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Standard Terminology Relating to Vehicle-Pavement Systems¹

This standard is issued under the fixed designation E867; 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 terminology covers definitions for approved standards under the jurisdiction of ASTM Committee E17 on Vehicle-Pavement Systems. Definitions of terms specific to an individual standard are listed in the appendix. For additional information, see Terminology D8, Terminology F538, Special Report 113, and SAE J 2047, or contact ISO, PIARC, or CEN.

1.2 Other publications may reference this terminology for terms used therein.

1.3 The standard containing the term and the responsible subcommittee of Committee E17 is listed at the end of each definition. Revision of the listed standard by that subcommittee will include review of the definition and approved changes or additions will be incorporated herein.

1.4 The terms in this terminology standard are listed in categories of the five groups of Committee E17. These are definitions that are in multiple standards in various subcommittees in Groups II to V. The structure of E17 is as follows: Group II on Skid Resistance, E17.21, E17.22, E17.23, E17.24, Group III Roughness E17.31, E17.32, Group IV Pavement Management E17.41, and Group V Intelligent Transportation Systems E17.51, E17.52, E17.54.

1.5 This terminology lists the definition as presented in the approved standards. Variation of any term is also listed and referenced to the defined term (for example the term *hydroplaning*, *viscous* is also listed and referenced to the defined **viscous hydroplaning**).

1.6 The term and its elements should appear in the following order; term; abbreviation; symbol; dimensions of quantities, measurement units; part of a speech; delimiting phrase; statement of meaning, including specifications limits where applicable; cross references to synonyms or related terms; attribution.

1.7 *This international standard was developed in accordance with internationally recognized principles on standard-*

ization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

- D8 Terminology Relating to Materials for Roads and Pavements
- E274 Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire
- E556 Test Method for Calibrating a Wheel Force or Torque Transducer Using a Calibration Platform (User Level)
- E950 Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer-Established Inertial Profiling Reference
- E965 Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique
- E1166 Guide for Network Level Pavement Management
- E1170 Practices for Simulating Vehicular Response to Longitudinal Profiles of Traveled Surfaces
- E1215 Specification for Trailers Used for Measuring Vehicular Response to Road Roughness
- E1274 Test Method for Measuring Pavement Roughness Using a Profilograph
- E1318 Specification for Highway Weigh-In-Motion (WIM) Systems with User Requirements and Test Methods
- E1337 Test Method for Determining Longitudinal Peak Braking Coefficient (PBC) of Paved Surfaces Using Standard Reference Test Tire
- E1448 Practice for Calibration of Systems Used for Measuring Vehicular Response to Pavement Roughness
- E1489 Practice for Computing Ride Number of Roads from Longitudinal Profile Measurements Made by an Inertial Profile Measuring Device
- E1656 Guide for Classification of Automated Pavement Condition Survey Equipment
- E1703/E1703M Test Method for Measuring Rut-Depth of Pavement Surfaces Using a Straightedge

¹ This terminology is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.14 on Terminology.

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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.



- E1778 Terminology Relating to Pavement Distress
 E1845 Practice for Calculating Pavement Macrotexture Mean Profile Depth
 E1859 Test Method for Friction Coefficient Measurements Between Tire and Pavement Using a Variable Slip Technique
 E1889 Guide for Pavement Management Implementation
 E1926 Practice for Computing International Roughness Index of Roads from Longitudinal Profile Measurements
 E1927 Guide for Conducting Subjective Pavement Ride Quality Ratings
 F538 Terminology Relating to the Characteristics and Performance of Tires

2.2 *Transportation Research Board Standard:*

Special Report 113 Standard Nomenclature and Definitions for Pavement Components and Deficiencies³

2.3 *SAE Standard:*

SAE J2047 Tire Performance Terminology⁴

2.4 *NIST Handbook:*

National Institute of Standards and Technology (NIST) Handbook 44⁵

3. Definitions that are in Multiple Standards

index, *n*—(synonymous with “number in Committee E17 usage, for example; PSI, RN), a number or formula expressing some property, form, ratio, etc. of the relation or proportion of one amount or dimension to another.

(E867, E17.14)

DISCUSSION—“Numeric” and “metric” also have meanings which are synonymous with index. However, either number or index is the preferred term for use in Committee E17 standards.

pavement characteristic, *n*—a physical feature or property of a pavement surface such as type, roughness, texture, and skid resistance.

(E867, E17.14)

present serviceability, *n*—the current condition of a pavement (traveled surface) as perceived by the traveling public.

(E867, E17.14)

present serviceability rating (PSR), *n*—a mean rating of the serviceability of a pavement (traveled surface) established by a rating panel under controlled conditions. The accepted scale for highways is 0 to 5, with 5 being excellent.

(E867, E17.14)

traveled surface, *n*—any man-made, solid surface for vehicular travel, for example, highways, runways, rails, guideways.

(E867, E17.14)

weigh-in-motion, *n*—the process of estimating a moving vehicle’s gross weight and the portion of that weight that is carried by each wheel, axle, and axle group, or a combination thereof, by measurement and analysis of dynamic vehicle tire forces.

(E1318, E17.52)

4. Definitions of Technical Group on Skid Resistance

baselength, *n*—the length of a segment of a pavement macrotexture profile being analyzed required to be 100 mm.

(E1845, E17.23)

calibration platform—on a moving platform for applying a force in the contact plane of a tire, and associated means for measuring the applied force. The calibration platform consists of a rigid plate with a high friction surface, in contact with the tire footprint, supported on a frictionless, preferably air, bearing. It may also be instrumented to measure vertical forces (loads).

(E556, E17.21)

calibration reference signals—repeatable signals in the range of expected wheel-force transducer system loading. These signals could either be constant voltages or preferably produced by a strain-gage calibration shunt resistor.

(E556, E17.21)

chirp test, *n*—the progressive application of brake torque required to produce the maximum value of longitudinal braking force that will occur prior to wheel lockup, with subsequent brake release to prevent any wheel lockup (tire slide).

(E1337, E17.21)

crosstalk, *n*—the undesired effect of force readings appearing on an unloaded axis of a transducer while applying force to another.

(E556, E17.21)

dynamic hydroplaning, *n*—hydroplaning of pneumatic tires with separation caused by a thick fluid film due principally to the generation of fluid inertial forces.

(E867, E17.14)

estimated texture depth, (ETD), *n*—the estimate of mean texture depth (MTD), by means of a linear transformation of mean profile depth (MPD).

(E1845, E17.23)

horizontal traction (traction)—a force acting in a horizontal axis through the wheel transducer; that is, locked wheel drag force.

(E556, E17.21)

hydroplaning (aquaplaning) of pneumatic tires, *n*—a phenomenon that occurs when the load-bearing surface of a pneumatic tire is separated from a solid surface by a substance (usually a fluid and usually water).

(E867, E17.14)

hydroplaning, dynamic—see **dynamic hydroplaning**.

hydroplaning, rubber reversion—see **rubber reversion hydroplaning**.

hydroplaning, viscous—see **viscous hydroplaning**.

hydroplaning speed, *n*—the initial speed at which a pneumatic tire begins to full dynamic hydroplaning under a given set of conditions.

(E867, E17.14)

hysteresis—the maximum difference between corresponding transducer outputs (of the wheel force transducer system) at increasing and decreasing applied calibration force, expressed as a percentage of full load output. Proven outliers are excluded.

(E556, E17.21)

³ Available from Transportation Research Board, 500 Fifth Street, NW, Washington, DC, 20001.

⁴ Available from Society for Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

⁵ Available from National Institute of Standards and Technology, 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460.



mean profile depth (MPD), n —the average of all of the mean segment depths of all segments of the profile.

(E1845, E17.23)

mean segment depth, n —the average value of the profile depth of the two halves of a segment having a given baselength.

(E1845, E17.23)

mean texture depth (MTD), n —the mean depth of the pavement surface macrotexture determined by the volumetric technique of Test Method E965.

(E1845, E17.23)

nonlinearity—the maximum deviation of the transducer output(s) (of the wheel force transducer system) from the best-fit linear relation to the applied calibration force, expressed as a percentage of full scale. Proven outliers are excluded.

(E556, E17.21)

pavement macrotexture, n —the deviations of a pavement surface from a true planar surface with the characteristic dimensions of wavelength and amplitude from 0.5 mm (0.2 in.) up to those that no longer affect tire-pavement interaction.

(E965, E17.23)

pavement-micro texture (micro-rugosity), n —the deviations of a pavement surface from a true planar surface with characteristic dimensions of wavelength and amplitude less than 0.5 mm (0.2 in.).

(E867, E17.14)

profile depth, n —the difference between the amplitude measurements pavement macrotexture profile and a horizontal line through the top of the highest peak within a given baselength.

(E1845, E17.23)

rubber reversion hydroplaning, n —hydroplaning of pneumatic tires with separation caused by devulcanized rubber.

(E867, E17.14)

skid number (friction number), n —the number that is used to report the results of a pavement skid test conducted in accordance with Test Method E274.

(E867, E17.14)

skid number-percent normalized gradient, n —the speed gradient divided by the skid number, both at the same speed and multiplied by 100. The percent normalized gradient is usually designated by the symbol PNG_v , where v is the speed at which the percent normalized gradient is determined.

(E867, E17.14)

$$PNG_v = 100(G/SN)_v \quad (1)$$

skid number-speed gradient, n —the slope of skid number versus speed multiplied by -1 . The gradient is normally designated by the symbol G_v , where v is the speed at which the slope is determined, SN is the skid number, and V is the speed:

$$G_v = -(dSN/dV), \text{ that may be approximated by:} \quad (2)$$

$$-(SN_1 - SN_2)/(V_1 - V_2)$$

(E867, E17.14)

skid resistance (friction number), n —the ability of the traveled surface to prevent the loss of tire traction.

(E867, E17.14)

test wheel—a wheel and test tire assembly mounted to a test vehicle by means of a force or torque transducer.

(E556, E17.21)

texture shape factor, n —average of weighted sum of the ratios of amplitude to wavelength, as determined from an amplitude versus wavenumber (reciprocal of wavelength) spectrum.

(E867, E17.14)

tire-wet pavement interaction, zone concept, n —a division of the load-bearing surface of a moving pneumatic tire into three basic zones; noncontact, partial contact, and contact.

(E867, E17.14)

vertical load (load)—force acting in a vertical axis through the wheel transducer; that is, weight.

(E556, E17.21)

viscous hydroplaning, n —hydroplaning of pneumatic tires with separation caused by a thin fluid film due principally to the generation of fluid viscous forces.

(E867, E17.14)

water depth-nominal, n —the nominal thickness of the water layer, that is, the volume of water divided by the area of the wetted pavement surface.

(E867, E17.14)

water depth-positive, n —the distance from the water surface to the reference plane which is the top of the pavement asperities.

(E867, E17.14)

wheel force transducer system—a force-to-electrical signal converter system including transducer(s), associated signal condition, zeroing, amplifying, recording, and monitoring instrumentation.

(E556, E17.21)

5. Definitions of Technical Group on Roughness

aliasing, n —the spectrum of a digitized data record exists over the range of frequencies from zero to one half the sampling frequency. If the spectrum of the original signal extends beyond one half the sampling frequency, then those components of the signal at frequencies higher than one half the sampling frequency will, when digitized, be folded back into the spectrum of the digitized signal. The excessive high frequency components will thus be “aliased” into low frequency components.

(E950, E17.33)

anti-aliasing filter, n —a low-pass analog filter applied to the original analog profile signal to suppress those components of the signal at frequencies higher than one half the intended digital sampling frequency.

(E950, E17.33)

frequency domain filtering, n —a filtering operation performed by first calculating the spectrum of the profile record and then multiplying the spectral components by the frequency response transfer function of the filter.

(E950, E17.33)

half-car roughness index (HRI), n —an index resulting from a mathematical simulation of vehicular response to the longitudinal profile of a pavement using the half-car simulation model described in Practice E1170 and a travelling speed of 50 mph (80 km/h).

(E1448, E17.31)

DISCUSSION—Units are in inches per mile or metres per kilometre.