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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Test Method for Measurement of Vehicular Response to Traveled Surface Roughness¹

This standard is issued under the fixed designation E 1082; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of vehicular response to traveled surface roughness.

1.2 This test method utilizes an apparatus that measures the relative motion of a sprung mass system in response to traveled surface roughness where the mass is supported by automotive type suspension and tires.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 6.

2. Referenced Documents

2.1 ASTM Standards:

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods²

E 178 Practice for Dealing with Outlying Observations²

E 867 Terminology Relating to Traveled Surface Characteristics³

E 1136 Specification for a Radial Standard Reference Test Tire³

3. Summary of Test Method

3.1 Vehicular response to traveled surface roughness is calculated from an accumulated displacement measurement divided by the test section length. A vehicle is brought to the desired test speed and lateral position in the lane to be tested. The test apparatus is placed in operation and a constant speed is maintained throughout the test. Pertinent information affecting test results must be noted.

4. Significance and Use

4.1 This test method provides a means of evaluating traveled surface roughness. The measured values represent vehicular response to traveled surface roughness obtained with the

equipment and procedures stated herein and do not necessarily agree or correlate directly with those obtained by other methods.⁴

5. Apparatus

5.1 *Test Apparatus*, consisting of an axle to frame the displacement measuring sensor, a displacement accumulator, a distance measuring system and a recording system mounted in a vehicle that is either a suitable passenger automobile with four wheels or a suitable single axle, towheel trailer towed by a vehicle.

5.2 *Test Automobile*—The vehicle used to house the displacement measurement sensor. It shall be equipped as follows:

5.2.1 Engine in front,

5.2.2 Rigid rear axle,

5.2.3 Rear springs (coil, single leaf, gas),

5.2.4 Rear sway bar,

5.2.5 Heavy duty shock absorbers,

5.2.6 Tires dynamically balanced (GM-TPC⁵ or Specification E 1136),

5.2.7 Cruise control⁶, and

5.2.8 Air conditioning.⁶

5.3 *Test Trailer*—A two-wheel trailer shall be specifically designed and equipped to house the displacement measurement sensor, meeting the following requirements:

5.3.1 120 ± 1 in. (3048 ± 25 mm) from the center of the hitch to the center of the axle,

5.3.2 65 ± 5 in. (1651 ± 127 mm) from the center of the tire to the center of the tire,

5.3.3 Coil spring-shock-absorber suspension system,

5.3.4 Sway bar,

5.3.5 Tires dynamically balanced (GM-TPC⁵),

5.3.6 Weight and suspension system balanced to provide a response to the range of traveled surface roughness to be measured, and

5.3.7 Rigid axle.

5.4 *Instrumentation:*

¹ This test method is under the jurisdiction of ASTM Committee E-17 on Vehicle-Pavement Systems and is the direct responsibility of Subcommittee E17.31 on Methods for Measuring Profile and Roughness.

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ *Annual Book of ASTM Standards*, Vol 04.03.

⁴ Gillespie, T. D., Sayers, M. W., and Segel, L., "Calibration of Response-Type Road Roughness Measuring System," *National Cooperative Highway Research Program Report 228*, December 1980.

⁵ General Motors, "Tire Performance Criteria, Procedures and Specifications," *Engineering Publication A-4082*, General Motors Corp., Milford, MI, 1982.

⁶ These items are optional but are listed since they can substantially affect the ease with which the test is run.