

Test Procedure for

LINEAR BAR SHRINKAGE OF SOILS AND BASE MATERIALS

TxDOT Designation: Tex-107-E

Effective Date: **July 2024****1. SCOPE**

- 1.1 Use this test procedure to determine the linear bar shrinkage of material passing the No. 40 sieve. It provides an indication of the presence of clay material that may impact the performance of pavements.
- 1.2 This test is required for embankment (soils), and for fine aggregate and mineral filler used to produce hot mix asphalt. It is also required when it is not possible to measure the liquid limit. This is when a groove closure before 20 blows cannot be obtained, such as for non-plastic, sand material having a low plasticity index.
- 1.3 *This test procedure does not claim to address the safety concerns associated with its use. It is the responsibility of the user of this test procedure to establish the appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations before use.*

2. APPARATUS AND MATERIALS

- 2.1 Balance, Class G1 in accordance with [Tex-901-K](#), minimum capacity of 200 g.
- 2.2 Distilled or deionized water.
- 2.3 Flexible spatula, with a blade approximately 4 in. long and 0.75 in. wide.
- 2.4 Grooving tool, ASTM grooving tool as shown in [Tex-104-E](#).
- 2.5 Linear bar shrinkage mold, stainless steel or aluminum, with section $0.75 \pm 0.02 \times 0.75 \pm 0.02 \times 5 \pm 0.02$ in.
- 2.6 Number 20 scale.
- 2.7 Oven, capable of maintaining a temperature of $230 \pm 9^\circ\text{F}$.
- 2.8 Petroleum Jelly
- 2.9 Porcelain evaporating dish, with a diameter of 4.5–5.5 in.
- 2.10 Straight edge.
- 2.11 Water, approved drinking source.

3. PREPARING SAMPLE

- 3.1 Sample embankment (soils) or flexible base in accordance with [Tex-100-E](#).
 - 3.2 Sample a fine aggregate stockpile in accordance with [Tex-221-F](#) or [Tex-400-A](#).
 - 3.3 Prepare the sample in accordance with [Tex-101-E](#), Part I to provide a minimum of 200 g.
 - 3.3.1 When testing material for the liquid limit ([Tex-104-E](#)) and it is not possible to produce a groove closure before 20 blows, use the remaining wet sample for this test. Proceed to Section 4.4.
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4. PROCEDURE

- 4.1 Grease the inside walls of the linear bar shrinkage mold with a thin layer of petroleum jelly to prevent any adhesion of the material to the mold.
- 4.2 Place a minimum of 100 g of material from the dry sample prepared in Section 3 in an evaporating dish.
- 4.3 Add water and thoroughly mix the material to a uniform consistency.
- 4.4 Shape the sample into a smooth layer about 0.5 in. thick on the bottom of the dish and make a groove with the grooving tool.
 - 4.4.1 The sample is ready for testing when the material immediately flows on its own and just closes the groove at the bottom. Proceed to Section 4.5.
 - 4.4.2 When it's necessary to tap the dish to close the groove, add more water and mix the material thoroughly. Verify the groove closure and proceed to Section 4.4.
 - 4.4.3 When the material is too wet, add dry material and mix it thoroughly. Verify the groove closure and proceed to Section 4.5.
- 4.5 Use a spatula and place the wet material into the greased mold.
 - 4.5.1 Hold the dish approximately 1 in. above the mold and slowly push the material out of the dish into the mold.
 - 4.5.2 Alternatively, pick up material from the dish using a spatula and gently tap the bottom of the mold to slide the material off the spatula and into the mold.
- 4.6 Gently tap the mold to cause the material to flow and to assist in the removal of entrapped air bubbles.
- 4.7 Continue to fill and remove entrapped air until the mold is filled with excess material.
- 4.8 Use a straightedge to smooth the surface level with the top of the mold.
 - 4.8.1 Discard or return any excess material to the dish to be used for another bar.
- 4.9 Wipe excess material from the top edges surrounding the bar.
- 4.10 Allow the mold and material to air dry until the color or the appearance changes slightly. This is to prevent excessive cracking or heaving of the bar during oven drying.

- 4.11 Place the mold in the drying oven at $230 \pm 9^{\circ}\text{F}$ and dry to a constant weight.
- 4.11.1 Constant weight is achieved when the weight loss is less than 0.1% of the sample weight after 4 hr. of drying.
- 4.12 Remove the mold from the oven and allow it to cool to room temperature or until it can be handled with bare hands.
- 4.13 Measure the length of the dry bar.
- 4.13.1 Do not remove the bar from the mold because this may damage the bar.
- 4.13.2 When there is shrinkage from both ends of the mold, use your finger or spatula and gently push the bar to one side of the mold.
- 4.13.3 Use a number 20 scale and measure to the whole percent.

5. CALCULATIONS

- 5.1 Use the following equation to determine the linear bar shrinkage.

$$LS = 100 - S_{20}$$
 Where:
 $100 =$ Length of the wet soil bar, 100%.
 $S_{20} =$ Length of the dry soil bar, % (Section 4.13.3).

6. REPORT

- 6.1 Report to the nearest whole percent.

7. ARCHIVED VERSION

- 7.1 An archived version is available.