

411SMA
STATE

OF

411SMA
TENNESSEE

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SPECIAL PROVISION

REGARDING

BITUMINOUS PLANT MIX (HOT MIX)

STONE MATRIX ASPHALT

Description: This specification covers the requirements for the placement of a Stone Matrix Asphalt wearing course with stone on stone contact. The work shall consist of the design and construction of an Asphalt Concrete surface in accordance with Section 407, 411, and 903 of the Specifications. All requirements for the Asphalt Concrete surface (Hot-mix) Grading D in section 407, section 411, and section 903 shall apply to this item except as revised herein.

Material: The contractor shall formulate and submit a job mix formula that satisfies the general design limits. All SMA mixture designs shall follow AASHTO Standard Practice PP 41, "*Designing Stone Matrix Asphalt (SMA)*" and AASHTO Standard Specification MP 8, "*Designing Stone Matrix Asphalt (SMA)*" published in 2003 except where modified here in except during the mixture design, the SMA shall be compacted with a gyratory compactor.

Coarse Aggregate: Coarse aggregates, materials retained above the #4 sieve, used shall be virgin and from approved sources. Coarse aggregates shall be crushed gravel, limestone, dolomite, sandstone, granite, traprock, ore tailings, slag or other similar materials, or blends of two or more of the above. All materials shall meet the requirements of 903.11(a) and (c) Grading D. The coarse aggregate shall have at least 90% crushed aggregate with 2 fractured faces, and a maximum absorption of 3.0%.

Fine Aggregate: Fine aggregates, materials passing the #4 sieve, shall meet 903.11(b), shall be 100% crushed. Natural sand may not be used.

Stabilizing Additive Material: Slag, Wool Fiber or Cellulose Fiber shall be blown into the asphalt plant and measured by a flow meter or approved sensing device. The minimum for a slag wool fiber shall be 0.4% by weight and the minimum for a cellulose fiber shall be 0.3% by weight. The stabilizing additive shall conform to Tables 3 and 4 in AASHTO MP 8.

Mineral Filler: The Mineral Filler shall be finely divided material matter free from organic impurities. It shall be dried, weighed and metered into the mixing plant with the use of a mineral filler silo and weigh pod.

Performance Graded Asphalt Cement: The Performance Graded Asphalt Cement shall be of the type specified on the plans and shall meet TDOT specification 904.01. The minimum asphalt cement content shall be 6.0%.

Gradation: The blended design gradation of the SMA shall be in the following tolerances:

Sieve Size	Percent Passing	Production Tolerances
3/4 inch	100	-
1/2 inch	90 - 100	±4%
3/8 inch	50 - 80	±3%
No. 4	20 - 35	±3%
No. 8	16 - 24	±3%
No. 200	8.0 - 11.0	±2.0%
Asphalt Cement	6.0% min.	±0.30%

If during production, the SMA gradation or asphalt content fall outside of the tolerances listed in the table, the contractor shall stop production and correct the problem. Then the contractor shall be limited to 100 tons production until gradation and asphalt content are inside the production tolerances listed above.

Revise SubSection 407.03-Composition of Mixtures. Section (C) to conform to the following:

(C) Job Mix Formula:

1. General:

At least 21 working days prior to the scheduled start of production of any asphalt paving mixture, the Contractor shall submit in writing in duplicate a proposed Job Mix Formula and Laboratory Design. The mix shall be designed according to **AASHTO PP 41 and AASHTO MP 8**. Design specimens shall be compacted at 50 gyrations and the optimum asphalt content and mixture volumetrics shall be determined at that compaction level. If the specification requirements are not met, it will be necessary to make adjustments to the aggregate types and proportions. If requested, the Department will assist the contractor with the design process. In addition the Contractor shall submit to the Engineer for approval an asphalt barge certification with temperature-viscosity curve for each mixture. A sample of each material to be used in the mix shall be delivered to the location designated by the Engineer.

The following information shall be furnished:

- a. The specific project on which the mixture will be used.
- b. The source and description of all materials to be used in the mix.

- c. The gradations and approximate proportions of the raw materials as intended to be combined in the paving mixture.
- d. A single percentage of the combined mineral aggregate passing each specified sieve. The combined aggregate gradation shall be plotted on a gradation chart with sieve sizes raised to the 0.45 power to assure a well graded mix.
- e. The Loss on Ignition (L.O.I.) results on the combined aggregate of the 411 Grading "D" mix.
- f. The Bulk Specific Gravity, Apparent Specific Gravity and absorption on the combined mineral aggregate in the paving mixture (AASHTO T 84 and T 85)
- g. The fractured face count and glassy particle count of the plus No. 4 material, if applicable.
- h. A single percentage of asphalt by weight of total mix intended to be incorporated in the completed mixture.
- i. The dosage rate and source of anti-stripping additive, if required, meeting the requirements of Section 918.09 (B), to be added to the asphalt.
- j. The maximum specific gravity of the asphalt mixture (AASHTO T 209).
- k. A single temperature at which the mixture is intended to be discharged from the plant.
- l. Evidence that the completed mixture will conform to all specified physical requirements set forth in 903.06 and 307.03 (a) or 903.11 and 411.03 (b) except the stability and flow requirements will be waived.
- m. The tensile strength ratio (TSR) indicating the stripping and moisture susceptibility characteristics of the mix.
- n. In order to identify critical mixes and make appropriate adjustments, the mix design should have the required design properties for the bitumen content range of Optimum Asphalt Cement $\pm 0.25\%$.
- o. The dosage rate and source of stabilizing additive, meeting the requirements of AASHTO MP8, that is sufficient to prevent draindown at plant-production temperature.
- p. Draindown sensitivity results, in accordance with AASHTO T 305, at the anticipated plant-production temperature and shall not exceed 0.30%.

The temperature shown on the Job Mix Formula shall be the optimum mixing temperature as shown on the temperature-viscosity curve. The mixing temperature of Polymer or Latex Modified Asphalt mixes shall be 300-340° F(150-170° C), unless otherwise specified by the manufacturer.

The Laboratory Design must be prepared and signed by a Certified Laboratory Technician. To be certified, the technician must have completed the TDOT Mix Design Workshop School conducted by the Department, including the written and lab performance testing.

2. Revision of **Job Mix Formula:**

The approved job mix formula shall remain in effect until a change is authorized in writing by the Engineer. The Contractor, at any time after construction has started, may request that the job mix formula be revised, providing evidence is shown that the revision is necessary and the revised aggregate gradation will meet all applicable gradation requirements.

A new design will be required for any change in source of materials. All requests for design mix adjustments, redesigns and new design mixes will be submitted in writing to the Engineer for approval.

3. Resistance to **RUTTING**:

The submitted job mix formula shall include enough raw materials (aggregate and asphalt cement) so that the TDOT Central Laboratory may conduct rut testing using the Asphalt Pavement Analyzer (APA). TDOT will compact specimens to 7 ± 1 % air voids and conduct the tests. Tests will be conducted at 147° F (64° C), with 100-psi hose pressure and 100 pounds wheel load. After 8000 cycles the maximum allowable rut depth will be 0.35 inch for roads with greater than or equal to 10,000 ADT and 0.40 inch with $< 10,000$ ADT. A new mixture design will be required if the mixture fails to meet the APA rut testing requirements.

Revise Subsection 407.03-Composition of Mixtures. Section (E) to the following:

Tensile Strength Ratio

Testing for stripping and moisture susceptibility of the mixture shall be in accordance with ASTM D 4867, Standard Test Method for Effect of Moisture on Asphalt-Concrete Paving Mixtures.

When polymer modified asphalt cement is specified, a minimum tensile strength of 690kPA and a minimum TSR of 80% shall be required.

Compaction: Compaction of the wearing course shall consist of steel double drum asphalt rollers with minimum weight of 10 tons, before the material temperature has fallen below 185° F. At no time shall the rollers be allowed to remain stationary on the freshly placed asphalt concrete. Rollers shall be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. A minimum of three roller units shall be supplied so the compaction will be accomplished promptly following the placement of the material. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. A minimum of **94%** of Maximum Theoretical Density (MTD) in place shall be required

Production: The temperature of the SMA shall not exceed 340° F (170° C) at any time during production.

Method of Measurement: As per **Subsection 411.09**, the accepted quantities of Stone Matrix Asphalt shall be paid for at the respective contract unit price per ton for Mineral Aggregate and Asphalt Cement. The addition of a stabilizing additive material (fiber) shall be included in the cost of the Asphalt Cement.

Basis of Payment: As per **Subsection 411.10**, the unit price per ton for the items composing the Asphalt Concrete mix shall include all labor, materials and equipment necessary to complete the work.