S T A T E **O F** **T E N N E S S E E**

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SPECIAL PROVISION

REGARDING

BITUMINOUS PLANT MIX PAVEMENTS (HOT MIX)

ROADWAY DENSITY

Description: This specification covers the requirements for obtaining proper compaction and roadway density for the various layers of bituminous plant mix.

All sections of Section 407 of the Standard Specification, and Supplemental Specifications are applicable except as modified herein.

Section 407.03(D)2.(c)8.- Contractor Quality Control System- Replace the first paragraph of this section with:

8. Mix Design/Production Verification. The Contractor will be required to sample and test asphaltic concrete base and surface mixes throughout production to verify that the mix being produced is within the criteria listed below. This information shall also be recorded on control charts. This requirement applies only to mixes designed in keeping with the Marshall Method of Mix Design. In addition, the Contractor will be required to conduct quality control testing of surface and binder mixes for roadway density throughout placement to verify that the mixture being placed meets specified density requirements. A Quality Control Plan (QCP) for this density testing is required. Acceptable methods of quality control testing include coring, nuclear gauge testing, and non-nuclear gauge testing.

Section 407.07- Rollers. Replace the entire section with the following:

The Contractor shall use a sufficient number and type of rollers to obtain proper compaction and obtain the specified densities.

When the Contractor is paving the inside shoulder concurrently with the inside traffic lane, an additional roller, no more than 1 ft.(300 mm) wider than the inside shoulder being paved, shall be required to compact the shoulder. Neither the roller(s) on the inside traffic lane nor the roller on the shoulder shall be allowed to traverse between the inside shoulder and the inside traffic lane.

Section 407.15- Compaction. – **Replace** the entire section with the following:

After the bituminous mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly compacted. The method employed must be determined by the contractor and be capable of compacting the mixture to the specified density while it is in a workable condition. Rollers shall not park on the bituminous pavement nor shall rollers be refueled on the bituminous pavements.

Density Requirements.

- Mix Types: B, BM, BM-2, D, E
- All levels of ADT
- %Gmm values specified here are for lot averages.

Travel Lane Density		
% Gmm		% Pay
Min	Max	
99.1	100	90
98.1	99	94
97.1	98	98
96.1	97	100
95.1	96	101
94.1	95	102
93.1	94	101
92.1	93	100
91.1	92	98
90.1	91	94
89.1	90	90
88.1	89	86
87.1	88	*
86.1	87	*
85.1	86	*
<85	85	*

Joint Density Incentive/Disincentive		
%Gmm		
Min	Max	$/L.F./Lot
99.1	100	*
98.1	99	*
97.1	98	-0.70
96.1	97	-0.42
95.1	96	0.00
94.1	95	0.00
93.1	94	0.07
92.1	93	0.14
91.1	92	0.07
90.1	91	0.00
89.1	90	-0.14
88.1	89	-0.42
87.1	88	-0.70
86.1	87	-0.98
85.1	86	*
<85	85	*

*Shall be removed and replaced at the contractors expense or as directed by the engineer.

Payment shall be for travel lanes only, even when the shoulder and travel lane are placed concurrently. No incentive shall be paid for the second travel lane mat unless the joint for that lot is a minimum of 90.1%.

Any lot of joint density tests averaging below 87% shall be sealed by a department-approved longitudinal joint sealer at the Contractor's expense. Sealing of deficient longitudinal joint lots will only be required for surface mixes.

- Mix Types: All shoulder mixes
- All levels of ADT
- %Gmm values specified here are for lot averages.

Shoulders		
%Gmm		%PAY
Min	Max	
99.1	100	*
98.1	99	*
97.1	98	96
96.1	97	98
95.1	**96**	**100**
94.1	**95**	**100**
93.1	**94**	**100**
92.1	**93**	**100**
91.1	**92**	**100**
90.1	**91**	**100**
89.1	**90**	**100**
88.1	**89**	**100**
87.1	88	98
86.1	87	94
85.1	86	90
<85	85	*

*Unacceptable or as directed by the engineer.

% Pay for shoulders shall be applied to the quantity of mix on the shoulder even when the travel lane and shoulder are place concurrently.

The density (bulk specific gravity) determination for a compacted asphalt mixture shall be performed in accordance with AASHTO T-166, Method A only. All core samples shall be COMPLETELY DRY before testing. Air drying is permitted provided core samples are weighed at 2-hour intervals until dry in accordance with AASHTO T166, Section 6.1. Cores may also be dried in accordance with ASTM D 7227.

Along forms, curbs, headers, walls and other places not accessible to the rollers, the mixture shall be compacted thoroughly with hot hand tampers, smoothing irons, or with mechanical tampers. On depressed areas, a trench roller may be used to compact the mix.

Any defective mixture shall be repaired or replaced to the satisfaction of the Engineer.

Test Strips.

The Contractor will be responsible for constructing Test Strips for all mixes to establish rolling patterns, to verify that the base course or surface course meets the density requirements of the specifications, and for mix design/ production verification as required.

1. The base course or other pavement course upon which a test strip is constructed shall have been approved by the Engineer prior to the construction of the test strip.

2. Equipment proposed for use in the compaction of test strips, shall meet the requirements set forth in this subsection and **Subsection 407.07**.

The test strip shall be constructed at the beginning of work on the pavement course. New test strips shall be required when:

1. A change in the job mix formula is necessary
2. A change in the source of materials occurs
3. A change in the material from the same source is observed
4. There is reason to believe that the test strip density is not representative of the bituminous mixture being placed.

Each test strip shall be constructed with approved bituminous mixture and shall remain in place as a section of the completed work. Each test strip shall be 1 paver width wide and have an area of at least 400 s.y.(350 m^2) and shall be of the depth specified for the pavement course concerned.

The Contractor shall provide the roller pattern, volumetric properties, and density results to TDOT which demonstrate the mixture meets all TDOT specifications.

In the event the density of the asphaltic concrete in the test strip does not meet specification requirements, the Contractor shall make whatever changes are necessary to obtain the specified density. Other sources and combinations of aggregates shall be used as required, subject to approval of the Engineer, to produce a mix meeting the required density.

Acceptance Testing

Mat Density- For density acceptance purposes, the pavement shall be divided into lots of 15,000 linear feet and sublots of 3,000 linear feet, or fraction thereof, per paving width per mixture type. Control strips shall not be included as part of acceptance lots. At the beginning

of the project, the first lot will begin immediately after the end of the control strip. When possible, attention should be provided to avoid cutting cores in areas where signal/loop wire may be affected. If random number selections indicate testing locations in these areas, a new random number should be selected.

Five randomly selected cores (4" min./ 6" max. diameter), from the travel lane, will be tested to determine density compliance and acceptance. One core shall be taken from each sublot. The Bulk Specific Gravity (G_{mb}) of the cores shall be determined as stated above and the average calculated. The maximum theoretical gravity (G_{mm}) from acceptance testing for that shift's production will be averaged and the percent density will be determined for compliance by dividing the G_{mb} average by the Gmm average. The Contractor will be responsible for obtaining the cores at the locations randomly selected by TDOT. Cores shall be tested by TDOT, by a certified plant technician.

Turn lane and ramp density cores shall be determined as described above when the total turn lane or ramp length is 15,000 linear feet or greater. When the total turn lane or ramp length is less than 15,000 linear feet, one density core shall be taken for each 3,000 linear feet. An average density shall be determined from the total number of cores taken from the turn lane or ramp.

Longitudinal Joints - Longitudinal density cores shall be taken after placement of adjoining traffic lane. The longitudinal joint shall be divided into lots of 15,000 linear feet and sublots of 3,000 linear feet.

For density acceptance purposes, one joint core (4" min./ 6" max. diameter) shall be cut at a randomly determined location along the longitudinal joint within each sublot. Each core taken shall be centered over the longitudinal joint. Joint density cores will be required only on the longitudinal joint between travel lanes and not on shoulder joints.

Longitudinal joint densities between travel lanes and turn lanes or ramps shall be determined as described above when the total turn lane or ramp longitudinal joint length is 15,000 linear feet or greater. When the total turn lane or ramp joint length is less than 15,000 linear feet, one longitudinal joint density core shall be taken for each 3,000 linear feet. An average density shall be determined from the total number of cores taken from the turn lane or ramp.

The Bulk Specific Gravity (G_{mb}) of the cores shall be determined as stated above and the average calculated. The maximum theoretical gravity (G_{mm}) from acceptance testing for both travel lanes will be averaged and the percent density will be determined for compliance by dividing the G_{mb} average by the G_{mm} average. The Contractor will be responsible for obtaining the cores at the locations randomly selected by TDOT. Cores shall be tested by TDOT, by a certified plant technician.

It is intended that acceptance density testing will be accomplished as soon as is practicable. If the average density of the lot does not conform to the requirements stated herein, or if an individual test value does not meet the requirements stated herein above, adjustments will be made as specified in section 407.20 B.5.

After obtaining the cores, all core holes shall be properly filled and compacted in kind with hot mix asphalt. There will be no additional compensation to comply with this section.

Cores shall be clearly labeled in a discrete, sequential manner (i.e. – M1, M2,...,M30; J1, J2,...,J15) throughout the course of the project. After testing, cores shall be retained along with copies of test results and will be periodically obtained by the regional materials office for spot-check verification testing.

Section 407.20, Basis of Payment, Revise section B.5. as follows:

5. Acceptance for Mix Density on the Roadway:

Mat Density -A deduction in payment, not as a penalty but as liquidated damages, shall be made for failure to meet the density requirements as outlined in Subsection 407.15. As soon as practical after the final rolling is completed on each lot, 5 density tests (1 per sublot) shall be performed by the Department at locations determined by the Engineer, and an average of all such tests shall be computed. Any deduction for failure to meet density requirements or incentive for exceeding density requirements shall be computed to the nearest 0.1% as a percentage of the total payment otherwise due for each lot. No incentive shall be paid for the second travel lane mat unless the joint for that lot is a minimum of 90.1%.

The percent of total payment shall be in accordance with tables shown in "Density Requirements" above. Any deduction in monies due the Contractor for failure to meet the Density Requirements shall be made under the item for Density Deduction.

Longitudinal Joints – The total incentive/disincentive payment shall be in accordance with tables shown in "Density Requirements" above**.** Any deduction in monies due the Contractor for failure to meet the Density Requirements shall be made under the item for Density Deduction. Any incentive payment due the contractor shall be under item Density Incentive. Any lot of joint density tests averaging below 87% shall be sealed by a department-approved longitudinal joint sealer at the Contractor's expense. Sealing will be required for surface mixes only.