 502.10(b)(4)b. For the final wearing course, areas with underthickness in excess of 1/4 inch (6 mm) shall be corrected to plan thickness at no direct pay by furnishing and placing a supplemental layer of wearing course mixture meeting specification requirements in accordance with Subsection 502.10(b)(4)a over the entire area for the full width of the roadway when grade adjustments are permitted.



When grade adjustments do not permit, the deficient underthickness area shall be removed and replaced at no direct pay.

**(b) Width:** The width of completed courses will be determined in accordance with DOTD TR 602. Underwidths shall be corrected by furnishing and placing additional mixture to a minimum width of 1 foot (0.3 m) and plan thickness at no direct pay.

**502.13 QUALITY LEVEL ANALYSIS.** The Quality Level Analysis is a statistical quality control/quality acceptance (QC/QA) method for validating Job Mix Formulas (JMF), contractors quality control, project acceptance and payment for all Superpave asphaltic concrete.

The mean ( $\bar{X}$ ) is the average of a set of numbers. To determine the mean add the numbers ( $X_i$ ) in the set and divide by the number of numbers ( $n$ ) in the set.

$$\text{Mean} = \bar{X} = \frac{X_1 + X_2 + X_3 + \dots + X_n}{n} = \frac{\sum_{i=1}^n X_i}{n}$$

The standard deviation of a set of numbers measures the spread of the numbers in the set or the deviation from the mean. Calculate the standard deviation according to the following formula:

$$\begin{aligned} \text{Standard Deviation} = s &= \sqrt{\frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \dots + (X_n - \bar{X})^2}{n - 1}} \\ &= \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1}} \end{aligned}$$

A Quality Index is calculated using both the upper and lower specification limits (if applicable). The Quality Index calculated using the upper or higher specification limit is called the Upper Quality Index ( $Q_U$ ). The Quality Index calculated using the lower specification limit is called the Lower Quality Index ( $Q_L$ ).

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To determine each Quality Index, the specification limits are added or subtracted from the mean of the test results and the result is divided by the standard deviation as shown below.

$$\text{UpperQualityIndex} = Q_U = \frac{\text{USL} - \bar{X}}{s} \quad \text{LowerQualityIndex} = Q_L = \frac{\bar{X} - \text{LSL}}{s}$$

Where: USL = upper specification limit  
LSL = lower specification limit

Table 502-6 is used to convert the Quality Index into the PWL value. A PWL is calculated for each Quality Index (upper and lower) and combined for a total PWL calculated in accordance with the formula:

$$\text{PWL} = \text{PWL}_L + \text{PWL}_U - 100$$

where:  $\text{PWL}_L$  = lower percent within limits  
 $\text{PWL}_U$  = upper percent within limits

In using Table 502-6, the appropriate columns corresponding to the number of test results must be used.

If a specification requirement does not have both an upper and lower limit only one Quality Index and PWL, upper or lower as appropriate, is calculated and the other PWL is equal to 100 in the total PWL calculation.

**502.14 LOT SIZES.** A lot is a segment of continuous production of asphaltic concrete mixture from the same job mix formula produced for the Department at an individual plant. A standard lot size is 5,000 tons (5000 Mg). A standard subplot size is 1,000 tons (1000 Mg). Additional adjustments may be made to the standard lot or subplot size as specified in this subsection. The final subplot, at the end of a project lot, may be increased up to 150 percent to accommodate hauling unit capacity.

With good historical performance, and when agreed upon by the engineer and contractor, the lot size may be increased up to 10,000 tons, with corresponding subplot size up to 2000 tons (2000 Mg). Twenty-four hour per day plant production usually necessitates such an increase.

The engineer or contractor may decrease the size of an individual lot for any of the following conditions:

(1) The interval between continuous production exceeds 7 calendar days.

(2) A new job mix formula is accepted.

(3) The final lot is less than 5,000 tons (5000 Mg).

(4) The total project quantity is less than 5000 tons (5000 Mg).

(5) A payment adjustment will be applied to the portion of the lot already produced, provided adjustments have been made to bring the asphaltic concrete into compliance with specifications.

For lots with 3000 tons or greater, PWL calculations will be required in accordance with Table 502-6 and Table 502-7.

Lots with less than 3000 tons (3000 Mg) of mix are paid as Small Quantity Lots. Only standard 1000 ton (1000 Mg) sublots will be allowed when determining pay for Small Quantity Lots. Each 1000 ton (1000 Mg) subplot, or less, as applicable, will be paid individually in accordance with Table 502-9.

Any mixtures used for bike paths, crossovers, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, shoulders, turnouts, patching, widening, and miscellaneous handwork will be paid as a Small Quantity Lot, and separately in 1000 ton sublots, or portions thereof, in accordance with this subsection and Table 502-9.

Pavement density and surface tolerance requirements will not be applied for short irregular sections, such as curbs, driveways, guardrail widening, islands, joint repair, leveling, and turnouts; however, hot mix shall be placed to provide a neat, uniform appearance and shall be compacted by satisfactory methods.

For projects, or separate locations within a project, requiring less than 250 tons (250 Mg), the job mix formula, materials, and plant and paving operations shall be satisfactory to the engineer. Sampling and testing requirements may be modified by the engineer and the payment adjustment for deviations waived.

**502.15 MEASUREMENT.** Asphalt tack coat, prime coat or curing membrane will not be measured for payment.

**(a) Weight Measurement:** Asphaltic concrete will be measured by the ton of 2,000 pounds (megagrams) from printed weights as provided in Section 503. Stamped printer tickets will be issued for each truckload of material delivered. Material lost, wasted, rejected or applied contrary to specifications will not be measured for payment.

Estimated quantities of asphaltic concrete shown on the plans are based on 110 lb/sq yd/inch (2.35 kg/sq m/mm) thickness. The measured quantity

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of asphaltic mixtures will be multiplied by the following adjustment factor to obtain the pay quantity.

| Theoretical Maximum Specific Gravity, ( $G_{mm}$ ) (DOTD TR 327) | Adjustment Factor |
|--|-------------------|
| 2.340 - 2.360  | 1.02              |
| 2.361 - 2.399  | 1.01              |
| 2.400 - 2.540  | 1.00              |
| 2.541 - 2.570  | 0.99              |
| 2.571 - 2.590  | 0.98              |

The adjustment factor for mixtures with theoretical maximum specific gravities less than 2.340 or more than 2.590 will be determined by the following formulas:

Theoretical maximum specific gravity less than 2.340:

$$F = \frac{2.400}{S}$$

Theoretical maximum specific gravity more than 2.590:

$$F = \frac{2.540}{S}$$

where,

F = quantity adjustment factor

S = theoretical maximum specific gravity of mixture from approved job mix formula

**(b) Volume or Area Measurement:** The quantities for payment will be the design quantities specified in the plans and adjustments thereto. Design quantities will be adjusted when the engineer makes changes to adjust to field conditions or when design changes are necessary. Design quantities are based on the horizontal dimensions and compacted thickness of the completed course shown on the plans.

**(c) Surface Tolerance Incentive Measurement:** At the completion of construction of the wearing course travel lanes, the contractor, in the presence of a DOTD representative, shall measure a continuous profile from the start station to the end station of the construction project for the purpose of determining qualification for

incentive pay under Subsection 502.16(e). Bridges and 300 feet (90 m) on each end of the bridge will be excluded from measurements for surface tolerance incentive pay.

### **502.16 PAYMENT.**

**(a) General:** Payment for asphaltic concrete will include furnishing all required materials, producing the mixtures, preparing the surfaces on which the mixtures are placed, hauling the mixtures to the work site, and placing and compacting the mixtures.

Payment for asphaltic concrete will be made at the contract unit price on a lot basis as defined in Subsection 502.14. When the mix does not meet requirements in the areas listed in this subsection, the Payment Adjustment Schedule shown in Tables 502-7, 502-8 or 502-9 will be applied. Production of mix that is not eligible for 100 percent payment will not be allowed on a continuous basis. When test results demonstrate that payment adjustments are necessary, satisfactory adjustments shall be made, or production shall be discontinued.

**(b) Wearing Course Mixes:** For wearing course travel lanes, adjustments in contract price for plant and roadway deficiencies or incentives will be based on the average of the percent payments for plant air voids, roadway density, and surface tolerance. For all other wearing course applications, payment adjustment will be based on the average of the percent payments for plant air voids and roadway density.

**(c) Base, Binder and Shoulder Mixes:** For base and binder courses for travel lanes and all shoulder mixes, adjustments in contract price for plant and roadway deficiencies or incentives will be based on the average of the percent payments for plant air voids and roadway density.

Final adjustments in unit price will be as described in Tables 502-7 and 502-9.

**(d) Erected Stringline:** When the use of an erected stringline is not specified, but directed by the engineer, an additional payment of \$500 per contract plus \$0.25 per linear foot (\$0.75 per lin m) will be made for mixtures placed by the erected stringline method. When the use of an erected stringline is specified, no additional payment will be made.

**(e) Longitudinal Surface Tolerance Incentive Pay:** For Category A projects and in accordance with Table 502-8A, a surface tolerance incentive payment equal to 5 percent of the contract unit price for the theoretical travel lane quantity of the wearing course item will be paid if the contractor achieves a project average IRI of 45 or less as measured at the completion of the project. No lot of wearing course on the project shall

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be less than 100 percent for surface tolerance. Only Category A projects are eligible for incentive pay. Any grinding except within 300 feet (90 m) of a bridge end will cause the roadway to be ineligible for surface tolerance incentive pay.

Payment will be made under:

| <b>Item No.</b> | <b>Pay Item</b>                                    | <b>Pay Unit</b>    |
|-----------------|--|--------------------|
| 502-01          | Superpave Asphaltic Concrete                       | Ton (Mg)           |
| 502-02          | Superpave Asphaltic Concrete                       | Cubic Yard (Cu m)  |
| 502-03          | Superpave Asphaltic Concrete,<br>( in ( mm) Thick) | Square Yard (Sq m) |

**Table 502-4  
Superpave Requirements**

| A. REQUIREMENTS FOR EXTRACTED ASPHALT CEMENT AND AGGREGATE GRADATION |                               |                             |                           |                               |                            |
|--|-------------------------------|-----------------------------|---------------------------|-------------------------------|----------------------------|
| U.S. (Metric) Sieve<br>% Passing                                     | 1/2 inch (12.5 mm)<br>Nominal | 3/4 inch (19 mm)<br>Nominal | 1 inch (25 mm)<br>Nominal | 1.5 inch (37.5 mm)<br>Nominal | Mix Tolerance <sup>1</sup> |
| 2 inch (50 mm)   | ---                           | ---                         | ---                       | 100                           | ±4                         |
| 1 1/2 inch (37.5 mm)   | ---                           | ---                         | 100                       | 90-100                        | ±4                         |
| 1 inch (25 mm)   | ---                           | 100                         | 90-100                    | 89 Max.                       | ±4                         |
| 3/4 inch (19 mm)   | 100                           | 90-100                      | 89 Max                    | ---                           | ±4                         |
| 1/2 inch (12.5 mm)   | 90-100                        | 89 Max                      | ---                       | ---                           | ±4                         |
| 3/8 inch (9.5 mm)  | 89 Max.                       | ---                         | ---                       | ---                           | ±4                         |
| No. 4 (4.75 mm)  | ---                           | ---                         | ---                       | ---                           | ±4                         |
| No. 8 (2.36 mm)  | 34-58                         | 29-49                       | 23-45                     | 19-41                         | ±3                         |
| No. 16 (1.18 mm)   | ---                           | ---                         | ---                       | ---                           | ±2                         |
| No. 30 (600 µm)  | ---                           | ---                         | ---                       | ---                           | ±2                         |
| No. 50 (300 µm)  | ---                           | ---                         | ---                       | ---                           | ±2                         |
| No 100 (150 µm)  | ---                           | ---                         | ---                       | ---                           | ±2                         |
| No. 200 (75 µm)  | 4.0-10.0                      | 3.0-8.0                     | 2.0-7.0                   | 1.0-6.0                       | ±0.7                       |
| Extracted Asphalt, %   | ---                           | ---                         | ---                       | ---                           | ±0.2                       |
| Mix Temperature  | ---                           | ---                         | ---                       | ---                           | ±25°F (±14°C)              |
| B. PAVEMENT REQUIREMENTS   |                               |                             |                           |                               |                            |
| Density, Min. % of Theoretical Maximum Specific Gravity, DOTD TR 327 |                               |                             |                           |                               |                            |
| Travel Lane Wearing, Binder and Base Courses                         |                               | 92.0                        |                           |                               |                            |
| Shoulders, Bike Paths, and Parking Lots                              |                               | 89.0                        |                           |                               |                            |
| Patching, Widening and Crossovers                                    |                               | 91.0                        |                           |                               |                            |
| Surface Tolerance Variation, inches (mm) <sup>2</sup>                |                               |                             | Transverse <sup>3</sup>   | Cross Slope <sup>3</sup>      | Grade <sup>4</sup>         |
| Roadway Travel Lane Wearing Courses                                  |                               |                             | 1/8 (3)                   | 3/8 (10)                      | 1/2 (15)                   |
| Binder Courses   |                               |                             | 1/4 (6)                   | 1/2 (15)                      | 1/2 (15)                   |
| Shoulder Wearing Course  |                               |                             | 3/16 (5)                  | 3/4 (20)                      | 3/4 (20)                   |

<sup>1</sup>Job Mix Formula based on validated mix design.

<sup>2</sup>For longitudinal surface tolerance requirements, see Subsection 502.10(d).

<sup>3</sup>Based on 10 feet (3.0 mm).

<sup>4</sup>Applicable only when grade is specified.

**Table 502-5  
Superpave General Criteria**

| Nominal Max., Size Agg.  | 0.5 inch<br>(12.5 mm)                  |                    |     | 0.75 inch<br>(19 mm) |                  |     | 1.0 inch<br>(25 mm) |                | 1.5 inch<br>(37.5 mm) |                |
|--|--|--------------------|-----|----------------------|------------------|-----|---------------------|----------------|-----------------------|----------------|
|  | Incidental<br>Paving <sup>1</sup>      | Wearing<br>Course  |     | Wearing<br>Course    | Binder<br>Course |     | Binder<br>Course    | Base<br>Course | Base<br>Course        |                |
| Level <sup>2</sup>   | A                                      | 1                  | 2   | 2                    | 1                | 2   | 1                   | 2              | 1                     | 1              |
| Asphalt Binder   | Table 502-2                            |                    |     |                      |                  |     |                     |                |                       |                |
| Friction Rating <sup>2</sup>                                       | Table 502-3                            |                    |     |                      |                  |     |                     |                |                       |                |
| Coarse Agg. Angularity,<br>+ No. 4 (4.75 mm)                       | 55                                     | 75                 | 95  | 95                   | 75               | 95  | 75                  | 95             | 75                    | 75             |
| Fine Agg. Angularity, Min. %<br>- No. 4 (4.75 mm)                  | 40                                     | 40                 | 45  | 45                   | 40               | 45  | 40                  | 45             | 40                    | 40             |
| Flat and Elongated<br>Particles, % Max. (5:1)<br>+ No. 4 (4.75 mm) | 10                                     |                    |     |                      |                  |     |                     |                |                       |                |
| Sand Equivalent, Min. %<br>(Fine Agg.), - No. 4 (4.75<br>mm)       | 40                                     | 40                 | 45  | 45                   | 40               | 45  | 40                  | 45             | 40                    | 40             |
| Natural Sand<br>Max. % of New Agg.                                 | N/A                                    | 15                 | 15  | 15                   | 15               | 15  | 15                  | 15             | 15                    | 25             |
| RAP, Max. % of Mix <sup>3</sup>                                    | 20                                     | 15                 | 15  | 15                   | 20               | 20  | 20                  | 20             | 30                    | 30             |
|  | Compacted Mix Volumetrics <sup>4</sup> |                    |     |                      |                  |     |                     |                |                       |                |
| VMA, Min. %  | 13                                     | 13                 | 13  | 12                   | 12               | 12  | 11                  | 11             | 11                    | 10             |
| Air Voids, % <sup>5</sup>  | 2.5-4.5                                |                    |     |                      |                  |     |                     |                |                       |                |
| VFA, % <sup>5</sup>  | 68-78                                  |                    |     |                      |                  |     |                     |                |                       |                |
| N <sub>initial</sub> 90% max. <sup>6</sup> (Gyrations)             | 7                                      | 7                  | 8   | 8                    | 7                | 8   | 7                   | 8              | 7                     | 7              |
| N <sub>design</sub> 96.5±1 % (Gyrations)                           | 75                                     | 75                 | 100 | 100                  | 75               | 100 | 75                  | 100            | 75                    | 75             |
| N <sub>max</sub> 98 % max. (Gyrations)                             | 115                                    | 115                | 160 | 160                  | 115              | 160 | 115                 | 160            | 115                   | 115            |
| Moisture Sensitivity, TSR<br>Min.                                  | 80                                     |                    |     |                      |                  |     |                     |                |                       |                |
| Dust/Effective Asphalt<br>Ratio, %                                 | 0.6 – 1.6                              |                    |     |                      |                  |     |                     |                |                       |                |
| Lift Thickness, inch (mm)  | 2.0-<br>(50-)                          | 1.5-2.0<br>(45-50) |     | 2.0-3.0<br>(50-75)   |                  |     | 2.5-4.0<br>(65-100) |                | 2.5+<br>(65+)         | 4.0+<br>(100+) |

<sup>1</sup>May be used for airports, bike paths, crossovers, curbs, driveways, guardrail widening, islands, joint repair, leveling, parking lots, shoulders, turnouts, and other incidental items approved by the engineer. (May also be used for mixtures specified as Marshall Type 3.)

<sup>2</sup>Mixtures designated as Level 1F and 2F shall meet the requirements for Level 1 and 2, respectively. Additionally, Level 1F and 2F shall meet the friction rating requirements in Table 502-3 for travel lane wearing courses with ADT > 7000.

<sup>3</sup>Maximum 20 % Rap will be allowed in all shoulder wearing course mixtures. RAP will not be allowed for airports.

<sup>4</sup>Air voids, VMA, VFA, % G<sub>mm</sub> @ N<sub>initial</sub>, and % G<sub>mm</sub> @ N<sub>design</sub> are determined on samples compacted to N<sub>design</sub>; The parameter of % G<sub>mm</sub> @ N<sub>max</sub> is determined on a sample compacted to N<sub>max</sub>.

<sup>5</sup>Air voids design target is 3.5%, VFA target is 73%.

<sup>6</sup>For Level 1 mixtures, N<sub>initial</sub> shall be 91.0 % max. For Level A mixes, N<sub>initial</sub> shall be 92.0 % max.



**Table 502-6**  
**Quality Index Values for Estimating Percent Within Limits**

| PWL | n = 3 | n = 4 | n = 5 - 6 | n = 7 - 9 | n = 10 - 12 | n = 13 - 15 |
|-----|-------|-------|-----------|-----------|-------------|-------------|
| 99  | 1.16  | 1.47  | 1.68      | 1.89      | 2.04        | 2.14        |
| 98  | 1.15  | 1.44  | 1.61      | 1.77      | 1.86        | 1.93        |
| 97  | 1.15  | 1.41  | 1.55      | 1.67      | 1.74        | 1.80        |
| 96  | 1.15  | 1.38  | 1.49      | 1.59      | 1.64        | 1.69        |
| 95  | 1.14  | 1.35  | 1.45      | 1.52      | 1.56        | 1.59        |
| 94  | 1.13  | 1.32  | 1.40      | 1.46      | 1.49        | 1.51        |
| 93  | 1.12  | 1.29  | 1.36      | 1.40      | 1.43        | 1.44        |
| 92  | 1.11  | 1.26  | 1.31      | 1.35      | 1.37        | 1.38        |
| 91  | 1.10  | 1.23  | 1.27      | 1.30      | 1.32        | 1.32        |
| 90  | 1.09  | 1.20  | 1.23      | 1.25      | 1.26        | 1.27        |
| 89  | 1.08  | 1.17  | 1.20      | 1.21      | 1.21        | 1.22        |
| 88  | 1.07  | 1.14  | 1.16      | 1.17      | 1.17        | 1.17        |
| 87  | 1.06  | 1.11  | 1.12      | 1.12      | 1.13        | 1.13        |
| 86  | 1.05  | 1.08  | 1.08      | 1.08      | 1.08        | 1.08        |
| 85  | 1.03  | 1.05  | 1.05      | 1.05      | 1.04        | 1.04        |
| 84  | 1.02  | 1.02  | 1.02      | 1.01      | 1.00        | 1.00        |
| 83  | 1.00  | 0.99  | 0.98      | 0.97      | 0.96        | 0.96        |
| 82  | 0.98  | 0.96  | 0.95      | 0.94      | 0.93        | 0.92        |
| 81  | 0.96  | 0.93  | 0.92      | 0.90      | 0.89        | 0.89        |
| 80  | 0.94  | 0.90  | 0.88      | 0.87      | 0.85        | 0.85        |
| 79  | 0.92  | 0.87  | 0.85      | 0.83      | 0.82        | 0.82        |
| 78  | 0.89  | 0.84  | 0.82      | 0.80      | 0.79        | 0.78        |
| 77  | 0.87  | 0.81  | 0.79      | 0.77      | 0.76        | 0.75        |
| 76  | 0.84  | 0.78  | 0.76      | 0.74      | 0.72        | 0.72        |
| 75  | 0.82  | 0.75  | 0.73      | 0.71      | 0.69        | 0.69        |
| 74  | 0.79  | 0.72  | 0.70      | 0.67      | 0.66        | 0.66        |
| 73  | 0.77  | 0.69  | 0.67      | 0.64      | 0.63        | 0.62        |
| 72  | 0.74  | 0.66  | 0.64      | 0.61      | 0.60        | 0.59        |
| 71  | 0.71  | 0.63  | 0.60      | 0.58      | 0.57        | 0.56        |
| 70  | 0.68  | 0.60  | 0.58      | 0.55      | 0.54        | 0.54        |
| 69  | 0.65  | 0.57  | 0.55      | 0.53      | 0.51        | 0.51        |
| 68  | 0.62  | 0.54  | 0.52      | 0.50      | 0.48        | 0.48        |
| 67  | 0.59  | 0.51  | 0.49      | 0.47      | 0.46        | 0.45        |
| 66  | 0.56  | 0.48  | 0.46      | 0.44      | 0.43        | 0.42        |
| 65  | 0.53  | 0.45  | 0.43      | 0.41      | 0.40        | 0.40        |
| 64  | 0.49  | 0.42  | 0.40      | 0.38      | 0.37        | 0.37        |
| 63  | 0.46  | 0.39  | 0.37      | 0.35      | 0.35        | 0.34        |
| 62  | 0.43  | 0.36  | 0.34      | 0.33      | 0.32        | 0.31        |
| 61  | 0.39  | 0.33  | 0.31      | 0.30      | 0.30        | 0.29        |
| 60  | 0.36  | 0.30  | 0.28      | 0.27      | 0.26        | 0.26        |
| 59  | 0.32  | 0.27  | 0.25      | 0.24      | 0.24        | 0.23        |
| 58  | 0.29  | 0.24  | 0.23      | 0.21      | 0.21        | 0.21        |
| 57  | 0.25  | 0.21  | 0.20      | 0.19      | 0.18        | 0.18        |
| 56  | 0.22  | 0.18  | 0.17      | 0.16      | 0.16        | 0.15        |
| 55  | 0.18  | 0.15  | 0.14      | 0.13      | 0.13        | 0.13        |
| 54  | 0.14  | 0.12  | 0.11      | 0.11      | 0.10        | 0.10        |
| 53  | 0.11  | 0.09  | 0.08      | 0.08      | 0.08        | 0.08        |
| 52  | 0.07  | 0.06  | 0.06      | 0.05      | 0.05        | 0.05        |
| 51  | 0.03  | 0.03  | 0.03      | 0.03      | 0.03        | 0.03        |
| 50  | 0.00  | 0.00  | 0.00      | 0.00      | 0.00        | 0.00        |

Note 1: For negative values of  $Q_U$  or  $Q_L$ .  $PWL_U$  or  $PWL_L$  is equal to 100 minus the tabular  $PWL_U$  or  $PWL_L$ .

Note 2: If the value of  $Q_U$  or  $Q_L$  does not correspond exactly to a value in the table, use the next higher value.

**Table 502-7  
Payment Adjustments for Superpave**

Payment adjustments will be based on specification limits.

**A) PLANT ACCEPTANCE**

Air Voids: The percent within limits (PWL) will be calculated for air voids for each lot and reported to the nearest whole number. Payment for plant acceptance will be in accordance with Table 502-7A.

**Table 502-7A  
Payment Adjustment Schedule for Plant Acceptance**

| Air Voids PWL | Percent Payment           |
|---------------|---------------------------|
| 100           | 103                       |
| 88-99         | 100                       |
| 71-87         | 98                        |
| 51-70         | 90                        |
| 21-50         | 80                        |
| ≤20           | 50 or Remove <sup>1</sup> |

<sup>1</sup>At the option of the Department after investigation.

**B) ROADWAY DENSITY**

The percent within limits (PWL) will be calculated for pavement density for each lot and reported to the nearest whole number. Payment for roadway density will be in accordance with Table 502-7B.

**Table 502-7B  
Payment Adjustment Schedule for Roadway Density**

| Roadway Density PWL | Percent Payment           |
|---------------------|---------------------------|
| 98-100              | 105                       |
| 89-97               | 100                       |
| 79-88               | 98                        |
| 61-78               | 90                        |
| 31-60               | 80                        |
| ≤30                 | 50 or Remove <sup>1</sup> |

<sup>1</sup>At the option of the Department after investigation.

**C) SURFACE TOLERANCE (Final Wearing Course Travel Lanes Only)**

Payment adjustments for surface tolerance for the final wearing course travel lanes will be based on the International Roughness Index (IRI) in accordance with Table 502-8A and Subsections 502.15 and 502.16. Percent payments will be determined for each subplot and averaged to determine payment for the lot.

**TOTAL PAYMENT**

The percent payment for the wearing course travel lanes will be the average of the percent payments for plant acceptance, roadway density, and surface tolerance for each lot. Incentive payment for surface tolerance will be in accordance with Subsection 502.16(e) and paid separately.

The percent payment for all other mix types will be the average percent payments for plant acceptance and roadway density for each lot.

All calculations for percent payment will be rounded to the nearest one (1) percent.

**Table 502-8A**  
**Payment Adjustment Schedules for Longitudinal**  
**Surface Tolerance, Maximum International Roughness Index,**  
**inches per mile (mm per km)**

| Percent of Contract Unit Price (by Sublot) <sup>1</sup>   | 103% <sup>2</sup> | 100%           | 90%                  | 80%                     | 50% or Remove <sup>3</sup> |
|---|-------------------|----------------|----------------------|-------------------------|----------------------------|
| Category A<br>All Interstates, Multi-Lift New Construction and Overlays of More than two Lifts                              | <55<br>(<870)     | <65<br>(<1030) | 65-75<br>(1030-1180) | NA                      | >75<br>(>1180)             |
| Category B<br>One or Two Lift Overlays Over Cold Planed Surfaces, and Two-Lift Overlays Over Existing Surfaces <sup>4</sup> | <65<br>(<1030)    | <75<br>(<1180) | 75-89<br>(1180-1400) | NA                      | >89<br>(>1400)             |
| Category C<br>Single-Lift Overlays Over Existing Surfaces <sup>4</sup>  | <75<br>(<1180)    | <85<br>(<1340) | 85-95<br>(1340-1500) | >95-110<br>(>1500-1740) | >110<br>(>1740)            |
| Longitudinal Surface Tolerance Incentive Pay, Final Completion, Average of All Travel Lanes <sup>5</sup>                    | ≤45 (≤710)        |                |                      |                         |                            |

<sup>1</sup>Or portion of sublot placed on the project.

<sup>2</sup>Maximum payment for sublots with exception areas, exclusions or grinding is 100 percent, unless the excluded area is a bridge end.

<sup>3</sup>At the option of the engineer.

<sup>4</sup>Existing surfaces include reconstructed bases without profile grade control.

<sup>5</sup>Only Category A projects are eligible for incentive. However, any grinding except within 300 feet (90 m) of a bridge end will cause the roadway to be ineligible for surface tolerance incentive pay.

**Table 502-8B**  
**Individual Wheelpath Deficient Area Limits**  
**Maximum International Roughness Index, inches per mile (mm per km)**

| Any 0.05 Mile (0.08 km) Segment | Wearing Course | Binder Course |
|---------------------------------|----------------|---------------|
| Category A                      | 89 (1400)      | 130 (2050)    |
| Category B                      | 99 (1560)      | 150 (2370)    |
| Category C                      | 110 (1740)     | N/A           |

**Table 502-9  
Payment Adjustment Schedule for Small Quantities of Superpave<sup>1</sup>**

| Parameter <sup>2</sup>                     | Percent of Contract Unit Price/Sublot |                                |                           |
|--|---------------------------------------|--------------------------------|---------------------------|
|  | 100                                   | 95                             | 50 or Remove <sup>3</sup> |
| % Air Voids                                | 2.5-4.5                               | 1.5-2.4 or 4.6-5.5             | <1.5 or >5.5              |
| Average Roadway Density, % G <sub>mm</sub> | ≥ Lower limit                         | -0.1 to -0.9 below lower limit | -1.0 below Lower limit    |

<sup>1</sup>See Subsection 502.14.

<sup>2</sup>For plant acceptance, use one sample for percent air voids to determine pay. For roadway acceptance, use the average of three cores to determine density and pay. Determine surface tolerance in accordance with Table 502-8A. The total percent payment for small quantities of Superpave mixtures will be the average of the percent payments for plant acceptance (air voids), roadway acceptance (density) and surface tolerance.

<sup>3</sup>At the option of the engineer.

## **Section 503**

### **Asphaltic Concrete Equipment and Processes**

**503.01 DESCRIPTION.** This section specifies requirements for certification of plant and paving equipment. It includes methods and equipment for handling and storing materials, producing asphaltic concrete, and transporting and placing asphaltic concrete at the job site.

The Department's publication entitled "Application of Quality Assurance Specifications for Asphaltic Concrete Mixtures" is hereby made a part of this specification by reference.

#### **503.02 PLANT EQUIPMENT.**

**(a) General:** Asphaltic concrete shall be mixed at a central mixing plant by either the batch, or continuous drum mixing process. Aggregates, additives and asphalt cement shall be proportioned in accordance with the approved Job Mix Formula. When the automatic adjustments or other critical control and shutoff devices are not functioning, the plant shall not operate. The plant shall operate with clean, easily accessible, and accurate thermometers, scales and meters, which shall be immediately repaired, replaced, or recalibrated when faulty operation is detected.

The system shall provide positive weight (mass) control of cold aggregates fed by a belt scale or other device interlocked with the asphalt measuring system to maintain required proportions of combined aggregates and asphalt. Aggregates shall be heated, dried and mixed with asphalt to produce a homogeneous mixture in which all aggregate particles are uniformly coated. Approved methods shall be provided to discard the first and last output of the plant after each interruption. Special requirements pertaining to batch plants shall be in accordance with Subsection 503.11.

Rates of production of every material used on a DOTD project shall be digitally displayed and the quantities totalized.

**(b) Certification and Calibrations:** Plants furnishing asphaltic concrete mixtures in accordance with Sections 502 and 508 shall be certified at least every two years in accordance with current Departmental procedures. All plant components and processes are subject to inspection and approval by the District Laboratory Engineer. The meters, scales, and measuring devices shall be tested, inspected and certified every 90 calendar days, and more often when directed, by a qualified independent scale

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service or the Weights and Measures Division, Louisiana Department of Agriculture and Forestry.

The contractor shall have a plant site laboratory conforming to Section 722 as a part of the plant facilities. The plant lab shall be equipped with a "land-based" telephone and made available for DOTD use. The plant site laboratory shall be located in close proximity to the plant operations, so that plant operations may be observed. All laboratory equipment shall be calibrated and verified by the procedures in AASHTO R18 and the appropriate test methods and by the frequency directed in AASHTO R18. Traceable standards and accreditation are not required. Documentation for the calibrations and verifications shall be available upon request by DOTD personnel.

## 503.03 AGGREGATES.

**(a) Stockpiles:** Aggregates shall be stored at the plant site so that no intermixing, segregation, or contamination will occur. Stockpiles shall be well drained.

Blending and proportioning of aggregates shall be done from cold feed bins and not in stockpiles or on the ground at the plant site or the source. Gradation and other properties of aggregate in stockpiles shall be such that when the aggregates are combined in proper proportions, the resulting combined gradation will meet the requirements of the approved job mix formula.

**(b) Cold Feed:** Cold aggregate bins shall be of sufficient size to store the amount of aggregates required for continuous plant operation. Partitions between bins shall extend a minimum of 1 foot (300 mm) above the top of bins and be sufficient to prevent intermixing of aggregate sizes. The unit shall include a feeder mounted under the bins with each bin compartment having an accurately controlled individual gate to form an orifice for measuring the material drawn from it. The orifice shall be rectangular, with one dimension adjustable by positive mechanized adjustment with locking system. Indicators shall be provided on each gate to show the gate opening in inches (mm) or a predetermined setting to match the calibration curves.

Calibration of the cold feed system shall be based on the weight (mass) of bin material. Material shall be fed from a bin through the individual orifice and bypassed to a container to be weighed, or over the calibrated weigh bridge. Material from each bin shall be calibrated separately. Calibration shall be performed at three different production rates with

records kept on file. The calibration process shall be part of the contractor's quality control.

An automatic plant shutoff shall be provided to operate when any aggregate bin becomes empty or flow is interrupted. The contractor shall provide belt scales for conveyor systems when the drum-mixer process is used, calibrated in accordance with Subsection 503.02(b).

The plant shall have an accurate mechanical means for uniformly feeding aggregate into the dryer. Feeders shall be capable of uniformly delivering the maximum number of required aggregate sizes in their proper proportion. When more than one cold bin feeder is used, each shall operate as a separate unit. The individual controls shall be integrated with a master control for all materials.

**(c) Moisture:** The contractor's Certified Asphaltic Concrete Plant Technician shall measure the moisture content of the cold feed aggregates daily in accordance with DOTD TR 319 when starting the plant. Adequately scheduled tests during plant operations and adjustments to the plant shall be made to correct for moisture in the aggregate. The schedule for moisture content testing will be subject to approval.

Provisions shall be made for introducing the latest moisture content of the cold feed aggregates into the belt weighing system, thereby correcting the conversion of wet aggregate weight (mass) to dry aggregate weight (mass). Dry weight (mass) of the aggregate flow shall be displayed digitally in appropriate units.

**(d) Screens:** The plant shall have a scalping system on the fine sand cold bin, the RAP bin and other bins as necessary, to ensure removal of objectionable material.

For continuous drum mix plants, and when a belt scale is used, an additional vibrating scalping screen will be required between the aggregate cold feed discharge and belt scale. Other processes will require a vibrating scalping screen between the cold feed discharge and mixing process. The screens shall be sized to remove all oversize aggregate and other objectionable material.

**(e) Reclaimed Asphaltic Pavement (RAP):** If used, a separate cold feed system, shall be provided for reclaimed asphaltic pavement (RAP). This system shall include a scalping screen, bin, feeder belt and weigh bridge which is fully integrated with the cold feed system and asphalt cement supply system. This system shall be calibrated in accordance with Subsections 503.02(b) and 503.03(b). RAP must be added to the dryer in a location, in accordance with the manufacturer's recommendation, that does not expose the material to direct flame.

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### 503.04 ASPHALT CEMENT.

**(a) Working Tank:** The asphalt cement working tank shall be capable of uniformly heating the material by approved methods, under positive control, to the required temperature as recommended by the supplier. The asphalt circulating system shall be of adequate size to ensure proper and continuous circulation (except while asphalt is being measured). New tanks shall be equipped with paddle-type mixers or agitators which keep the material in motion and minimize prolonged exposure to the heating source. Proper mixing temperature of asphalt shall be maintained. Pipelines and fittings shall be heated or insulated. A sampling spigot shall be provided in each tank or the supply line. Strainers or screens must be placed between the working tank and mixing unit to filter undesirable material. A thermometer graduated in 5°F (2°C) increments and having an accuracy of ±5°F (±2°C) shall be fixed in the asphalt feed line at an approved location near the discharge valve at the mixer unit to indicate the temperature of asphalt from storage.

**(b) Measurement:** Asphalt cement shall be measured either by weight (mass) or volume. All scales and meters shall be accurate to 0.5 percent and be calibrated and verified in accordance with Subsection 503.02(b). The rate of flow of asphalt cement shall also be digitally displayed and the quantity used totalized.

**(1) Weight Measurement:** Scales shall read to the nearest pound (kg).

**(2) Volume Measurement:** Measurement by volume shall be by means of a positive displacement pump and shall be recorded in digital form to the nearest gallon (L). Provisions shall be made to periodically check by weight (mass) the quantity of asphalt cement delivered. The rate of asphalt cement delivery and the total quantity delivered shall be continuously displayed in digital form corrected to 60°F (15°C). The quantity of asphalt cement delivered shall be corrected to the approved job mix temperature. Measurement shall be continuous and accurate to 1.0 percent of the required measurement.

**503.05 ADDITIVES.** The rate of flow of anti-strip, shall be digitally displayed and the quantity used totalized. When used, the rate of flow of mineral filler, lime and/or fibers shall also be digitally displayed and the quantity used totalized. All meters shall be accurate to 0.5 percent.

**(a) Anti-strip:** The anti-strip additive storage tank shall be a recirculating tank provided with uniform heat and an indicating thermometer at an approved location near the tank discharge point. A



thermometer graduated in 5°F (2°C) increments and having an accuracy of ±5°F (±2°C) shall be placed at an approved point near the anti-stripping tank discharge point before the meter. Anti-strip additive shall be dispensed directly into the asphalt feed line at a location between the asphalt control valve and the end of the asphalt discharge line. The anti-strip delivery system shall ensure that the proper amount of material is delivered continuously and in correct proportion to the asphalt cement. This system may be a paddle-type no-flow indicator, which triggers a light or alarm in the control room and an alarm in the plant lab when the anti-strip material is not flowing. Other similar systems may be allowed with approval by the District Laboratory Engineer. In either system, if the anti-strip flow is not restored within 15 minutes, production shall be discontinued until the system is repaired. The equipment shall include a positive displacement accumulating meter which accumulates and displays materials used, and reads to the nearest 0.25 gallon (L). Additionally, a measuring dip stick and a chart correlating tank quantity with height of anti-strip liquid shall be provided.

**(b) Mineral Filler:** Mineral filler shall be proportioned separately from a hopper equipped with an adjustable feed which can be accurately and conveniently calibrated and which shall be interlocked with the aggregate and asphalt feeds. The feeder shall accurately proportion the mineral filler and provide a constant flow of material. For batch plants, the mineral filler shall be batched into the mix along with the aggregates. For continuous drum mixer plants, the mineral filler shall be introduced to the mix at an approved location sufficiently in advance of the addition of the asphalt to allow proper drying time.

For mineral filler, a separate bin and feeder in accordance with Subsection 503.03(b) shall be furnished with its drive interlocked with the aggregate feeders. Mineral filler shall be introduced directly into the drum near the asphalt discharge.

**(c) Hydrated Lime:** When hydrated lime additive is mixed with aggregate on the belt feed, the hydrated lime additive equipment shall be interlocked and synchronized with cold feed controls to operate concurrently with the cold feed operation. A positive signal system that will automatically shut the plant down when a malfunction causes an improper supply of additive or water shall be installed. The plant shall not operate unless the entire additive system is functioning properly. The hydrated lime additive system shall consist of the following equipment.

**(1)** A separate bulk storage bin with a vane feeder or other approved feeding system which can be readily calibrated. The system shall

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provide a means for easy sampling of additive and verification of the quantity dispensed by weight (mass). The feeder system shall continuously record the total amount of additive dispensed.

**(2)** An approved spray bar or other approved system capable of spraying the composited aggregate with potable water before the addition of hydrated lime additive when the moisture content of the composited aggregate falls below 3 percent. An alternate system for spraying coarse aggregate stockpiles may be allowed when approved. The approved equipment and methods shall consistently maintain the aggregates in a uniform, surface wet condition. The moisture content of the aggregate-lime additive mixture following spraying and mixing shall be introduced into the automatic moisture controls of the plant.

**(3)** An approved pugmill or other approved mixing device to uniformly coat the composited aggregates with the hydrated lime additive shall be located between the point at which the additive is placed on the composited aggregate and the dryer.

The hydrated lime additive shall be dispensed directly onto the composited aggregate between the cold feed and the dryer. When cold feed control is used, the additive shall be introduced after the composited aggregate has passed through the vibrating scalping screen. The additive shall be uniformly blended with the composited aggregate before entry into the dryer. The process and equipment used for mixing the lime additive and aggregate shall be approved and shall provide that no less than the required amount of additive is continuously blended with the aggregate. When a belt scale is used on the composited aggregate feed belt, it shall be positioned to record the combined weight (mass) of the blended aggregate and hydrated lime additive.

**(d) Fibers:** A separate feed system shall be used to accurately proportion the required quantity of mineral fibers into the mixture in such a manner that uniform distribution is obtained. The proportioning device shall be interlocked with the aggregate feed or weigh system to maintain the correct proportions for all rates of production. The fiber proportion shall be controlled to within plus or minus 10 percent of the amount of fibers required. Flow indicators or sensing devices shall be provided for the fiber system, interlocked with plant controls so that the mixture production will be interrupted if introduction of the fiber fails. For drum plants, the fiber shall be added in such a manner that it will not become entrained in the exhaust system of the dryer or plant.

**503.06 DRYER.** The plant shall include one or more dryers, with automatic burner controls, that continuously agitate aggregates during heating and drying. The equipment shall be capable of heating and drying aggregates in the necessary quantities to supply the mixing unit continuously at its operating capacity and at a specified temperature and acceptable moisture content. Aggregates shall be heated and dried to produce a mixture meeting specification requirements without burner fuel contamination. Slope of dryers shall be in accordance with approved recommendations of the dryer manufacturer.

**503.07 SECONDARY DUST COLLECTOR.** When a dust collection system returns fines to the mixture, the fines shall be returned at a uniform and regulated rate and at an approved location. In the drum-mix process, baghouse fines shall be added near the asphalt cement discharge. Baghouse fines shall be dispensed into the aggregate mixture by an approved feed control device from a collector box, surge bin or filler silo. This provision does not apply to primary collectors.

**503.08 MIXER.** The mixer unit shall produce a uniform blend at the specified production rate, with rapid and complete asphalt coating of aggregate. As a minimum, 95 percent of the coarse aggregate particles retained on the No. 4 (4.75 mm) sieve shall be completely coated when tested in accordance with DOTD TR 328.

The aggregate, asphalt cement and the mixture shall be processed at the temperature specified in the approved job mix formula. The temperature of the mixture at discharge from the mixer shall be within  $\pm 25^{\circ}\text{F}$  ( $\pm 14^{\circ}\text{C}$ ) of the optimum mixing temperature in the job mix formula. When the mixing, coating, placing or density requirements are not being met, the engineer may require that the job mix temperature be changed or that the foregoing temperature range be restricted.

### **503.09 STORAGE AND LOADING ASPHALTIC CONCRETE MIXTURE.**

**(a) Mix Conveyors:** The mix shall be transported directly from plant to silos or bins by means of an enclosed continuous type conveyor system designed to prevent spillage and match the production rate of the plant. The mixture from the silo or surge bin shall remain within  $\pm 15^{\circ}\text{F}$  ( $\pm 8^{\circ}\text{C}$ ) of plant discharge temperature.

The plant shall be equipped with an approved recording thermometer graduated in maximum  $10^{\circ}\text{F}$  ( $5^{\circ}\text{C}$ ) increments and having an accuracy of

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$\pm 5^{\circ}\text{F}$  ( $\pm 2^{\circ}\text{C}$ ) and a sensitivity which will provide an indication of temperature change at a rate of at least  $10^{\circ}\text{F}$  ( $5^{\circ}\text{C}$ ) per minute. It shall be placed at the dryer discharge chute or approved location to register automatically the temperature of, the asphaltic concrete mixture at discharge.

**(b) Storage Silos and Surge Bins:** For drum mix plants storage silos or surge bins shall be used for storing asphaltic concrete mixtures and approved by the engineer.

Use of silos or bins shall conform to the limitations on retention time, type of mixture, heater operation, bin atmosphere, bin level or other characteristics set forth in these specifications and other requirements stated in granting approval of these facilities. An indicator device which is activated when material in the bin drops below the top of the sloped portion shall be affixed to each bin and be visible to the loading operator. Mixtures shall be maintained above this level during production, except for extended periods when the plant is not in operation. If extra storage time is anticipated, 0.1 percent asphalt cement may be added to the mix.

When the mixture is placed into a silo or bins through a surge device, an automatic warning system shall be provided to audibly warn the operator of a gate malfunction. Silo or bin unloading gates shall be either clam shell gates operating under gravity feed or other approved gates that will not cause segregation or be detrimental to the mix.

**(1) Silos:** If heated, the storage silo heating system shall be capable of uniformly maintaining mix temperature without localized heating.

Without prior approval, maximum allowable storage time for asphaltic concrete mixtures is 18 hours. The Department may grant permission to exceed the storage time, provided test results and other data indicate that the additional storage time is not detrimental to the mix.

**(2) Unheated Surge Bins:** Storage time for surge bins depends on the temperature of the stored mix. The mix temperature, when discharged from the surge bin, must not be lower than  $25^{\circ}\text{F}$  ( $\pm 14^{\circ}\text{C}$ ) below the optimum mixing temperature in the job mix formula.

**(c) Loading and Sampling:** Haul trucks shall conform with Subsection 503.13.

The sampling platform shall be a sturdy, secured metal platform with protective rails, at least 15 square feet in area, and set at the proper height to easily obtain a sample.

The plant shall be equipped with an approved pressurized system capable of spraying a uniform coating of an approved asphalt mix release

agent into the haul unit bed prior to loading. Diesel is not allowed as a mix release agent.

### **503.10 SCALES AND METERS.**

**(a) Scales:** Scales and meters shall be accurate to  $\pm 0.5$  percent of the indicated load. They shall be designed, constructed and installed so that operations do not affect their accuracy. Calibrations are required in accordance with Subsection 503.02(b). All asphaltic concrete mixtures shall be measured by weigh hoppers or truck platform scales to determine weight (mass) for pay.

**(b) Weigh Hoppers:** Weigh hoppers weigh the mixture or individual material components. Hoppers for weighing a mixture from a storage or surge bin shall not leak or cause segregation. Weigh hoppers shall be suspended from calibrated springless dial scales or load cell scales. The weigh hopper shall be equipped with an approved automatic printer system that will print the certified tare weight (mass) of the truck, each batch weight (mass) and total weight (mass) of mixture loaded into the truck

**(c) Platform Scales:** Truck-platform scales shall be of sufficient length to weigh the entire unit transporting the mix. Scales shall be equipped with an approved automatic printer system that will print the tare weight (mass) as well as the total weight (mass) of the unit and the mix. The truck must be weighed empty to determine tare weight prior to mixture loading.

**(d) Printers:** In the event of a breakdown of the printing mechanism, the contractor may be permitted to operate during the 48-hour period immediately following the breakdown provided an accurate weight (mass) of mixture can be determined and recorded, and repeated breakdowns do not occur.

### **503.11 BATCH PLANTS.**

**(a) Screens:** Batch plant screens, if used, shall proportion and screen aggregates to the required sizes. The normal capacity of the screens shall exceed the full capacity of the mixer or dryer. The screens shall be exposed for inspection as directed.

**(b) Hot Bins:** Hot aggregate shall be stored in bins. Storage shall be accomplished to minimize segregation and loss of temperature of aggregates. Bin sizes shall be adequate for continuous operation of the plant at rated capacity. Bins shall be arranged to ensure separate and adequate storage of appropriate fractions of aggregate. Adequate dry

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storage shall be provided with an overflow pipe or chute to prevent contamination of materials. Each size of aggregate shall be stored in separate bins when screens are used. For screenless operation, aggregate shall be stored in one or more bins with adequate provisions to prevent segregation.

The temperature of the heated aggregates shall be measured at an approved location and continuously recorded. The thermometer shall be graduated in maximum 10°F (5°C) increments with an accuracy of ±5°F (±2°C) and a sensitivity to temperature change at a minimum rate of at least 10°F (5°C) per minute.

When plant operation is interrupted and the temperature of material in hot storage cools to 25°F (14°C) or more below the specified mixing temperature, or when a plant changes type of mix and the change requires a change of materials, bins shall be pulled and the material discarded.

Fiber, if used in a batch plant, must be added to the aggregate in the weigh hopper or as approved and directed by the engineer. Also, for batch plants, the dry mixing time shall be increased by 8 to 12 seconds, or as directed by the engineer, from the time the aggregate is completely emptied into the pugmill.

**(c) Mixer Unit:** Batch plants shall have an approved pugmill and spray bar. Prior to adding asphalt cement, the combined aggregate shall be thoroughly mixed dry, after which the proper amount of asphalt cement shall be sprayed over aggregates and mixed to produce a homogeneous mixture in which all aggregate particles are uniformly coated. Mixing times shall be in accordance with the approved job mix formula. The mixer shall have an approved timing device to prevent entrance of additional material during mixing. The device shall also lock the asphalt cement bucket throughout the dry mixing period. The pugmill shall not be operated above the rated capacity. The discharge gates shall be locked to ensure proper mixing.

**(d) Weigh Hoppers:** In batch plants, asphalt cement and aggregate hoppers shall be of sufficient size to weigh the total batch in one operation.

To determine percent asphalt cement for the mix, the contractor shall provide an approved printer system which will print separately the weight (mass) of aggregates and asphalt cement. These weights (masses) shall be used for calculating the percent asphalt cement in the mixture. When a mixture is loaded directly into the haul truck, these weights (masses) shall be used for the purpose of determining pay weights (masses) for the mix. Printing equipment shall also print zero weight (mass) for each batch and total weight (mass) of mixture loaded in trucks.

In the event of a breakdown of the printing mechanism, the contractor may be permitted to operate during the 48-hour period immediately following the breakdown, provided an accurate weight (mass) of mixture can be determined and recorded, and provided repeated breakdowns do not occur.

**503.12 PAVING EQUIPMENT.** All primary roadway equipment, including asphalt distributors, pavers, rollers and hauling equipment, must be certified at least every two years in accordance with current DOTD policies.

**503.13 HAUL TRUCKS.** Equipment for transporting asphaltic mixtures shall have tight, clean, smooth metal beds or approved equal, sprayed daily or as often as directed with an approved asphalt mix release agent.

Each vehicle shall have a cover of canvas or other suitable material large enough to completely cover the top and extend over the sides of the bed to protect the mixture from the weather or loss of heat due to excessive haul time. The cover shall have sufficient tie-downs to hold the cover to the bed during hauling. The covers shall be used as directed.

The hauling unit shall discharge the mixture in a continuous manner so the spreader apron of the paver or MTV will not be overloaded. If the hauling unit or paver is causing surface tolerance penalties or excessive bumps, its use shall be discontinued.

Bottom dump equipment producing windrows will not be allowed.

When size, speed and condition of trucks interfere with orderly paving operations, changes in equipment and/or operations shall be made. Load restrictions shall be in accordance with Subsection 105.14.

**503.14 DISTRIBUTORS.** The asphalt cement distributor shall meet the requirements of 507.03(a) or the following:

The asphalt distributor shall be equipped with a suitable spray bar and nozzles designed to distribute material within the specified temperature range and shall be equipped with thermometers to indicate temperature of material in the tank. The distributor shall be designed to maintain a constant uniform pressure on asphalt material as it passes through nozzles and to apply asphalt material at the required rate. The distributor shall be equipped with a valve system that controls the flow of asphalt materials, a pump tachometer or pressure gauge that registers pump output, a bitumeter

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and odometer that indicates both the speed of the distributor in feet (m) per minute and total distance traveled, and measuring devices, as necessary.

Charts shall be provided for an accurate, rapid determination and control of the amount of asphalt materials being applied per square yard (sq m) of surface under operating conditions. The bitumeter shall be calibrated to ensure accurate spraying operations and shall be kept clean of asphalt buildup. The distributor shall be equipped with a hand-held spray attachment for applying asphalt materials to areas inaccessible with the spray bar.

**503.15 MATERIAL TRANSFER VEHICLE (MTV).** When placing the final two lifts of asphaltic concrete on the roadway travel lanes, an approved material transfer vehicle (MTV) will be required to deliver mixtures from the hauling equipment to the paving equipment, and to prevent segregation of the asphaltic concrete hot-mix. The MTV is required regardless of average daily traffic (ADT). The MTV shall perform additional mixing of the asphaltic concrete mixtures and then deposit the mixture in the paving equipment hopper to reduce segregation and facilitate continuous production. As a minimum, the MTV shall have a high capacity truck unloading system which will receive mixtures from the hauling equipment; a storage bin in the MTV to continuously mix the mixture prior to discharge to a conveyor system; a discharge conveyor, with the ability to swivel, deliver the mixture to a paving equipment hopper while allowing the MTV to operate from an adjacent lane; and a paver insert hopper with a minimum capacity of 18 tons (18 Mg) which can be inserted into conventional paving equipment hoppers. Other pavers approved by the Department may be used without an insert.

If the weight of the MTV is determined by the engineer to cause settlement or movement in the base or sub-base, the use of the MTV shall be discontinued for this section.

When a malfunction occurs in the MTV during lay-down operations, work may continue for the balance of that day on any course other than the final wearing course. When an MTV malfunctions during final wearing course paving operations, plant operations shall be immediately discontinued and shall not resume until the MTV malfunctions have been remedied. Wearing course materials in transit may be placed. This procedure in no way alleviates the contractor from meeting contract specifications.

Due to the weight of the loaded MTV, the following restrictions shall apply at bridge crossings:



- (a) The MTV shall abide by posted weight limits.
- (b) The MTV shall be as near empty as possible prior to crossing a bridge.
- (c) The MTV shall be moved across a bridge without any other vehicles being on the bridge.
- (d) The MTV shall be moved on a bridge only within the limits of the travel lanes and shall not be moved on the shoulders of the bridge.
- (e) The MTV shall move at a speed no greater than 5 miles per hour without acceleration or deceleration when crossing a bridge.

**503.16 PAVERS.** Pavers shall be equipped with automatic screed and slope control devices for use with an approved traveling reference plane or erected stringline, as directed.

Pavers shall be capable of placing mixtures within specified tolerances. A screed or strike-off assembly shall be used to distribute the mixture over the entire paving strip. The width of the paving strip will be approved. Assemblies, including extensions, shall place mixtures that are uniform in appearance and quality. The assembly shall be adjustable to provide the required cross section. The assembly shall be equipped with a heater and a vibrator.

In hilly terrain, when mix is discharged directly into the paver hopper, a positive connection shall be provided between paver and hauling unit. When the hauling unit discharges directly into the paver hopper, the paver shall be capable of pushing the hauling unit.

Pavers shall be equipped with hoppers adequately designed and maintained to prevent spillage. Pavers shall also be equipped with augers to place the mix evenly in front of the screed, including extensions. Pavers shall be equipped with a quick and efficient steering device and shall be capable of traveling both forward and in reverse. Pavers shall be capable of spreading mixes to required thickness without segregation or tearing.

For shoulder construction or other incidental applications, modified pavers or widening machines may be used when permitted.

A screed extension shall consist of a screed plate or plates, which meet all requirements for the screed set forth in these specifications. Screed extensions used during roadway paving operations shall be heated. The bottom surface of the screed extension shall be in the same plane as the bottom surface of the screed plate. Auger assembly extensions shall be used when screed extensions in excess of 1 foot (300 mm) on a side are to be continuously used in the pavement operation. Such auger extensions shall extend to within 1 foot (300 mm) of the end of the screed. With

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approval, the use of an auger extension with screed extensions in excess of 1 foot (300 mm) on one side may be waived for transitions, taper sections and similar short sections. The engineer may waive the requirement for auger extensions when hydraulically extended screeds, which trail the main screed assembly, are used, provided required density and surface texture are obtained.

A strike-off assembly or boxed extension shall not be used for paving within the traveled way, except when approved for short irregular sections or non-typical sections.

Pavers shall be equipped with automatic screed and adjustable slope control devices capable of placing the mixture to grade within the tolerances specified, and distributing the mixture over the entire lane width and such partial lane widths as may be approved. Pavers shall be equipped with two grade sensors when required.

Pavers shall be equipped to work from an erected stringline, shoe device or an approved traveling reference plane that will accurately reflect, the average grade of the surface on which it is to be operated and which will result in a finished surface conforming to grade and surface requirements.

## 503.17 COMPACTION EQUIPMENT.

**(a) General:** Compaction equipment shall be self-propelled and be capable of reversing without backlash. It is the contractor's responsibility to provide the number, type and size of rollers sufficient to compact the mixture to the specified density and surface smoothness. The contractor shall establish, and modify as necessary, the number, type, size and rolling pattern on the first day of production. Poorly performing compaction equipment will not be allowed and shall be replaced with suitable equipment or supplemented as necessary.

**(b) Steel Wheel Rollers:** Steel wheel rollers may be either vibratory or nonvibratory. Wheels shall be true to round and equipped with suitable scrapers and watering devices. Vibratory rollers shall be designed for asphaltic concrete compaction and shall have separate controls for frequency, amplitude and propulsion.

**(c) Pneumatic Tire Rollers:** All tires shall be treadless, shall be the same size and ply rating, and shall be inflated to a uniform pressure not varying more than  $\pm 5$  psi ( $\pm 35$  kPa) between tires. Wheels shall not wobble and shall be aligned so that gaps between tires on one axle are covered by tires of the other axle. Tires shall be equipped with scrapers to prevent adhesion of mixture. The engineer may require additional cleaning and water apparatus on tires if material adhesion is detrimental to the mat.

**503.18 MISCELLANEOUS EQUIPMENT AND HAND TOOLS.**

Power revolving brooms or power blowers shall be provided and maintained in a satisfactory working condition.

In areas that are inaccessible to conventional rollers, satisfactory mechanical compaction equipment, or hot hand tampers, shall be used. Tamping tools may be used for compacting edges.

**503.19 MEASUREMENT.** Asphaltic concrete mixtures shall be measured for payment in accordance with appropriate subsections. Scales and meters for measuring asphalt materials and mixture shall conform to the requirements in this subsection.

## **Section 504 Asphalt Tack Coat**

**504.01 DESCRIPTION.** This work consists of preparing and treating existing asphaltic or portland cement concrete pavement surfaces with asphalt material in accordance with these specifications and in conformity with the lines shown on the plans or established.

**504.02 ASPHALT MATERIALS.** Tack coat shall be an undiluted modified asphalt emulsion Grade CRS-2P, CSS-1, SS-1, SS-1P, or SS-1L complying with Section 1002.

**504.03 WEATHER LIMITATIONS.** Asphalt tack coat shall not be applied on a wet surface or when the ambient air temperature is below 40°F (5°C).

**504.04 EQUIPMENT.** The contractor shall provide equipment for applying asphalt material and preparation of the surface to be tacked. Equipment shall conform to Subsections 503.14 and 503.18. A hand-held pressure nozzle may be used for tack coat application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet (450 m) or less.

**504.05 SURFACE PREPARATION.** The surface shall be cleaned by sweeping or other approved methods. Edges of existing pavements which will form joints with new pavement shall be satisfactorily cleaned before tack coat is applied.

**504.06 APPLICATION.** Asphalt shall be uniformly applied to a clean dry surface with no bare areas, streaks or puddles with an asphalt distributor at a rate in accordance with Table 504-1. These rates may be raised or reduced as directed.

**Table 504-1  
Asphalt Tack Coats**

| Existing Surface                 | Rate; Gal/Sq yd (L/Sq m) <sup>1</sup> |
|----------------------------------|---------------------------------------|
| Bleeding Surface Treatment       | 0.02 (0.09)                           |
| Dry Surface Treatment            | 0.03 (0.14)                           |
| New Hot Mix                      | 0.03 (0.14)                           |
| Old Hot Mix                      | 0.07 (0.32)                           |
| Portland Cement Concrete         | 0.07 (0.32)                           |
| Friction Course                  | 0.05 (0.23)                           |
| Cold Planed Surface <sup>2</sup> | 0.08 (0.36)                           |

<sup>1</sup>Rates are minimum rates of undiluted asphalt emulsion.

<sup>2</sup>Minimum of two applications.

The minimum application temperature of the modified asphalt emulsions and emulsified asphalt Grade CRS-2P is 160°F (71°C) and Grades CSS-1, SS-1, SS-1L and SS-1P is 70°F (21°C).

Tack coat shall be applied in such manner as to cause the least inconvenience to traffic. The contractor will be permitted to apply the tack coat one calendar day prior to the mixture laydown; however, when tack coat has been damaged by traffic pick-up or contaminated by dirt, dust or mud, the surface shall be cleaned and retacked prior to the mixture laydown at no direct pay. Tacked surfaces exposed to traffic for more than 24 hours or damaged due to inclement weather shall be retacked at no direct pay.

**504.07 MEASUREMENT AND PAYMENT.** Asphalt tack coat will not be measured for payment; however, payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials.

## **Section 505 Asphalt Prime Coat**

**505.01 DESCRIPTION.** This work consists of preparing and treating a surface with asphalt material in conformance with these specifications and in conformity with lines shown on the plans or established.

**505.02 ASPHALTIC MATERIALS.** Prime coat shall be cutback asphalt Grade MC-30, MC-70, or AEP Emulsified Asphalt complying with Section 1002.

**505.03 WEATHER LIMITATIONS.** Asphalt materials shall not be applied on a wet surface or when ambient air temperature is less than 35°F (2°C) in the shade.

**505.04 EQUIPMENT.** The contractor shall provide the necessary equipment for proper construction of the work. Equipment shall be approved before construction begins and shall be maintained in satisfactory working condition. Equipment shall conform to Subsection 503.14.

**505.05 SURFACE PREPARATION.** The surface to be coated shall be shaped to required grade and section, shall be free from ruts, corrugations, segregated material or other irregularities, and shall be compacted to required density. Delays in priming may necessitate reprocessing or reshaping to provide a smooth, compacted surface.

**505.06 APPLICATION.** Prime coat shall extend 6 inches (150 mm) beyond the width of surfacing shown on the plans. The prime coat shall not be applied until the surface has been satisfactorily prepared and is dry.

Prime coat shall be applied at the rates and temperatures shown in Table 505-1. Quantities of prime coat shall not vary from that shown in Table 505-1.

**Table 505-1  
Prime Coats**

| Asphalt Grade | Application Rate<br>Gal/Sq Yd (L/Sq m) |             | Application<br>Temperature °F (°C) |          |
|---------------|--|-------------|------------------------------------|----------|
|               | Min.                                   | Max.        | Min.                               | Max      |
| MC-30         | 0.25 (1.15)                            | 0.30 (1.35) | 60 (15)                            | 120 (50) |
| MC-70         | 0.25 (1.15)                            | 0.30 (1.35) | 100 (40)                           | 180 (80) |
| AEP           | 0.25 (1.15)                            | 0.30 (1.35) | 60 (15)                            | 120 (50) |

**505.07 PROTECTION.** After prime coat has been applied it shall cure for a minimum of 24 hours before the surfacing is placed. The contractor shall keep traffic off the surface until the prime coat has properly cured, unless otherwise permitted.

If traffic is permitted, the contractor may be required to spread approved granular material, as directed, over the prime coat at no direct pay.

The prime coat shall be maintained intact. When required, the primed surface shall be thoroughly cleaned prior to the placement of surfacing.

Where the prime coat has failed, the failed area shall be cleaned and be recoated with prime coat at no direct pay. When the prime coat is generally unsatisfactory, the contractor shall reprime the unsatisfactory surface at no direct pay.

**505.08 MEASUREMENT AND PAYMENT.** Asphalt prime coat will not be measured for payment; however, payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Payment for surface preparation will be made under other items.

## **Section 506**

### **Asphalt Curing Membrane**

**506.01 DESCRIPTION.** This work consists of the application and maintenance of an asphalt curing membrane to the surface of cement or lime treated or stabilized materials in compliance with these specifications or as directed.

**506.02 MATERIALS.** Asphalt for curing membrane shall be an emulsified asphalt or an emulsified petroleum resin (EPR-1) complying with Section 1002. Water shall comply with Subsection 1018.01.

**506.03 WEATHER LIMITATIONS.** Asphalt curing membrane shall not be applied when the temperature is below 35°F (2°C), unless otherwise permitted.

**506.04 EQUIPMENT.** The contractor shall provide and maintain the necessary equipment for proper construction of this work. The equipment shall be approved before construction begins.

**506.05 SURFACE PREPARATION.** The surface to which curing membrane is to be applied shall be free from ruts, corrugations, loose material or other irregularities.

**506.06 APPLICATION.** The asphalt curing membrane shall be applied immediately upon completion of final finishing of the final lift of the surface. The emulsified asphalt curing membrane shall be uniformly applied at a minimum rate of 0.10 gallon per square yard (0.45 L/sq m) of undiluted emulsified asphalt. The EPR-1 curing membrane shall be uniformly applied at a minimum rate of 0.20 gallon per square yard (0.90 L/sq m) of undiluted resin. The undiluted emulsified petroleum resin shall consist of 5 parts water and 1 part resin concentrate. Any additional applications required shall be placed by the contractor at no direct pay. When emulsified asphalt is diluted with water and applied in multiple passes of the distributor, the total amount of asphalt material applied shall be increased so that the residual amount of asphalt material equals a minimum of 0.10 gallon per square yard (0.45 L/sq m). Extraneous material which has collected on the base shall be removed before additional



application of asphalt curing membrane. The surface shall be maintained and repaired before additional applications.

**506.07 PROTECTION.** After the curing membrane has been applied, the contractor shall keep public and construction traffic off the surface until the curing membrane has properly cured, unless otherwise directed. The curing membrane shall be maintained by the contractor at no direct pay until the surfacing has been placed. When traffic is permitted, additional curing membrane shall be applied at intervals to protect and cure the surface at no direct pay.

**506.08 MEASUREMENT AND PAYMENT.** Asphalt curing membrane will not be measured for payment; however, payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Water will not be measured for payment.

## **Section 507**

### **Asphaltic Surface Treatment**

**507.01 DESCRIPTION.** This work consists of furnishing properly distributed asphalt material followed by a uniform application of aggregate for building a riding surface, improving the surface friction of a roadway, sealing cracks in the roadway, reducing the rate of oxidation of a surface mixture, or as an interlayer to delay or reduce the occurrence of reflective cracking.

Asphaltic Surface Treatment (AST), sometimes referred to as "chip seal", shall consist of a specified emulsion applied "cold" or modified asphalt material applied "hot", at the temperature range specified in Table 507-1 for emulsions or Table 507-2 for hot applications, respectively. If not designated on the plans, the contractor shall have the option of providing either a hot or cold application. The application rates of asphalt material and aggregates will vary with aggregate size and existing roadway conditions but, for bid purposes only, shall meet the requirements of Table 507-1 or Table 507-2. The engineer will approve the actual application rates.

**507.02 MATERIALS.** The asphalt material shall comply with Section 1002. Aggregates shall comply with Subsection 1003.05. Allowed aggregates shall be as shown herein or as designated on the plans. Aggregates shall be from approved sources as shown in QPL 2.

Aggregates, except for limestone and interlayer aggregates, for hot application shall be precoated with a paving grade asphalt cement or a cationic emulsion in accordance with Section 1002. The residual asphalt content shall be a minimum of 1.0 percent by weight (mass) of the aggregate for high absorption aggregates and 0.5 percent minimum by weight (mass) for low absorption aggregates as defined in DOTD TR 300. The precoat applicator shall certify the quantities of precoat used in the process. The uncoated and precoated aggregate shall flow freely through the spreader as verified by DOTD by spread rate measurements. The gradation requirements apply to the aggregate after precoating for hot application. A gradation certification report shall be submitted with each aggregate shipment. If an emulsion is used for precoating, the stockpiled precoated aggregate shall be cured prior to use.

Hot asphalt shall be smooth and homogeneous and shall comply with the specifications for PAC-15 as shown in Table 1002-11.

Samples of asphalt material will be taken by the contractor in the presence of the engineer's representative. The engineer's representative will immediately take possession of the samples.

**507.03 EQUIPMENT.** The contractor shall provide and maintain the necessary equipment for proper construction. The equipment shall be approved, and calibrated before construction begins.

Storage tanks, piping, booster tanks, distributors and all other equipment used in delivering, storing or handling asphaltic materials shall be kept clean and in good operating condition.

Equipment shall consist of the following:

**(a) Power Asphalt Distributor:** The asphalt distributor shall be computer operated and capable of maintaining the allowable variation from any specified rate within  $\pm 0.02$  gallons per square yard ( $\pm 0.09$  L/sq m). The distributor shall be equipped with a height adjustable spray bar with spray nozzles recommended by the nozzle manufacturer which yield uniform double coverage as a minimum. The end nozzle over the roadway edge shall provide a sharp line of asphalt material parallel to the direction of travel. For hot applications, the distributor shall maintain constant circulation throughout the spreader bar to prevent blockage in the nozzles.

Means shall be provided, under operating conditions, for an accurate and rapid determination of the control and amount of asphalt materials being applied per square yard (sq m) of surface. The distributor shall be equipped with thermometers to indicate the temperature of the material in the tank. The distributor shall be equipped with a hand-held spray attachment for applying asphalt materials to areas inaccessible with the spray bar.

Prior to use, the asphalt distributor shall have been calibrated in accordance with ASTM D 2995 within the previous 12 months. The contractor shall provide the ASTM calibration and shall furnish the engineer an accurate and satisfactory calibration record prior to beginning the work. The engineer may at any time require verification of calibration accuracy of the asphalt distributor in accordance with ASTM D 2995.

**(b) Pneumatic-tire Rollers:** A minimum of two self-propelled rollers, weighing at least 12 tons (11 Mg) each shall be used. Tires shall be smooth tread, of the same size and ply rating, and shall be inflated to a minimum uniform tire pressure of 60 psi (400 kPa), unless damage occurs. The engineer may require a reduction in roller pressure to prevent damage

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to the aggregate or underlying base course. Wheels shall not wobble and shall be aligned so that gaps between tires on one axle are covered by tires of the other axle. Tires shall be equipped with scrapers to prevent adhesion of material. The engineer may require cleaning apparatus on the tires if material adhesion causes imperfections in the surface treatment.

**(c) Power Broom or Blower:** A power revolving broom or power blower shall be used to clean the surface of dust, dirt, mud, and loose or excess material.

**(d) Aggregate Spreader:** A self-propelled, pneumatic tire power spreader designed, equipped and operated to spread aggregate uniformly at the designated rate within the limits of the desired roadway width shall be used. The aggregate spreader shall be capable of maintaining an allowable variation from the specified rate within  $\pm 0.5$  pounds per square yard ( $\pm 0.3$  kg per sq m) or  $\pm 0.25$  pounds per square yard ( $\pm 0.14$  kg per sq m) for expanded clay.

The aggregate spreader shall be calibrated in accordance with ASTM D 5624.

**(e) Vacuum-Sweeper:** A vacuum-sweeper will be required when there is a dusting problem, as determined by the project engineer.

**507.04 WEATHER LIMITATIONS.** Asphaltic surface treatments shall not be applied on a wet surface nor when the air temperature or pavement surface temperature in the shade is less than 60°F (15°C). Interlayers may be placed during any month of the year. Cold applied emulsions shall be placed within the months of April through October. Hot applied modified asphalt material shall be placed within the months of May through September.

**507.05 PREPARATION OF EXISTING SURFACE.** Potholes and surface depressions will be repaired by the Department prior to the asphaltic surface treatment work unless specified otherwise in the plans.

Immediately prior to application of the asphalt material, existing pavements shall be cleaned over the full width to be treated. Raised pavement markers shall be removed before application of asphaltic surface treatment, unless specified otherwise in the plans.

The pavement shall then be swept with a power broom or blower to remove all loose material. Areas not reached by the power broom or blower shall be cleaned by hand brooming.

If a prime coat or curing membrane is present prior to asphaltic surface treatment operations, it shall be satisfactorily cured and maintained in

accordance with Sections 505 and 506 prior to application of asphaltic surface treatment.

The pavement shall be considered excessively moist when it is visibly wet or when a one (1) square foot piece of polyethylene film condenses moisture after being tightly placed on the pavement surface for 15 minutes.

The surface shall be approved by the engineer prior to application of asphaltic surface treatment.

**507.06 APPLICATION.** After the existing surface has been approved, asphalt material and aggregates shall be applied in the amounts determined by the contractor and approved by the engineer, and by the sequence specified herein.

Application temperatures and sequence of application and spreading for asphaltic surfacing shall be as given in Table 507-1 or 507-2. The quantities of material given in Table 507-1 or 507-2 may be adjusted by the engineer as field conditions warrant. The type and condition of the surface being covered will affect the required application rate of asphalt material. The quantities to be used shall be as recommended by the contractor and approved by the engineer and shall be established during the first asphalt and aggregate application.

Before the asphaltic surface treatment operation begins the contractor shall calibrate and set the flow rates of his distributor and spray bar along with the aggregate spreader at a remote location offsite in a manner acceptable to the engineer. Aggregate spread rates may be adjusted by the engineer. It should be noted that after the aggregate spreader passes, the aggregate should never cover 100 percent of the roadway surface. The asphalt coated surface should be visible between the aggregates. Aggregate trucks must be struck off at the loading area for proper material yield measurements.

The aggregate spreader shall follow immediately behind the asphalt distributor. The roller shall make the initial pass immediately following the aggregate spreader before the emulsion breaks.

**(a) Asphalt Material:** The quantities in Tables 507-1 and 507-2 are for bid purposes only and shall be adjusted as recommended by the contractor and approved by the engineer as field conditions warrant. In general, the rate of asphalt is increased if the road is absorbent, badly cracked, or coarse, and is decreased if the road is smooth and flushed with asphalt. Guidelines for adjusting the rate of asphalt emulsion in gallons per square yards (L per sq m) are as follows:

Black, flushed asphalt, -0.1 to -0.06 (-0.4 to -0.27)

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Smooth, non-porous, 0.00 (0.00)

Absorbent, porous, oxidized, 0.03 to 0.09 (0.14 to 0.40)

If asphalt cement is used, multiply these factors by 0.67.

The length of spread of asphalt material shall not exceed that which can be covered by aggregate within approximately one minute.

The rate of asphalt material placed shall be applied uniformly for the full width of treatment unless otherwise directed by the engineer. If the contractor is unable to keep the application of asphalt material consistently within  $\pm 0.02$  gallons per square yard ( $\pm 0.09$  L per sq m), construction shall be stopped and the distributor shall be recalibrated to the satisfaction of the engineer.

The height of the spray bar and the angle of the nozzles shall be adjusted so that individual spray fans do not interfere with each other and uniform double or triple coverage is achieved. A minimum of 100 gallons (380 L) of asphalt material shall be maintained in the distributor during operation.

One of the special spray nozzles at the ends of the spray bar shall be adjusted and maintained to provide a sharp edge for the asphalt material on the edge of the roadway surface being covered. When the application is less in width than the length of the spray bar, these special nozzles shall be moved to provide the specified edge lines.

When any nozzles become blocked during application of asphalt material, the flow of material shall be immediately stopped and the nozzles cleaned. When the engineer directs that application be made over less than the full width of the roadway at a time, there shall be a slight longitudinal overlapping of adjacent treatments. The distributor shall be operated along a marked edge to keep the surface treatment in proper alignment.

To secure uniform distribution at the transverse junction of two treatments, the distributor shall be promptly stopped before the flow decreases. Building paper or other suitable material shall be placed over the end of the previous application. The joining application shall start on the building paper. Building paper so used shall be removed and disposed of satisfactorily. Burning of building paper will not be permitted within the right-of-way.

During application of asphalt material, adjacent pavements, structures, and trees shall not be splattered with asphalt material. The distributor shall not be cleaned or discharged into ditches, borrow pits, on shoulders or along the right-of-way.

Excess asphalt material at the junction between distributor loads shall be removed and satisfactorily corrected. Areas of the surface to be treated

which are not covered with asphaltic material directly from the distributor shall be covered by means of a hand-held spray attachment equipped with nozzles.

**(b) Aggregates:** The quantities in Tables 507-1 and 507-2 are for bid purposes only and shall be adjusted by the engineer as field conditions warrant. Aggregate spreading operations shall begin immediately after the application of the asphalt materials. All aggregates for hot applications shall be placed in a surface dry condition. Aggregate material shall be applied within approximately one minute after application of the asphalt material.

Aggregate shall be uniformly spread over the full width of asphaltic material with one pass of the spreading equipment with the application being sharply defined at edges. Equipment shall not be driven on uncovered asphalt material. When necessary to obtain uniform coverage, the surface shall be hand broomed.

Hand spreading will be permitted in conjunction with self-propelled spreaders over areas inaccessible to spreaders. Asphalt material shall be covered with the appropriate rate of aggregate before rolling is allowed.

**(c) Multiple Applications:** When multiple applications are to be placed, a minimum of 48 hours shall elapse between the application of each successive treatment of emulsions. Successive hot applications can be placed without delay.

**(d) Interlayers:** An interlayer shall be Type E as specified herein and may be placed on raw or stabilized base, on a milled surface, between lifts of asphalt, or over existing portland cement concrete pavement which will be overlaid with asphalt. The liquid application rate shall correspond to the proper aggregate size given in Table 507-1 or 507-2 as adjusted by the engineer to meet existing conditions. Asphaltic concrete shall not be placed on an emulsion surface treatment for a minimum of five days after application. Hot applied interlayers may be overlaid immediately.

### **507.07 ROLLING AND BROOMING AGGREGATE MATERIAL.**

Immediately after spreading the aggregate material, the surface shall be rolled using a minimum of two pneumatic tire rollers. The first pass shall be made within approximately one minute. Rolling shall proceed in a longitudinal direction, beginning at the outer edges of the application. Each pass shall overlap the previous pass by 1/2 the roller width. A minimum of three (3) passes shall be made over a single point. All rolling shall be completed within 1/2 hour after aggregate material has been spread. Deficiencies or damage in the aggregate material detected during

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rolling shall be immediately corrected and rerolled as directed. Rolling aggregate material shall be continued until uniform coverage has been obtained. The remaining applications shall be rolled as specified for the first application. A steel wheel roller will not be allowed.

The surface shall be lightly broomed or blown to remove loose material. All loose material shall be completely removed from all roadway surfaces, including paved shoulders. If the engineer determines the amount of loose material is excessive, it shall be picked up and removed from the project instead of broomed onto the adjacent slopes.

**507.08 PROTECTION.** Traffic shall not be allowed on the surface until the aggregate has been placed, rolled, and, if necessary, lightly broomed or blown. Each treatment shall be lightly broomed or blown beginning the next morning, and will continue up to final acceptance of the project if necessary, to remove loose aggregate.

Maintenance of the surface shall include the distribution of aggregate material over the surface to absorb any free asphalt, covering any area deficient with aggregate material, and additional rolling as directed at no direct pay. Maintenance shall be conducted not to displace imbedded material.

When lightweight aggregate is used, a vacuum sweeper without the sweeper engaged will be required to remove loose aggregate when a dusting problem occurs. Loose aggregate material will not be permitted on the surface and will be promptly removed.



**Table 507-1  
Asphaltic Surface Treatment (AST) Requirements  
(Emulsion)**

| TYPE AST  | Course No. | TYPE A <sup>1</sup>     |                         | TYPE B <sup>1</sup>     |                         | TYPE C <sup>1</sup>     | TYPE D                  |                         |                         | TYPE E <sup>2</sup><br>(Interlayer) |
|---|------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------------------|
| Agg. Friction Rating  |            | I, II                   |                         | I, II, III              |                         | I, II, III              | I, II, III, IV          |                         |                         | I, II, III, IV                      |
| Asphalt Emulsion  |            | CRS-2P                  |                         | CRS-2P                  |                         | CRS-2P                  | CRS-2P                  |                         |                         | CRS-2P                              |
| Application Temp.<br>Minimum                                  |            | 160°F (70°C)            |                         | 160°F (70°C)            |                         | 160°F (70°C)            | 160°F (70°C)            |                         |                         | 160°F (70°C)                        |
| Maximum   |            | 175°F (80°C)            |                         | 175°F (80°C)            |                         | 175°F (80°C)            | 175°F (80°C)            |                         |                         | 175°F (80°C)                        |
| Number of Applications  |            | 2                       | 1                       | 2                       | 1                       | 1                       | 3                       | 2                       | 1                       | 2                                   |
| Asphalt Emulsion <sup>3</sup><br>Application Rates Per Course | 1          | 0.39<br>(1.77)          | 0.41<br>(1.86)          | 0.39<br>(1.77)          | 0.31<br>(1.40)          | 0.41<br>(1.86)          | 0.46<br>(2.08)          | 0.39<br>(1.77)          | 0.31<br>(1.40)          | 0.39<br>(1.77)                      |
|   | 2          | 0.29<br>(1.31)          | ---                     | 0.29<br>(1.31)          | ---                     | ---                     | 0.36<br>(1.63)          | 0.29<br>(1.31)          | ---                     | 0.29<br>(1.31)                      |
|   | 3          | ---                     | ---                     | ---                     | ---                     | ---                     | 0.26<br>(1.18)          | ---                     | ---                     | ---                                 |
| Aggregate <sup>4</sup><br>Application Rates Per Course        | 1          | S2-0.0111<br>(S2-0.010) | S2-0.0111<br>(S2-0.010) | S2-0.0111<br>(S2-0.010) | S3-0.0075<br>(S3-0.007) | S2-0.0111<br>(S2-0.010) | S1-0.0200<br>(S1-0.018) | S2-0.0111<br>(S2-0.010) | S3-0.0075<br>(S3-0.007) | S2-0.0111<br>(S2-0.010)             |
|   | 2          | S3-0.0075<br>(S3-0.007) | ---                     | S3-0.0075<br>(S3-0.007) | ---                     | ---                     | S2-0.0111<br>(S2-0.010) | S3-0.0075<br>(S3-0.007) | ---                     | S3-0.0075<br>(S3-0.007)             |
|   | 3          | ---                     | ---                     | ---                     | ---                     | ---                     | S3-0.0075<br>(S3-0.007) | ---                     | ---                     | ---                                 |

<sup>1</sup>Only lightweight aggregate, crushed slag or crushed stone shall be used for Types A, B or C Asphaltic Surface Treatment.

<sup>2</sup>Lightweight aggregate will not be allowed.

<sup>3</sup>Application rates are in gallons of asphalt emulsion per square yard (liters of asphalt emulsion per sq m) of AST.

<sup>4</sup>Size aggregate and application rates. For example, S2 is Size 2 aggregate and 0.0111 is the application rate in cubic yards of aggregate per square yard (0.010 cu m of aggregate per sq m) of AST.

**Table 507-2  
Asphaltic Surface Treatment (AST) Requirements  
(Hot Application)**

| TYPE AST   | Course No. | TYPE A <sup>1</sup>     |                         | TYPE B <sup>1</sup>     |                         | TYPE C <sup>1</sup>     | TYPE D                  |                         |                         | TYPE E <sup>2</sup><br>(Interlayer) |
|--|------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------------------|
| Agg. Friction Rating   |            | I, II                   |                         | I, II, III              |                         | I, II, III              | I, II, III, IV          |                         |                         | I, II, III, IV                      |
| Asphalt Cement <sup>3</sup>                                    |            | PAC-15                  |                         | PAC-15                  |                         | PAC-15                  | PAC-15                  |                         |                         | PAC-15                              |
| Application Temp.<br>Minimum                                   |            | 300°F (149°C)           |                         | 300°F (149°C)           |                         | 300°F (149°C)           | 300°F (149°C)           |                         |                         | 300°F (149°C)                       |
| Maximum  |            | 360°F (182°C)           |                         | 360°F (182°C)           |                         | 360°F (182°C)           | 360°F (182°C)           |                         |                         | 360°F (182°C)                       |
| Number of Applications   |            | 2                       | 1                       | 2                       | 1                       | 1                       | 3                       | 2                       | 1                       | 2                                   |
| Asphalt Cement <sup>4</sup><br>Application Rates Per<br>Course | 1          | 0.30<br>(1.36)          | 0.31<br>(1.40)          | 0.30<br>(1.36)          | 0.24<br>(1.09)          | 0.31<br>(1.40)          | 0.36<br>(1.63)          | 0.30<br>(1.36)          | 0.24<br>(1.09)          | 0.30<br>(1.36)                      |
|  | 2          | 0.23<br>(1.04)          | ---                     | 0.23<br>(1.04)          | ---                     | ---                     | 0.28<br>(1.27)          | 0.23<br>(1.04)          | ---                     | 0.23<br>(1.04)                      |
|  | 3          | ---                     | ---                     | ---                     | ---                     | ---                     | 0.20<br>(0.91)          | ---                     | ---                     | ---                                 |
| Aggregate <sup>5</sup><br>Application Rates Per<br>Course      | 1          | S2-0.0111<br>(S2-0.010) | S2-0.0111<br>(S2-0.010) | S2-0.0111<br>(S2-0.010) | S3-0.0075<br>(S3-0.007) | S2-0.0111<br>(S2-0.010) | S1-0.0200<br>(S1-0.018) | S2-0.0111<br>(S2-0.010) | S3-0.0075<br>(S3-0.007) | S2-0.0111<br>(S2-0.010)             |
|  | 2          | S3-0.0075<br>(S3-0.007) | ---                     | S3-0.0075<br>(S3-0.007) | ---                     | ---                     | S2-0.0111<br>(S2-0.010) | S3-0.0075<br>(S3-0.007) | ---                     | S3-0.0075<br>(S3-0.007)             |
|  | 3          | ---                     | ---                     | ---                     | ---                     | ---                     | S3-0.0075<br>(S3-0.007) | ---                     | ---                     | ---                                 |

<sup>1</sup>Only lightweight aggregate, crushed slag or crushed stone shall be used for Types A, B or C Asphaltic Surface Treatment.

<sup>2</sup>Lightweight aggregate will not be allowed.

<sup>3</sup>See Table 1002-11.

<sup>4</sup>Application rates are in gallons of asphalt cement per square yard (liters of asphalt cement per sq m) of AST.

<sup>5</sup>Size aggregate and application rates. For example, S2 is Size 2 aggregate and 0.0111 is the application rate in cubic yards of aggregate per square yard (0.010 cu m of aggregate per sq m) of AST.

**507.09 MEASUREMENT.** The quantities of asphalt material and aggregate incorporated in the completed and accepted asphaltic surface treatment will be measured separately. Design quantities are based on horizontal dimensions. Design quantities will be adjusted when the engineer makes changes to adjust to field conditions. Each size aggregate will be measured by the square yard (sq m) per application. Asphalt material will be measured in the distributor by the gallon (L) at application temperatures.

**507.10 PAYMENT.** Payment for placement and maintenance of asphalt materials and aggregates will be made at the contract unit prices, subject to the payment adjustment provisions of Section 1002 for specification deviations of asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials.

Payment will be made under:

| <b>Item No.</b> | <b>Pay Item</b>         | <b>Pay Unit</b>    |
|-----------------|-------------------------|--------------------|
| 507-01          | Asphalt Material (type) | Gallon (L)         |
| 507-02          | Aggregate (size)        | Square Yard (Sq m) |

## **Section 508**

### **Stone Matrix Asphalt**

**508.01 DESCRIPTION.** This work consists of furnishing and constructing Stone Matrix Asphalt (SMA) which is a plant mixed asphalt concrete wearing course for high traffic applications. This mixture is a rut resistant hot mix design with stone on stone contact. The mixture shall be composed of a PG 76-22m asphalt cement and a gap graded coarse aggregate structure. Mineral filler and/or fibers shall be used to control draindown. This work shall be in accordance with these specifications, plan details, and as directed. All requirements of Section 502 apply to Stone Matrix Asphalt, except as modified herein. All plant and paving equipment and processes must meet the requirements of Section 503.

Mixture used for shoulder may be Stone Matrix Asphalt or any mixture type shown in Table 502-5.

#### **508.02 MATERIALS.**

**(a) Asphalt Cement:** Asphalt cement shall be PG 76-22m as listed on QPL 41 and complying with Section 1002.

**(b) Aggregate:** Aggregates shall be in accordance with Subsection 1003.06(b) and Table 508-1.

**(c) Additives:** Additives shall meet the requirements of Subsection 502.02(b) except mineral filler and/or fibers will be required.

**(1) Anti-Strip:** An approved anti-strip additive as listed in QPL 57 shall be added.

**(2) Mineral Filler:** Mineral filler shall comply with Subsection 1003.06(a)(6).

**(3) Fibers:** A cellulose or mineral fiber, meeting the requirements of Subsection 1002.02(d), shall be used to prevent draindown or to serve as a filler. Fibers shall be added at a minimum rate of 0.1 percent by weight (mass) of mixture and at a rate sufficient to prevent draindown.

**508.03 JOB MIX FORMULA (JMF).** The contractor shall submit a job mix formula to the District Lab Engineer at least 10 days prior to construction. One laboratory specimen at optimum design shall be cut in half and submitted to the District Lab Engineer for visual examination. A "stone-on-stone" structure will be required for the coarse aggregate (as retained on the No.4 (4.75 mm) Sieve). The Job Mix Formula shall meet

the requirements of Table 508-1. Moisture susceptibility shall be determined in accordance with DOTD TR 322. An anti-strip additive shall be included in accordance with Subsections 502.02(b)(2) and 502.03.

The contractor shall utilize a Superpave gyratory compactor in design of SMA in accordance with AASHTO M 323 with the following modifications. Seventy-five (75), ( $N_{\text{design}} = N_{\text{max}}$ ), revolutions of the gyratory compactor will be required. Percent  $G_{\text{mm}}$  at  $N_{\text{design}}$  shall be not more than 89 percent at 9 revolutions and not more than 96.5 percent at 75 revolutions. The mixture shall exhibit a minimum of 16.0 percent VMA in design and shall maintain a minimum average of 16.0 percent VMA for each lot during production.

A maximum 0.3 percent draindown of asphalt cement by weight (mass) will be allowed and shall be calculated in accordance with ASTM D 6390.

**508.04 VALIDATION.** Production of the job mix formula will be allowed pending validation on a plant produced mixture. Validation will be on the first 1000 ton (Mg) subplot and will include the QC and QA results on mixture gradation, percent asphalt cement, volumetrics, asphalt draindown, percent anti-strip additive, and moisture susceptibility testing. One random sample from each third of the validation subplot shall be taken. The average of test results shall meet specification requirements for final job mix formula approval. If the mix fails to validate, one additional attempt may be allowed by the Laboratory Engineer before requiring redesign of the mixture.

**508.05 QUALITY CONTROL.** Percent asphalt cement, gradation,  $G_{\text{mm}}$ , and volumetrics shall be measured in accordance with Section 502. Lot sizes for both QC and acceptance will be determined in accordance with Subsection 502.14, except that all travel lane SMA, regardless of the quantity produced, will be paid in accordance with these specifications, not as a Small Quantity Lot. A lot size shall be 5000 tons (5000 Mg) and a subplot size shall be 1000 tons (1000 Mg). The minimum sampling and testing frequency shall be once per subplot. Aggregate gradations shall be controlled to the tolerances shown in Table 508-1.

If the average quality control tests for the lot for gradation, percent air voids, and VMA are not within specification requirements, corrections shall be made or operations ceased. Surface tolerance shall be monitored and controlled in accordance with Subsection 502.10(b).

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**508.06 ACCEPTANCE TESTING.** Acceptance tests shall be performed at the plant unless otherwise directed by the engineer. The Department will take samples for both plant and roadway acceptance tests in accordance with Section 502. The plant acceptance tests will be taken at random at a rate of once per 1000 tons (1000 Mg) subplot. Lot sizes are in accordance with Subsection 508.05. Plant acceptance tests will include percent anti-strip, air voids, VMA and gradation [No. 4 and No. 200 (4.75 mm and 75  $\mu$ m) sieves]. Roadway acceptance tests will include pavement density and surface tolerance. All acceptance test results will be in accordance with the approved job mix formula and the tolerances specified in Table 508-1. Acceptance tests will be subject to payment adjustments in accordance with Table 508-2.

**(a) Theoretical Maximum Specific Gravity ( $G_{mm}$ ):** Theoretical maximum specific gravities ( $G_{mm}$ ) in accordance with DOTD TR 327 will be determined by Department personnel at the plant on each sample taken and reported for each subplot

**(b) Plant Volumetrics:** Percent  $G_{mm}$  at  $N_{initial}$ , percent air voids at  $N_{design}$ , and percent VMA will be determined on the compacted briquette maintaining 2.5-4.5 percent air voids at  $N_{design}$ .

**(c) Asphalt Draindown:** A minimum of one asphalt draindown test will be made per lot. A maximum 0.3 percent draindown of asphalt cement by weight (mass) will be allowed in accordance with ASTM D 6390.

**(d) Roadway Density:** The percent roadway density will be determined for each subplot by taking 3 roadway cores per subplot and comparing the bulk specific gravity of the 3 roadway cores to the average  $G_{mm}$  for each subplot. The average percent  $G_{mm}$  for the subplot will be determined.

**(e) Surface Tolerance:** Surface tolerance will be measured in accordance with Subsection 502.11(b).

**508.07 ACCEPTANCE FOR PAY.** Payment based on acceptance tests will be made in accordance with Table 508-2. Acceptance will be based on Plant Acceptance Tests and Roadway Acceptance Tests as follows:

**(a) Plant Acceptance Tests:**

**(1) Percent Air Voids:** The percent deviations from the job mix formula tolerances for each subplot will be calculated and then the percent deviations of the sublots will be averaged for the lot.

**(2) Percent VMA:** The percent deviations below the minimum limit for each subplot will be calculated and then the percent deviations of the sublots will be averaged for the lot.

**(3) Percent Passing the No. 4 (4.75 mm) Sieve:** The percent deviations from the job mix formula tolerances for each subplot will be calculated and then the percent deviations of the sublots will be averaged for the lot.

**(4) Percent Passing the No. 200 (75  $\mu$ m) Sieve:** The percent deviations from the job mix formula tolerances for each subplot will be calculated and then the percent deviations of the sublots will be averaged for the lot.

**(5) Percent Payment for Plant Acceptance:** The average of the percent payments for items (1) through (4) will be the percent payment for the plant.

**(b) Roadway Acceptance Tests:**

**(1) Roadway Density:** The average subplot percent density will be used to determine the subplot percent deviation from the JMF. The subplot deviation will be used to determine percent payment for the subplot. The percent payment for roadway density for each lot will be the average of the percent payments for each subplot.

**(2) Surface Tolerance:** The percent payment reported for surface tolerance will be for the entire lot in accordance with Section 502.

**(3) Percent Payment for Roadway Acceptance:** The percent payment for the roadway will be the average of the above percents payment for roadway density and surface tolerance.

**(c) Total Percent Payment for Lot:** The percent payment for the lot of SMA used on the project will be the lowest value of the percent payment for plant acceptance and the percent payment for roadway acceptance. All calculations for percent payment will be rounded to the nearest one (1) percent.

**508.08 CONSTRUCTION REQUIREMENTS.** Existing paving markings shall be removed before placing SMA. The SMA mix shall not be produced above a plant discharge temperature of 350°F (177°C). The SMA mix shall not be accepted at the entry of the material transfer vehicle (MTV) at less than 300°F (149°C). The paving operation shall be conducted in such a manner that the forward speed of the paver is kept continuous and does not exceed 25 feet (7.6 m) per minute or as directed.

The SMA mix shall be rolled immediately after placement. Two breakdown rollers capable of rolling across the width of the mat in one pass are recommended. Rolling shall be accomplished with steel wheel rollers weighing a minimum of 10 tons (89 kN). Pneumatic rollers shall not be used. Vibratory rollers shall be limited to high frequency and low

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amplitude and used only as necessary to achieve density. The mastic shall not be allowed to migrate to the surface. Rolling shall continue until all roller marks are eliminated and minimum density is obtained, but not after the mat has cooled to 220°F (104°C), or lower. Traffic will not be allowed on the newly compacted surface until the mat has cooled to 140°F (60°C), or lower.

**508.09 MEASUREMENT.** SMA will be measured by the ton (Mg) in accordance with Subsection 502.15(a) and as amended herein.

**508.10 PAYMENT.** The SMA will be paid for by the ton (Mg) in place which will include all surface preparation, materials, equipment, production, haul, roadway operations, compaction, quality control, and incidentals. Payment will be made at an adjusted contract unit price per lot in accordance with Table 508-2.

Payment will be made under:

| <b>Item No.</b> | <b>Pay Item</b>                       | <b>Pay Unit</b> |
|-----------------|---------------------------------------|-----------------|
| 508-01          | Asphalt Concrete (SMA) Wearing Course | Ton (Mg)        |



**Table 508-1  
Stone Matrix Asphalt (SMA) Mix Properties**

| A. MIXTURE REQUIREMENTS  |                    |                  |  |              |                |
|--|--------------------|------------------|--|--------------|----------------|
| GRADATION  |                    |                  | VOLUMETRICS  |              |                |
| US Sieve<br>(Metric Sieve)   | Percent<br>Passing | JMF Tolerance, % | Properties   | Requirements | Tolerance      |
| 3/4 inch (19 mm)   | 100                | ±4               | % G <sub>mm</sub> @ N <sub>initial</sub> (9 revolutions) | 89 maximum   | ±1.0           |
| 1/2 inch (12.5 mm)   | 90 - 100           | ±4               | Air Voids, % (75 revolutions)                            | 3.5          |                |
| 3/8 inch (9.5 mm)  | 75 Max.            | ±4               | VMA, %   | 16.0 minimum | For Info. Only |
| No.4 (4.75 mm)   | 24 - 34            | ±4               |  |              |                |
| No.8 (2.36 mm)   | 16 - 28            | ±4               | VFA, %   | Per JMF      | ±0.022         |
| No. 30 (600 μm)  | 12 - 25            | ±3               | G <sub>mb</sub> (Control Only)                           |              |                |
| No. 50 (300 μm)  | 11 - 22            | ±3               | G <sub>mm</sub> (Control Only)                           | Per JMF      | ±0.020         |
| No. 200 (75 μm)  | 7 - 13             | ±1               |  |              |                |
| Extracted % AC   | 6.0 min.           | ±0.4             |  |              |                |
| B. PAVEMENT DENSITY REQUIREMENTS                                     |                    |                  |  |              |                |
| Density, Min. % of Theoretical Maximum Specific Gravity, DOTD TR 327 |                    |                  |  |              |                |
| Travel Lane  |                    |                  | 94.0   |              |                |
| Shoulders  |                    |                  | 89.0   |              |                |
| C. SURFACE TOLERANCE REQUIREMENTS                                    |                    |                  |  |              |                |
| Surface Tolerance Variation - Refer to Section 502                   |                    |                  |  |              |                |

**Table 508-2  
Payment Adjustment Schedules**

| Values shall be based on average of sublots unless otherwise noted:    | Percent of Contract Unit Price Per Lot |                   |           |                           |
|--|--|-------------------|-----------|---------------------------|
|  | 100                                    | 95                | 80        | 50 or Remove <sup>1</sup> |
| A. Asphalt Properties, %<br>(Reference Table 1002-1)                   | ---                                    | ---               | ---       | ---                       |
| B. Plant Acceptance:   |  |                   |           |                           |
| Anti-Strip Additive, % Below JMF per Sublot                            | ---                                    | 0.2 or More Below | ---       | ---                       |
| % Air Voids, Average Sublot % Deviation from JMF Limits/Lot            | 0.0 - 0.1                              | 0.2 - 0.3         | 0.4 - 0.5 | 0.6 and Greater           |
| % VMA, Average Sublot % Deviation from JMF Below the Minimum Limit/Lot | 0.0 - 0.2                              | 0.3 - 0.5         | 0.6 - 0.8 | 0.9 and Greater           |
| Aggregate Gradation, Average Sublot % Deviation from JMF Limits/Lot    |  |                   |           |                           |
| No. 4 (4.75 mm)  | 0.0 - 1.0                              | 1.1 - 2.0         | 2.1 - 3.0 | 3.1 and Greater           |
| No. 200 (75 µm)  | 0.0 - 0.5                              | 0.6 - 1.0         | 1.1 - 2.0 | 2.1 and Greater           |
| C. Roadway Acceptance:   |  |                   |           |                           |
| Roadway Density, Average Individual Sublot % Deviation from Minimum    | 0.0                                    | 0.1 - 1.0         | 1.1 - 2.5 | 2.6 and Greater           |
| Surface Tolerance, in inches/mile (mm/km)                              | Per Section 502                        |                   |           |                           |

<sup>1</sup> At the option of the engineer.

## **Section 509**

### **Cold Planing Asphaltic Pavement**

**509.01 DESCRIPTION.** This work consists of removing asphaltic concrete surfacing in accordance with these specifications and in conformity with the average depth, width, grade, cross-slope and typical sections shown on the plans or established.

**509.02 EQUIPMENT.** Equipment for cold planing asphaltic surfacing shall be an approved, self-propelled planing machine or grinder. Equipment shall have sufficient power, traction and stability to remove the thickness of asphaltic concrete necessary to provide profile grade and cross slope uniformly across the surface. Cold planing equipment shall be capable of working from an erected stringline, shoe device or approved traveling reference plane that will accurately reflect, the average grade of the surface on which it is to be operated and shall have an automatic system for controlling cross slope at a given rate. Adequate loading equipment shall be provided to immediately remove materials cut from the surface and discharge the cuttings into a truck or on the shoulder as specified or directed. Adequate personnel shall be provided to ensure that the millings are removed from the surface daily. The drum shall be round and true with sufficient number of teeth to yield a uniform and fine textured surface. The machine shall be equipped with means to control dust created by the cutting action and shall have a system providing for uniformly varying the depth of cut while the machine is in motion.

#### **509.03 CONSTRUCTION REQUIREMENTS.**

**(a) General:** The maximum forward speed of the planing machine shall be 40 feet (12.0 m) per minute. The engineer may approve forward speeds greater than 40 feet (12.0 m) per minute provided the planed surface is uniform and fine textured and conforms to the surface tolerance requirements for a binder course. This speed may be reduced as directed to provide a planed surface of uniform and fine texture with the specified grade and cross slope. If ridges are excessive, the engineer may require additional milling, replacement of teeth, or other corrective action. The maximum depth of cold planing shall be 2 inches (50 mm) per pass when traffic is being maintained.

## 509.03

The traveling reference plane will be used on the first pass of the cold planing machine. The shoe device may be used on adjacent passes. This is the minimum acceptable method and the contractor must meet or exceed current surface tolerance specifications.

When the entire roadway width has not been planed to a flush surface by the end of a work period resulting in a vertical or near vertical longitudinal face exceeding 2 inches (50 mm) in height, this longitudinal face shall be sloped as directed. The contractor shall place smooth transitions at transverse joints prior to restoring to traffic by milling or by using an asphaltic concrete mix. RAP shall not be used. Transitions shall be a minimum length of one linear foot per 1/4 inch (0.3 m per 0.6 mm) of cold planed depth. Provisions shall be made at drives and turnouts to maintain local traffic.

Asphaltic concrete next to structures or in small irregular areas that cannot be removed by the planing machine shall be removed by other acceptable methods.

Pavement surfaces resulting from planing operations shall be of uniform texture, grade and cross-slope and free from loose material. Planed surfaces not meeting these requirements shall be replaned at no direct pay. No uneven, undulating surfaces will be accepted. The contractor shall provide drainage of planed areas where needed by cutting through the shoulder to the ditch on the same day that adjacent cold planing is performed.

The cold planing operation shall not precede the subsequent paving operation by more than 15 calendar days. This time may be extended by the engineer if extensive joint repairs, patching or shoulder stabilization is required.

In accordance with Section 713, temporary pavement markings shall be in place prior to opening the roadway to traffic.

The DOTD encourages reclamation and recycling of all materials obtained within the project limits. All reclaimed asphaltic pavement (RAP) material to be retained by the DOTD for its recycling program, or by other government entities, shall be hauled by the contractor to the storage facility indicated on the plans and stockpiled as directed. The contractor may also be required to retain a specified percentage or quantity of the RAP generated by the project. When so specified, the bidder shall indicate in his bid the value of the retained material that he used in calculating his bid.

Millings containing lightweight aggregate shall not be used as RAP in asphaltic concrete mixtures.

Required joint repairs shall be made after planing. Pavement patching shall be completed before planing, unless additional areas requiring patching

are exposed by the cold planing. Pavement patching and joint repair shall be in accordance with Section 510.

(b) The surface tolerance requirements of the cold planed surface for single lift overlays shall meet the requirements for binder course in Section 502.

**509.04 MEASUREMENT.** Measurement of cold planing will be made by the square yard (sq m) of asphaltic concrete surfacing satisfactorily removed. No additional measurement will be made for multiple passes required to achieve total cold planing depth indicated in the plans. Measurement of contractor retained RAP will be by the cubic yard (cu m), theoretical in-place plan quantity, and will be credited to the Department by treating it as a negative quantity in the Schedule of Pay Items.

**509.05 PAYMENT.** Payment for cold planing of asphaltic pavement will be made at the contract unit price per square yard (sq m), which includes the costs for removing, hauling and stockpiling of RAP material. The value of the RAP material retained by the contractor will be credited to the Department at the contract unit price for the retained material.

Drainage cuts placed through the shoulders and transitions at transverse joints will be at no additional pay.

Payment for temporary pavement markings will be included under appropriate pay items.

Payment will be made under:

| <b>Item No.</b> | <b>Pay Item</b>                                  | <b>Pay Unit</b>    |
|-----------------|--|--------------------|
| 509-01          | Cold Planing Asphaltic Pavement                  | Square Yard (Sq m) |
| 509-02          | Contractor Retained Reclaimed Asphaltic Pavement | Cubic Yard (Cu m)  |

## **Section 510**

### **Asphaltic Concrete Pavement Patching, Widening and Joint Repair**

**510.01 DESCRIPTION.** This work consists of patching, widening and joint repair of existing asphaltic concrete pavements in accordance with these specifications and in conformity with the lines, grades and typical sections shown on the plans or as directed. Asphaltic concrete shall be used for patching, widening, and joint repair.

**510.02 MATERIALS.** Asphaltic concrete for patching and widening may be any type mixtures listed in Section 502, except that 1/2 inch (12.5 mm) nominal maximum size mixtures shall not be used. Asphaltic concrete for joint repair shall be Superpave Asphaltic Concrete (Level A) complying with Section 502. Asphalt tack coat shall comply with Section 504.

**510.03 EQUIPMENT.** Equipment furnished shall meet the specification requirements for the types of material used.

**510.04 GENERAL CONSTRUCTION REQUIREMENTS.** The contractor shall remove existing surfacing and base materials and perform all required excavation for patching and widening. When through traffic is maintained, the contractor shall complete the replacement of pavement, place the widening material, or fill and compact open areas or trenches at the end of each day's operations.

Excavation and compaction of the subgrade shall be in accordance with the plans or as directed. The subgrade shall be compacted uniformly.

Existing surfacing and excess excavation shall be disposed of beyond the right-of-way in accordance with Section 202.

For joint repair, contact surfaces of existing pavement shall be cleaned and a thin, uniform asphalt tack coat applied prior to placing asphaltic mixture in the joint.

Patching and widening with asphaltic concrete shall conform to Section 502, except that priming of the subgrade will not be required. Contact surfaces of pavement shall be cleaned and a uniform coat of asphalt tack coat applied before placement of asphaltic concrete. Patches shall not be overlaid for a minimum of 5 calendar days.

Spreading, finishing and compaction of asphaltic concrete shall leave the surface smooth and level with, or slightly above, the edge of existing pavement. To provide lateral support, the contractor will be permitted to construct temporary berms of excavated material against the outside edge of widening strips prior to rolling.

#### **510.05 MEASUREMENT.**

**(a) Patching:** Patching of pavement will be measured by the square yard (sq m) of existing pavement designated to be removed and replaced. Removal of existing surfacing and base course, tack coat, and required excavation will not be measured for payment.

**(b) Widening:** The quantities of widening for payment will be the design areas as specified on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are made. Design quantities are based on the horizontal dimensions shown on the plans. Required excavation, removal of existing pavement and base course, asphaltic tack coat and disposal of removed material will not be measured for payment. No measurement for payment will be made for widening placed outside the dimensions shown on the plans or established by the engineer.

**(c) Joint Repair:** Joint repair will be measured by the ton (Mg) of asphaltic concrete used to fill the joint. Measurement will be made in accordance with Subsection 502.15.

#### **510.06 PAYMENT.**

**(a) Patching:** Payment for pavement patching will be made at the contract unit prices per square yard (sq m), subject to the following provisions:

Payment adjustments for deficiencies in asphaltic concrete and asphalt materials will be applied to 1/2 the contract unit price for pavement patching.

When the engineer orders additional thickness of patching in excess of plan thickness, payment for the additional thickness will be made as follows. The value per inch (mm) thickness will be determined by dividing the contract unit price per square yard (sq m) by the plan thickness. Thickness of patches will be measured from the surface that exists at the time of patching. Payment for the additional thickness will be made at 50 percent of the value per inch (mm) thus determined.

## 510.06

When the engineer approves of an underthickness of patching less than plan thickness, a deduction in payment will be made. This deduction per inch (mm) of underthickness will be made at 50 percent of the value per inch (mm). The value per inch (mm) will be calculated by dividing the contract unit price per square yard (sq m) by the plan thickness.

Any patching that develops or is required between the time of initial patching operations and the placement of the first lift of asphaltic concrete will be paid for at the contract unit price. Any patching required due to base failure after placement of the first lift of asphaltic concrete will be paid for at twice the contract unit price.

Asphaltic concrete will be subject to the payment adjustment provisions of Section 502.

**(b) Widening:** Payment for pavement widening will be made at the contract unit prices per square yard (sq m). Overwidths will be accepted at no additional pay. Underwidth shall be corrected by furnishing and placing additional asphaltic concrete to a minimum width of 1 foot (0.3 m) and plan thickness at no direct pay.

**(c) Joint Repair:** Payment for pavement joint repair will be made at the contract unit price per ton (Mg), subject to the following provisions:

Asphaltic concrete for joint repair will be subject to the payment adjustment provisions of Section 502 except for surface tolerance and density; however, payment adjustments will be applied to 1/3 the contract unit price for joint repair. The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt material.

Payment will be made under:

| <b>Item No.</b> | <b>Pay Item</b>       | <b>Pay Unit</b>    |
|-----------------|-----------------------|--------------------|
| 510-01          | Pavement Patching     | Square Yard (Sq m) |
| 510-02          | Pavement Widening     | Square Yard (Sq m) |
| 510-03          | Pavement Joint Repair | Ton (Mg)           |