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Standard Test Method for Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures[1]

This standard is issued under the fixed designation D 6390; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the amount of draindown in an uncompacted asphalt mixture sample when the sample is held at elevated temperatures comparable to those encountered during the production, storage, transport, and placement of the mixture. The test is particularly applicable to mixtures such as porous asphalt (open-graded friction course) and stone matrix asphalt (SMA)

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]

D 979 Practice for Sampling Bituminous Paving Mixtures[3]

D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus[3]

D 4753 Test Method for Evaluating, Selecting, and Specifying Balances and Scales, for Use in Testing Soil, Rock, and Related Construction Materials[4]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *draindown*—for the purpose of this test method, draindown is considered to be that portion of material which separates itself from the sample as a whole and is deposited outside the wire basket during the test. The material which drains may be composed of either asphalt binder or a combination of asphalt binder, additives, or fine aggregate.

4. Summary of Test Method

4.1 A sample of the asphalt mixture to be tested is prepared in the laboratory or obtained from field production. The sample is placed in a wire basket which is positioned on a plate or other suitable container of known mass. The sample, basket, and plate or container are placed in a force draft oven for one hour at a pre-selected temperature. At the end of one hour, the basket containing the sample is removed from the oven along with the plate or container and the mass of the plate or container containing the drained material, if any, is determined. The amount of draindown is then calculated.

5. Significance and Use

5.1 This test method can be used to determine whether the amount of draindown measured for a given asphalt mixture is within specified acceptable levels. The test provides an evaluation of the draindown potential of an asphalt mixture during mixture design and/or during field production. This test is primarily used for mixtures with high coarse aggregate content such as porous asphalt (open-graded friction course) and stone matrix asphalt (SMA).

6. Apparatus

6.1 *Forced Draft Oven*, capable of maintaining the temperature in a range from 120 to 175°C. The oven should maintain the set temperature to within ± 2°C.

6.2 *Plates*, or other suitable containers of appropriate size. The plates or containers used should be of appropriate durability to withstand the oven temperatures. Cake pans or pie tins are examples of suitable types of containers.

6.3 *Standard basket* meeting the dimensions shown in Fig. 1. The basket shall be constructed using standard 6.3 mm sieve cloth as specified in Specification E 11.

6.4 *Balance*—A balance readable to 0.1g and conforming to the requirements of Specification D 4753, GP2.

7. Sample Preparation

7.1 *Laboratory Prepared Samples*:

7.1.1 *Number of Samples*—For each mixture tested, the draindown characteristics should be determined at two different temperatures. The two temperatures should be the anticipated plant production temperature as well as 10°C above (see

[1] This test method is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.25 on Analysis of Bituminous Mixtures.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.03.

[4] *Annual Book of ASTM Standards*, Vol 04.08.

[5] *Annual Book of ASTM Standards*, Vol 14.02.

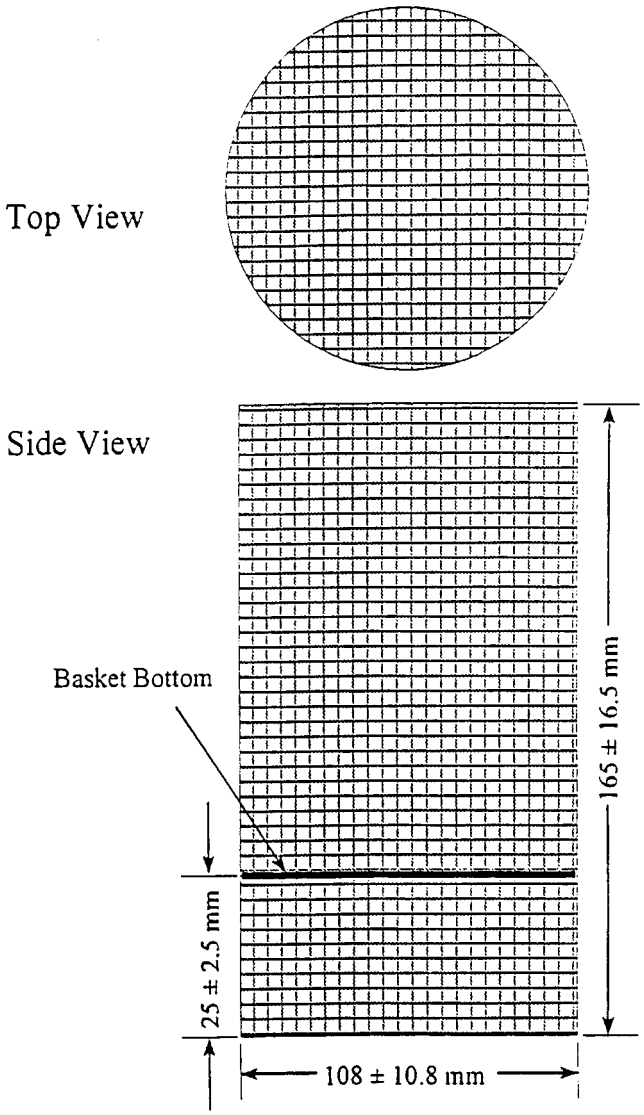

FIG. 1 Wire Basket Assembly (Not to Scale)

Note 1). For each temperature, duplicate samples should be tested. Thus for one asphalt mixture, a minimum of four samples will be tested.

7.1.2 Dry the aggregate to constant mass and sieve it into appropriate size fractions as indicated in Test Method D 1559.

7.1.3 Determine the anticipated plant production temperature for the specific mix to be tested based on the specifications, mix design, or recommendations of the binder supplier.

7.1.4 Place into separate pans for each test sample the amount of each size fraction required to produce completed mixture samples having a mass of 1200 ± 200 g. The aggregate fractions shall be combined such that the resulting aggregate blend has the same gradation as the job-mix formula. Place the aggregate samples in an oven and heat to a temperature not to exceed the temperature established in 7.1.1.

7.1.5 Heat the asphalt binder to the temperature established in 7.1.1.

7.1.6 Place the heated aggregate in the mixing bowl. Add any stabilizers (see Note 2) and thoroughly mix the dry components. Form a crater in the aggregate blend and add the required amount of asphalt binder. The amount of asphalt binder shall be such that the final sample has the same asphalt content as the job-mix formula. At this point, the temperature of the aggregate and asphalt binder shall be at the temperature determined in 7.1.1. Mix the aggregate (and stabilizer if any) and asphalt binder quickly until the aggregate is thoroughly coated.

7.2 *Plant Produced Samples*:

7.2.1 *Number of Samples*—For plant produced samples, triplicate samples should be tested at the plant production temperature.

7.2.2 Samples should be obtained in accordance with Practice D 979 during plant production by sampling the mixture at any appropriate location such as the trucks prior to the mixture leaving the plant. Samples obtained during actual production should be reduced to the proper test sample size.

NOTE 1—When using the test as part of the mixture design procedure, the test should be performed at two temperatures in order to determine the potential effect that plant temperature variation may have on the mixture during production. When the test is used in the field during production, it should be necessary to perform the test at the plant production temperature only.

NOTE 2—Some types of stabilizers such as fibers or some polymers are added directly to the aggregate prior to mixing with the asphalt binder. Other types of stabilizers are added directly to the asphalt binder prior to blending with the aggregate.

8. Procedure

8.1 Weigh the empty wire basket described in 6.3 (Mass A). Transfer the laboratory produced or plant produced uncompacted mixture sample to the wire basket as soon as possible. Place the entire sample in the wire basket. Do not consolidate or otherwise disturb the sample after transfer to the basket. Determine the mass of the wire basket plus sample to the nearest 0.1 g. (Mass B).

8.2 Determine and record the mass of a plate or other suitable container to the nearest 0.1 gram at ambient temperature (Mass C). Place the basket on the plate or container and place the assembly into the oven at the temperature as determined in 7.1.1 or 7.2.1 for 1 h ± 5 min.

8.3 After the sample has been in the oven for 1 h ±5 min, remove the basket and plate or container from the oven. Let cool to ambient temperature. Determine and record the mass of the plate or container plus drained material to the nearest 0.1 g (Mass D).

9. Calculation

9.1 Calculate the percent of mixture which drained to the nearest 0.1 % as follows:

$$\text{draindown (percent)} = (D-C)/(B-A) \times 100 \quad (1)$$

where:

A = mass of the empty wire basket,
B = mass of the wire basket and sample,
C = mass of the empty catch plate or container, and
D = mass of the catch plate or container plus drained material.

10. Report

10.1 Report the average percent drainage at each of the test temperatures to the nearest 0.1 %.

11. Precision and Bias [6]

11.1 See Table 1 for precision statements for mixtures with draindown values of less than 1.0 % (see Note 3).

NOTE 3—These precision statements are based on an analysis of a round-robin study conducted by the National Center for Asphalt Technology, using one stone matrix asphalt mix, three replicates, and ten laboratories. The precision statements are based on a mixture that had an average draindown value of 0.3 %.

[6] Supporting data are available from ASTM Headquarters. Request RR:D04–1013.

TABLE 1 Precision Statements for Mixtures With Draindown Values of Less Than 1.0 %

Test and Type Index	Coefficient of Variation (% of mean)[A]	Acceptable Range of Two Test Results (% of mean)[A]
Single operator precision: Draindown, %	32.5	92.0
Multilaboratory precision: Draindown, %	68.2	193.0

[A] These numbers represent, respectively, the (1s %) and (d2s %) limits as described in Practice C 670.

11.2 See Table 2 for precision statements for mixtures with draindown values of more than 1.0 % (see Note 4).

NOTE 4—These precision statements are based on an analysis of a round-robin study conducted by the National Center for Asphalt Technology, using one stone matrix asphalt mix, three replicates, and ten laboratories. The precision statements are based on a mixture that had an average draindown value of 1.4 %.

11.3 *Bias*—The test method has no bias because the values determined can be defined only in terms of the test method.

12. Keywords

12.1 asphalt mixtures; draindown; open-graded friction courses; stone matrix asphalt

TABLE 2 Precision Statements for Mixtures With Draindown Values of More Than 1.0 %

Test and Type Index	Coefficient of Variation (% of mean)[A]	Acceptable Range of Two Test Results (% of mean)[A]
Single operator precision: Draindown, %	28.1	79.5
Multilaboratory precision: Draindown, %	35.9	101.6

[A] These numbers represent, respectively, the (1s %) and (d2s %) limits as described in Practice C 670.