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SAE J1846 JUN89

Characterizing a Test Surface for Motorcycle Side Stand Retraction Performance Testing

SAE Recommended Practice
Issued June 1989

Submitted for Recognition as an American National Standard

SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
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SPECIALIZED VEHICLE PRACTICE

SAE J1846

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CHARACTERIZING A TEST SURFACE FOR MOTORCYCLE SIDE STAND RETRACTION PERFORMANCE TESTING

1. SCOPE:

This recommended practice is intended for use only in characterizing test surfaces used in motorcycle side stand retraction testing (SAE J1578). The equipment and procedure described in this recommended practice yields repeatable results in characterizing test surfaces in a way found to be related to retraction performance. The test results obtained with this procedure do not necessarily correlate with measurements obtained with other friction measurement procedures which have been developed for other purposes.

2. INTRODUCTION:

The retraction performance of a side stand/motorcycle combination is related to the frictional characteristics of the test surface. For this reason, it is important to have a standardized and repeatable method of characterizing test surfaces used for motorcycle side stand retraction performance testing. This recommended practice describes a durable, economical, and repeatable method to characterize frictional distinctions of pavement surfaces.

3. PURPOSE:

The purpose of this recommended practice is to establish a uniform method of characterizing the frictional characteristics of pavement test surfaces used in motorcycle side stand retraction performance testing.

4. APPARATUS:

4.1 Carpet Sled: The apparatus shall consist of a "carpet sled", which is a piece of 15 x 15 cm (approximately 6.0 x 6.0 in) plywood approximately 1.9 cm (3/4 in) thick. Covering one 15 x 15 cm face shall be a 15 x 15 cm piece of carpet meeting the requirements of 4.4. The backing of the carpet shall be affixed to the plywood with strong adhesive. Screwed into the middle of each edge of plywood shall be a small eye in which a piece of chain approximately 30 cm (12 in) long can be hooked onto. The opposite end of the chain shall be attached to a force measurement device such as a spring scale.

4.2 Force Measurement Device: A force measurement device such as a spring scale or equivalent device shall be used. The device shall be configured so as not to contact the test surface when it is used to pull the sled according to section 6. The device shall indicate force with a minimum precision of 1.0 N (0.25 lbf).

4.3 Carpet Sled Weight: The sled shall be weighted with a sack containing sand, leadshot, or similar "shape conforming" material. The total weight of the loaded sack, sled, and chain shall be 45 N ± 1.0 (10.0 lbf ± 0.25) when weighed with the same force measurement device which is used for the pull test.

4.4 Carpet Specifications:

* Stitch count -- 8.5 stitches per inch
* Pile height -- 0.250 in average pile thickness
* Surface texture -- textured level loop
* Face yarn -- continuous filament Antron nylon
  Primary backing material -- polypropylene
  Secondary backing material -- jute
  Machine gage -- 5/32 in
  Yarn density -- 30 oz yarn/in^2

The specifications describe a commercially available, industrial grade of indoor carpeting. If possible, carpet that matches the listed specifications exactly should be used. In the event that substitution becomes necessary, the parameters which are most significant for carpet sled performance, are identified with an asterisk (*). The carpet that matches the most significant parameters shall be used.

5. PREPARATION:

A one-time break-in is needed for new sleds. Do this by pulling the weighted sled for approximately 60 cm (2 ft) three times from each hook on a pavement with a Carpet Sled Ratio (CSR) of 0.70 to 1.00 (see section 6).

6. PROCEDURE:

6.1 Calibration: The force measurement device shall be calibrated by using it to support reference masses weighing approximately 20 and 40 N (5 and 10 lbf). The force measurement device shall indicate the actual weight of the masses within ±1.0 N (±0.25 lbf) for each of the two masses. This calibration procedure shall be performed three times to ensure repeatability.

6.2 Temperature Limits: The ambient temperature during the measurements of 6.4 shall be between 0 and 30°C (32 and 86°F).

6.3 Surface Specimen: An individual specimen of the test surface shall be a circular area 100 cm (approximately 39 in) in diameter. Clear any loose debris from the surface specimen, i.e., sand, gravel, or dirt. The surface specimen shall be dry and level.

6.4 Measurements:

6.4.1 Place the weighted carpet sled on the surface specimen with the carpet fully contacting the test surface. The carpet shall be dry.

6.4.2 Keeping the connecting chain parallel to the test surface, pull the carpet sled across the test surface in the direction of travel of the motorcycle with the force measurement device.

6.4.2.1 The carpet sled shall be pulled for a distance of not less than 30 cm (12 in) and not more than 50 cm (20 in) across the test surface, remaining within the test specimen area.

6.4.2.2 The carpet sled shall be pulled at a steady speed sufficient to provide smooth movement, without intermittent stopping or jerking and at a speed not more than 5.0 cm/s (2.0 in/s).

6.4.3 After 5 cm (2 in) of travel, the force required to pull the sled over the remainder of the test distance shall be observed and recorded to the nearest 1.0 N (0.25 lbf). The initial 5 cm (2 in) of the test distance is ignored to eliminate acceleration of the sled from rest as a factor in the force measurements.

6.4.4 The steps of 6.4.1 through 6.4.3 shall be repeated five times from each of the carpet sled's four sides. The first two measurements for each side are discarded and the last three measurements for each side are recorded making a total of twelve recorded pull measurements for each surface specimen.

6.4.5 Carpet Sled Ratio: The Carpet Sled Ratio for the test surface specimen is defined as the sum of the twelve recorded carpet sled pull force measurements divided by twelve times the measured pull sled weight:

$$\text{Carpet Sled Ratio} = \frac{\text{Sum of 12 Individual Measurements}}{\text{Sled Weight} \times 12}$$

7. REFERENCES:

7.1 SAE J1578 JUN89, Motorcycle Side Stand Retraction Test Procedure.

RATIONALE:

The retraction performance of a side stand/motorcycle combination is related to the frictional characteristics of the test surface. For this reason, it is important to have a standardized method of characterizing test surfaces used for motorcycle side stand retraction performance testing.

The Side Stand Retraction Task Force examined existing surface frictional measurement techniques to determine if any might be appropriate for determining the test surface characteristics that affect motorcycle side stand retraction performance. Among the tests examined were:

-- American Society for Testing and Materials skid number test -- ASTM E 274-79, Skid Resistance of Paved Surfaces Using a Full-Scale Tire

-- American Society for Testing and Materials tire pendulum test -- ASTM E 303-83, Measuring Surface Frictional Properties Using the British Pendulum Tester

-- metal tip friction coefficient test

-- American Society for Testing and Materials sand patch test -- ASTM E 965-83, Measuring Surface Macrotexture Depth Using a Sand Volumetric Technique

During the early development of SAE J1846, the task force thought it would be necessary to use a separate frictional measure and a macrotexture measure to distinguish the test surface characteristics that affect motorcycle side stand retraction performance. Frictional measures such as the ASTM skid number test or the tire pendulum test required costly or unwieldy equipment. The task force wanted to avoid such specialized equipment if it would be possible to characterize important surface characteristics through other methods.

As a result, the Carpet Sled Ratio (CSR) test was developed. The CSR test has proven useful in providing an indication of both the frictional and macrotexture characteristics of a test surface. Specifically, the task force determined that test surfaces with a CSR of 0.50 to 0.55 had frictional and macrotexture characteristics, which provided a challenging test surface for side stand retraction performance.

Following the development of the CSR test, some task force members felt that a test which attempted to more closely replicate a side stand foot contacting a pavement surface should be used. Some work was done to develop a test device consisting of a metal tip approximately 2 cm (3/4 in) in diameter, weighted to create a downward force of approximately 45 N (10 lbf), contacting the test surface. This test may hold promise for the future, but the task force elected to concentrate test development efforts on the CSR test rather than delay SAE J1578 by developing two surface friction test methods.

Advantages of the Carpet Sled Test

A major advantage of the carpet sled test over other test methods is its ability to characterize test surfaces reliably and with easily available equipment. As used by the task force members, a common fish weighing scale proved adequate for force measurements. Carpet sleds are not commercially available, but the materials to make a sled are readily available.

The carpet used to make the carpet sleds used by the task force was an industrial grade indoor carpet manufactured by Holitex, 300 N. Baldwin Park Blvd., City of Industry, CA, and distributed under the commercial description of Portheon 527-156 Attica Grey carpet. Sample 15 x 15 cm pieces of the reference carpet may be obtained by contacting Leo Lake at Yamaha Motor Corporation, U.S.A., 6555 Katella Avenue, Cypress, CA 90630, telephone (714) 761-7345.

The durability of the carpet sled has been found to be quite good.

Disadvantages of the Carpet Sled Test

The major disadvantage of the carpet sled test is its sensitivity to carpet specifications. Although a sufficient supply of carpet exists to make a large number of additional carpet sleds, some users may choose to use a different carpet for their carpet sled. As specified in the recommended practice, CSR results are most sensitive to stitch count, pile height, carpet surface texture, and face yarn type. A higher carpet pile height yields a higher CSR. A lower stitch count yields a higher CSR.

When tested with a variety of carpet types, the CSR of a given surface was found to vary by -4% to +21% for all the carpet samples, and by -4% to +21% for carpets closest to meeting the essential specifications outlined above.

Because side stand retraction is affected by test surface characteristics, because test surface characterization by the carpet sled test is affected by the carpet on the carpet sled, and because an ample supply of the reference carpet is available from a single source, the task force recommends using the reference carpet except in the most unusual circumstances.

Another minor disadvantage of the carpet sled test is its tendency to evoke a humorous response in reviewers or users in their first introduction to the test method. Experienced users, however, appreciate the simple elegance of the test's ability to provide useful and usable data.

Comment on Specific Sections

4.1 and 4.3 Carpet Sled and Carpet Sled Weight: A 15 x 15 cm size, and 45 N test weight were chosen because these closely match the 6 x 6 in, 10 lbf size and weight of the sleds used during development of the CSR test. The size and weight of the equipment makes it handy to carry around during testing.

4.4 Carpet Specifications: This was discussed above.

6.2 Temperature Limits: Some task force members noted the CSR results for a test surface may depend on the temperature of the carpet sled. For this reason, an ambient temperature limit of 0 to 30°C (32 to 86°F) was specified. CSR values tend to increase with decreasing temperature, perhaps because of increasing stiffness of the carpet fibers.

6.4.2.2 Pull Speed: A slow and steady pull speed was shown to yield the most consistent force measurement results. For this reason, a maximum speed is specified. Some task force members obtained good results with a crank device which yielded steady and slow pull speeds.

6.4.4 Number of Test Pulls per Side: Some testers found that the force readings for the first two pulls on a side of the carpet sled were higher than subsequent readings. For this reason, five pulls per side are required, with the first two readings per side being discarded.

6.4.5 Carpet Sled Ratio (CSR): The CSR is defined as the sum of the 12 recorded pull force measurements divided by 12 times the carpet sled weight. This ratio is called the CSR, and NOT the coefficient of friction, because the task force wanted to specify clearly that the results were derived from the SAE 1846 test and are to be used only for SAE J1578 testing.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

Not applicable.

APPLICATION:

This recommended practice is intended for use only in characterizing test surfaces used in motorcycle side stand retraction testing (SAE J1578 JUN89, Motorcycle Side Stand Retraction Test Procedure). The equipment and procedure described in this recommended practice yields repeatable results in characterizing test surfaces in a way found to be related to retraction performance. The test results obtained with this procedure do not necessarily correlate with measurements obtained with other friction measurement procedures.

REFERENCE SECTION:

SAE J1578 JUN89, Motorcycle Side Stand Retraction Test Procedure