



Standard Test Method for Sweep Test of Bituminous Emulsion Surface Treatment Samples¹

This standard is issued under the fixed designation D 7000; 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 measures the curing performance characteristics of bituminous emulsion and aggregates by simulating the brooming of a surface treatment in the laboratory.

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

1.3 A precision and bias statement for this standard has not been developed at this time. Therefore, this standard should not be used for acceptance or rejection of a material for purchasing purposes.

1.4 *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:²

C 127 Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

D 8 Terminology Relating to Materials for Roads and Pavements

D 75 Practice for Sampling Aggregates

D 140 Practice for Sampling Bituminous Materials

D 226 Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

D 977 Specification for Emulsified Asphalt

D 2397 Specification for Cationic Emulsified Asphalt

2.2 ISSA Document:

ISSA Technical Bulletin No. 100 Test Method for Wet Track Abrasion of Slurry Surfaces³

3. Summary of Test Method

3.1 The sweep test is effective for defining the film formation stage of bituminous emulsions. A brush (designed to closely replicate the sweeping action of a broom) exerts a force on the aggregate used on surface treatments. Bituminous emulsion is applied to an asphalt felt disk. Aggregate is applied and embedded into the bituminous emulsion. The sample is then conditioned at a prescribed temperature and time period before testing. A mixer abrades the surface of the sample using a nylon brush. After one minute of abrasion, the test is stopped, any loose aggregate is removed, and the percent mass loss is calculated.

4. Significance and Use

4.1 This test method is useful for classifying rapid-setting bituminous emulsions and is applicable to surface treatments that require a quick return to traffic. It has the capability to predict surface treatment performance in the formative stage using construction components. This performance test is intended to evaluate the potential curing characteristics of a binder-aggregate combination to ensure that the surface treatment is sufficiently cured before allowing traffic onto the seal.

5. Apparatus

5.1 *Mixer*^{4,5}—Use to abrade the sample.

³ Available from International Slurry Surfacing Association (ISSA), 3 Church Circle, PMB 250, Annapolis, MD 21401.

⁴ The sole source of supply of the Hobart Mixer 1/3 H.P. Fixed Speed Motor, model A 120 known to the committee at this time is Hobart Corporation 701 S. Ridge Ave. Troy, OH 45374.

⁵ If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.24 on Bituminous Surface Treatments.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

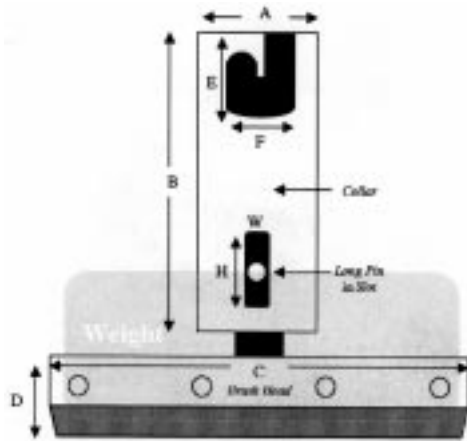


FIG. 1 Brush Holder

Dimensions		
ID	Name	mm
A	Collar diameter	36
B	Collar height	76
C	Brush head length	128
D	Overall brush head height	19
E	Groove height	17
F	Groove width	18
H	Slot height	19
W	Slot width	7

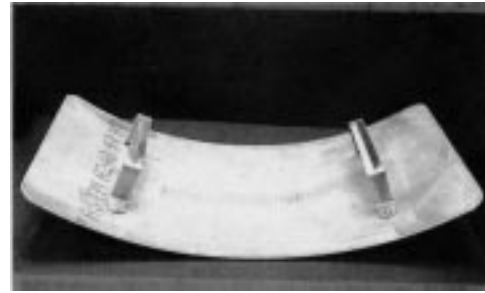


FIG. 2 Sweep Test Compactor

Overall Trim	25.4 mm
Overall Length	127 ± 1 mm
Backing size	#7
Fill Material	Crimped black nylon
Nylon Type	6.0
Fill Diameter	0.254 mm
Weight	35 ± 2 g

5.8 *Strike-off Template*—The template should consist of a flat, stainless steel metal plate. It shall include a 280 ± 3 mm diameter cut out with a flush edge. A 16 gage U.S. Standard (Plate and Sheet Metal) will suffice in most cases.

NOTE 1—Emulsion mass may vary according to emulsion viscosity and applied strike off pressure. Alternative gages may be necessary for emulsion mass correction for varying aggregate sizes and shapes.

5.9 *Strike-off Rod*—The 750 ± 100 mm rod shall be made of 8 mm electrical conduit for striking off emulsion from the template surface.

5.10 *Sweep Test Compactor*—A suitable compaction device with a minimum curved surface radius of 550 ± 30 mm and shall weigh 7500 ± 500 g. A picture of this apparatus can be seen in Fig. 2.

6. Materials

6.1 *Bituminous Emulsion*—The bituminous emulsion should meet all applicable specifications for the surface treatment application. The bituminous emulsion shall be equilibrated to a temperature of 60°C for sample production.

6.2 *Aggregates*—The job aggregates should be sampled and split according to Practice D 75. They shall be placed in an oven and dried to a constant weight. The aggregates shall be dry sieved to obtain a test sample that has 100 % passing the 9.5 mm sieve and <1 % passing the 4.75 mm sieve. The amount of aggregate used for each specimen shall be in accordance to the equation below and can be seen by the example in Table 1. The aggregate amount shall be interpolated between values when necessary, and with a tolerance of ± 1 %.

$$\frac{A(202.1X - 15.8)}{100} + \frac{B(146.4X - 4.7)}{100} = Y \quad (1)$$

where:

- A = % of aggregate from 9.5 to 6.3 mm,
- B = % of aggregate from 6.3 to 4.75 mm,
- X = bulk specific gravity (BSG), and
- Y = amount of aggregate needed for the sweep test, g.

6.3 *Asphalt Felt Disk*—Produce sample disks from 30 lb asphalt felt paper, Specification D 226, Type II. The asphalt felt discs shall not have breaks, cracks, tears, protuberances,

5.2 *Quick-clamp Mounting Base*^{5,6}—This base must be an adequate and level support for clamping the sample in place. The test sample should not move during abrasion.

5.3 *Pan*—An appropriate pan will contain the test sample on the mixer and hold dislodged aggregate.

5.4 *Oven*—The conditioning oven shall be a constant temperature forced draft oven meeting the following requirements containing shelves with at least 65 % voids. The shelves shall be placed at least 120 mm apart and 100 mm away from the top and floor.

Oven Type	Forced draft oven
Min. Inside D × W × H	460 × 460 × 460 mm
Accuracy	±1.0° C

5.5 *Balance*—A balance capable of weighing 800 g or more to within ±0.1 g. A minimum platform length and width of 240 mm is required.

5.6 *Removable Brush Holder*—The brush holder shall be attachable to the mixer and capable of a free floating vertical movement of 19 ± 1 mm having the dimensions listed in Fig. 1. A drawing of this apparatus can be seen in Fig. 1. The total weight of the brush head and the attached weight shall weigh 1500 ± 15 g. The collar and nylon strip brush are not included in this weight. The brush clamping system shall hold the nylon strip brush in place so that it will not move or dislodge during testing.

5.7 *Nylon Strip Brush*^{5,7}—The brush shall conform to the following specifications.

⁶ The sole source of supply of the Wet Track Abrasion Tester (ISSA TB100) known to the committee at this time is Mastrad Limited, Finch House, 25 Finch Road, Douglas, United Kingdom IM1 2PS.

⁷ The sole source of supply of the nylon strip brush part # MB7006 known to the committee at this time is Tanis Incorporated, 501 Maple Ave. (Hwy "E"), Waukesha, WI 53188-9436, <http://www.tanisinc.com>.

TABLE 1 Example

BSG	100 % 6.3 mm to 4.75 mm	50/50 Blend	100 % 9.5 mm to 6.3 mm
2.00	288 g	338 g	388 g
2.25	325 g	382 g	439 g
2.50	361 g	425 g	489 g
2.75	398 g	469 g	540 g
3.00	435 g	513 g	591 g

indentations, or splices. The felt shall be cut to make 300 ± 10 mm diameter disks. The disks shall be placed in a 50°C oven for 24 to 72 h to flatten. Manipulate the disks until they are flat and store at room temperature at least three days before use.

7. Test Specimens

7.1 Weigh the asphalt felt disk to the nearest 0.1 g and record as the asphalt sample disk weight. Place the asphalt felt disk on a flat table. Manipulate the felt disk so that it lies flat against the surface. Replace the disk if the edges curl, bubble, or the disk contains foreign matter. Pre-weigh the aggregate and record as aggregate weight (see Table 1 for proper amounts of aggregate). A strike-off template is placed over the felt disk, centering the hole of the template over the felt disk. 83 ± 5 g of bituminous emulsion (application rate of 1.42 kg/m^2) at 60°C is poured along the top arc of the exposed felt disk. Excess bituminous emulsion is removed with the strike-off rod in a gentle side-to-side continuous motion. This shall be completed within a 3 ± 1 s period. The strike-off motion should not be stopped until the excess materials are off of the felt disk. The template is quickly removed. A picture of this procedure can be seen in Fig. 3.

NOTE 2—Downward pressure, strike-off speed, and template thickness can be adjusted to ensure correct emulsion mass.

7.2 Immediately apply the pre-weighed aggregate sample onto the bituminous emulsion using an even back and forth motion. Once the aggregate has been placed on the sample, compact the aggregates using the sweep test compactor three half cycles in one direction and three half cycles in a perpendicular direction to set the aggregate. Care should be taken not to apply any additional manual downward force to the compactor. Immediately weigh the sample and record as sample weight. Place the specimen in the forced draft oven. Sample production and weighing shall take no more than four minutes.

8. Conditioning

8.1 The specimen is immediately placed in a forced draft oven for the specified time, temperature, and relative humidity based on desired field performance.

NOTE 3—Typical testing parameters for a rapid return to traffic and quick brooming of the product have been a time of one hour at 35°C and 30 % relative humidity. These values vary based on different climate areas of product application.

8.1.1 The time and oven temperature shall be kept to a tolerance of 10 % of the desired values. The tolerance of the relative humidity shall be 25 % of the desired value unless otherwise specified.



FIG. 3 Emulsion Strike-Off In Template

NOTE 4—The oven door should only be opened once within a 20 min period to maintain constant curing conditions.

8.2 At the end of the conditioning time, the specimen is turned vertically and any loose aggregate is removed by gentle hand brushing of the technician's fingers back and forth across the sample. The specimen is then weighed, and the weight recorded to the nearest 0.1 g as the initial specimen weight. The time from conditioning oven to being placed in the test apparatus should be no greater than two minutes.

NOTE 5—The hand brushing of the technician's fingers across the sample has proven to be the preferred method versus a brush for removing any loose aggregate that has not fallen off when the specimen is turned vertically.

9. Procedure

9.1 Attach, then leave the specimen in the clamping device for 180 ± 30 s. During the equilibration time, the brush is secured into the brush head and the brush head with the weight is attached to the mixer. At the end of the equilibrating time, the brush head is put into contact with the sample making sure there is free floating vertical movement of the brush head. The mixer is then turned onto setting #1 (0.83 gyrations per second) for 60 s. After the brush head has come to a complete stop, the table is lowered and the sample is removed from the clamping device. The specimen is held vertically and any loose aggregate is removed by gentle hand brushing of the technician's fingers back and forth across the sample (see Note 5). The abraded sample is weighed to the nearest 0.1g and recorded as final specimen weight. A picture of this procedure can be seen in Fig. 4.

10. Calculation

10.1 This equation represents the total mass loss based on the initial aggregate sample weight. The mass loss as a percentage of the area exposed to the abrading force:

$$\% \text{ Mass Loss} = \left(\frac{A - B}{A - C} \right) \times 100 \times 1.33 \quad (2)$$

where:

- A = initial specimen weight,
- B = final specimen weight, and
- C = asphalt sample disk weight.

11. Precision and Bias

11.1 The between-laboratory reproducibility of this test method is being determined and will be available on or before



FIG. 4 Apparatus Set-Up

December 2008. For the initial samples tested, the repeatability standard deviation was 15 % of the measured loss. Results were from repeated tests on two different emulsions with different types of emulsifiers and varying curing conditions. Twenty replicates were run so that the results would be of statistical significance. The average loss for each sample run was reported along with the standard deviation reported as a percentage of the average loss.

11.2 No information can be presented on the bias for measuring percent mass loss in this test method because no material having an acceptable reference value is available.

12. Keywords

12.1 aggregate; bituminous emulsion; surface treatment; sweep

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