

	SURFACE VEHICLE RECOMMENDED PRACTICE	
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Measurement of Vehicle-Roadway Frictional Drag		

RATIONALE

This document has been revised with editorial changes suggested during a review by the Accident Investigation and reconstruction practices committee

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1. SCOPE

This SAE Recommended Practice provides guidelines for procedures and practices used to obtain and record measurements and to analyze and present results of frictional drag tests of a vehicle with its brakes fully applied at a given roadway location. It is for use at accident sites and test sites and is applicable to straight-line stopping of vehicles such as passenger cars, light trucks and vans under fully braked conditions including locked-wheel skids for vehicles with a conventional braking system and for vehicles with full or partial antilock braking systems (ABS). The average deceleration resulting from a given series of tests is intended to be representative of a frictional drag factor for the conditions under which the test was conducted such as the type of vehicle, type and condition of tires, roadway material and roadway surface conditions. The frictional drag factor is intended to conform to use with the stopping distance formula (Fricke, 1990) as stated in Equation 1. Two methods are included: Stopping Distance Method (measurement of the distance required to bring a vehicle to a complete stop from a known initial speed) and Average Acceleration Measurement (using acceleration measuring devices and data analysis to determine the average drag factor). The Recommended Practice applies to vehicles stopping in a fully braked condition. Values of roadway frictional drag obtained by other means do not necessarily agree or correlate (Lock, et al., 1982) with full vehicle testing and are not recommended.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this recommended practice to the extent specified herein. Unless otherwise specified, the latest version of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J670 Vehicle Dynamics Terminology

2.1.2 NIST Publication

Available from National Institute of Standards and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070, Tel: 301-975-6478, www.nist.gov.

Taylor, B. N., Guide for the Use of the International System of Units (SI), NIST SP 811, 1995

2.2 Related Publications

The following publications are for information purposes only and are not a required part of this document.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J2909 Light Vehicle Dry Stopping Distance

SAE J299 SEP93 Stopping Distance Test Procedure

TSB 003 Rules for SAE Use of SI (Metric) Units

SAE Paper 940722 Uncertainty in Accident Reconstruction Calculations, Brach, R. M., 1994

SAE Paper 940918 Analysis of Accelerometer Data for Use in Skid-Stop Calculations, Robinson, E. L., 1994

2.2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 274-93 Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire

ASTM E 445/E 445M-88 Test Method for Stopping Distance on Paved Surfaces Using a Passenger Vehicle Equipped with Full-Scale Tires

ASTM E 456-96 Standard Terminology for Relating to Quality and Statistics

ASTM E 503/E 503M-88 (1994) Test Methods for Measurement of Skid Resistance on Paved Surfaces Using a Passenger Vehicle Diagonal Braking System

ASTM F 403-86 (Reapproved 1993) Test Method for Tires for Wet Traction in Straight-Ahead Braking, Using Highway Vehicles

ASTM F 811-95 Practice for Accelerometer Use in Vehicles for Tire Testing

2.2.3 NIST Publication

Available from National Institute of Standards and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070, Tel: 301-975-6478, www.nist.gov.

Taylor, B. N. and C. E. Kuyatt, Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results, NIST Technical Note 1297, US Dept of Commerce, 1994

2.2.4 Other Publications

Fricke, Lynn B., Traffic Accident Reconstruction, Vol 2, Traffic Accident Investigation Manual, Northwestern University Traffic Institute, 1990

Lock, J. R., D. L. Ivey, A. S. Jones, K. E. Barnes, O. J. Pendelton and T. Chira-Chavala, Pavement Condition Measurement for Safety Improvements, Vol 1, "Development of Procedures", Final Report, Texas Transportation Institute, College Station, TX, 1982

3. DEFINITIONS

The following terms and acronyms are defined for use herein.

3.1 ABS

Antilock Braking System

3.2 Braking Distance, d

The straight line distance on a flat surface taken to bring a vehicle to rest by rapid full application of the braking system.

3.3 Fifth Wheel

An instrumented wheel device attached to a vehicle that provides kinematic data in the heading direction of the vehicle.

3.4 Frictional Drag

The total retarding force on a moving vehicle between its tires and the roadway surface, exerted as a result of brake application.

3.5 Frictional Drag Coefficient (Coefficient of Friction)

The ratio of the frictional drag force to the vehicle's weight at a given speed, position or instant of time.

3.6 Frictional Drag Factor, f

The frictional drag coefficient averaged over a fully braked stop as calculated using the stopping-distance formula (see Equation 1).

3.7 Full Brake Application

The production of sufficient brake pedal force to cause wheels with conventional brakes to lock and/or for continual operation of an ABS system.