Test Procedure for

WET BALL MILL OF FLEXIBLE BASE

TxDOT Designation: Tex-116-E

Effective Date: April 2024

1. SCOPE

1.1 This test method determines the resistance of aggregate in flexible base material to disintegration in the presence of water. This provides a measure of degradation in the flexible base by detecting soft aggregate that is subject to crushing and weathering. The results of this test are the Wet Ball Mill percent and percent increase passing the No. 40 sieve as required in Item 247, "Flexible Base."

1.2 *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

2.1 *Balance,* Class G5 in accordance with Tex-901-K, with a minimum capacity of 33 lb.

2.2 *Container*, 2 L (0.5 gal.)

2.3 *Metal spheres*, used as the abrasive charge, consisting of six steel spheres approximately 47.6 mm (1.875 in.) in diameter, weighing between 390 and 445 g.

2.4 *Oven*, capable of maintaining a temperature of 230 ± 9°F.

2.5 *Sieve*, No. 40 meeting the requirements of Tex-907-K.

2.6 *Water,* approved drinking source.

2.7 *Wet Ball Mill machine*, consisting of a watertight steel cylinder closed at one end with inside dimensions of 258.8 ± 3 mm (10.188 ± 0.125 in.) in diameter and 273.1 ± 3 mm (10.75 ± 0.125 in.) in length.

2.7.1 Cylinder is fitted with a removable lid with a watertight gasket attached.

2.7.2 Cylinder is mounted in a rigid support such that it is rotated about the central axis in a horizontal position.

2.7.3 Steel baffle, projecting radially 82.6 ± 3 mm (3.25 ± 0.125 in.) into the cylinder and 273.1 ± 3 mm (10.75 ± 0.125 in.) in length and is welded along one element of the interior surface of the cylinder.

2.7.4 Baffle must be rigid and mounted to the cylinder.

2.7.5 Machine must operate at a uniform speed of 58–62 rpm.

PART I—WET BALL MILL PERCENT

3. PROCEDURE

3.1 Sample flexible base material in accordance with Tex-100-E.

3.1.1 Split or quarter the sample in accordance with Article 6., "Preparing Flexible Base Samples for Testing," of Tex-100-E.

3.2 Prepare the material and determine a bulk gradation in accordance with Tex-101-E, Part II.

3.2.1 Report the total weight from each sieve that was used to determine the bulk gradation.

3.3 Weigh a 3500 ± 50 g (7.7 ± 1.1 lb.) sample using the bulk gradation from Section 3.2. into a pan and record to the nearest g or 0.1 lb.

3.4 Place six steel spheres into the wet ball mill (WBM) machine cylinder.

3.5 Pour 2 L (0.5 gal.) water into the pan.

3.5.1 Alternatively, place the dry sample into the cylinder and pour 2 L (0.5 gal.) water into the cylinder to cover the sample completely.

3.6 When this amount of water does not fully cover the sample in the pan or in the cylinder, use the smallest amount of water possible to cover the sample.

3.7 Allow the sample to soak for 1 hr. ± 5 min.

3.8 When the sample is soaked in a pan, decant the water and transfer the sample into the cylinder.

3.9 Fill the cylinder with water.

3.9.1 Use this water to wash material from the pan into the cylinder.

3.10 Fasten the lid and run the WBM machine for 600 revolutions.

3.11 Remove the lid and empty the water, sample, and steel spheres into a pan.

3.12 Remove the steel spheres and separate the sample by washing it over a No. 40 sieve.

3.13 Dry the aggregate retained on the No. 40 sieve to constant weight at 230 ± 9°F.

3.13.1 Constant weight is achieved when the weight loss is less than 0.1% of the sample weight after 4 hr. of drying.

3.14 Sieve over a No. 40 sieve and weigh the material retained on the sieve to the nearest 1 g or 0.1 lb. and record.

3.14.1 Additional sieves with larger openings may be placed on top of the No. 40 sieve to avoid overloading the No. 40 sieve.

3.15 Proceed to Article 5., "Calculations," to calculate the Wet Ball Mill percent.

PART II—WET BALL MILL PERCENT INCREASE PASSING THE NO. 40 SIEVE

4. PROCEDURE

4.1 Weigh a 3,000 ± 50 g (6.6 ± 1.1 lb.) sample using the bulk gradation from Section 3.2. and record to the nearest g or 0.1 lb.

4.2 Wash the sample over a No. 40 sieve.

4.3 Dry the aggregate retained on the No. 40 sieve to a constant weight as defined in Section 3.13.1., at 230 ± 9°F.

4.4 Sieve over a No. 40 sieve and weigh the material retained on the sieve to the nearest 1 g or 0.1 lb. and record.

4.4.1 Additional sieves with larger openings may be placed on top of the No. 40 sieve to avoid overloading the No. 40 sieve.

4.5 Proceed to Article 5., "Calculations," to calculate the Wet Ball Mill percent increase passing the #40 sieve.

5. CALCULATIONS

5.1 Calculate the Wet Ball Mill percent from Part I.

$$Wet\ Ball\ Mill\ \% = 100 \times \frac{(W_{Initial} - W_{No.40})}{W_{Initial}}$$

Where:

$W_{Initial}$ = Weight of total sample from Section 3.3.

$W_{No.40}$ = Weight of material retained on the No. 40 sieve from Section 3.14.

5.2 Calculate the percent of material passing the No. 40 sieve from Part II.

$$\%\ Passing\ No.40 = 100 \times \frac{(W_{Initial} - W_{No.\ 40})}{W_{Initial}}$$

Where:

$W_{Initial}$ = Weight of total sample from Section 4.1.

$W_{No.40}$ = Weight of material retained on the No. 40 sieve from Section 4.4.

5.3 Calculate the Wet Ball Mill percent increase passing the No. 40 sieve from Part II.

$$Percent\ Increase\ No.40\ Sieve = Wet\ Ball\ Mill\ \% - \%\ Passing\ No.40$$

Where:

Wet Ball Mill %, calculated from Section 5.1.

% Passing No. 40, calculated from Section 5.2.

6. REPORTING TEST RESULTS

6.1 Report the Wet Ball Mill percent to the nearest whole number.

6.2 Report the Wet Ball Mill increase passing the No. 40 sieve to the nearest whole number.

7. ARCHIVED VERSIONS

7.1 Archived versions are available.