



Standard Practices for Simulating Truck Response to Longitudinal Profiles of Vehicular Traveled Surfaces¹

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1. Scope

1.1 These practices cover the calculation of truck response to longitudinal profiles of traveled surface roughness.

1.2 These practices utilize computer stimulations to obtain two truck responses including: sprung and unsprung mass vertical displacement, velocity and acceleration, and sprung mass pitch angular displacement, velocity and acceleration.

1.3 These practices present standard truck simulations (quarter truck, half-single unit truck, and half-tractor semi-trailer) for use in the calculations.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E867 Terminology Relating to Vehicle-Pavement Systems

E950 Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

2.2 *ISO Standard:*³

2631 Guide for the Evaluation of Human Exposure to Whole-Body Vibration

3. Terminology

3.1 See Terminology E867.

¹ These practices are under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and are the direct responsibility of Subcommittee E17.33 on Methodology for Analyzing Pavement Roughness.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

4. Summary of Practice

4.1 These practices use a measured profile (see Test Method E950) or a synthesized profile as a part of a computer simulation to obtain truck response.

4.2 The first practice uses a standard truck simulation to obtain truck sprung mass vertical acceleration. The acceleration history can be computed as a function of time or distance. One application of this practice is to use the acceleration history in ride quality evaluation, such as the ISO Guide 2631. Another application is to use the sprung mass vertical displacement history as input to a suspended seat model in ride quality evaluation.

4.3 The second practice uses a truck simulation model to obtain tire/pavement vertical forces as a function of time or distance. One application of this practice is to use the tire/pavement history in pavement loading evaluation.⁴

4.4 For all calculations, a truck speed is selected and maintained throughout the calculation. Pertinent information affecting the results must be noted.

5. Significance and Use

5.1 These practices provide a means for evaluating truck ride quality and pavement loading exerted by truck tires.

6. Apparatus

6.1 *Computer*—The computer is used to calculate truck response to a traveled surface profile using a synthesized profile or a profile obtained in accordance with Test Method E950 as the input. It is recommended that a 16 or more-bit digital computer be used.

6.2 *Data-Storage Device*—A data storage device shall be provided for the reading of profiles and the recording and long-term storage of computed data. Profile data shall be scaled to maintain resolution of 0.025 mm (0.001 in.) and to accommodate the full range of amplitudes encountered during normal

⁴ Todd, K.B., and Kulakowski, B.T., "Simple Computer Models for Predicting Ride Quality and Pavement Loading for Heavy Trucks," *Transportation Research Record* 1215, 1989, pp. 137–150.