No. 109
Issued 1969
Revision 9/2022

INTERNATIONAL SLURRY SURFACING ASSOCIATION

TECHNICAL BULLETIN

800 Roosevelt Road, Building C-312, Glen Ellyn, IL 60137

Test Method for Measurement of Excess Asphalt in Slurry Surfacing Systems by Use of a Loaded Wheel Tester and Sand Adhesion

1. Scope

1.1 This test method is used to determine the maximum asphalt content of slurry surfacing systems by using a loaded wheel tester. Excess asphalt content may result in severe asphalt flushing and/or densification under heavy traffic loads.

NOTE 1: The ISSA Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal (A105), Polymer-Modified Slurry Seal (A115), and Micro Surfacing (A143) provide specific target values for sand adhesion test results.

NOTE 2: It is acceptable to obtain sand adhesion results on a sample that has been cured and tested according to TB No. 147 (Test Method for Measurement of Lateral and Vertical Displacement of Micro Surfacing Systems) as long as the mold required by this method (see Table 1, Section 7.1) is 12.7 mm (0.5 in) thick.

1.2 *Safe equipment operation, proper regulatory compliance, and accepted safe laboratory practices for the associated laboratory equipment and chemicals presented here are the sole responsibility of the user of this bulletin.*

2. Referenced Documents

2.1 ISSA Recommended Guidelines/Technical Bulletins:

A105 Recommended Performance Guideline for Emulsified Asphalt Slurry Seal
A115 Recommended Performance Guideline for Polymer-Modified Emulsified Asphalt Slurry Seal
A143 Recommended Performance Guideline for Micro Surfacing
TB No. 147 Test Method for Measurement of Lateral and Vertical Displacement of Micro Surfacing Systems
TB No. 113 Test Method for Determining Mix Time for Slurry Surfacing Systems

2.2 ASTM Standards:

ASTM C778 Standard Specification for Standard Sand

3. Significance

3.1 The sand adhesion test is used to identify excess asphalt in slurry surfacing system mixtures by measuring the weight of sand adhered to a sample.

4. Summary of Method

4.1 A mixture of the components identified by TB No. 113 is prepared. The mixture is immediately cast into the specified mold and struck off flush.

4.2 After removal of the mold, the specimen is cured, run on the loaded wheel apparatus, and weighed. Heated sand is applied to the specimen, additional cycles are run on the loaded wheel apparatus, the excess sand is removed, and a final weight is recorded. The weight gain per unit area is calculated as sand adhesion.

5. Apparatus

5.1 **Single Track Loaded Wheel Tester** consisting of the following main components (see Figures 1, 2 and 3):

5.1.1 Frame of steel channel.
5.1.2 1/3 HP, 1750 RPM flanged motor.
5.1.3 40:1 horizontal, double output shaft gear reducer.
5.1.4 Drive cranks, 15.24 cm (6 in) radius.
5.1.5 Drive connecting arms of steel channel.

5.1.6 60-70 Shore A hardness rubber tread molded onto a wheel with a total diameter of 76.2 ± 3.8 mm (3 ± 0.15 in) and a width of 25.4 ± 1.3 mm (1 ± 0.05 in) mounted at a sufficient horizontal distance between the drive crank and the caster axle traveling 304.8 ± 12.7 mm (12 ± 0.5 in) in a path parallel to the specimen. When the loaded wheel tester is not in use, the wheel shall be stored in a raised position so that the weight (referred to in 5.1.10) doesn't create a flat spot on the wheel.

5.1.7 Resettable cycle counter. One back and forth pass is considered a cycle.

5.1.8 Securing mechanism for the galvanized plate/specimen.

5.1.9 Securing mechanism for the sand frame.

5.1.10 Weights centrally positioned over the wheel and secured directly over the axle (see Appendix A.1 – A.2).

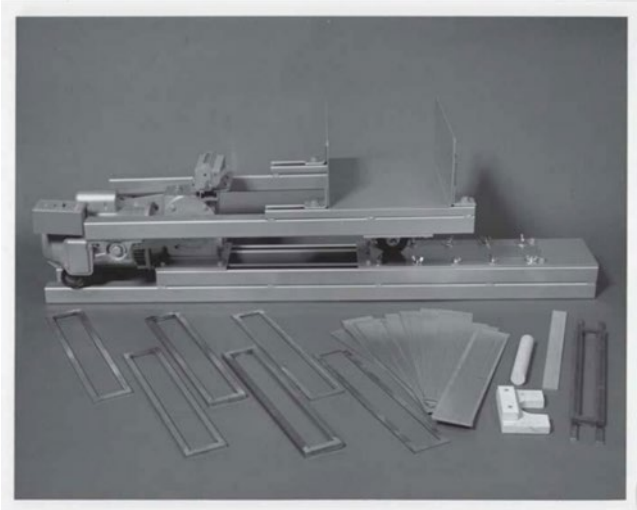

Figure 1 - Single Track Loaded Wheel Tester

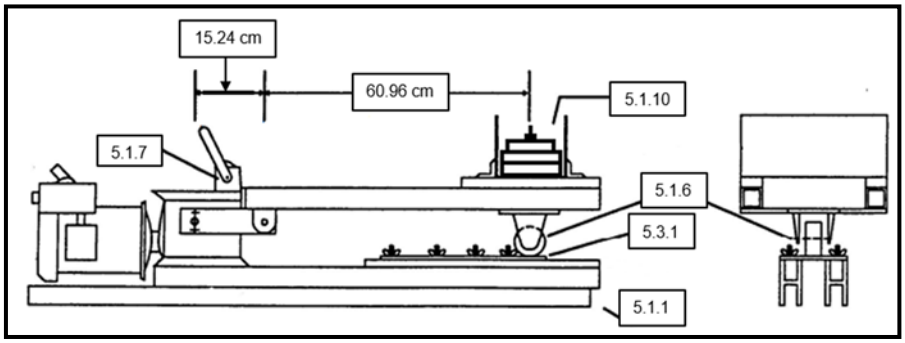

Figure 2 - Single Track Loaded Wheel Tester - Side and End Views

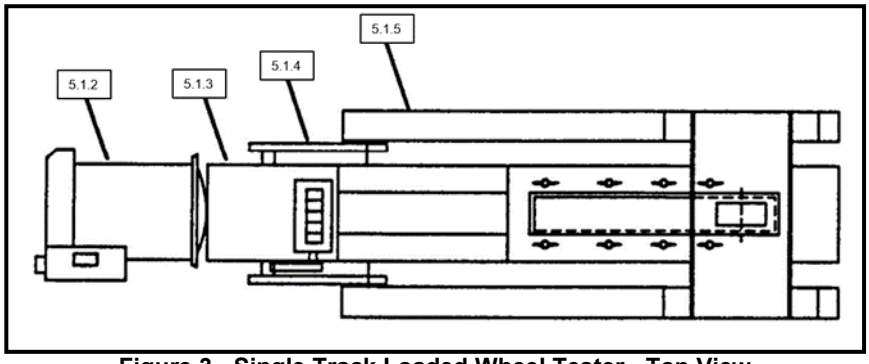

Figure 3 - Single Track Loaded Wheel Tester - Top View

5.2 **Triple Track Loaded Wheel Tester** consisting of the following main components (see Figures 4 and 5):

5.2.1 Frame of steel channel.

5.2.2 ¾ HP motor and reciprocating table providing 40-50 cycles/minute.

5.2.3 Stroke of 304.8 ± 12.7 mm (12 ± 0.5 in).

5.2.4 Pneumatically controlled pressure system for adjustment of applied load for each wheel (see Appendix A.3 – A.4).

5.2.5 70-80 Shore A hardness rubber tread molded onto a wheel with a total diameter of 203.2 ± 4.1 mm (8 ± 0.16 in) and a width of 40-45 mm at the contact point with the sample. When the loaded wheel tester is not in use, the wheels shall be stored in a raised position so that the load (referred to in 5.2.4) doesn't create a flat spot on the wheel.

NOTE 3: A rubber covered wheel that meets these requirements is Part # 3G269. One supplier of this wheel is Grainger.

5.2.6 Resettable cycle counter. One back and forth pass is considered a cycle.

5.2.7 Securing mechanism for the galvanized plate/specimen.

5.2.8 Securing mechanism for the sand frame.

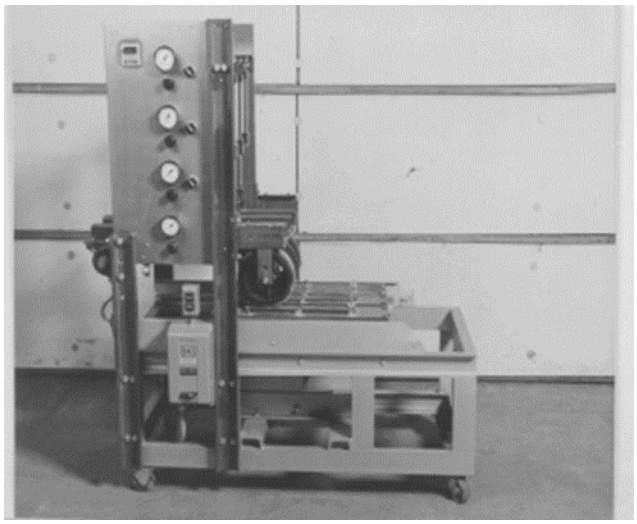

Figure 4 - Triple Track Loaded Wheel Tester

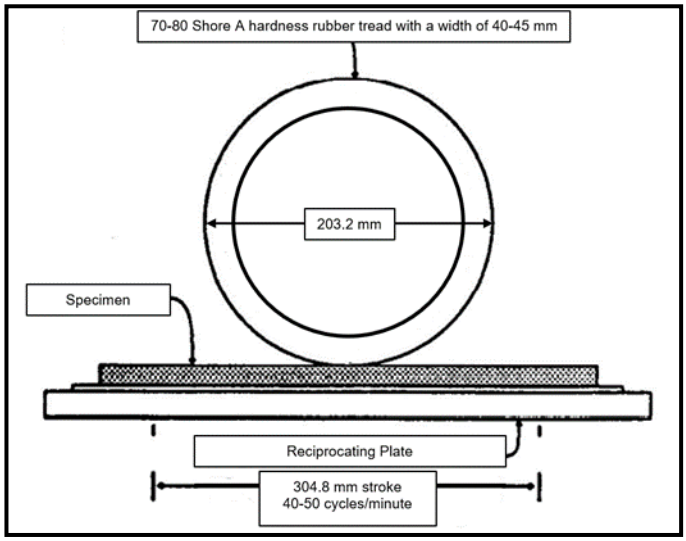

Figure 5 - Triple Track Wheel and Reciprocating Plate

5.3 **Equipment for Sample Preparation and Testing**

5.3.1 Specimen mounting plate, as shown in Figure 6, made of 24-gauge galvanized steel, with measurements of 76.2 ± 1.6 mm x 406.4 ± 3.2 mm (3 ± 0.0625 in x 16 ± 0.125 in).

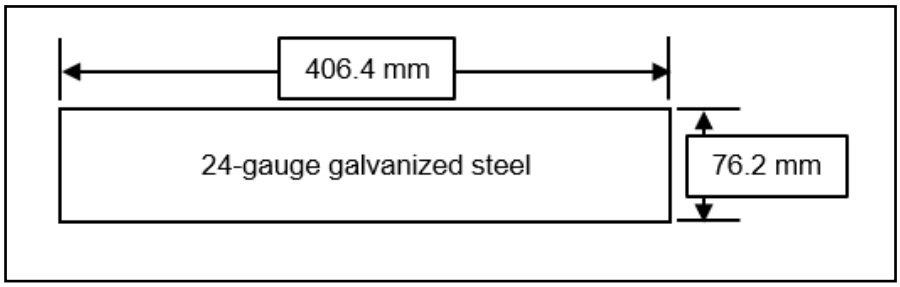

Figure 6 - Specimen Mounting Plate

5.3.2 Specimen mold, as determined using Table 1, and having the dimensions outlined in Figures 7, 8 and 9.

5.3.2.1 Molds with depths of:
A1 = 3.2 ± 0.2 mm (0.125 ± 0.008 in) or,
A2 = 6.4 ± 0.8 mm (0.25 ± 0.03 in) or,
A3 = 12.7 ± 0.8 mm (0.5 ± 0.03 in).

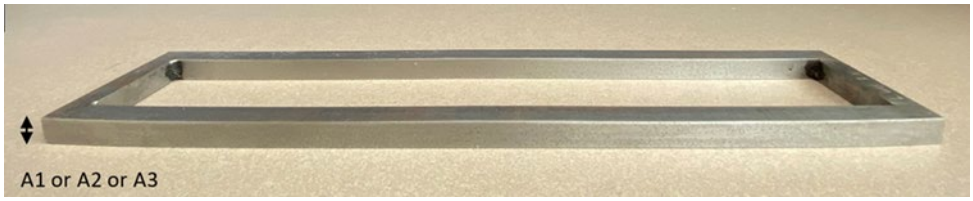

Figure 7 - Side View of Specimen Mold

5.3.2.2 All molds with outside widths of:
B = 76.2 ± 1.6 mm (3 ± 0.0625 in) and
outside lengths of:
C = 406.4 ± 3.2 mm (16 ± 0.125 in).

5.3.2.3 All molds with inside widths of:
D = 50.8 ± 1.6 mm (2 ± 0.0625 in) and
inside lengths of:
E = 381 ± 3.2 mm (15 ± 0.125 in).

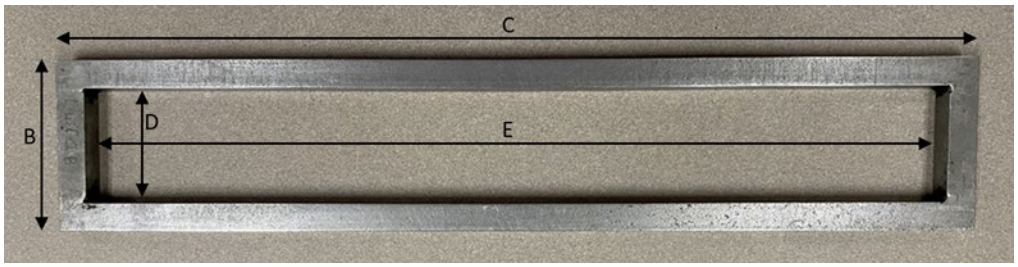

Figure 8 - Top View of Specimen Mold

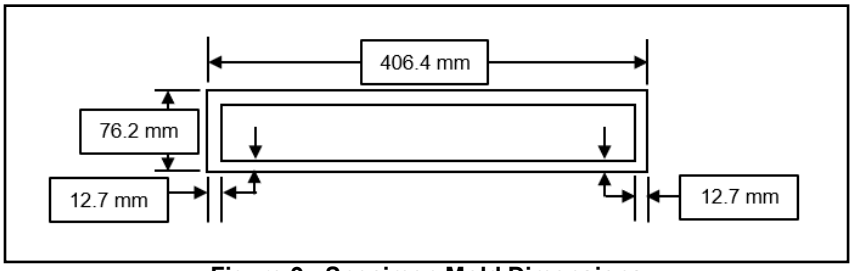

Figure 9 - Specimen Mold Dimensions

5.3.3 Suitable strike-off apparatus such as a 25.4 mm (1 in) diameter x 152 – 203 mm (6 – 8 in) long dowel, a "U"-shaped screed, or a dough scraper.

5.3.4 Sand frame and metal strip as seen in Figures 10, 11 and 12 and having the dimensions outlined below.

5.3.4.1 Sand frame with depth of:
F = 4.8 ± 0.8 mm (0.188 ± 0.03 in).

5.3.4.2 Adhesive-backed foam rubber insulation (weather stripping) measuring 6.4 mm thick x 12.7 mm wide (0.25 in thick x 0.5 in wide) shall be applied to the bottom of the frame (see Figure 10).

Figure 10 - Side View of Sand Frame with Weather Stripping Applied

5.3.4.3 Sand frame with outside width of:
G = 63.5 ± 1.6 mm (2.5 ± 0.0625 in) and
outside length of:
H = 381 ± 3.2 mm (15 ± 0.125 in).

5.3.4.4 Sand frame with inside width of:
I = 38.1 ± 1.6 mm (1.5 ± 0.0625 in) and
inside length of:
J = 355.6 ± 3.2 mm (14 ± 0.125 in).

5.3.4.5 Metal strip that when centered in the sand frame results in no single gap greater than 1.5 mm (0.0625 in).

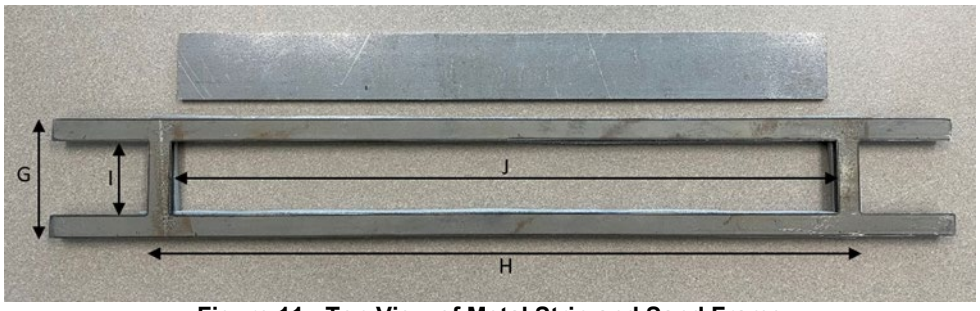

Figure 11 - Top View of Metal Strip and Sand Frame

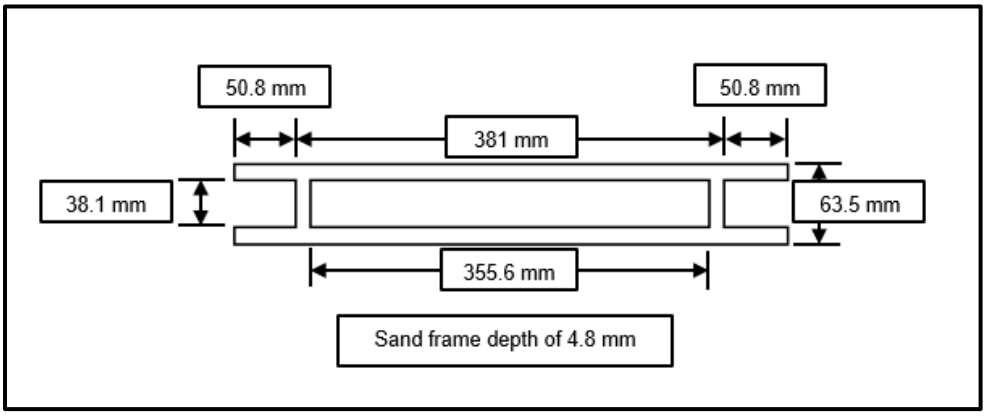

Figure 12 - Sand Frame Dimensions

5.3.5 Platform scale, or load cell, capable of weighing a minimum of 91 kg (200 lb) to within 0.57 kg (1.25 lb).

5.3.6 Balance, capable of weighing 2000 g to within 0.1 g.

5.3.7 Forced draft oven thermostatically controlled at 60 ± 3°C (140 ± 5.4°F).

5.3.8 Suitable smooth surface bowl to contain sample during mixing.

5.3.9 Suitable mixing spoon or spatula of sufficient size to accomplish mixing.

5.3.10 Sieve, 850 µm (No. 20).
5.3.11 Wash bottle filled with water.
5.3.12 ASTM C778 Graded Sand [Fine Ottawa Sand, graded between 600-µm (No. 30) and 150-µm (No. 100) sieves].
5.3.13 Oven thermostatically controlled to 82 ± 1°C (180 ± 2°F).
5.3.14 Sufficiently sized container for sand.
5.3.15 Thermometric device suitable to measure sand temperature to within 1°C (2°F).

6. Materials

6.1 Aggregate shall be representative of the material to be used on the project. Care should be taken to prevent segregation.

6.2 Emulsified asphalt shall be representative of the material to be used on the project and should be uniformly mixed. Oversized particles of asphalt shall be removed by pouring the sample through the 850 µm (No. 20) sieve.

6.3 Water should be potable.

6.4. Mineral fillers and other liquid and/or solid additives shall be representative of the materials to be used on the project. If required, the type and concentration of liquid additives should be recorded.

7. Procedure for Preparation of Test Specimen

7.1 For ISSA gradations, and other gradations meeting one of the conditions described, use the molds as specified in Table 1, below. For other gradations, select the minimum mold thickness from those listed in 5.3.2.1 that will result in a specimen that is at least 25% thicker than the coarsest aggregate particle present in the gradation (see the example below).

Table 1 - Mold Size Based on Gradation

Gradation	ISSA Type I	ISSA Type II	ISSA Type III
Gradation contains material retained on the 4.75 mm (No. 4) sieve	-	12.7 mm (0.5 in)	12.7 mm (0.5 in)
Gradation is 100% passing the 4.75 mm (No. 4) sieve	-	6.4 mm (0.25 in)	-
Gradation contains material retained on the 2.36 mm (No. 8) sieve	6.4 mm (0.25 in)	-	-
Gradation is 100% passing the 2.36 mm (No. 8) sieve	3.2 mm (0.125 in)	-	-

Example:
If the aggregate is 100% passing the 9.5 mm (0.375 in) sieve, then the coarsest particle is slightly less than 9.5 mm (0.375 in). The mold selected should be the thinnest size that is at least 9.5 mm + 25% x (9.5 mm) = 11.9 mm. From the choices in 5.3.2.1, the mold selected would be the 12.7 mm (0.5 in) mold. If the gradation has material retained on the 9.5 mm (0.375 in) sieve use the 12.7 mm (0.5 in) mold.

7.2 Center the mold on a specimen mounting plate.
NOTE 4: It may be desirable to coat the inside surfaces of the mold with a thin coating of liquid dish detergent or suitable release agent to prevent the mix from sticking.

7.3 Determine the amount of mix that will overfill the mold. Approximately 200 g of mix is sufficient for the 3.2 mm (0.125 in) mold, 300 g for the 6.4 mm (0.25 in) mold and 500 g for the 12.7 mm (0.5 in) mold.

7.4 A starting ratio of system components, based on dry aggregate weight, should have been established according to TB No. 113. If the sample size is larger than one used for TB No. 113, make trial mixes to observe the consistency characteristics of the selected formulation. If changing the sample size adversely affects mix consistency, adjust the water content as necessary. Record the formulation percentages listing the quantity of aggregate, mineral filler, water (and liquid additive, if required) and emulsified asphalt.
NOTE 5: The ratio of system components is mathematically based on dry aggregate weight. To prevent segregation, use of aggregate containing moisture is best practice.

7.5 Weigh the aggregate quantity determined in 7.3, based on dry aggregate weight, into the mixing container. Using the spoon, or spatula, mix the mineral filler into the aggregate until uniformly distributed. Add the water (and liquid additive, if required) and mix until all the components are uniformly wet. Add the emulsified asphalt, mix for 30 seconds ensuring the components are adequately coated and homogeneous, and then immediately cast.

7.6 To cast, distribute the mixture into the mold starting at one end and working toward the other. Lay the strike-off apparatus across the width of the mold at one end. Move the strike-off in a side-to-side fashion across the width of the mold, completely filling it with the mixture and levelling the mix with the top (see Figure 13). The leveling shall be performed in a single pass and the process of filling and casting should be completed within 30 seconds.

Figure 13 - Levelling the Mix

7.7 Remove the mold when the mixture has set sufficiently to prevent slumping.
NOTE 6: If the mixture slumps so that the sides of the sample are not straight, remake the sample reducing water to adjust the consistency of the mixture.
7.8 Place the specimen in a 60 ± 3°C (140 ± 5.4°F) oven within three hours of casting.
7.9 Dry the specimen to constant weight for a minimum of 15 hours and for no longer than 30 hours. The sample will be considered at constant weight when the difference in mass between two consecutive measurements, taken 1 hour apart, is less than 0.1% of the previous measurement.
7.10 Remove the sample from the oven once it has reached constant weight.
7.11 Allow the sample to reach room temperature of 22 ± 3°C (72 ± 5°F) and test within 12 hours.

8. Sand Adhesion Test

8.1 Maintain room temperature at 22 ± 3°C (72 ± 5°F).
8.2 Heat the sand to 82 ± 1°C (180 ± 2°F).
8.3 Inspect and thoroughly clean the wheel surface with water or by scraping with a spatula taking care not to damage it. Avoid the use of any cleaning agent that may change the Shore A hardness.
8.4 Secure the mounted specimen in position ensuring that the wheel tracks down the center.
8.5 Set the counter to zero.
8.6 Place the wheel on the specimen and begin the test.
8.7 Occasionally, an audible tackiness and visible shine may be noted. If this occurs, use a wash bottle to add sufficient water to prevent adhesion of the specimen to the wheel. Record the number of cycles required to reach the tack point.
8.8 Stop the machine at 1000 cycles.
8.9 Unload the specimen and invert to remove any loose particles. If water was used in 8.7, the specimen must be dried at 60 ± 3°C (140 ± 5.4°F) to constant weight. The sample will be considered at constant weight when the difference in mass between two consecutive measurements, taken 1 hour apart, is less than 0.1% of the previous measurement.
8.10 If the specimen was dried in the oven, allow the sample to reach room temperature of 22 ± 3°C (72 ± 5°F).
8.11 Weigh and record the weight of the specimen.
8.12 Mount the specimen in its original position.
8.13 Center the sand frame with the foam rubber against the specimen and secure to prevent loss of sand.
8.14 Uniformly spread approximately 120 g of heated sand in the frame and cover with the metal strip. The elapsed time from beginning sand application to starting the 100 cycles must be no more than two minutes.
8.15 Run the machine for 100 cycles.
8.16 Remove the specimen, sand frame, and metal strip as a unit.
8.17 Disassemble over a waste container and gently tap the back of the specimen to remove the loose sand.
NOTE 7: Excess sand outside of the sand frame opening may be removed by brushing with a small, bristled paintbrush.
8.18 Weigh and record the final weight of the specimen with adhered sand.

9. Calculation

9.1 Subtract the original specimen weight (see 8.11) from the final weight of the specimen with adhered sand (see 8.18) to achieve grams of adhered sand.
9.2 Divide grams of adhered sand by the area of the opening in the sand frame in m^2 (ft^2) to achieve g/m^2 (g/ft^2).

10. Report

10.1 Report sand adhesion in g/m^2 (g/ft^2).
10.2 If a tack point occurs, report as _____ cycles of 56.75 ± 0.45 kg (125 ± 1 lb) load at 22 ± 3°C (72°F ± 5°F).

Appendix
Adjusting the Load Applied to the Sample

Single Track Loaded Wheel Tester

A.1 With the connecting arms of the loaded wheel tester parallel to its frame, place the wheel on a platform scale or load cell.

A.2 Add sufficient solid weights as necessary to meet a total load on the sample of 56.75 ± 0.45 kg (125 ± 1 lb). Fix added weights in such a manner as to prevent shifting during testing.

Triple Track Loaded Wheel Tester

A.3 Lower the wheel onto a platform scale or load cell.

A.4 Adjust the air pressure controlling each wheel as necessary to meet a total load on the sample of 56.75 ± 0.45 kg (125 ± 1 lb).