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Terminology Relating to Vehicle-Pavement Systems¹

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1. Scope

1.1 This terminology covers definitions for approved standards under the jurisdiction of ASTM Committee E-17 on Vehicle-Pavement Systems. Definitions of terms specific to an individual standard are listed in the appendix. For additional information, see Terminology D 8, Terminology F 538, Special Report 1132.2, and SAE J 2047.

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 E-17 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 are listed in categories of the five groups of Committee E-17. These are Administration, Skid Resistance, Roughness, Pavement Management, and Intelligent Vehicle/Highway Systems.

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**).

2. Referenced Documents

2.1 ASTM Standards:

D 8 Terminology Relating to Materials for Roads and Pavements²

E 556 Test Method for Calibrating a Wheel Force or Torque Transducer Using a Calibration Platform (User Level)²

E 950 Test Method for Measuring Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference²

E 965 Test Method for Measuring Pavement Macrot texture Depth Using a Volumetric Technique²

E 1166 Guide for Network Level Pavement Management²

E 1170 Practices for Simulating Vehicular Response to Longitudinal Profiles of a Vehicular Traveled Surface²

E 1215 Specification for Trailers Used for Measuring Ve-

hicular Response to Road Roughness²

E 1274 Test Method for Measuring Pavement Roughness Using a Profilograph²

E 1318 Specification for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Method²

E 1337 Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire²

E 1364 Test Method for Measuring Road Roughness by Static Level Method²

E 1442 Practice for Highway-Traffic Monitoring²

E 1448 Practice for Calibration of Systems Used for Measuring Vehicular Response to Pavement Roughness²

E 1489 Practice for Computing Ride Number of Roads from Longitudinal Profile Measurements Made by an Inertial Profile Measuring Device²

E 1500 Practice for Computing Mean Square Numerics from Road Surface Profile Records²

E 1572 Practice for Classifying Highway Vehicles from Known Axle Count and Spacing²

E 1656 Guide for Classification of Automated Pavement Condition Survey Equipment²

E 1703 Test Method for Measuring Rut-Depth of Pavement Surfaces Using a Straightedge²

E 1778 Terminology Relating to Pavement Distress²

E 1845 Practice for Calculating Pavement Macrot texture Mean Profile Depth²

E 1889 Guide for Pavement Management Implementation²

E 1926 Practice for Computing International Roughness Index from Longitudinal Profile Measurements²

E 1927 Guide for Conducting Subjective Pavement Ride Quality Ratings²

F 538 Terminology Relating to Characteristics and Performance of Tires³

2.2 *Transportation Research Board Standard: Special Report 113, Standard Nomenclature and Definitions for Pavement Components and Deficiencies*⁴

2.3 SAE Standard:

SAE J2047 Tire Performance Terminology⁵

¹ This terminology is under the jurisdiction of ASTM Committee E-17 on Vehicle-Pavement Systems and is the direct responsibility of Subcommittee E17.14 on Terminology.

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² *Annual Book of ASTM Standards*, Vol 04.03.

³ *Annual Book of ASTM Standards*, Vol 09.02.

⁴ Available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, DC, 20418.

⁵ Available from Society for Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

3. Definitions of Administrative Group

index, *n*—(synonymous with “number in Committee E-17 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.
(E 867, E 17.14)

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 E-17 standards.

pavement characteristic, *n*—a physical feature or property of a pavement surface such as type, roughness, texture, and skid resistance
(E 867, E 17.14)

present serviceability, *n*—the current condition of a pavement (traveled surface) as perceived by the traveling public.
(E 867, E 17.14)

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.
(E 867, E 17.14)

traveled surface, *n*—any man-made, solid surface for vehicular travel, for example, highways, runways, rails, guideways.
(E 867, E 17.14)

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.
(E 1845, E 17.23)

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).
(E 1337, E 17.21)

dynamic hydroplaning, *n*—hydroplaning of pneumatic tires with separation caused by a thick fluid film due principally to the generation of fluid inertial forces.
(E 867, E 17.14)

estimated texture depth, *n*—the estimate of mean texture depth, by means of a linear transformation of mean profile depth.
(E 1845, E 17.23)

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).
(E 867, E 17.14)

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.
(E 867, E 17.14)

mean profile depth (MPD), *n*—the average of all mean segment depths of all segments of the profile.
(E 1845, E 17.23)

mean segment depth, *n*—the average value of the profile depth of the two halves of a segment having a given baselength.
(E 1845, E 17.23)

mean texture depth (MTD), *n*—the mean depth of the

pavement macrotexture profile determined by the volumetric technique of Test Method E 965.
(E 1845, E 17.23)

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 up to those that no longer affect tire-pavement interaction.
(E 965, E 17.23)

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. It is suggested that the symbol *mitx* be used.
(E 867, E 17.14)

profile depth, *n*—the difference between the pavement macrotexture profile and a horizontal line through the top of the highest peak within a given baselength.
(E 1845, E 17.23)

rubber reversion hydroplaning, *n*—hydroplaning of pneumatic tires with separation caused by devulcanized rubber.
(E 867, E 17.14)

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 E 274.
(E 867, E 17.14)

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.
(E 867, E 17.14)

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

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:

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

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

(E 867, E 17.14)

skid resistance, *n*—the ability of the traveled surface to prevent the loss of tire traction.
(E 867, E 17.14)

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.
(E 867, E 17.14)

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.
(E 867, E 17.14)

viscous hydroplaning, *n*—hydroplaning of pneumatic tires with separation caused by a thin fluid film due principally to the generation of fluid viscous forces.
(E 867, E 17.14)

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.
(E 867, E 17.14)

water depth-positive, *n*—the distance from the water surface to the reference plane which is the top of the pavement asperities.
(E 867, E 17.14)

5. Definitions of Technical Group on Roughness

aliasing, *n*—the spectrum of a digitized data recording system.

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. (E 1500, E 17.33)

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. (E 1500, E 17.33)

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. (E 1500, E 17.33)

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 E 1170 and a measured speed of 50 mph (80 km/h). (E 1448, E 17.31)

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

international roughness index (IRI), *n*—an index computed from a longitudinal profile measurement using a quarter-car simulation at a simulation speed of 50 mph (80 km/h). (E 1448, E 17.31 and E 1926, E 17.33)

DISCUSSION—IRI is reported in either inches per mile (in./mile) or metres per kilometre (m/km). (Note—1 m/km = 63.36 inches/mile).

international roughness index, true—see **true international roughness index**.

longitudinal profile, *n*—the perpendicular deviations of the pavement surface from an established reference parallel to the lane direction, usually measured in the wheel tracks. (E 867, E 17.14) (E 1656, E 17.52)

longitudinal profile measurement, *n*—a series of elevation values taken at a constant interval along a wheel track. (E 1926, E 17.33)

DISCUSSION—Elevation measurements may be taken statically, as with rod and level (see Test Method E 1364) or inclinometer, or dynamically, as with an inertial profiler (see Test Method E 950).

mean roughness index (MRI), *n*—the average of the international roughness index (IRI) values for the right and left wheel tracks. (E 867, E 17.14 and E 1926, E 17.33)

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

mean panel rating (MPR), *n*—the average value, for each section of highway pavement, of ride quality ratings assigned by a ride rating panel. (E 1927, E 17.33)

profile, longitudinal—see **longitudinal profile**.

profile, transverse—see **transverse profile**.

profile record, *n*—a data record of the surface elevation, slope or acceleration, of arbitrary length. (E 1500, E 17.33)

profile segment, *n*—that part of a profile record for which the profile index will be calculated. (E 1500, E 17.33)

profilometer, *n*—equipment used to measure profile of traveled surface roughness. (E 867, E 17.14)

response-type system number (RTSN), *n*—the raw measured output from a response-type system. (E 867, E 17.14) (E 1448, E 17.31)

DISCUSSION—Units are arbitrary, being whatever the road meter in the response-type systems measures.

rideability, *n*—a subjective judgement of the comparative discomfort induced by traveling over a specific section of highway pavement in a vehicle. (E 1927, E 17.33)

rideability index (RI), *n*—an index derived from controlled measurements of the longitudinal profile in the wheel tracks and correlated with panel ratings of rideability. (E 1489, E 17.33)

ride number (RN), *n*—rideability index of a pavement using a scale of 0 to 5, with 5 being perfect and 0 being impassable. (E 1489, E 17.33)

ride quality rating, *n*—a numerical value subjectively assigned to a section of highway pavement by an individual quantifying his judgement of the level of ride quality for that section based on a psychophysical scale. (E 1927, E 17.33)

ride rating panel, *n*—a group of highway users, statistically representative of the total expected highway user population, in rating the ride quality of pavements. (E 1927, E 17.33)

road meter, *n*—equipment that measures the vehicle axle vertical motion relative to the vehicle frame during travel to yield a measure of roughness, for example, Mays, PCA, Soiltest, Cox. (E 867, E 17.14)

roughness index, half-car (HRI)—see **half-car roughness index**.

roughness index, international (IRI)—see **international roughness index**.

roughness index, mean (MRI)—see **mean roughness index**.

roughometer, *n*—a road meter that measures the unidirectional vertical movement of damped, leaf-sprung wheel relative to the road meter’s trailer frame during travel to yield a measure of roughness. (E 867, E 17.14)

spatial domain filtering, *n*—a filtering operation performed directly on the profile record. (E 1500, E 17.33)

transverse profile, *n*—the vertical deviations of the pavement surface from a horizontal reference perpendicular to the lane direction. (E 867, E 17.14)

traveled surface roughness, *n*—the deviations of a surface from a true planar surface with characteristic dimensions that affect vehicle dynamics, ride quality, dynamic loads, and drainage, for example, longitudinal profile, transverse profile, and cross slope. (E 867, E 17.14 and E 1926, E 17.33)

true international roughness index, *n*—the value of international roughness index that would be computed for a longitudinal profile measurement with the constant interval approaching zero. (E 1926, E 17.33)

wave number, *n*—the inverse of wavelength. (E 1926, E 17.33)

DISCUSSION—Wave number, sometimes called spatial frequency, typically has units of cycle/m or cycle/ft.

wheel track, *n*—a line or path followed by the tire of a road vehicle on a traveled surface. (E 1926, E 17.33)