Designation: E 867 – 02a

Terminology Relating to Vehicle-Pavement Systems[1]

This standard is issued under the fixed designation E 867; 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 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 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 are listed in categories of the five groups of Committee E17. 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 Pavements[2]

E 274 Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire[2]

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 Reference[2]

E 965 Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique[2]

E 1166 Guide for Network Level Pavement Management[2]

E 1170 Practices for Simulating Vehicular Response to Longitudinal Profiles of a Vehicular Traveled Surface[2]

E 1215 Specification for Trailers Used for Measuring Vehicular Response to Road Roughness[2]

E 1274 Test Method for Measuring Pavement Roughness Using a Profilograph[2]

E 1318 Specification for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Method[2]

E 1337 Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire[2]

E 1448 Practice for Calibration of Systems Used for Measuring Vehicular Response to Pavement Roughness[2]

E 1489 Practice for Computing Ride Number of Roads from Longitudinal Profile Measurements Made by an Inertial Profile Measuring Device[2]

E 1656 Guide for Classification of Automated Pavement Condition Survey Equipment[2]

E 1703 Test Method for Measuring Rut-Depth of Pavement Surfaces Using a Straightedge[2]

E 1778 Terminology Relating to Pavement Distress[2]

E 1845 Practice for Calculating Pavement Macrotexture Mean Profile Depth[2]

E 1859 Test Method for Friction Coefficient Measurements Between Tire and Pavement Using Variable Slip Technique[2]

E 1889 Guide for Pavement Management Implementation[2]

E 1926 Practice for Computing International Roughness Index from Longitudinal Profile Measurements[2]

E 1927 Guide for Conducting Subjective Pavement Ride Quality Ratings[2]

F 538 Terminology Relating to Characteristics and Performance of Tires[3]

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 Terminology[5]

2.4 *NIST Handbook:*

[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.

Current edition approved June 10, 2002. Published August 2002. Originally published as E 867 – 82. Last previous edition E 867 – 02.

[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.

National Institute of Standards and Technology (NIST) Handbook 44[6]

3. Definitions of Administrative Group

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. **(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 E17 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)**

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. **(E 1318, E 17.52)**

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. **(E 1845, E 17.23)**

calibration platform—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). **(E 556, E 17.21)**

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. **(E 556, E 17.21)**

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). **(E 1337, E 17.21)**

crosstalk, *n*—the undesired effect of force readings appearing on an unloaded axis of a transducer while applying force to another. **(E 556, 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, (ETD), *n*—the estimate of mean texture depth (MTD), by means of a linear transformation of mean profile depth (MPD). **(E 1845, E 17.23)**

horizontal traction (traction)—a force acting in a horizontal axis through the wheel transducer; that is, locked wheel drag force. **(E 556, E 17.21)**

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). **(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)**

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. **(E 556, E 17.21)**

mean profile depth (MPD), *n*—the average of all of the 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 surface macrotexture determined by the volumetric technique of Test Method E 965. **(E 1845, E 17.23)**

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. **(E 556, E 17.21)**

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 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 amplitude measurements 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)**

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

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)**

test wheel—a wheel and test tire assembly mounted to a test vehicle by means of a force or torque transducer. **(E 556, E 17.21)**

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. **(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)**

vertical load (load)—force acting in a vertical axis through the wheel transducer; that is, weight. **(E 556, E 17.21)**

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

wheel force transducer system—a force-to-electrical signal converter system including transducer(s), associated signal condition, zeroing, amplifying, recording, and monitoring instrumentation. **(E 556, E 17.21)**

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. **(E 950, 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 950, 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 950, 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 travelling 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 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 17.41)**

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 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 quality 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 950, E 17.33)**

profile segment, *n*—that part of a profile record for which the profile index will be calculated. **(E 950, 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 quality 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**.

roughness traveled surface—see **traveled surface roughness**.

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 950, 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 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)**

6. Definitions of Technical Group on Pavement Management

alligator (crocodile) cracking, *n*—interconnected or interlaced cracks forming a pattern which resembles an alligator's hide. **(E 1778, E 17.41)**

bituminous bleeding, *n*—excess bitumen on the surface of the pavement, usually found in the wheel paths. **(E 1778, E 17.41)**

bituminous pavement, *n*—a pavement comprising an upper layer or layers of aggregate mixed with a bituminous binder, (such as asphalt, coal tars and natural tars) and surface treatments such as chip seals, slurry seals, sand seals, and cape seals are also included. **(E 1778, E 17.41)**

block cracking, *n*—a pattern of cracks that divide the pavement into approximately rectangular pieces, ranging in size from approximately 0.1 m^2 to 10 m^2 (1 to 100 ft^2). **(E 1778, E 17.41)**

blowups, *n*—localized upward movement of the pavement surface at transverse joints or cracks, often accompanied with shattering of the concrete in that area. **(E 1778, E 17.41)**

champion, *n*—an advocate, or small group of advocates, in an agency that recognizes the need for a pavement management system and works to get it adopted and implemented. **(E 1889, E 17.41)**

continuously reinforced concrete pavement (CRCP), *n*—Portland cement concrete pavement with sufficient longitudinal steel reinforcement to control transverse crack spacings and openings in lieu of transverse contraction joints for accommodating concrete volume changes and load transfer. **(E 1778, E 17.41)**

corner breaks, *n*—*(JCP only)* a portion of the slab separated by a crack that intersects the adjacent transverse and longitudinal joints, describing approximately a 45° angle with the direction of traffic, where the length of the sides is from 0.3 m (1 ft) to one half the width of the slab. **(E 1778, E 17.41)**

corrugation, *n*—transverse undulations at regular intervals in the surface of the pavement consisting of alternate valleys and crests not more than 1 m (3 ft) apart. **(E 1778, E 17.41)**

crack, *n*—fissure or discontinuity of the pavement surface not necessarily extending through the entire thickness of the pavement. **(E 1778, E 17.41)**

cracking, alligator (crocodile)—see **alligator (crocodile) cracking.**

cracking, block—see **block cracking.**

cracking, durability "D"—see **durability "D" cracking.**

cracking, edge—see **edge cracking.**

cracking, longitudinal—see **longitudinal cracking.**

cracking, map—see **map cracking.**

cracking, reflection, at joints—see **reflection cracking at joints.**

cracking, slippage—see **slippage cracking.**

cracking, transverse—see **transverse cracking.**

depression, *n*—localized pavement surface areas at a lower elevation than the adjacent paved areas. **(E 1778, E 17.41)**

durability "D" cracking, *n*—closely spaced crescent-shaped hairline cracking pattern that initiates adjacent to joints, cracks, or free edges, first manifesting itself at the intersection of joints, cracks, or free edges; dark coloring of the cracking pattern and surrounding area often exists with "D" cracking. **(E 1778, E 17.41)**

edge cracking, *n*—crescent-shaped cracks or fairly continuous cracks that are located within 0.6 m (2 ft) of the pavement

edge. **(E 1778, E 17.41)**

faulting of joints and cracks, *n*—difference in elevation across a joint or crack. **(E 1778, E 17.41)**

free edge, *n*—an unrestrained pavement boundary. **(E 1778, E 17.41)**

jet-blast erosion, *n—(airfields only)* darkened areas on the pavement surface where bituminous binder has been burned or carbonized; localized burned areas may vary in depth up to approximately 15 mm (½ in.) **(E 1778, E 17.41)**

joint, *n*—a discontinuity made necessary by design or by interruption of a paving operation. **(E 1778, E 17.41)**

jointed concrete pavement (JCP), *n*—Portland cement concrete pavement that has transverse joints placed at planned intervals. **(E 1778, E 17.41)**

joint seal deterioration, *n*—any condition that enables incompressible materials or water to infiltrate into a previously sealed joint from the surface. **(E 1778, E 17.41)**

joint spalling, *n*—cracking, breaking, or chipping of concrete pavement edges within 0.6 m (2 ft) of a joint. **(E 1778, E 17.41)**

lane-to-shoulder dropoff, *n*—(*highways, roads and streets only*) difference in elevation between the traveled surface and the shoulder surface. **(E 1778, E 17.41)**

lane-to-shoulder separation, *n*—(*highways, roads and streets only*) widening of the joint between the edge of the slab and the shoulder. **(E 1778, E 17.41)**

longitudinal cracking, *n*—cracks in the pavement predominantly parallel to the direction of traffic. **(E 1778, E 17.41)**

map cracking, *n*—a series of interconnected cracks that extend only into the upper portion of the slab. **(E 1778, E 17.41)**

network level analysis, *n*—evaluation of a network of pavement to enable selection of candidate projects, project scheduling, and budget estimates. **(E 1166, E 17.41)**

oil spillage, *n*—a localized deterioration or softening of a bituminous pavement surface caused by the spilling of oil, fuel, or other solvents. **(E 1778, E 17.41)**

patch, *n*—a portion of pavement surface that has been replaced or where additional material has been applied to the pavement after original construction. **(E 1778, E 17.41)**

pavement, bituminous—see **bituminous pavement.**

pavement, continuously reinforced concrete (CRCP)—see **continuously reinforced concrete pavement.**

pavement, jointed concrete (JCP)—see **jointed concrete pavement.**

pavement, Portland cement concrete—see **Portland cement concrete pavement.**

pavement condition, *n*—a quantitative representation of distress in pavement at a given point in time. **(E 1166, E 17.41)**

pavement distress, *n*—external indications of pavement defects or deterioration. **(E 1778, E 17.41)**

pavement management section/segment, *n*—a contiguous pavement area considered to have uniform construction, maintenance, usage history, and condition. **(E 1166, E 17.41)**

pavement performance, *n*—ability of a pavement to fulfill its purpose over time. **(E 1166, E 17.41)**

polished aggregate, *n*—exposed aggregate worn sufficiently smooth to affect frictional characteristics. **(E 1778, E 17.41)**

popouts, *n*—small holes in the pavement surface, normally ranging in diameter from 25 mm (1 in.) to 100 mm (4 in.) and depth from 13 mm (0.5 in.) to 50 mm (2 in.). **(E 1778, E 17.41)**

Portland cement concrete pavement, *n*—a pavement having a surface of aggregate mixed with Portland cement paste binder or a mixture of Portland cement and other pozzolans. **(E 1778, E 17.41)**

potholes, *n*—bowl-shaped holes in the pavement surface, grater than 100 mm (4 in.) in diameter, and more than 25 mm (1 in.) in depth. **(E 1778, E 17.41)**

project level analysis, *n*—evaluation of a pavement section to select the type and timing of rehabilitation or maintenance corrective actions. **(E 1166, E 17.41)**

pumping, *n*—ejection of liquid or solid material, or both, from beneath the pavement through a crack or joint. **(E 1778, E 17.41)**

punchouts, *n*—a broken area of a concrete slab bounded by closely spaced cracks (usually less than 1 m (3 ft)). **(E 1778, E 17.41)**

raveling, *n*—loss of pavement surface material involving the dislodging of aggregate particles and degradation of the bituminous binder. **(E 1778, E 17.41)**

reflection cracking at joints, *n*—cracks in bituminous overlay surfaces that occur over concrete pavements at joints. **(E 1778, E 17.41)**

rut, *n*—a contiguous longitudinal depression deviating from a surface plane defined by transverse cross slope and longitudinal profile. **(E 1778, E 17.41)**

scaling, *n*—the deterioration of the upper concrete slab surface, normally 3 mm (0.125 in.) to 13 mm (0.5 in.) in depth, resulting in the loss of surface mortar. **(E 1778, E 17.41)**

shoving, *n*—the horizontal displacement of a localized area of the pavement surface that may also include some vertical displacement. **(E 1778, E 17.41)**

slippage cracking, *n*—cracking associated with the horizontal displacement of a localized area of the pavement surface. **(E 1778, E 17.41)**

swell, *n*—a hump in the pavement surface that may occur over a small area or as a longer, gradual wave; either type of swell can be accompanied by surface cracking. **(E 1778, E 17.41)**

transverse construction joint deterioration, *n*—(*CRCP only*) series of closely spaced transverse cracks or a large number of interconnecting cracks occurring near a construction joint. **(E 1778, E 17.41)**

transverse cracking, *n*—cracks in the pavement that are predominantly perpendicular to the direction of traffic. **(E 1778, E 17.41)**

7. Keywords

7.1 definitions; terminology; vehicle-pavement systems

APPENDIX

(Nonmandatory Information)

X1. CATEGORIES FOR DEFINITIONS OF TERMS SPECIFIC TO COMMITTEE E-17

X1.1 Scope

X1.1.1 This appendix lists definition of terms specific to a standard for approved standards under the jurisdiction of ASTM Committee E17 on Vehicle-Pavement Systems.

X1.1.2 The definition of terms specific to a standard are listed in categories of the four groups of Committee E17. They are: Skid Resistance, Roughness, Intelligent Transportation Systems, and Intelligent Vehicle/Highway Systems. Each group is further subdivided by each standard that contains definition of terms specific to a standard.

X1.2 Definitions of Terms Specific to a Standard of Technical Group on Skid Resistance

X1.2.1 *E 1337, Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire*:

braking force, tire—the negative longitudinal force resulting from braking torque application.

braking force coefficient, tire—the ratio of braking force to vertical load.

braking force coefficient, tire, peak—the maximum value of tire braking force coefficient that occurs prior to wheel lockup as the braking torque is progressively increased.

braking force coefficient, tire, slide—the value of the braking force coefficient obtained on a locked wheel.

braking torque—the negatively directed wheel torque. (See **torque (T), wheel**).

longitudinal force, tire (F_x)—the component of a tire force vector in the X' direction.

tire-axis system—the origin of the tire-axis system is the center of the tire contact. The X′ axis is the intersection of the wheel plane and the road plane with a positive direction forward. The Z′ axis is perpendicular to the road plane with a positive direction downward. The Y′ axis is in the road plane, its direction being chosen to make the axis system orthogonal and right-hand.

tire forces—the external forces acting on the tire by the road.

torque (T), wheel—the external torque applied to a tire from a vehicle about the wheel spin axis. Driving torque is positive wheel torque; braking torque is negative wheel torque.

vertical load (F_z)—the downward vertical component of force between the tire and the road.

X1.2.2 *E 1859, Test Method for Friction Coefficient Measurements Between Tire and Pavement Using a Variable Slip Technique*

[E 17.21]

peak slip friction number, *n*—the maximum value of the slip friction number.

slip friction number, *n*—the quotient of the longitudinal friction force in the road plane over the normal load force at any instant in time and location, multiplied by 100.

slip speed, *n*—the difference between the speed of the axis of the measuring wheel, which is equal to the traveling speed of the measuring device, and the tangential velocity measuring wheel with undeflected radius *r*.

slip-to-skid friction number, *n*—the value of the slip friction number at which the test wheel reaches zero rotational speed during a brake test.

slope indicator, *n*—the rate of change of the slip friction number expressed as an angle near the peak slip friction number.

tire longitudinal stiffness indicator, *n*—the rate of change of the slip friction number expressed as an angle near the zero value of the time or location.

X1.3 Definitions of Terms Specific to a Standard of Technical Group on Roughness

X1.3.1 *E 1215, Specification for Trailers Used for Measuring Vehicular Response to Road Roughness*:

(E 17.31)

sprung mass—the total mass minus the unsprung mass.

suspension deflection—the change in the vertical distance between the axle at its centerline and a hypothetical reference line directly above the axle centerline on the rigid frame structure.

X1.3.2 *E 1274, Test Method for Measuring Pavement Roughness Using a Profilograph*:

(E 17.32)

blanking band—a band of uniform height with its longitudinal center positioned optimally between the highs and lows of the surface record depicting at least 100 ft (30 m) of pavement.

cutoff height—a specified distance of a high on the surface record from a chord representing 25 ft (7.5 m) on the longitudinal scale. The chord may represent less than 25 ft (7.5 m) if it is from the lows on each side of the high.

rate of roughness—sum of the roughness divided by longitudinal distance covered by the blanking band.

roughness—height of each continuous scallop rounded to the nearest 0.05 in. (1 mm), except those less than 0.03 in. (0.8 mm) vertically and 2 ft (0.6 m) longitudinally.

scallops—excursions of the surface record above and below the blanking band.

X1.3.3 *E 1448, Practice for Calibration of Systems Used for Measuring Vehicular Response to Pavement Roughness*:

(E 17.31)

response type system number (RTSN)—the raw measured output from a response type system being calibrated. Units are arbitrary, being whatever the road meter in the response type system measures. (See Terminology E 867, Section 5).

(E 17.31)

X1.3.4 *E 1703, Test Method for Measuring Rut-Depth of Pavement Surfaces Using a Straight Edge*:

(E 17.31)

rut-depth—the maximum measured perpendicular distance between the bottom surface of the straightedge and the contact area of the gage with the pavement surface at a specific location.

trueness—the lack of significant curvature, inclination, noteworthy elevations, or depressions.

X1.4 Definitions of Terms Specific to a Standard of Technical Group on Intelligent Transportation Systems

X1.4.1 *E 1656, Guide for Classification of Automated Pavement Condition Survey Equipment*

(E 17.52)

characteristic—a directly measurable distinguishing property of the pavement surface. Examples are pavement longitudinal profile, transverse profile, and separations in the continuity of a pavement surface. (See Terminology E 867).

dynamic intermediate precision—the precision of the measurement of a characteristic determined under dynamic intermediate precision conditions in which the same equipment moving at operating speed measures the characteristic at the same location repeatedly.

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

resolution—the smallest increment that a characteristic measuring process must distinguish and display.

stationary repeatability precision—the precision of the measurement of a characteristic determined under repeatability condition with the instrumented equipment stationary.

tolerance—the defined limits of allowable (acceptable) departure from the true value of a measured quantity.

X1.5 Definitions of Terms Specific to a Standard of Technical Group on Intelligent Vehicle/Highway Systems

X1.5.1 *E 1318, Specification for Highway Weigh-in-Motion Systems With User Requirements and Test Method*:

(E 17.52)

accuracy, *n*—the closeness or degree of agreement (within a stated tolerance and probability of conformity) between a value measured or estimated by a WIM system and an accepted reference value.

axle, *n*—the axis oriented transversely to the nominal direction of vehicle motion, and extending the full width of the vehicle, about which the wheels(s) at both ends rotate.

axle-group load [lb (kg)]**,** *n*—the sum of all tire loads on a group of adjacent axles a portion of the gross vehicle weight.

DISCUSSION—An axle group can be defined in terms of the number of axles included in the group and their respective interspaces.

axle load [lb (kg)]**,** *n*—the sum of all tire loads of the wheels on an axle; a portion of the gross-vehicle weight.

dynamic vehicle tire force [lb (kg)]**,** *n*—the component of time-varying force applied perpendicularly to the road surface by the tire of a moving vehicle.

DISCUSSION—In addition to the force of gravity, this force can include the dynamic effects of influences such as road surface roughness, vehicle acceleration, out-of-round tires, dynamically unbalanced wheels, tire inflation pressure, vehicle suspension and aerodynamic features, and wind. For purposes of this specification, the WIM System shall be adjusted or calibrated to indicate the magnitude of the measured dynamic vehicle tire force in units of mass, lb (kg).

gross-vehicle weight [lb (kg)]**,** *n*—the total weight of the vehicle or the vehicle combination including all connected components; also, the sum of the tire loads of all wheels on the vehicle.

single axle load, [lb (kg)]**,** *n*—the loads transmitted to the road surface by the tires of all wheels lying between two parallel transverse vertical planes 3.3 ft (1 m) apart, extending across the full width of the vehicle; a portion of the gross-vehicle weight.

tandem-axle load, [lb (kg)]**,** *n*—the total load transmitted to the road surface by the tires on all wheels of two consecutive vehicle axles that are more than 3.3 ft (1 m) and not more than 8 ft (2.4 m) apart; a portion of the gross-vehicle weight.

tire-load [lb (kg)]**,** *n*—the portion of the gross-vehicle weight imposed upon the static tire at the time of weighing, expressed in units of mass, due only to the vertically-downward force of gravity acting on the mass of the static vehicle.

tolerance—the defined limit of allowable departure of a value measured or estimated by a WIM system from an accepted reference value.

triple-axle load, [lb (kg)]**,** *n*—the total load transmitted to the road surface by the tires on all wheels of three consecutive vehicle axles, with not more than 12 ft (3.7 m) between the two axles furthest apart; a portion of the gross-vehicle weight.

weigh, *vt*—to measure the tire load on one or more tires by using a vehicle scale, an axle-load scale, a portable axle-load weigher, or a wheel-load weigher.

DISCUSSION—Refer to Sec.2.20 of National Institute of Standards and Technology (NIST) Handbook 44 for a definition of each type of weighing device. These devices are usually subjected to field standard test weights at each locality of use and are adjusted to indicate units of mass. (See Sec. 3.2, Appendix B, *NIST Handbook 44*.)

weight, [lb (kg)]**,** *n*—the external force of gravity vertically downwards upon a body with a magnitude equal to the body's mass multiplied by the local acceleration of free fall.

DISCUSSION—force of gravity—thus, the acceleration of free fall—is different at various locations on or near the surface of the Earth; therefore, weighing devices in commercial use or in official use by government agencies for enforcement of traffic and highway laws or collecting statistical information are usually used in one locality and are adjusted or calibrated to indicate mass at that locality. The indicated mass can be converted to weight (in units of force) by multiplying by the local value of the acceleration of free fall, if it is known. The conventional value adopted by ISO is 32,174 049 ft/s (9.806 65 m/s). Weight is a special case of force, as weight is due only to the local force of gravity, which is always directed vertically downwards. For purposes of this specification, and in accordance with common weighing practice, the WIM System shall be adjusted or calibrated to indicate the magnitude of estimated weight and load in units of mass, pounds (avoirdupois) (kilograms), and the direction of the associated force vector will always be downwards toward the approximate center of earth.

wheel load, (lb (kg))**,** *n*—the sum of the tire loads on all tires included in the wheel assembly on one end of an axle; a wheel assembly may have a single tire or dual tires.

WIM system—a set of sensors and supporting instruments that measures the presence of a moving vehicle and the related dynamic tire forces at specified locations with respect to time. Estimates tire loads, calculates speed, axle spacing, vehicle class according to axle arrangement, and other parameters concerning the vehicle, and processes, displays, stores, and transmits this information. This standard applies only to highway vehicles.