INTERNATIONAL SLURRY SURFACING ASSOCIATION

TECHNICAL BULLETIN

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

No. 139

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Test Method to Determine Set and Cure Development of Slurry Surfacing Systems by Cohesion Tester

1. Scope

1.1 This test method is used to determine initial set and cure development of slurry surfacing systems as a function of torque over time. The Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal and Micro Surfacing, ISSA A105 and A143, provide specific target values for cohesion results at 30 and 60 minutes.

2. Referenced Documents

2.1 ISSA Technical Bulletins:
A105 Recommended Performance Guideline for Emulsified Asphalt Slurry Seal
A143 Recommended Performance Guideline for Micro Surfacing
TB No. 113 Test Method for Determining Mix Time for Slurry Seal and Micro Surfacing Systems

2.2 ASTM Standards:
D 3910 Standard Practices for Design, Testing, and Construction of Slurry Seal
E 11 Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.3 Other Documents:
Benedict, C.R. "Classification of Asphalt Emulsion Aggregate Systems by Cohesion Tester for Measurement of Set and Cure Characteristics," 21st ISSA Convention, Phoenix, AZ, 1983.
"Uses of the Modified Cohesion Test for Emulsion Formulation and Mix Design of Performance Cold Mix Systems," 12th AEMA Convention, New Orleans, LA, 1985.
"Experiments with Cured Cohesion Testing of Slurry Seals and Thin Layered Cold Mixes," 24th ISSA Convention, San Francisco, CA, 1986.

3. Significance

3.1 This test quantifies the time required before a slurry surfacing system may be subjected to straight rolling traffic.

4. Summary of Method

4.1 Slurry surfacing mixture is prepared and cast into appropriate molds. After the sample is firm enough to resist flow, the mold is removed.

4.2 Torque values are recorded at specific intervals to determine cure development.

5. Apparatus

5.1 Cohesion Tester, as follows:

a. Double rod end air cylinder, 1-1/8" (27-30 mm) diameter with 5/16" (8 mm) diameter rods and 3" (76 mm) stroke.
b. 1/4" (6.0-6.6) x 1-1/8" (27-30 mm) diameter, 50-70 durometer neoprene rubber foot.
c. Air pressure regulator with a variable down stream bleed valve so that constant pressure is maintained.
d. Four-way directional control valve with exhaust port regulating valves.
e. Air pressure gauge with a 0-100 psig (0-700 kPa) range.
f. 100 psig (700 kPa) air supply.
g. Torque meter capable of measuring and marking at least 35 kg-cm torque.

5.2 Suitable number of ring molds with a depth of 5.7-6.3 mm x 65-75 mm inside diameter and 9.5-10.5 mm x 65-75 mm inside diameter.

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5.3 15 lb (6.8 kg) saturated roofing felt sized to fit the cohesion ring molds and fit in the tester.
5.4 4.75 mm (No. 4) and 8.00 mm (5/16") standard ASTM E11 sieves.
5.5 Mixing containers, such as suitably sized, smooth surface, non-absorbent drink cups or bowls.
5.6 Mixing utensil, such as a spatula suitably sized for the mixing container, for preparing the mix.
5.7 Spatula, for cleaning the neoprene rubber foot.
5.8 Sieve, No. 20 (850 µm).
5.9 Balance, capable of weighing 500 grams to within 0.1 gram.
5.10 220 grit sandpaper.
5.11 Timer, suitable for measuring to the nearest second.

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 No. 20 (850 µm) sieve.
6.3 Water should be potable.
6.4. Mineral fillers and other liquid and/or solid additives shall be representative of the material to be used on the project. If required, the type and concentration of liquid additives should be recorded.

7. Calibration

7.1 (A calibration development method is currently underway by the ISSA Technical Committee)

8. Procedure

8.1 Screen the aggregate through the appropriate sieve and discard the retained portion. For Type II gradations use the 4.75 mm (No. 4) and for Type III gradations use the 8.00 mm (5/16") sieve.
8.2 Center the appropriate ring mold on a roofing felt square. The 6 mm ring molds are used for Type II gradations and 10 mm ring molds for Type III gradations. Cast a suitable number of identical samples for the number of tests required. Torque measurements are made at 15 or 30 minute intervals after casting. Each sample is tested once.
8.3 Prepare a suitably sized mix as outlined in ISSA TB No. 113, and mix for 30 seconds.
8.4 While tilting the mix container, use the spatula blade to direct and slightly overfill the ring mold with the mix.
8.5 Immediately after each mold is filled, using the spatula blade tilted at approximately 45° and with a continuous sawing motion, screed the sample level with the top of the mold to provide a flat surface. Sample preparation of all ring molds should be completed within 75 seconds from the time the mixing was initiated.
8.6 When the samples are firm enough to resist flow, remove the ring mold. The ring mold must be removed before the sample is tested.
8.7 Prepare the instrument for testing by setting the air pressure to 200 kPa. Ensure the neoprene foot has been prepared for testing (See Appendix 1).
8.8 The torque meter is "zeroed" and placed on top of the rod end. The sample is centered under the prepared neoprene foot and the sample substrate held with one hand. The foot is lowered to the sample at a rate of 8 to 10 cm per second. After 5 to 6 seconds of contact with the sample, rotate the torque meter with the opposite hand. Use a continuous, horizontal motion without downward pressure to rotate the torque meter through a 90 to 120° arc within 0.5 to 0.7 seconds.
8.9 Note the torque reading and mode of rupture (See Appendix 2).
8.10 Raise the foot and clean by scraping with a spatula.

9. Report

9.1 The torque reading is recorded along with the mode of rupture and time interval.

10. Set Time and Traffic Time Defined

10.1 Set time is the point at which the slurry system reaches a minimum of 12 kg-cm torque.
10.2 Straight rolling traffic time occurs at a minimum torque of 20 kg-cm, or near spin mode of rupture.
10.3 A quick-set system reaches a minimum of 12 kg-cm torque within 30 minutes.
10.4 A quick-traffic system reaches a minimum of 20 kg-cm torque within 60 minutes.

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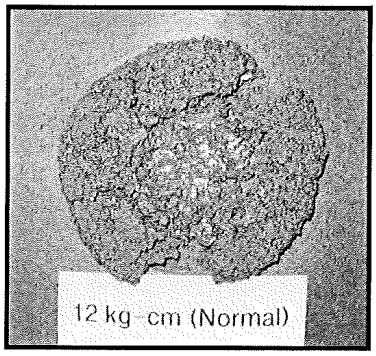
Appendix 1: Initial Neoprene Foot Preparation

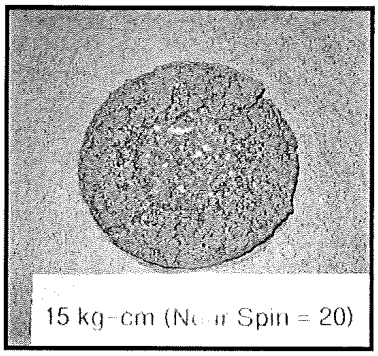
The neoprene foot requires replacement periodically due to wear. The rate of wear depends on the materials being tested and frequency of use. A new foot requires preparation. A series of tests shall be made with the 220 grit sandpaper until the torque values are consistent.

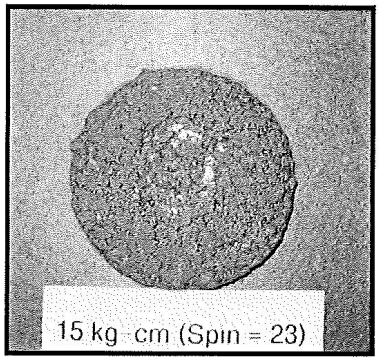
Appendix 2: Modes of Rupture

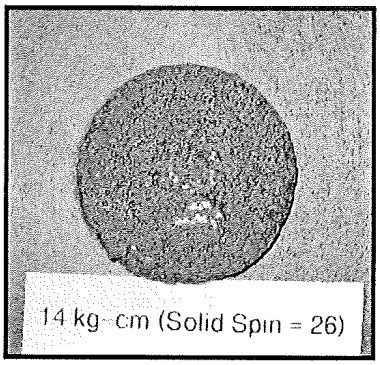
On occasion, maximum torque values below 20 kg-cm are reached due to the curing characteristics of the system. Once the maximum is reached, the foot may generate less friction with the surface of the specimen. When this happens, the value assigned the test specimen may be determined visually according to the modes of rupture described below in lieu of the measured torque value.

N = Normal. Below 12 kg-cm, multiple radial cracks are apparent.
NS = Near Spin. Only one radial crack appears. The equivalent cohesion value is ~ 20 kg-cm.
S = Spin. No cracks appear but aggregate is dislodged directly beneath the foot and "roll" under the foot. The equivalent cohesion value is ~ 23 kg-cm.
SS = Solid Spin. There are no cracks or dislodged aggregate. The foot skids, or slides, over the surface. Some asphalt film may be removed. The equivalent cohesion value is ~ 26 kg-cm.









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