Test Procedure for

MOLDING, TESTING, AND EVALUATING ASPHALT BLACK BASE MATERIALS

TxDOT Designation: Tex-126-E

Effective Date: June 2013

1. SCOPE

1.1 Use this method to mold, test, and determine the design asphalt content for asphalt stabilized materials (black base).

1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

2. DEFINITIONS

2.1 Maximum Density—Maximum density is the highest density calculated based on dry weight of material per cubic foot.

2.2 Minimum Asphalt Content—Minimum asphalt content \((AC_{\text{min}})\) is the percent asphalt that will produce the maximum density under a given compacted effort.

2.3 Maximum Asphalt Content by Density—Maximum asphalt content by density \((AC_{\text{max-d}})\) is the corresponding asphalt content at 97% of the maximum density and above the minimum asphalt content.

2.4 Maximum Asphalt Content by Strength—Maximum asphalt content by strength \((AC_{\text{max-s}})\) is the corresponding asphalt content at 85 psi of indirect tensile strength and above the minimum asphalt content.

2.5 Design Asphalt Content—Design asphalt content \((AC_{\text{design}})\) is the average of the minimum asphalt content and the maximum asphalt content either by density or by specified strength, whichever is smaller.

3. APPARATUS

3.1 Superpave gyratory compactor (SGC), in accordance with Tex-241-F.

3.2 Specimen height measurement and recording device, in accordance with Tex-241-F.

3.3 Specimen molds, in accordance with Tex-241-F.
3.4 *Ram heads and mold bottoms*, in accordance with Tex-241-F.

3.5 *Loading press*, capable of applying a compressive load at a controlled deformation rate of 2 in. per minute.

3.6 *Loading strips*, consisting of $0.75 \times 0.75$ in. square steel bars for 6 in. diameter specimens. Machine the surface in contact with the specimen to the curvature of the test specimen.

3.7 *Mercury thermometer*, marked in $5^\circ$F ($3^\circ$C) divisions or less, or a digital thermometer capable of measuring the temperature specified in this test procedure.

3.8 *Electric balance/scale*, Class G2 in accordance with Tex-901-K, with a minimum capacity of 10,000 g.

3.9 *Heating oven*, capable of maintaining a temperature of at least $325 \pm 5^\circ$F ($163 \pm 3^\circ$C).

3.10 *Metal pans*, with flat bottom, approximately $530 \times 38 \times 100$ mm ($21 \times 15 \times 4$ in.)

3.11 *Supply of small tools*, scoop, spatula, trowel, etc.

3.12 *Filter paper discs*, 152.4 mm (6 in.) in diameter.

3.13 *Insulating gloves*.

3.14 *Lubricating materials*.

3.15 *Mechanical mixer*.

3.16 *Standard U.S. sieve*, No. 4 (4.75 mm), meeting the requirements of Tex-907-K.

### 4. calibration

4.1 Items requiring periodic verification of calibration include:

- ram pressure
- angle of gyration
- gyration frequency
- LVDT (or other means used to continuously record the specimen height)
- oven temperature.

4.2 Verification of the mold and platen dimensions and the inside finish of the mold are also required.

4.3 When the computer and software options are used, periodically verify the data processing system output using a procedure designed for such purposes.
4.4 The manufacturer, other agencies providing such services, or in-house personnel may perform the verification of the calibration system standardization and quality checks. Frequency of verification must follow manufacturer’s recommendations.

5. **SAMPLE PREPARATION**

5.1 *Selecting Materials:*

5.1.1 Obtain a minimum 50 lb. (25 kg) representative sample of each aggregate type and source in accordance with Tex-400-A.

5.1.2 Obtain an adequate quantity of asphalt and additives in accordance with Tex-500-C.

5.1.3 Dry the aggregate, including recycled asphalt pavement (RAP) when applicable, to constant weight at a temperature of 140°F (60°C).

5.1.4 If the stockpile gradation is unknown, obtain the gradation of each proposed aggregate stockpile in accordance with Tex-200-F, Part I. Use the construction stockpile gradation when it is available. When applicable, heat the RAP at 140°F (60°C), break it apart until friable, and quarter to obtain representative samples.

5.1.5 Calculate the percentages of each proposed aggregate type so that the blended combination will fall within the gradation ranges specified in Item 292, Table 2.

5.1.6 When lime is used, the combined gradation will include the lime as an aggregate type when determining the percentages for the combined aggregate blend.

5.1.7 Check asphalt and additives for compliance with Item 292.

5.2 *Preparing Batching Materials:*

5.2.1 Estimate the material weight to result in a compacted specimen 6 in. (150 mm) in diameter and 4.5 ± 0.2 in. (115 ± 5 mm) in height at 75 gyrations.

**Note 1**—It may be necessary to produce a trial specimen to achieve this height requirement. Generally, 4700–4800 g of aggregate is required.

5.2.2 Use the estimated weight from Section 5.2.1 and the percentages of the various sizes of aggregates to calculate the cumulative weights of each size. Combine all cumulative weights to make a large sample for molding a specimen.

5.2.3 Separate the virgin aggregates using a No. 4 (4.75 mm) sieve. Keep the RAP separate from the virgin aggregates.

5.2.4 Place the virgin aggregates retained on the No. 4 (4.75 mm) sieve in a tared mixing pan; place the virgin aggregates passing the No. 4 (4.75 mm) sieve in a smaller tared pan. Place RAP in a third tared mixing pan, if applicable. Record the tare weights.
5.3  *Mixing Black Base Specimens:*

5.3.1 Place the pans containing the virgin aggregates and RAP (if applicable) and a supply of asphalt in an oven set to the temperature specified in Tex-205-F for the binder grade, and heat for 2 hours.

5.3.2 Remove the pans containing the virgin aggregates and RAP (if applicable) from the oven and weigh. Obtain the total dry weight of the aggregates by adding the weights of virgin aggregates and RAP (if applicable) and subtracting the sum of the tares of the pans.

5.3.3 Place all the pans back in the oven.

5.3.4 Calculate the weight of asphalt required in the specimen based on the pre-determined percentage of asphalt content and the total dry weight of virgin aggregates and RAP (if applicable), then place the mixing pan containing the virgin aggregates retained on No. 4 (4.75 mm) sieve on the balance and accurately weigh in the hot asphalt from the oven.

5.3.5 Place the material in the mixing pan into a mechanical mixer and mix until the aggregates are well coated. This may require several minutes.

5.3.6 Remove the pan containing the aggregate passing the No. 4 (4.75 mm) sieve from the oven, add the contents to the mechanical mixer, and continue mixing until uniformly mixed.

5.3.7 If applicable, add the RAP last and complete the mixing.

5.3.8 Put the mixed materials in a large pan and place it in the oven with temperature set in accordance with Tex-205-F depending on binder grade for 2 hours prior to molding.

5.4  *Molding Black Base Specimens:*

5.4.1 Preheat the mold, top, and base plate in the oven in accordance with Tex-205-F for at least 1 hour to help retain the heat of the mixture during loading and compaction.

5.4.2 Once the mixture has cured for 2 hours, remove the heated mold and base plate from the oven, put the base plate in position in the mold, and place a filter paper disc in the bottom of the mold.

5.4.3 Place the mixture into the mold in one lift. Take caution to avoid segregation in the mold.

5.4.4 After all the mix is in the mold, level the mix with a spatula and place another filter paper disc and the top plate on the leveled material.

5.4.5 Load the specimen mold with the mix into the compactor and center the mold under the loading ram.

5.4.6 Lower the ram until the pressure on the specimen reaches 87 ± 2 psi (600 ± 18 kPa), and begin the gyratory compaction in accordance with Tex-241-F.

5.4.7 Allow compaction to proceed for 75 gyrations.
5.4.8 When monitoring the specimen height, record to the nearest 0.004 in. (0.1 mm) after each revolution.

5.4.9 Once the compaction reaches 75 gyrations, raise the loading ram, remove the mold from the compactor, and extrude the specimen from the mold.

Note 2—For lean, rich, and tender mixtures, do not immediately extrude the specimen. Allow the mold to cool first for at least 10 min. in front of a fan before extruding.

5.4.10 Remove the filter paper discs from the top and bottom of the specimen.

Note 3—Before reusing a mold, place it in the oven for at least 5 min. before wiping it clean. Using multiple molds will speed up the compaction process.

5.4.11 Store the fresh, hot molded specimen at room temperature [77°F (25°C)] for further testing. Space very rich specimens at least 2 in. (50 mm) apart to prevent damage in the case of slumping.

6. TESTING INDIRECT TENSILE STRENGTH OF BLACK BASE SPECIMENS

6.1 Perform indirect tensile strength (IDT) testing on the compacted black base specimens after 24 hours in accordance with Tex-226-F.

6.2 Plot the laboratory molded density and IDT results as a function of asphalt content. Determine the maximum density from the plot; the asphalt content at this density is the traditional optimum asphalt content. See Figure 1.

Figure 1—Asphalt Content/Density/IDT Curve

6.3 Convert the density to relative density by dividing the measured densities by the maximum density and plot with IDT strength. See Figure 2.
6.4 Report the minimum asphalt content (AC, min) where the maximum density is achieved. See Figure 3.

6.5 Determine the maximum asphalt content (not to exceed 6%), where the relative density is equal to 97% (AC, max-d).

6.6 Determine maximum asphalt content (not to exceed 6%) where the IDT strength is equal to 85 psi (AC, max-s).

6.6.1 Report the smaller of AC, max-d and AC, max-s as the maximum asphalt content (AC, max).
6.6.2 Select average of \( AC_{\min} \) and \( AC_{\max} \) as the design asphalt content (\( AC_{\text{design}} \)).

6.6.3 Report target field density at \( AC_{\text{design}} \) as the required density.

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### 7. CALCULATIONS

7.1 Calculate volume of specimen:

\[
Volume \text{ of Specimen (ft}^3) = \frac{\pi \times D\text{(in.\text{)}^2}}{6912} \times h\text{(in.\text{)}
\]

\[
Volume \text{ of Specimen (m}^3) = \frac{\pi \times D\text{(m\text{)}^2}}{4} \times h\text{(m)}
\]

Where:
- \( D \) = specimen diameter
- \( h \) = specimen height.

7.2 Calculate density of specimen:

\[
Density \text{ of Specimen (lb/ft}^3) = \frac{\text{Weight of Specimen (lb.)}}{\text{Volume of Specimen (ft}^3)}
\]

\[
Density \text{ of Specimen (kg/m}^3) = \frac{\text{Weight of Specimen (kg)}}{\text{Volume of Specimen (m}^3)}
\]

7.3 Calculate percent actual density of a compacted field mix:

\[
Percent \text{ Actual Density in Field} = \frac{Density \text{ of Core}}{Target \text{ Density}} \times 100
\]

or

\[
Percent \text{ Actual Density in Field} = \frac{Nuclear \text{ Density}}{Target \text{ Density}} \times 100
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### 8. ARCHIVED VERSIONS

8.1 Archived versions are available.