INTERNATIONAL SLURRY SURFACING ASSOCIATION

TECHNICAL BULLETIN

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Test Method for Measurement of Excess Asphalt In Bituminous Mixtures by Use of a Loaded Wheel Tester and Sand Adhesion

1.0 Scope

1.1 The loaded wheel test is intended to compact fine aggregate bituminous mixtures such as slurry seal by means of a loaded, rubber tired reciprocating wheel. The test may be used for design purposeds to establish maximum limits of for asphalt content and enable the mix designer to avoid severe asphalt flushing under heavy traffic loads.

1.2 Various accessory measurements may also be made during this test to study compaction rates and plastic deformation of mono and multiple layered bituminous mixture specimens. Refer to ISSA TB#104 No. 147, "Test Method for Measurement of Stability and Resistance to Compaction, Vertical and Lateral Displacement of Multilayered Fine Aggregate Cold Mixes."

2.0 Apparatus and Materials

2.1 Loaded Wheel Testing machine as shown in Figures 1 and 2 consisting of the following main components:

a. Frame of adjustable steel channel.

b. Mounting plate for specimens

c. 1/3 HP, 1750 RPM flanged motor.

d. 40:1 horizontal double output shaft gear reducer.

e. Drive cranks, 6-inch (15.24 cm) radius.

f. Driven connecting arms of adjustable, steel channel.

g. Weight box, centrally adjustable positioned over the wheel.

h. Bassick caster frame #3YY6-2 with wheel #WR6203 with 3"(76.2 mm) diameter x 1"(25.4 mm) soft (60-70 durometer) rubber tire Soft (60-70 durometer) rubber wheel, 3 ± 0.0125" (76.2 ± 3 mm) diameter by 1 ± 0.0625" (25.4 ± 1.5 mm) mounted at a sufficient horizontal distance between the drive crank and the caster axle for the travel path of the wheel on the specimen to be 12" ± 0.5". horizontal distance of 24"(60.96 cm) between drive and caster axles. (Other wheels may be used.)

i. Resetable revolution counter.

j. 5-25 lb.(11.34 kg) bags of #7(2.8 mm) or #8(2.36 mm) lead shotSufficient solid weights as necessary to meet the defined total load requirement in section 4.3, fixed in such a manner as to prevent weight shift during testing.

k. Specimen mounting plates, made of 24 gauge galvanized steel, with measurements of 3 ± 0.0125" x 16 ± 0.0125" (0.70 mm x 76 ± 3 mm x 406 ± 3 mm). Specimen mounting plates, 24 ga. (.024"-.60mm) galvanized steel x 3" ± 0.125"(76.2 ± 3 mm) x 16" ± 0.125" (406.4± 3 mm), deburrred.

l. Various specimen molds, measuring Specimens molds, variously.125, .188, .250, .313, .375 and .500 inches thick (3.2, 4.8, 6.4, 8.0, 9.5, 12.7mm), x 3"(76.2 mm) x 16"(406.4 mm) outside and 2" (50.8 mm) x 15" (381 mm) inside dimensions. Mold dimension tolerances shall be ± 5%.

m. 1" (25.4 mm) dia. X 6"(152.4 mm) long wood strike-off dowel or "U"-shaped screed. Dimension tolerances shall be ± 5%.

n. Steel sand frame, with .188" x 2.5" x 15" (4.76 mm x 63.5mm x 381 mm) outside and 1.5" x 14" (38.1 mm x 355.6 mm) inside dimensions. Completely line the bottom side of the frame with 1/2" x 1/2"(12.7 x 12.7mm) adhesive-backed foam rubber insulation. Mold and foam dimension tolerances shall be ± 5%.

o. Hold-down clamps.

p. Metal strip, such that the gap between the outside width dimensions of the strip and the inside width dimensions of the sand frame are no greater than 0.0625".

o. Flat, platform scale, 250 lb. (113.4 kg) capacity, sen- sitive to 1 lb.(.45 kg).

q. Platform scale or load cell capable of weighing a minimum of 200 lbs to within 1.0 lb.

r. Wash bottle of 500 ml minimum size.

2.2 Sample Preparation Apparatus:
Balance of 2000 grams or more capacity and sensitive to 0.1 gram, forced draft oven thermostatically controlled at 60°C(140°F) ± 3°C(5°F), constant temperature ovem 140°F(60°C), 600 to 1000 ml. mixing bowl or beaker, 1" (25.4 mm) mixing spatula or spoon suitable mixing spoon or spatula of sufficient size to accomplish mixing, specimen mounting plates (see 2.1.k) and strike-off dowel or "uU"-shaped screed (see 2.1.m), and specimen molds (see 2.1.ll), cone consistency apparatus (ISSA TB# No.106).

2.3 Sand Adhesion Apparatus and Materials:
Fine Ottawa Sand –30 (600 µm), +100 (150 µm) mesh (ASTM Designation C-109-graded standard), hot plate or oven for heating sand 180°± 2(82.2°C)to 82.2°C (180°F) ± 1.1°C (2°F), 1000-5000 ml. Metal bowl, household vacuum cleaner, thermometer for measuring sand temperature, steel sand frame with foam rubber strips (2.1 n).

2.4 Optional compaction and distortion measuring apparatus such as a suitable profilograph and calipers.

3.0 Test Specimens

3.1 Slurry Seal mixtures are prepared with formulations selected for test using project materials.

3.2 Mold thickness is selected that will result in a specimen of desired thickness for testing, e.g., 25% thicker than the coarsest particle thickness.

3.3 25 to 35% more material than required to fill the mold is mixed.
(Normally, 300 grams of aggregate fills the 1/4" (6.4 mm) mold.)

3.4 Trial mixes are made to determine the consistency characteristics of the selected formulation. (See ISSA TB~~#106~~ No. 106). Notation of the exact percentage formulation to be used is made listing the quantity of aggregate, filler, water, emulsion and the consistency obtained; e.g., 100-2-10-18-3 cm.

3.5 The materials are carefully weighed into the mixing container. Mixing should proceed rapidly and thoroughly so that the specimen is cast 30 seconds after the addition of the emulsion.

3.6 The selected mold is centered over a previously weighed specimen mounting plate and uniformly over-filled with the mixture. Using a horizontal sawing motion with the strike-off bar held in a vertical position, the specimen is struck off level with the specimen frame. When the specimen has set sufficiently to prevent displacement , the mold is removed . The specimen is dried for a minimum of 12 hours to constant weight in a ~~140°(60°C)~~ 60°C(140°F) ± 3°C(5°F) oven. The specimen is removed from the oven and cooled to room temperature.

4.0 Adjustment and Weight of the Loaded Wheel Tester

4.1 The travel path of the wheel on the specimen shall be 12" ± 0.5". ~~The connecting arm bearings and caster assembly are adjusted and secured so that the projected horizontal~~

~~distance between the crank and wheel axles is 24 inches (609.6 mm).~~ The wheel assembly must be aligned so the wheel runs true and parallel with the ~~frame~~ specimen.

~~7.0 Report~~

4.2 ~~The tack is reported as_____cycles of_____pound load at~~The weight box is centered and secured directly over the ~~_____°F(°C).~~ wheel axle.

4.3 The wheel is placed on a platform scale so that the connecting arms are parallel with the frame. ~~The lead weights are added to the weight box until the desired weight is obtained~~. The total load should be adjusted using the weights described in 2.1.j until the weight measured by the load cell or platform scale is 125 ± 1 lb.

5.0 Mounting the Specimen

5.1 The specimen is then placed on the mounting plate firmly against the locating pins and clamped in position with the clamp washer and wing nuts provided.

6.0 Procedure

6.1 Temperature is maintained at ~~77°F±2° (25°C±1.1°)~~ 72 ± 5°F (22 ± 3°C) ~~or as~~ unless otherwise specified or noted.

6.2 The wheel is inspected and thoroughly cleaned. ~~with evaporative solvent and water~~ **Note:** In time, solvents may saturate the rubber tire and give false tach tack point and sand adhesion values. A fine disc sander mounted onto a 1/4"(6.4 mm) or 3/8"(9.5 mm) drill is recommended to clean the rubber tire. ~~(see note 6.2)~~. The wheel is then placed on the specimen. ~~and the weight box is loaded to the desired weight (see note).~~

6.3 The counter is returned to zero and compaction is started with the electrical switch. The cycles per minute should be 44 at the stated drive ratios. (Caution: Care should be taken to guard the ~~machined~~ machine against ~~personal~~ contact with the moving parts. Careless, unguarded operation can result in serious injury.)

6.4 At some point during the compaction, an audible tackiness and visible shine may be noted. At this point, ~~sufficient~~ sufficient water to prevent adhesion of the specimen to the wheel must be added from the wash bottle. (With certain aggregates, it may become necessary to liberally flush the wheel path with water to prevent abraded fines from impacting the specimen.) Notation of the ~~revolutions~~ cycles required to reach the tack point is made.

6.5 After 1000 cycles, ~~or as otherwise specified~~, the machine is stopped, unloaded, and ~~then specimen washed of~~ loose particles are removed from the specimen. If water is used in 6.4, the specimen must be ~~and~~ dried at ~~140°F(60°C)~~ 60°C(140°F) ± 3°C(5°F) to constant weight.

6.6 The ~~dried~~ weight of the specimen is noted recorded. ~~and the specimen~~ It is mounted ~~on the mounting plate~~ in its original position. The sand frame is centered, ~~over on the specimen and~~ with the foam rubber against the specimen, and secured to prevent loss of sand.

6.7 Weigh 200 grams of sand. Heat the sand to 180°± 2 F (82.2°C). Uniformly spread it in the frame and cover with the metal strip. Sand application must be completed within two minutes. Operate the machine ~~the compaction wheel then rides on the metal strip~~ for 100 cycles. ~~Better reproducibility and less mess is experienced by this method. When the metal strip is used, vacuum is unnecessary. The specimen assembly may be~~

NOTE: Another option is to weigh 300 grams of sand, heated and applied in the same manner as in 6.7 but without the use of the metal strip. ~~All loose sand is removed with the vacuum cleaner and the specimen is removed and weighed. The increase in weight due to sand adhesion is noted.~~

6.8 Remove the assembly as a unit. Disassemble over a waste container and gently tap the specimen to remove the ~~unadhered~~ loose sand.

6.9 Record the final weight of the specimen with adhered sand.

7.0 Calculation

7.1 Subtract original specimen weight (see 6.6) from the final weight of the specimen with adhered sand (see 6.9) to achieve grams of adhered sand.

7.2 Divide grams of adhered sand by the area of the metal strip in ft^2 (m^2) to achieve g/ft^2 (g/m^2).

NOTE: When using the 300 grams of sand option, replace the area of the metal strip with the area of the wheel's travel path.

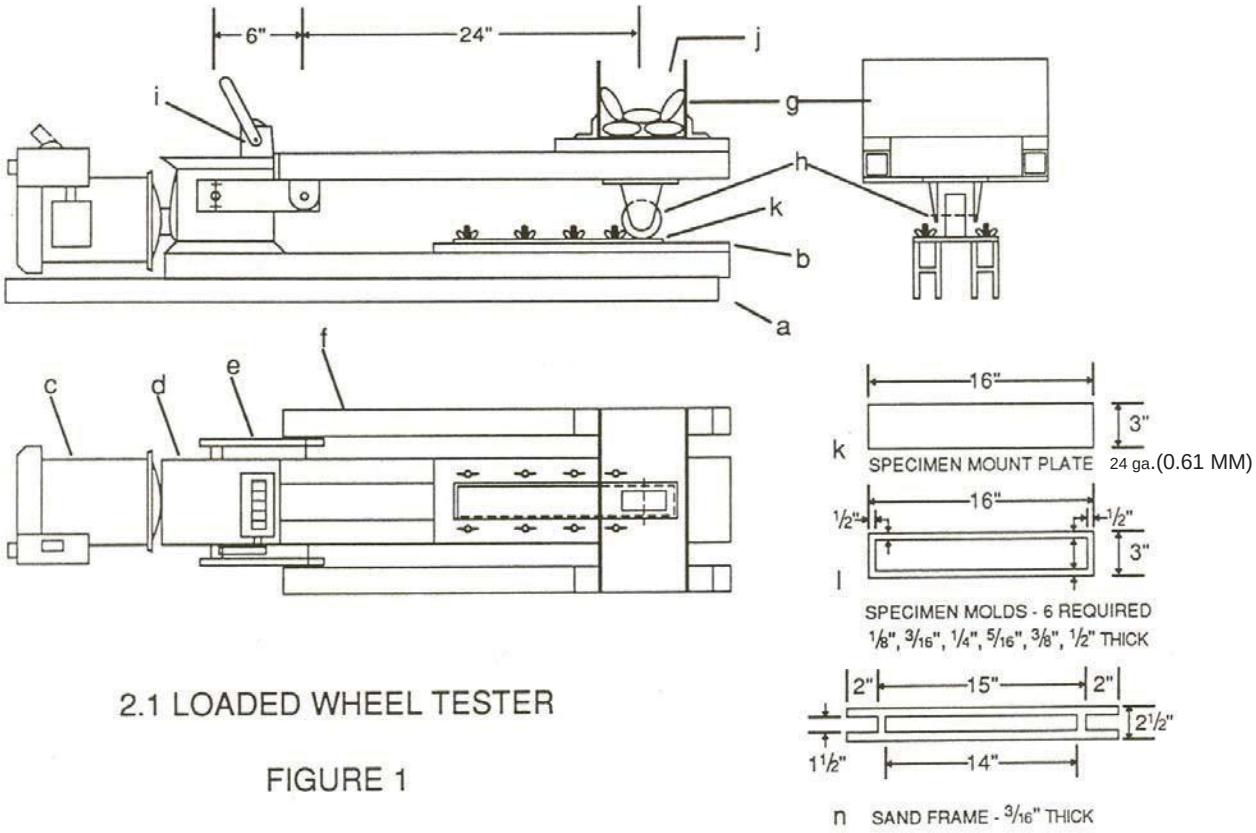
8.0 Report

8.1 Report sand adhered per square foot (square meter).

8.2 The tack is reported as _____cycles of ____pound load at ____°F (°C).

~~180°± 2 F (82.2°C) is uniformly spread in the sand mold. Sand application must be completed within two minutes. The wheel is immediately loaded on the specimen and 100 cycles is completed.* (see Note 6.)~~
~~It is convenient to use 200 grams, preweighed and preheated in a suitable container (e.g., 200 ml beaker). The 200 grams of hot sand is uniformly spread in the sand frame and covered. The compaction wheel then rides on the metal strip. Better reproducibility and less mess is experienced by this method. When the metal strip is used, vacuum is unnecessary. The specimen assembly may be removed as a unit, disassembled over a waste container and gently tapped to remove the unadhered loose sand.~~
~~7.2 Sand adhesion is reported as_____grams adhered after cycles of_____pound load @ _°F(°C).~~

~~**Notes:**~~
~~6.2 In time, solvents may saturate the rubber tire and give false tach tack point and sand adhesion values. A fine disc sander mounted onto a 1/4"(6.4 mm) or 3/8"(9.5 mm) drill is recommended to clean the rubber tire.~~



2.1 LOADED WHEEL TESTER

FIGURE 1

1/8”	3/16”	1/4”	5/16”	3/8”	1/2”	1-1/2”	2”	2-1/2”	3”	6”	14”	15”	16”
3.18 mm	4.76 mm	6.4 mm	7.94 mm	9.53 mm	12.7 mm	38.1 mm	50.8 mm	63.5 mm	76.2 mm	15.24 cm	35.56 cm	38.1 cm	40.64 cm

Conversion Table

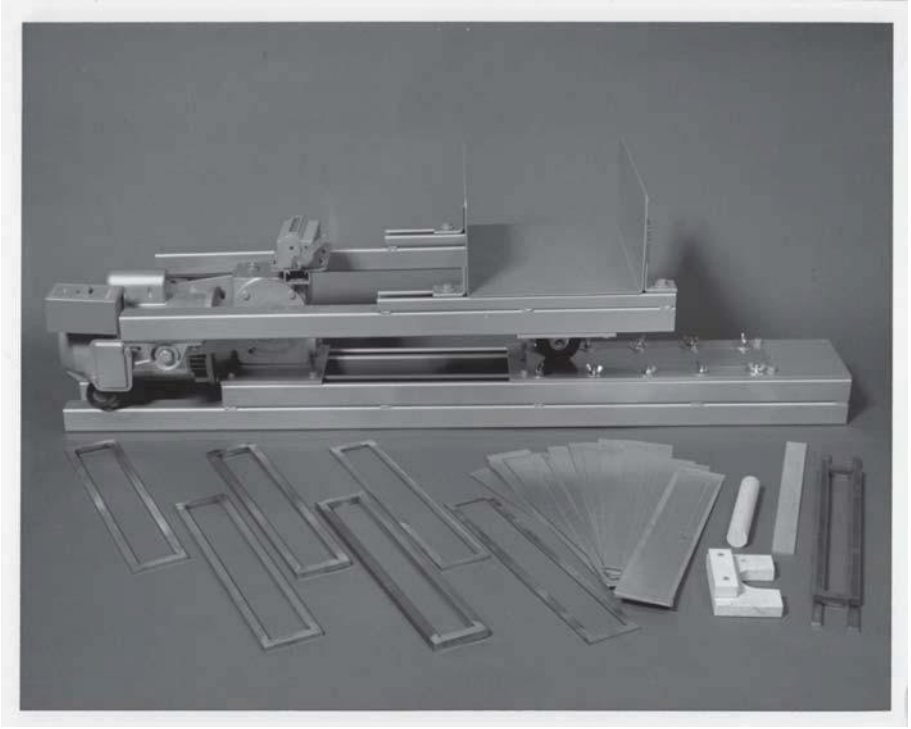


FIGURE 2