# Glossary of Terms

**A**

**AASHO Road Test** – conducted from 1958 to 1961 to evaluate the performance of highway pavements under moving loads with known magnitude and frequency. The Road Test was constructed near Ottawa, IL.

**AASHTO –** American Association of State Highway and Transportation Officials.

**Accelerometer** – a sensor that measures acceleration. An inertial profiler uses the signal from the on-board accelerometer(s) to compute the inertial reference value (i.e., relative height) that can be combined with the height sensor data to produce a complete profile. See also Height Sensor.

**Acceptance** – is the program of activities conducted by the owner or its representatives (i.e., consultants) to determine the degree of compliance with the contract requirements and to determine the corresponding value for a given product (AASHTO 2011).

**Accuracy** – the degree to which a measurement, or the mean of a distribution of measurements, tends to coincide with the true population mean (AASHTO 2011).

**Adhesion Friction** – the friction component generated by the establishment of small-scale bonding/interlocking between a vehicle tire rubber and the pavement surface.

**Aerodynamic Noise** – the noise caused by the movement of air around the vehicle is referred to as aerodynamic noise. Aerodynamic noise will dominate the total noise level only at very high speeds.

**Agency Costs** – all costs incurred by the agency for construction, maintenance, and rehabilitation of the pavement facility over the analysis period. Agency costs typically also include costs for preliminary engineering, contract administration, construction supervision, and associated administrative costs.

**Aggregate** – the collective term for the mineral materials such as sand, gravel and crushed stone that are used with a binding medium (such as water, bitumen, portland cement, lime, etc.) to form compound materials (such as asphalt and concrete mixtures).

**Aggregate Base** – a base course consisting of compacted mineral aggregates. Also referred to as granular base and unbound granular base.

**Aggregate Source Certification** – is a process in which an agency pre-approves a producer’s aggregate source (pit or quarry).

**Aggregate Subbase** – a subbase course consisting of compacted mineral aggregates. Also referred to as granular subbase and unbound granular subbase.

**Aggregate-Surfaced Road** (a.k.a., Gravel Road) – an unpaved roadway surface with gravel.

**Air Voids (asphalt), Va** – the total volume of the small pockets of air between the coated aggregate particles throughout a compacted paving mixture, expressed as percent of the bulk volume of the compacted paving mixture.

**Air Voids (concrete)** – a space which is filled with air in cement paste, mortar, or concrete.

**Alkali-Carbonate Reactivity (ACR)** – occurs due to the breakdown of certain dolomitic aggregate which can lead to expansion.

**Alkali-Silica Reactivity (ASR)** – aggregates containing certain forms of silica react with the alkali hydroxide in concrete. This reaction forms a gel which can swell as it adsorbs water from the surrounding cement paste and/or the environment. The swelling of the gel can induce enough expansive pressure to cause cracking in the concrete.

**Alligator Cracking** – see fatigue cracking.

**Allocate** – Distribution of available resources among programs or geographic districts/regions.

**Alternative –** activities over a specified analysis period that define a strategy for achieving the performance goals of a project. In LCCA, all design strategy alternatives considered for a project will equally meet the performance requirements of the project.

**Alternative Bidding (aka A+C or A+B+C Bidding)** – include two or more designs provided by the agency. The Contractor selects, prepares, and submits a bid for a single chosen design. The designs typically include an asphalt and concrete pavement alternative, which are either deemed equivalent by the agency in terms of design life or are assigned a life-cycle cost adjustment factor (C) which must be accounted for in the bid price. The life-cycle cost adjustment factor is determined by the agency based on the expected future maintenance and rehabilitation cost (and user delay cost, if desired) associated with each alternative. The factor is typically added to the construction cost (A+C bidding), but may be incorporated into a cost-plus-time bid yielding an A+B+C bidding structure).

**Amplitude** – the maximum value of a periodic curve measured along its vertical axis with reference to the horizontal axis.

**Analysis Period** – the time period used for comparing design alternatives. May contain several preservation and rehabilitation activities.

**Analytical Tools** – Process or procedure (typically computer based) for reviewing an assets effectiveness.

**Angularity** – the percent of fractured faces on an aggregate particle; coarse aggregate angularity determined in accordance with AASHTO T 335, *Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate*, and fine aggregate angularity determined in accordance with AASHTO T 304, *Standard Method of Test for Uncompacted Void Content of Fine Aggregate*.

**Apparent Specific Gravity** – the specific gravity of a material excluding the permeable voids (i.e., volume of aggregate only).

**Asphalt Additives/Modifiers** – the material (such as polymers, fibers, crumb rubber) added to the asphalt binder to enhance low and high temperature properties.

**Asphalt Batch Plant** – Process used to produce asphalt mixtures in which the aggregate and asphalt binder are proportioned and mixed in single batches. The batch size is dependent on the pugmill capacity but typically varies from 2 to 8 tons.

**Asphalt Cement** – the refined residue that remains after the lighter petroleum fractions are removed during distillation.

**Asphalt Drum Plant** – Process used to produce asphalt mixtures in which the aggregate is dried and heated, the asphalt binder added and mixed all in the same drum in a continuous operation.

**Asphalt Mixture Performance Test (AMPT)** – testing machine used in the evaluation of an asphalt mixtures resistance to rutting, dynamic modulus, development of the master curve, flow number, and flow time (see AASHTO TP 79, *Determining the Dynamic Modulus and Flow Number for Hot Mix Asphalt (HMA) Using the Asphalt Mixture Performance Tester (AMPT)*).

**Asphalt Pavement** – a pavement that is surfaced with an asphalt mixture. This includes such mixtures as hot mix asphalt, warm-mix asphalt (WMA), recycled asphalt, and cold-mix asphalt.

**Asphalt Pavement Analyzer (APA)** – an empirical test method used to assess the rutting resistance of mixtures prepared using the Superpave gyratory compactor; conducted in accordance with AASHTO TP 63, *Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (asphalt) Using the Asphalt Pavement Analyzer (APA)*.

**Asphalt-Treated Base (ATB)** – dense-graded asphalt mixture that typically includes a wide gradation band and lower asphalt binder content.

**Asphalt-Treated Permeable Base** – an open-graded cold-mix or asphalt mixture placed beneath the surface layer (either asphalt or concrete) designed to drain infiltrating water.

**Asset** – The physical infrastructure (e.g., right-of-way, pavements, structures, roadside features). Assets can also include other agency resources capable of providing added value (e.g., human resources, real estate, equipment and materials).

**Asset Management** – Business processes for resource allocation and utilization with the objective of better decision-making based upon quality information and well-defined objectives.

**Asset Management Plan** – Tactical plan for managing an agency’s infrastructure (and/or other assets) to deliver an agreed upon level of service. Typically, the asset management plan encompasses more than one asset (e.g., a system approach).

**Atterberg Limits** – testing procedures that include liquid limit and plastic limit for distinguishing between silt and clay soils. See also liquid limit and plasticity index.

**Automatic Vehicle Classification (AVC) –** a system for identification, summarization, and reporting of traffic volume by vehicle configuration.

**Average Annual Daily Traffic (AADT)** – the estimate of typical traffic on a road segment for all days of the week over the period of one year.

**Average Annual Daily Truck Traffic (AADTT)** – the estimate of typical truck traffic on a roadway segment for all days of the week over the period of one year.

**A-Weighting (dBA)** – denotes the decibel level most sensitive to the human ear.

**Axial Resolution** – See resolution.

**Axle Load** – the sum of all tire loads on an axle.

**Axle Load Spectra** – the distribution of axle loads according to axle type (single, tandem, tridem, and quad) and weight applied to a pavement structure for a given traffic stream.

**B**

**Backcalculation** – the iterative process of assuming parameters, calculating the theoretical result, comparing it to the experimental result, and repeating until the error between the theoretical result and the experimental result is minimized.

**Backer Rod** – A compressible material that is placed in joints or cracks before applying sealant to prevent bonding of the sealant on the bottom of the joint, control sealant depth, and prevent sagging of the sealant.

**Base** – the layer or layers of specified or select material of designed thickness placed on a subbase or subgrade to support a surface course.

**Base Course** – the portion of a pavement structure immediately beneath the surface course. Its major function is structural support and usually consists of aggregate and can be either stabilized or unstabilized.

**Base Year** – the first year of traffic after construction.

**Bending Beam Rheometer (BBR)** – a testing device used to determine the susceptibility of the asphalt binder to thermal cracking. See AASHTO T 313, *Standard Method of Test for Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR).*

**Benefit/Cost** – a comparison analysis of the economic benefit of an investment to its cost. The benefit/cost analysis should include all costs and benefits to both the agency and the users of the facility over an appropriate life cycle period. In asset management, benefit/cost can be applied for prioritizing projects, evaluation of the benefits and costs for all projects in a program, and determination of program tradeoffs.

**Bias** – an error, constant in direction, that causes a measurement, or the mean of a distribution of measurements, to be offset from the true population mean (AASHTO 2011).

**Binder Course** (a.k.a., Intermediate Course) – a layer of asphalt concrete placed between the base course and surface course.

**Bituminous Surface Treatment (BST)** (a.k.a. seal coat or chip seal) – a thin layer of asphalt binder followed by layer of aggregate. Primarily used on low volume roadways or as a preventive maintenance treatment on more heavily trafficked asphalt pavements.

**Blanking Band** – a band that is placed over a profilograph trace to “mask” the portion of the trace that is not counted as roughness.

[**Bleeding**](http://pavementinteractive.org/index.php?title=Bleeding) – in asphalt pavements "bleeding (or flushing)" is a film of asphalt binder on the pavement surface caused by the upward migration of asphalt binder in an asphalt pavement. In concrete pavement "bleeding" is the flow of mixing water from the freshly placed concrete mixture.

[**Block Cracking**](http://pavementinteractive.org/index.php?title=Block_Cracking) – the interconnected cracks in asphalt pavements that divide the pavement up into rectangular pieces.

[**Blowup**](http://pavementinteractive.org/index.php?title=Blowup) **(aka buckling)** – the localized upward concrete slab movement and shattering at a joint or crack. Usually occurs in spring or summer and is the result of insufficient room for slab expansion during hot weather.

**Bond Breaker** – Any material used to prevent bonding or to separate adjacent pavement layers. Thin asphalt pavement layers are often used as bond breaker layers between a concrete pavement and an unbonded concrete overlay.

**Bonded Concrete Overlay** – a new thin (typically 2 to 4 in.) concrete overlay placed directly on top of an existing concrete pavement. Surface preparation (typically shotblasting) of the existing pavement is required to promote bonding. Existing pavement must be comparatively free of distress. Transverse joints in the overlay must match those of the underlying pavement.

**Borrow Material** – material, usually soil, gravel, or sand that is excavated from a pit source and typically placed in fill locations or over weaker subgrade soils.

**Bounce Test** – a procedure performed on laser profiler to verify that sensors and accelerometers are functioning properly.

**British Pendulum Number (BPN)** – a surrogate microtexture measurement parameter obtained using the British Pendulum Tester (BPT).

**British Pendulum Tester (BPT)** – a portable, stationary testing device used in the field or laboratory to measure pavement/aggregate microtexture. See AASHTO T 278, *Standard Method of Test for Surface Frictional Properties Using the British Pendulum Tester.*

**Bulk Specific Gravity (Gmb)** – a test procedure that considers the overall volume of the aggregate, including the pores that become filled with water, determined in accordance with AASHTO T 166, *Standard Method of Test for Bulk Specific Gravity of Compacted Hot Mix Asphalt (asphalt) Using Saturated Surface-Dry Specimens*.

**C**

**Calibration** – a set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or between values represented by a material measure or a reference material, and the corresponding values realized by standards (AASHTO 2011).

**Calibration Factor** – facture used to adjust a model to fit measured performance data.

**California Bearing Ratio, CBR** – penetration test for evaluation of mechanical strength of road subgrades and base courses. Test measures the pressure required for the piston to penetrate a soil sample. See AASHTO T 193, *Standard Method of Test for the California Bearing Ratio.*

**Cape Seal** – A surface treatment that involves the application of slurry seal to a newly constructed surface treatment or chip seal. Cape seals are used to provide a dense, waterproof surface with improved skid resistance and ride quality.

**Capillarity** – the surface tension and adhesion that causes water to rise in a thin tube against the forces of gravity.

**Capital** – Type of investment that generally involves construction or major repair and can include: new construction, reconstruction, structural and functional improvements, and rehabilitation.

**Carpet Drag** – a texturing method where burlap or artificial turf, attached to the finishing machine, is dragged on the wet concrete pavement surface.

**Cement Treated Base (CTB)** – a base course consisting of mineral aggregates blended in place or through a pugmill with a small percentage of concrete to provide cementitious properties and strength.

**Chemically Stabilized Material** – subgrade materials whose plasticity characteristics have been modified using materials such as lime, flyash, or concrete.

**Chemically Stabilized Soils** – soil stabilization process that alters the engineering properties of a soil material through a chemical reaction. Common chemical stabilizers include, lime, lime-fly ash, lime-flyash-cement, asphalt, pozzolans, and slag.

**Chip Seal** – a surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and immediately covered with aggregate and rolled.

**Close-Proximity Method** – measures the sound generated at the tire-pavement interface using a single microphone and test tire mounted on a trailer or on an especially designed vehicle. Sound measurements (A-weighted sound pressure level) are typically recorded at travel speeds of 30, 50, or 70 mph.

**Coefficient of Lateral Pressure, k0** – ratio of the lateral earth pressure to the vertical earth pressure. For unbound granular, subgrade, and bedrock materials the in-situ values range from 0.4 to 0.6.

**Coefficient of Thermal Contraction, Lmix** – expressed as the change in length per unit length for unit decrease in temperature of asphalt. Typical values range from 2.2 to 3.4 /ºC.

**Coefficient of Thermal Expansion (CTE)** – expressed as the increase in length per unit length for a unit increase in temperature. Directly influences the curling stress developed in the concrete slab and also influences the joint sealant reservoir design and the selection of sealant materials. Critical in the prediction of cracking in concrete pavements.

**Cohesion** – the internal bond within a joint sealant material. Cohesion loss is seen as a noticeable tear along the surface and through the depth of the sealant.

**Cohesionless Soils** – soil whose strength is dependent on friction between particles (i.e., sand or gravel).

**Cohesive Soils** – soil whose strength is dependent on the surface tension of capillary water (i.e., clay or clayey silt). Shear strength is approximately half of its unconfined compressive strength.

**Cold Applied Sealant** – a crack-sealing compound that is applied in an unheated state (generally at ambient temperature) and then reaches final properties through a curing process.

**Cold In-Place Recycling (CIR)** – a process in which a portion of an existing asphalt pavement is pulverized or milled, and then the reclaimed material is mixed with new binder and, when needed, virgin aggregates. The binder used most often is emulsified asphalt with or without a softening agent. The resultant blend is placed as a base for a subsequent overlay or surface treatment.

**Cold Milling** – see milling.

**Cold-Mix Asphalt** – an asphalt mixture generally consisting of emulsified or cutback asphalt and aggregate.

**Complex shear modulus, G\*** – fundamental asphalt mixture property. In general, mixtures with higher complex shear modulus, at a given temperature, will exhibit lower permanent deformation values. See ASTM D7552, *Standard Test Method for Determining the Complex Shear Modulus (G\*) of Bituminous Mixtures using Dynamic Shear Rheometer.*

**Composite pavement** – a pavement which has both concrete and asphalt structural layers, such as an asphalt pavement overlay of a concrete pavement or a concrete overlay of an asphalt pavement. Its behavior under loading is a combination of the behavior of both concrete and asphalt pavements.

**Compressible Insert** – material used to separate freshly placed concrete from existing hardened concrete.

**Compressive Strength, f’c** – testing of cylindrical concrete specimens obtained either from molded cylinders made from fresh concrete or cores retrieved from hardened concrete. See AASHTO T 22, *Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens*.

**Concrete Pavement** – a composite material consisting of portland or hydraulic cement binding medium and embedded particles or fragments of aggregate.

**Condition** – Measure of the physical state of an asset as affected by deterioration and past maintenance and repair.

**Confining Stress** – the stress induced within a sample when load is applied vertically to the specimen.

**Construction Joint** – A joint constructed in a transverse direction in concrete pavements to control cracking of the slab as it cures.

**Continuously Reinforced Concrete Pavement (CRCP) –** concrete pavement containing longitudinal reinforcing steel placed at or above mid-depth, designed to hold shrinkage cracks tightly closed. Transverse joints only occur for construction purposes and at structure locations.

**Controlled Pass-By Method** – similar to the statistical pass-by method except the sound measurement is based on a single selected vehicle traveling at a specified speed.

**Corner Break** – a portion of a concrete slab separated by a crack that intersects the adjacent transverse or longitudinal joints at about a 45 º angle with the direction of traffic.

[**Corrugation**](http://pavementinteractive.org/index.php?title=Corrugation) **–** pavement surface distortion perpendicular to the traffic direction caused by plastic movement and typified by ripples across a pavement surface.

**Cost-Plus-Time Bidding (aka A+B Method**) – involves time, with an associated costs, in the low bid determination. The “A” component is the traditional bid for the contract items and the “B” component represents the total number of calendar days to complete the work. Bid award cost = A + (B x Road User Cost/Day).

**Crack Filling** – the placement of materials into nonworking cracks to substantially reduce the intrusion of incompressibles and infiltration of water.

**Crack Sealing** – the placement of specialized materials into working cracks using unique configurations to reduce the intrusion of incompressibles into the crack and to prevent infiltration of water into the underlying pavement layers.

**Crash costs** – costs associated with additional crashes brought about by work zones or by rough or slippery roads. Crash costs are primarily comprised of the costs of human fatalities, non-fatal injuries, and property damage.

**Creep Compliance** – material parameter that is indicative of the tensile compliance of the material when subjected to an indirect tensile strength test under strain levels that keep the material in its viscoelastic range and at a temperature of -4, 14, and 32 ºF. See AASHTO TP 9, *Determining the Creep Compliance and Strength of Hot Mix Asphalt (Asphalt) Using the Indirect Tensile Test Device.*

**Curing Compound** – a liquid that is applied as a coating to the surface of newly placed concrete to retard the loss of water.

**Curling** – deformation of a concrete slab caused by a temperature difference between the upper and lower surfaces.

**Cutback Asphalt** – manufactured by blending asphalt cement with a petroleum solvent.

**D**

**Data** – Measurements (or observations) that represent a qualitative or quantitative attribute of a variable or set of variables.

**Data integration** – Process of combining or linking two or more data sets from different sources to facilitate data sharing, promote effective data gathering and analysis, and support overall information management activities in an organization.

**Daylighting** – roadway section feature where the base and subbase layers are exposed to allow moisture to flow into ditches.

**Decibel (dB)** – the logarithmic scale that quantifies the measure of sound.

**Decision** – Determination of a course of action or selection of an option from available choices.

**Decision Support** – The use of information (e.g., from management systems, other analytic tools, or estimates and studies by staff) to help understand the consequences of decisions.

**Deficiency** – Gap between an asset’s current condition/performance and a defined target or threshold value; deficiency implies a need for work.

**Deflection** – vertical deformation of a pavement under an applied load.

**Deflection Basin** – deflection values recorded at various distances from the load or impact applied during deflection testing.

**Deflection Testing** – the nondestructive testing of a pavement performed by imposing a load or impact on the pavement and measuring the amount of deflection.

**Degree of Saturation, Sopt** – represents the total volume of water (sum of drainable and bound water) present in an aggregate or soil material.

**Dense-Graded Aggregate** – a mechanically crushed aggregate having a particle size distribution such that when it is compacted, the resulting voids between the aggregate particles, expressed as a percentage of the total space occupied by the material, are relatively small.

**Dense-Graded Asphalt** – paving material produced by blending densely-graded aggregates with asphalt binder.

**Density** – the mass per unit volume (lb/cu ft).

**Design Life** – the length of time for which a pavement structure is being designed, including the time from construction until major programmed rehabilitation. Also referred to as performance period.

**Design-Bid-Build** – traditional contracting approach where the transportation agency designs the project, requests bids based on estimated quantities and fixed-unit prices, and awards to the lowest-bidder who then constructs the project.

**Design-Build** – project delivery system used to deliver a project in which the design and construction services are contracted by a single entity (i.e., design builder). Used to minimize risks of the project owner and to reduce the delivery schedule by overlapping the design phase and the construction phase.

**Design-Build-Maintain Contracts** – similar to a design-build contract, this project deliver system includes a provision that the design-builder will also maintain the project over the life of the contract.

**Destructive Sampling** – the permanent removal or cores, soil borings, or other samples of material to be tested.

**Deterministic Approach** – applies procedures and techniques without regard for the variability of the inputs. The primary disadvantage of this traditional approach is that it does not account for the variability associated with the LCCA input parameters.

**Diamond Grinding** – a pavement preservation technique that uses specifically designed power driven, self-propelled machines outfitted with diamond tipped saw blades to smooth and texture of the hardened concrete surface. Typically conducted in the longitudinal direction.

**Dielectric Constant** – a material property defined by how a certain material will interact with electromagnetic (EM) waves.

**Dipstick®** – a static, inclinometer-based proprietary device used to measure elevations at individual points (originally used for measuring floor flatness). See AASHTO R 41, *Standard Practice for Measuring Pavement Profile Using a Dipstick®*.

**Discomfort costs** – Costs associated with driving in congested traffic or on rough roads.

**Discount Rate** – the rate of interest reflecting the investor’s time value of money used to determine discount factors for converting benefits and costs occurring at different times to a baseline date. Discount rates can incorporate an inflation rate depending on whether real discount rates or nominal discount rates are used. The discount rate is often approximated as the difference between the interest rate and the inflation rate.

**Distance Measurement Instrument (DMI)** – a transducer used to determine the longitudinal distance that the measurement vehicle has traveled.

**Dowel Bar** – a load transfer device across a transverse joint in a concrete slab, usually consisting of a plan cylindrical steel bar.

**Dowel Bar Retrofit** – a concrete rehabilitation technique that is used to increase the load transfer capability of the existing transverse joints by placing of dowel bars across joints and/or cracks.

**Drainage Adjustment Factor (Cd)** – factor used in the 1993 Guide to modify layer coefficients as a function of how well they pavement structure can handle the adverse effects of water infiltration.

**Dry Density (or Bulk Dry Density)** – the mass of the oven-dried material divided by the volume occupied by the particles (including solids and internal voids) and inter-particle void volume (which is filled with water and/or air).

**Durability** – a measure of how asphalt binder or concrete physical properties change with age. In general, as an asphalt binder ages, its viscosity increases and it becomes more stiff and brittle (sometimes called age hardening), and as a concrete pavement ages freeze-thaw cycles and chemical attack degrade it.

[**Durability “D” Cracking**](http://pavementinteractive.org/index.php?title=Durability_Cracking) **–** in concrete pavements, a series of closely spaced, crescent-shaped cracks near a joint, corner or crack. It is caused by freeze-thaw expansion of the large aggregate within the concrete slab. Durability cracking is a general concrete pavement distress and is not unique to pavements.

**Dust Proportion** – the ratio of the percent aggregate passing the No. 200 sieve and the effective binder content; range in values from 0.6 to 1.2.

**Dynamic Cone Penetrometer, DCP** – instrument designed to provide a measure of the in-situ resistance to the penetration of a metal cone (dropped at a height of 2.26 ft, with a weight of 17.6 lb). See ASTM D6951, *Standard Test Method for Use of the Dynamic Cone Penetrometer in Shallow Pavement Applications.*

**Dynamic Friction Tester (DF Tester)** – a portable, stationary test device used in the field or laboratory to measure pavement/aggregate microtexture. See ASTM E1911, *Standard Test Method for Measuring Paved Surface Frictional Properties Using the Dynamic Friction Tester*.

**Dynamic Modulus, E\*** – the relationship between stress and strain under continuous sinusoidal loading. Used to evaluate the elastic-viscoelastic response parameters of an asphalt material. See AASHTO TP 62, *Standard Method of Test for Determining Dynamic Modulus of Hot Mix Asphalt.*

**Dynamic Shear Rheometer (DSR)** – a testing device used to measure of both the viscous and elastic behavior of the asphalt binder at the high-end of in-service temperatures to assess the potential for rutting under traffic. See AASHTO T 315, *Standard Method of Test for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)* and AASHTO TP 70, *Standard Method of Test for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)*.

**E**

**Effective Binder Content, Vbeff** – represents the total asphalt binder content (by volume) of the paving mixture minus the portion of asphalt binder absorbed into the aggregate particles. See AASHTO R 35, *Standard Practice for Superpave Volumetric Design for Hot Mix Asphalt.*

**Effective Specific Gravity (Gse)** – considers the overall volume of the aggregate exclusive of the volumes of pores that absorb asphalt binder.

**Elastic (or Young’s) Modulus** – represents the stiffness of a material, measured as the slope of the stress-strain curve in the elastic range.

**Elastic Modulus, E** – the relationship between stress and strain within a material’s elastic range.

**Electromagnetic (EM) Waves** – the energy waves which affect the electric and magnetic fields of materials they pass through.

**Emulsified Asphalt** – finely divided asphalt particles suspended in water; often used to overcome the needed for heating such as in seal coats, surface treatments, and cold-mix asphalt mixtures.

**End Result Specification** – stipulate the final characteristics of the product within established limits (e.g., minimum pavement thickness), allowing the contractor freedom in providing the product based on conformance to these stipulations.

**Enhanced Integrated Climate Model (EICM)** – model developed to simulate temporal variations in the temperature, moisture, and freeze-thaw conditions internal to the pavement and their impact on key pavement material properties.

**Environmental costs** – costs associated with traffic noise and construction equipment operation.

**Equivalent Single Axle Load (ESAL)** – a numerical factor that expresses the relationship of a given axle load (typically 18,000 lbs) to another axle load in terms of the relative damage to the pavement structure.

**Equivalent Uniform Annual Costs (EUAC)** – represents the NPV of all discounted cost and benefits of an alternative as if they were to occur uniformly throughout the analysis period. EUAC is a particularly useful indicator when budgets are established on an annual basis. The preferred method of determining EUAC is first to determine the NPV, and then convert it to EUAC.

**Estimated Mean Texture Depth (EMTD)** – an estimated value of mean texture depth (MTD) macrotexture measurement parameter. It is derived using mean profile depth (MPD) measurements and established transformation equations.

**Exposed Aggregate Concrete** – a concrete pavement surface finish where the cement paste is washed away to expose the coarse aggregate.

**F**

**Falling Weight Deflectometer (FWD)** – an impact load device used to deliver a transient impulse load to the pavement surface and measure the resultant pavement response (its deflection) by a series of sensors. See ASTM D4694, *Standard Test Method for Deflections with a Falling-Weight-Type Impulse Load Device*.

[**Fatigue Cracking**](http://pavementinteractive.org/index.php?title=Fatigue_cracking) – cracking of the pavement surface as a result of repetitive loading; may be manifested as longitudinal or alligator cracking in the wheel paths for asphalt pavements and transverse (and sometimes longitudinal) cracking for jointed concrete pavements. Also referred to as alligator cracking.

**Faulting** – the elevation or depression of concrete slab in relation to an adjoining slab, usually at transverse joints and cracks.

**Federal Highway Administration (FHWA)** – a division of the U.S. Department of Transportation which funds research and oversees the distribution of federal highway funding.

**Finite Element Analysis** – a rigorous mathematical process, often employing complex differential equations of an engineering problem is approximated algebraically. The geometry of the problem is described by discrete elements of finite dimensions that are analyzed through the application of engineering mechanics principles. Results of the finite element analyses are aggregated to approximate the exact mathematical solution.

**Flat and Elongated** – a testing procedure that assess the coarse aggregate particle shape, conducted in accordance with ASTM D4791, *Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate*.

**Flexural Fatigue** – used in fatigue models to predict fatigue cracking in pavements; conducted in accordance with AASHTO T 321, *Standard Method of Test for Determining the Fatigue Life of Compacted Hot Mix Asphalt (HMA) Subjected to Repeated Flexural Bending*.

**Flexural Strength** – see modulus of rupture.

**Fog Seal** – A light application of slow setting asphalt emulsion diluted with water and without the addition of any aggregate applied to the surface of an asphalt pavement. Fog seals are used to renew aged asphalt surfaces, seal small cracks and surface voids, or adjust the quality of binder in newly applied chip seals.

**Forensic Investigation** – the detailed study of a section of pavement, generally one which failed prematurely, is showing premature deterioration, or has performed well above expectations, in order to determine the cause of the notable performance.

**Framework** – Basic conceptual structure used to solve or address complex issues.

**Friction** – the retarding force developed at the pavement-tire interface that resists longitudinal sliding when braking forces are applied to the vehicle tires or sideways sliding when a vehicle corners around a curve. Friction is the result of a complex interplay between two key mechanisms—adhesion and hysteresis—and is most critical during periods of wet pavement.

**Friction Number (FN)** – a friction measurement parameter used with the locked-wheel friction tester specified in AASHTO T 242, *Standard Method of Test for Frictional Properties of Paved Surfaces Using a Full-Scale Tire*. FN can be obtained at different speeds using a ribbed (AASHTO M 261, *Standard Specification for Rib-Tread Standard Tire for Special-Purpose Pavement Frictional-Property Tests*) or smooth (AASHTO M 286, *Standard Specification for Smooth-Tread Standard Tire for Special-Purpose Pavement Frictional-Property Test*) test tire.

**Frost Heave** – results from ice forming beneath the surface of soil during freezing conditions.

**Full-Depth Patching** – removal and replacement of a segment of pavement to the level of the subgrade in order to restore areas of deterioration.

**Full-Depth Reclamation** – a rehabilitation procedure that recycles (typically in-place) all of the surface and one or more of the supporting layers.

**Functional Performance** – a pavement’s ability to provide a safe, smooth riding surface. These attributes are typically measured in terms of ride quality (see International Roughness Index) or skid resistance (see International Friction Index).

**Funding Levels** – Sum of money that is either dedicated or needed for a transportation asset.

**G**

**Geographic Information System (GIS)** – A tool to organize geographically based data, create maps, and perform spatial analyses.

**Geogrid** – a polymeric grid material having relatively high tensile strength and a uniformly distributed array of large apertures. The apertures allow soil particles on either side to come in direct contact, thereby increasing the interaction between the geogrid and the surround soils. Primarily used for reinforcement.

**Geomembrane** – a impermeable polymer sheeting used as fluid barriers to prevent mitigation of liquids in soils.

**Geosynthetic** – a planar material manufactured from polymeric material used in geotechnical-related applications. Primary functions include filtration, drainage, separation, reinforcement, fluid blockage, and protection. Typically include geotextiles, geomembranes, and geogrids.

**Geotextile** – a permeable fabric made of textile materials. Used as filters to prevent soil mitigation and mixing.

**Global Positioning System (GP**S) – satellite based navigation system.

**Goals** – Desired outcomes, broadly defined, as expressed in policy.

**Gradation** – a sieve analysis for the fraction of soil or aggregate retained on a specified sieve.

**Granular Base** – see aggregate base.

**Granular Subbase** – see aggregate subbase.

**Gravel** – a coarse aggregate resulting from natural disintegration and abrasion of rock or processing of weakly bound conglomerate.

**Grinding Head** – arbor or shaft containing numerous diamond blades or carbide teeth on diamond grinding or cold milling equipment.

**Grooving** – a longitudinal texturing method using diamond saw blades to promote improved surface texture characteristics.

**Ground Penetrating Radar (GPR)** – a testing device that emits short pulses of radio wave energy travel through the pavement structure and creates echo’s at boundaries of dissimilar materials, such as at an asphalt-base interface. See AASHTO R 37, *Standard Practice for Application of Ground Penetrating Radar (GPR) to Highways.*

**H**

**Half-Car Roughness Index (HRI)** – a number calculated by applying the IRI algorithm to the average of two profiles.

**Hamburg Wheel-Track Test** – test procedure to evaluate asphalt mixtures moisture sensitivity (see AASHTO T 324, *Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)*).

**Headwall** – placed at the end of pipe outlets to prevent damage to the pipe. Typically constructed using concrete.

**Heat Capacity, Q** – the heat required to raise the temperature of a unit mass of material by a unit temperature.

**Heater Scarification** – the initial phase of a hot in-place (HIR) recycling process in which the surface of the existing asphalt pavement is heated and mechanically raked before being removed and recycled.

**Hertz** (Hz) – one oscillation per second.

**High-Speed Profiler** – an inertial profiler (vans, trucks, cars, etc.) that is operated at prevailing highway speed. See also Inertial Profiler and Light-Weight Profiler.

**Hot Compressed Air Lance** – a device that uses heated compressed air to clean, dry, and warm cracks prior to sealing.

**Hot In-Place (HIR) Recycling** – a process which consists of softening the existing asphalt surface with heat, mechanically removing the surface material, mixing the material with a recycling agent, adding asphalt binder and virgin aggregate to the material (if required), and replacing the material on the pavement.

**Hot Mix Asphalt** – a high quality, thoroughly controlled hot mixture of asphalt binder and aggregate that can be compacted into a uniform dense mass.

**Hourly Distribution Factor** – a factor used to describe the proportion of traffic on a given roadway for a given hour of the day.

**Hydroplaning** – a phenomenon whereby the tires of moving vehicle are partially or completely separated from the road surface by a layer or film of water.

**Hydroplaning Speed (HPS)** – the critical speed of a vehicle above which hydroplaning will occur, given a specified water film thickness (WFT) and tire inflation pressure.

**Hysteresis Friction** – the friction component generated by deformation of the tire rubber as it comes into contact with pavement surface projections.

**I**

**Impact** – Effect or result, as of a project, program, policy, level of investment, or budget.

**Impact Echo (IE)** – nondestructive testing device based on impact generated response to determine concrete layer thickness, underlying voids, and delaminations.

**Impactor** – a small hammer-like tool used to create impact vibrations in NDT testing.

**Improvement** – A project or investment that enhances transportation system functionality; may include capacity additions or operations enhancements to existing facilities, or construction of new facilities.

**Impulse Response (IR)** – nondestructive testing procedure that includes an instrumented hammer and a surface motion sensor, or geophone. Used to identify localized weak areas and verification of strengthened areas.

**Incentives/Disincentives** – are used to encourage contractors to stay within the required specifications. Target values and allowable ranges are established and pay is based on the contractors ability to meet these requirements.

**Incremental Damage (ΔDI)** – approach used to calculate the accumulated damage in the pavement over the design life.

**Independent Assurance** – are activities that are an unbiased and independent evaluation of all the sampling and testing (or inspection) procedures used in the quality assurance program (AASHTO 2011).

**Indirect Tensile Strength (IDT)** – a testing device that assesses the mixture tensile strength at various temperatures, most often used to support analysis of low temperature cracking; conducted in accordance with AASHTO T 322, *Standard Method of Test for Determining the Creep Compliance and Strength of Hot Mix Asphalt (HMA) Using the Indirect Tensile Test Device.* High temperature testing for evaluation of rut resistance is conducted in accordance with AASHTO T 283, *Standard Method of Test for Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage.*

**Indirect Tensile Strength, ft** – diametrical loading of a cylindrical concrete specimen causing a tensile deformation perpendicular to the loading direction, which yields a tensile failure. See AASHTO T 198, *Standard Method of Test for Splitting Tensile Strength of Cylindrical Concrete Specimens*

**Inertial Profiler** – a profile measurement device that measures the pavement profile using an accelerometer to form an inertial reference and a height sensor to measure the pavement surface height relative to that reference.

**Inflation Rate** – the rate of increase in the prices of goods and services (construction and upkeep of highways) that has occurred in the past and represents past changes in the purchasing power of money. The inflation rate is derived from economic indicators like the consumer price index (CPI). It should only be used in the LCCA to bring past monetary values to present values. Forecasting future inflation rates is difficult if not impossible to predict. Recommendations for including future inflations projections in the discount rate used in the LCCA should be resisted without reliable forecasting methods. Should an agency select to include future inflation projections in the LCCA, care should be taken to include it in the projections of costs as well.

**Information** – processed or refined data in a form that communicates meaningful indications of current status or calculations and predictions useful for decision support.

**Initial Serviceability, p0** – serviceability of the pavement structure prior to traffic loading.

**In-Place Surface Recycling** – a rehabilitation treatment that consists of either hot or cold processes to remove part of the existing surface, rejuvenate it, add new material as needed, and relay it, all in one operation (single-unit or multi-unit operations).

**Integration** – Combining of data or results from multiple systems.

**Interest Rate** – is associated with the cost of borrowing money and represents the earning power of money. Often referred to as the market interest rate.

**Internal Rate of Return** – primarily used in private industry, represents the discount rate necessary to make discounted cost and benefits equal. While the IRR does not generally provide an acceptable decision criterion, it does provide useful information, particularly when budgets are constrained or there is uncertainty about the appropriate discount rate.

**International Friction Index (IFI)** – a “golden” friction measurement parameter that can be derived using (a) friction values obtained with different friction testing devices and different test speeds and (b) established equations and calibration constants developed from an international harmonization experiment. The IFI consists of two numbers—a friction number *F(60)* and a speed constant *SP*. See ASTM E1911,[*Standard Test Method for Measuring Paved Surface Frictional Properties Using the Dynamic Friction Tester*](http://www.astm.org/DATABASE.CART/HISTORICAL/E1911-98.htm).

**International Roughness Index (IRI)** – a statistic used to estimate the amount of roughness in a measured longitudinal profile. The IRI is computed from a single longitudinal profile using a quarter-car simulation. See ASTM E1926,[*Standard Practice for Computing International Roughness Index of Roads from Longitudinal Profile Measurements*](http://www.astm.org/Standards/E1926.htm).

**Inventory** – A compilation of the agency infrastructure assets, relevant characteristics (e.g., count or quantity, location, size, functional classification, traffic usage, district responsibility), and depending on agency practice, may include condition or performance data.

**Investment Analysis** – System or process that provides general guidance on predicting the performance of one or more assets within a specified budget level.

**J**

**J Factor** – a factor that accounts for [load transfer efficiency](http://pavementinteractive.org/index.php?title=Load_Transfer) of a concrete pavement (the lower the J Factor the better the load transfer). The J Factor for the [AASHO Road Test](http://pavementinteractive.org/index.php?title=AASHO_Road_Test) was estimated to be 3.2, and ranges from 2.3 to 3.8.

[**Joint Reflection Cracking**](http://pavementinteractive.org/index.php?title=Reflection_Cracking) – cracks in an asphalt overlay of a jointed concrete pavement with cracks occurring directly over the underlying concrete pavement joints.

**Joint Sealant** – compressible material used to minimize water and solid debris infiltration into the sealant reservoir and joint.

**Jointed Plain Concrete Pavement (JPCP)** – a concrete pavement containing transverse joints spaced to accommodate temperature gradient and drying shrinkage stress to avoid cracking. May or may not contain joint load transfer devices at transverse joints.

**Jointed Reinforced Concrete Pavement (JRCP)** – a concrete pavement containing distributed steel reinforcement to control random cracking, usually contains transverse load transfer devices. Due to performance issues, this pavement is generally no longer constructed.

**K**

**k-value** – see modulus of subgrade reaction.

**L**

**L10** – represents the sound level that is exceeded 10 percent of the time.

**Lane Distribution Factor** – a factor describing the percentage (of traffic in one direction) of a given vehicle class using a given lane.

**Lane Rental** – a rental fee applied during construction lane closures. The intent of lane rental is to encourage the contractor to minimize the user impact during construction.

**Lane/Shoulder Drop-Off** – the difference in elevation between the traffic lane and the shoulder.

**Layer Coefficients –** the empirical relationship between the structural number (SN) and layer thickness which expresses the relative ability of a material to function as a structural component of the pavement.

**Layered Linear Analysis** – a pavement analysis technique where each material is assumed to be elastic and each layer is assumed to be infinite in both horizontal directions. The subgrade is assumed to be a semi-infinite half space, where it is infinite in both horizontal direction and has infinite depth.

**Lean Concrete Base (LCB)** – a base course consisting of mineral aggregate, concrete, and water. Mixed at the plant and placed with a paver. Provides a strong platform for additional pavement layers.

**Lean Concrete Base (LCB)** – a base course consisting of mineral aggregate, concrete, and water. Mixed at the plant and placed with a paver. Provides a strong platform for additional pavement layers.

**Leq** – equivalent sound level during the measurement time. Mathematically, Leq is the sum of the sound energy during the measurement period divided by the measurement time. Leq represents the actual traffic noise and is a function of both vehicle type (e.g., cars and trucks), speed, and pavement surface type.

**Level of Service (LOS)** – Measures related to the public’s perception of asset condition or of agency services; used to express current and target values for maintenance and operations activities.

**Leveling Course** – a thin layer of asphalt concrete placed on an existing pavement to correct minor surface variations.

**Life Cycle** – A length of time that spans the stages of asset construction, operation, maintenance, rehabilitation, and reconstruction or disposal/abandonment; when associated with analyses, refers to a length of time sufficient to span these several stages and to capture the costs, benefits, and long-term performance impacts of different investment options.

**Life-Cycle Cost Analysis (LCCA)** – method for comparing the cost-effectiveness of a number of different strategies by considering all costs that can be expected to be incurred over a given analysis period.

**Light Reflectance/Luminance** – the physical measure of brightness of a pavement surface, as created by reflected light.

**Light-Weight Profiler** – an inertial profiler that is relatively light-weight (golf cart, ATV, etc.) compared with high-speed profilers. It is often operated much slower than prevailing traffic speed. See also Inertial Profiler and High-Speed Profiler.

**Lime-Stabilized Soil** – a prepared and mechanically compacted mixture of hydrated lime, water, and soil supporting the pavement system that has been engineered to provide structural support.

**Linear Referencing System (LRS)** – Protocol for locating features on a highway system. The LRS enables mapping and locating asset condition, performance measures, traffic characteristics, crashes, and performance of work activities.

**Liquid Limit** – a moisture content at which a groove cut into a soil sample is closed with 25 blows, determined in accordance with AASHTO T 89, *Standard Method of Test for Determining the Liquid Limit of Soils*.

**Lmax** – the maximum sound level during the measurement period.

[**Load Transfer**](http://pavementinteractive.org/index.php?title=Load_Transfer) – the transfer or distribution of load across pavement discontinuities such as joints or cracks.

**Load Transfer Efficiency (LTE)** – the ability of a joint to transfer load from one side to another. LTE is defined as the deflection of the unloaded side divided by the loaded side times 100.

**Locked-Wheel Friction Tester** – a friction test trailer comprised of a specified friction test tire (ribbed or smooth), water dispenser, braking system, and drag-force measurement system. The locked-wheel tester is towed behind a drive vehicle at a constant speed (typically 40 mi/hr and friction measurements are obtained by applying water in front of the test tire, engaging the braking system so as to fully lock the tire, and measuring the resistive drag force.

**Longitudinal Cracking** – a pavement crack predominately parallel to the direction of traffic. Usually a type of fatigue cracking.

[**Longitudinal Cracking**](http://pavementinteractive.org/index.php?title=Longitudinal_Cracking) – in asphalt pavements, cracks parallel to the pavement's centerline or laydown direction. Usually a type of fatigue cracking.

**Longitudinal Edgedrains** – a drainage system consisting of slotted collection pipes placed in trenches backfilled with drainable material, and non-slotted outlet pipes that run the length of the pavement section.

**Longitudinal Joint** – a constructed joint in a pavement layer that is oriented parallel to the pavement centerline.

**Longitudinal Profile** – the elevation profile of a highway pavement in a vertical plane parallel to traffic flow. Longitudinal profile encompasses both grade (measure of the incline or slope of a roadway, usually expressed as a percentage) and evenness (degree of uniformity to or the lack of deviation from a design longitudinal profile).

**Long-Life Pavement** – often referred to as perpetual pavement, use multiple layers of highly engineered material to produce a safe, smooth, long-lasting road without expensive, time-consuming, and traffic-disrupting reconstruction or major rehabilitation.

[**Long-Term Oven Conditioning**](http://pavementinteractive.org/index.php?title=Corrugation_and_Shoving) – asphalt mixture sample conditioning to simulate aging of in-service asphalt pavements (see AASHTO R 30, *Standard Practice for Mixture Conditioning of Hot Mix Asphalt (HMA)*).

**Low-Volume Road** – a roadway generally subjected to low levels of traffic, structural design is based on less than 1,000,000 ESAL for asphalt and concrete pavements, and less than 100,000 ESALs for aggregate-surfaced roads.

**M**

**Macrotexture** – a surface texture defined by wavelengths of 0.02 to 2 in and vertical amplitudes between 0.005 and 0.8 in. Defined by mixture properties (shape, size, and aggregate gradation) of an asphalt paving material and finishing/texture (depth, width, spacing, and direction of tining/grooving) of a concrete pavement material.

**Maintenance** – Activities that enable a transportation system to continue to perform at its intended level; comprises a range of services in preservation, cleaning, replacing worn or failed components, periodic or unscheduled repairs and upkeep, motorist services (incident response, hazardous materials response), snow and ice control, and servicing of traffic devices and aids; does not add to structural or operational capacity of an existing facility.

**Management Systems** – System that is designed to support one or more assets, such as: bridge management, maintenance management, pavement management, and others. These systems general include data related to asset inventory and condition levels. Can also consist of a software application that supports a particular set of an agency’s business processes, whether in managing assets or resources (e.g., pavements, bridges, human resources, equipment fleets, materials stockpiles, lands and buildings), performing prescribed functions (e.g., planning, project development, construction management, maintenance management), recording and managing transactions (e.g., financial management and accounting, payroll), or processing and communicating information (e.g., executive information, customer comments and complaints).

**Maximum Dry Unit Weight, γdmax** – the unit weight of a soil when all void spaces of the soil are completely filled with air, with no water. See AASHTO T 99 (or T 180), *Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.*

**Mean Panel Ratings** – a subjective rating system whereby automobile passengers rate the smoothness of a given road after driving on it.

**Mean Profile Depth (MPD)** – a two-dimensional estimate of the three-dimensional mean texture depth (MTD) macrotexture measurement parameter. It is generated using surface profile readings from laser-based texture measurement devices.

**Mean Roughness Index (MRI)** – a number calculated by averaging the IRI values from the two wheelpath profiles.

**Mean Texture Depth (MTD)** – a macrotexture measurement parameter obtained using the sand patch method (SPM) specified in ASTM E 965.

**Mechanistic-Empirical** – a design philosophy or approach using mechanics of solids and empirically derived relationships to estimate performance prediction.

**Megatexture** – a surface texture defined by wavelengths of 2 to 20 in and vertical amplitudes between 0.005 and 2 in. Defined by the surface properties of the aggregate particles.

**Method Specification** – outline specific materials selection requirements and construction processes to be followed in supplying/constructing a product.

**Microsurfacing** – a mixture of polymer modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives, properly proportioned, mixed, and spread on a paved surface. Microsurfacing can be used on high volume roadways to correct wheel path rutting and provide a skid resistant pavement surface.

**Microtexture** – a surface texture defined by wavelengths less than 0.02 in and vertical amplitudes between 0.04 and 20 mils. Defined by the surface properties of the aggregate particles.

**Milling** – a process of removing pavement material from the surface of the pavement either to prepare the surface prior to overlay or to restore pavement cross slopes and profile.

**Modified Lottman Procedure** – test procedure to evaluate an asphalt mixtures moisture sensitivity (see AASHTO T 283, *Standard Method of Test for Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage)*).

**Modified Proctor Test** – testing method used to determine the relation between the moisture content and density of a soil. See AASHTO T 180, *Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop*.

**Modulus** – the relationship between stress and strain for a given material. See also dynamic modulus, elastic modulus, and resilient modulus.

**Modulus of Elasticity, E** – the ratio of stress to strain in the elastic portion of a stress-strain curve.

**Modulus of Rupture, MR** – the maximum tensile stress at the bottom of a simply supported concrete beam, loaded at the third points at failure. Indicator of flexural bending strength of concrete. See ASTM C78 or AASHTO T97, *Standard Test Method for Flexural Strength of Concrete (Using Simple Beam and Third Point Loading).*

**Modulus of Subgrade Reaction (k-value)** – the load in pounds per square inch on a loaded area of the roadbed soil or subbase dived by the deflection in inches of the roadbed soil or subbase. Used in the design of concrete pavements. Dynamic modulus of subgrade reaction is determined through backcalculation of FWD deflections or backcalculation from deflection obtained from the elastic layered program where resilient modulus values are assigned to each layer. The dynamic value is approximately twice the static value. See ASTM D1196,[*Standard Test Method for Nonrepetitive Static Plate Load Tests of Soils and Flexible Pavement Components, for Use in Evaluation and Design of Airport and Highway Pavements*](http://www.astm.org/Standards/D1196.htm)*.*

**Moisture Content** – the percent moisture in a soil or aggregate sample, determined in the laboratory accordance with AASHTO T 265, *Standard Method of Test for Laboratory Determination of Moisture Content of Soils*, or AASHTO T 255, *Standard Method of Test for Total Evaporable Moisture Content of Aggregate by Drying*, or in the field using AASHTO T 310, *Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*.

**Moisture Susceptible Soils** – soils whose properties are significantly affected in the presence of moisture.

**Monitoring** – Collecting and processing condition and performance data and related data (e.g., traffic usage) to understand the current status of the transportation system, identify problem areas, gauge improvements resulting from investments, and track progress toward performance targets; provides a feedback mechanism for resource allocation and utilization decisions.

**Monthly Distribution Factor, MAF** – a factor describing the proportion of total roadway traffic of a given class using a roadway during a given month of the year.

**N**

**Ndesign** – a level of compaction that is expected to be obtained at the end of construction, achieving an air void content of 4 percent.

**Need** – Work required to help attain a policy objective or performance target, or to address a problem or deficiency.

**Net Present Value (NPV)** – is the discounted monetary value of expected net benefits (i.e., benefits minus costs). NPV is computed by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits. Also referred to as Net Present Worth (NPW).

**Network** – System of assets to provide transportation services to customers.

**Network level** – The most common level at which pavement management decisions are made. Network level decisions typically involve choices about how to use available funding across the entire road network. Other decision levels include project level and the strategic level.

**Ninitial** – a level of compaction to avoid tender mixes.

**Nmaximum** – a compactive effort that corresponds to the maximum density that the mix should achieve under traffic which is an air void content of 2 percent.

**Noise** – an unwanted sound.

**Nondestructive Testing (NDT)** – methods for testing a material which do not involve any permanent change or damage to the material.

**O**

**Objective** – Translation of a policy goal into a more specific measure of attainment (e.g., a policy goal of improved pavement performance expressed as improved serviceability or ride quality, or reduced roughness; a policy goal of improved mobility might be expressed through an objective of reduced travel time or total trip time, percentage increase in user benefits, or improvement in congestion measures or indexes).

**On-Board Sound Intensity (OBSI) Method** – a testing device that consists of a phase-matched pair of microphones positioned to isolate the sound generated near the tire-pavement interface. See AASHTO TP 76, *Standard Method of Test for Measurement of Tire/Pavement Noise Using the On-Board Sound Intensity (OBSI) Method*. A standard tire, as specified by ASTM F 2493 *Standard Reference Test Tire (SRTT)*, is used during testing.

**Open-Graded Friction Course (OGFC)** – an open-graded, permeable mix designed using only crushed stone (or gravel) and a small percentage of manufactured sands. Effective at reducing tire-road noise, tire splash/spray in wet weather, and typically smoother than dense-graded asphalt.

**Optimal** – The preferred or best option based on specified criteria.

**Optimization** – use of a mathematical model that defines both objectives and constraints using mathematical terms. Common methods of optimization include linear programming, non-linear programming, and dynamic programming.

**Optimum Moisture Content, wopt** – the water content at which a specified compactive force can compact a soil mass to its maximum dry unit weight.

**Options** – See alternatives.

**Outcome** – Result or consequence (especially in terms of performance), as of an investment decision, a particular allocation of resources, completion of a project, conduct of maintenance at a particular level of service, or selection of a particular alternative.

**Outflow Time (OFT)** – a volumetric-based surface drainage measurement parameter derived using the Outflow Meter. On impervious surfaces, it provides an indication of the level of macrotexture. See [ASTM E2380, *Standard Test Method for Measuring Pavement Texture Drainage Using an Outflow Meter*](http://www.astm.org/Standards/E2380.htm).

**Outlets** – a non-perforated pipe used in subdrainage systems to carry water from edgedrains to the ditch. Outlets are typically spaced no more than 250 feet apart.

**Output** – A product or service produced by a program or process.

**Overbanding** – Overfilling of a joint or crack reservoir so that a thin layer of crack or joint sealant is spread onto the pavement surface center over the joint or crack.

**P**

**Partial-Depth Patching** – repairs of localized areas of surface deterioration of concrete pavements that are within the upper one-third of the slab depth.

**Pavement Condition Index (PCI)** – a numerical rating resulting from a pavement condition survey that represents the severity of surface distresses. See [ASTM D6433, *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*](http://www.astm.org/Standards/D6433.htm).

**Pavement Design** – is defined under 23 CFR Section 500.203 as “. . . a project-level activity where detailed engineering and economic considerations are given to alternate combinations of subbase, base, and surface material which will provide adequate load carrying capacity. Factors that are considered include: materials, traffic, climate, maintenance, drainage, and life cycle costs.”

**Pavement Management** – A set of tools or methods that can assist decision-makers in finding cost-effective strategies for providing, evaluating, and maintaining pavements in a serviceable condition (AASHTO).

**Pavement Management System** – The computerized tool used to assist decision-makers in finding cost-effective strategies for providing, evaluating, and maintaining pavements in a serviceable condition.

**Pavement Performance** – a pavement condition or serviceability over time or with accumulated traffic.

**Pavement Preservation** – a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety, and meet motorist expectations.

**Pavement Structure** – a combination of surface, base, and subbase course placed on a subgrade to support the traffic load and distribute it to the roadbed.

**Pavement Surface Characteristics** – the properties of a pavement surface that help define the functional, non-structural aspects of a pavement. Surface characteristics consist of various physical attributes (texture, longitudinal and transverse profile, porosity) and dynamic attributes (friction, smoothness, hydroplaning potential, splash/spray, rolling resistance, tire wear, and light reflectance/luminance).

**Performance Grade (PG)** – an asphalt binder grading systems based on the average seven-day maximum pavement temperature (°C) and the minimum pavement design temperature (°C). See AASHTO R 29, *Standard Practice for Grading or Verifying the Performance Grade (PG) of an Asphalt Binder* and AASHTO R 49, *Standard Practice for Determination of Low-Temperature Performance Grade (PG) of Asphalt Binders*.

**Performance Measure** – An indicator, preferably quantitative, of service provided by the transportation system to users; the service may be gauged in several ways (e.g., quality of ride, efficiency and safety of traffic movements, services at rest areas, quality of system condition).

**Performance Period** – the period of time that an initially constructed or rehabilitated pavement structure will perform before reaching its terminal condition. Also referred to as design life.

**Performance Specification** - similar to end-result specifications, the contractor is allowed freedom in supplying/constructing the product, as long as it performs according to established criteria (e.g., pavement smoothness).

**Performance Target** – Threshold value of a performance measure.

**Permanent Strain** – a material deformation when subjected to loading.

**Permeability** – the ability of a pavement material to be penetrated/infiltrated by water. Permeability is measured by the rate of flow of water through the material.

**Permeable Base** – an open-graded drainage layer, generally considered to be able to drain moisture at a rate of more than 1000 ft/day. May consist of asphalt-treated, cement-treated, or untreated aggregate materials.

**Pervious Concrete Pavement** – a concrete pavement that consist of a high-porosity (15 to 20 percent) concrete permeable surface layer to promote drainage of water into either the underlying soil or drainage system.

**Phase Angle, δ –**provides a relative indication of the viscous and elastic behavior of the asphalt binder (related to the time lag between input and output signals). The lower the phase angle, the more elastic the asphalt binder and less likely to form wheel ruts. See AASHTO T 315, *Standard Method of Test for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)*.

**Plastic Limit** – the water content at which a soil formed into a cylinder (by rolling) crumbles at the edge, determined in accordance with AASHTO T 90, *Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils*.

**Plasticity Index (PI)** – the size of the range of water contents where the soil exhibits plastic properties. The PI is measured as the difference between the liquid limit and the plastic limit. Soils with a high PI tend to be clay, those with a lower PI tend to be silt, and those with a PI of 0 tend to have little or no silt or clay*.*

**Poisson's Ratio, μ** – a ratio of the contraction or transverse [strain](http://en.wikipedia.org/wiki/Strain_%28materials_science%29) (perpendicular to the applied load), to the extension or axial strain (in the direction of the applied load).

**Polymers** – a complex chain or cluster molecules formed from many (poly) small molecules (monomers). Polymers can be broadly grouped into two categories: elastomers (rubber) and plastomer (plastic). Common elastomers include natural rubbers, styrene-butadiene rubber (SBR) latexes, styrene-isoprene-styrene (SIS) block copolymers, polychloroprene latexes, and crumb rubber modifiers made from ground tires. Plastomers include polyethylene, polypropylene, ethyl vinyl acetate (EVA), polyvinyl chloride (PVC), ethylene propylene (EPDM), and polyolefins.

[**Popouts**](http://pavementinteractive.org/index.php?title=Popouts) – a small pieces of concrete that break loose from the surface leaving small divots or pock marks.

**Porosity** – a measure of the inter-connective air void spaces within a material, computed as a percentage of the volume of voids to total material volume.

**Porous Asphalt Pavements** – a pavement structure designed to allow precipitation to percolate directly through the surface into the base/subgrade layers. Underlying layers are designed to store infiltrating water, releasing it to the subgrade or into a specially design sub-surface drainage system.

[**Portland Cement**](http://pavementinteractive.org/index.php?title=Portland_Cement) – a hydraulic cement composed primarily of hydraulic calcium silicates.

[**Pothole**](http://pavementinteractive.org/index.php?title=Potholes) – a bowl-shaped openings in a pavement resulting from localized disintegration.

**Powertrain Noise** – a noise primarily attributed to engine noise and exhaust emissions.

**Precision** – the degree of agreement among a randomly selected series of measurements; or the degree to which tests or measurements on identical samples tend to produce the same results (AASHTO 2011).

**Present Serviceability Index (PSI)** – an index derived by formula for estimating the serviceability rating from measurements of physical features of the pavement.

**Present Serviceability Rating (PSR)** – a definition of pavement serviceability based on individual observations.

**Preservation** – Actions to deter or correct deterioration of an asset to extend its useful life; does not entail structural or operational improvement of an existing asset beyond its originally designed strength or capacity.

**Pressure Aging Vessel (PAV)** – a testing device used to simulate long-term (approximately 5 to 10 years) oxidative aging of the asphalt binder. See AASHTO R 28, *Standard Practice for Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)*.

**Preventive Maintenance** – a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity) (AASHTO).

**Prime Coat** – a thin liquid asphalt coating applied to the surface of an untreated aggregate base layer to minimize the flow of asphalt cement from the asphalt concrete layer to the aggregate base and to promote a good interface bond (Christopher et al., 2006).

**Probabilistic Approach** – includes the individual analysis inputs to be defined by a frequency (probability) distribution. Probabilistic LCCA accounts for uncertainty and variation in individual inputs and allows for differing assumptions for many different variables at the same time.

**Profiler** – an instrument used to measure road profiles.

**Profilograph** – a device used to measure smoothness by measuring the deviations of a pavement surface using a mid-point measuring wheel from the reference established by a set of wheels (6 for a California-type) at either end of the device. See [ASTM E1274, *Standard Test Method for Measuring Pavement Roughness Using a Profilograph.*](http://www.astm.org/Standards/E1274.htm)

**Profilograph Index (PrI)** – a smoothness index that is computed from a profilograph trace. This is sometimes called Profile Index (PI), but is more specifically called PrI.

**Program** – A set of projects of similar type of work (e.g., pavement rehabilitation) or serving a similar objective (e.g., to improve mobility or safety).

**Project** – Construction work to address a need or deficiency in system preservation, improvement, or operations.

**Project level** – One of the three decision levels used in pavement management (with network and strategic levels). At the project level, very detailed information on a small subset of the network is used to design the appropriate treatment.

**Propulsion Noise** – a noise generated by the propulsion of the vehicle and includes: engine, exhaust, intake, and other powertrain components.

**ProVal** – a computer program used for viewing and analyzing pavement profiles.

**Public-Private Partnerships** – contractual agreement between a public agency and a private sector entity to deliver a service or facility for use by the general public. The private sector entity designs, finances, constructs, operates, and maintains the transportation project. Financing is conducted through tolling or reimbursement of the private sector entity through predetermined payments from the public agency.

**Pumping** – the ejection of foundation material, either wet or dry, through joints or cracks, or along edges of concrete slabs resulting from vertical movements of the slab under traffic, or from cracks in semi-rigid pavements.

[**Punchout**](http://pavementinteractive.org/index.php?title=Punchout) – in concrete pavements (especially CRCP), a localized slab portion broken into several pieces.

**P-waves** – the primary or compression component of seismic waves. Also referred to as pressure waves, they travel about twice as fast as S-waves, and can travel through any material.

**Q**

**Quad Axle Load** – the total load transmitted by all wheels onto four axles (spaced more than 120 in., but not more than 160 in. apart), extending across the full width of the vehicle.

**Quality Control (QC)** – the system used by a contractor to monitor, assess, and adjust its production or placement processes to ensure that the final product will meet the specified level of quality. Quality control includes sampling, testing, inspection, and corrective action (where required) to maintain continuous control of a production or placement process (AASHTO 2011).

**Quarter-Car Model** – a model used to simulate one corner (a quarter) of a car.

**R**

**RADAR** – Standing for RAdio Detection And Ranging, the use of EM waves and their subsequent echoes to measure the distance to objects.

**Ranking** – listing needs in accordance with a set of rules that rank projects from highest priority to lowest priority. The most common approach to ranking is to place the highest priority on the roads in worst condition. Although this is a popular method of managing a pavement network, it is not cost-effective.

**Raveling** – a pavement distress characterized by the loss of surface material involving the dislodgment of aggregate particles and degradation of the binder material.

**Rayleigh Waves** – component of a seismic wave which travels along the surface of a material, which travel at about 90% of the speed of S-waves.

**Reconstruction** – the replacement of the entire existing pavement structure by the placement of an equivalent, or increased, structure.

**Reclaimed Additive** – waste product introduced into a paving process, which had not originally produced it, thus offsetting the use of an equivalent quantity of new materials.

**Recycled Additive** – waste product re-introduced into the paving process, which had originally produced it, thus offsetting the use of an equivalent quantity of new materials.

**Recycled Asphalt Pavement (RAP)** – typically generated by (1) milling machines in rehabilitation projects or (2) a special crushing plant used to break down large pieces of discarded asphalt pavement.

**Recycled Concrete Aggregate (RCA)** – concrete pavement that has been crushed and processed into specified sizes. Can be used in lieu of virgin aggregate, but may require modification due to physical and mechanical properties that are slightly different than virgin materials.

**Recycling Agents** – organic materials with specific chemical and physical characteristics selected to address binder deficiencies and to restore aged asphalt material to desired specifications in pavement recycling.

**Reference Device** – a device used to obtain the true profile of a pavement. Devices such as the Dipstick® and walking profiler are considered reference devices.

**Reflective Cracking** – cracks in asphalt or concrete pavement surfaces, occurring over existing joints or cracks of the underlying layers.

**Rehabilitation** – “structural enhancements that extend the service life of an existing pavement and/or improve its load-carrying capacity. Rehabilitation techniques include restoration treatments and structural overlays (AASHTO Highway Subcommittee on Maintenance).”

**Reinforcement** – steel embedded in a concrete slab to resist tensile stresses and detrimental opening of cracks.

**Rejuvenating Agent** – similar to recycling agents in material composition, these products are added to existing aged or oxidized asphalt pavements in order to restore pavement surface flexibility and to retard block cracking.

**Reliability** – the probability that a given pavement design will last for the anticipated design life.

**Resilient Modulus, Mr** – a standardized measure of the modulus of elasticity of a subgrade soil or other pavement material. See AASHTO T 307, *Standard Method of Test for Determining the Resilient Modulus of Soils and Aggregate Materials* andASTM D5102, *Standard Test Methods for Unconfined Compressive Strength of Compacted Soil-Lime Mixtures.*

**Resolution** – in nondestructive testing, the ability for the testing method to distinguish one feature from another, and to determine their location and depth. Also referred to as axial resolution.

**Resource** – An input to the construction, operation, maintenance, repair, renewal, or disposal of transportation infrastructure assets; provides value-added to these processes; may include labor knowledge and skills, financial capacity, real estate, corporate information, or equipment and materials.

**Results Monitoring** – Systems that help track treatment (e.g., maintenance or new construction) performance and cost with time.

**Ride Number (RN)** – a calculated roughness index, between 0 and 5, that approximates the Mean Panel Rating for a pavement surface. See also Mean Panel Ratings, IRI, and PrI.

**Roller Compacted Concrete (RCC)** – blend of cement, water, and aggregates, but much drier with essentially no slump, as compared to conventional concrete. RCC is placed in a manner similar to paving, often by dump trucks or conveyors, spread by bulldozers or special modified asphalt pavers. After placement it is compacted by vibratory rollers.

**Rolling Resistance** – the force that resists the rolling of a wheel along a pavement surface, created by the natural deformations (bending, stretching and recovering) that occur in the pavement tire as it encounters the pavement and by the tread’s interaction with the road.

**Rolling Thin-Film Oven Test (RTFO)** – a testing device used to simulate oxidative aging that would be expected to occur during construction. See AASHTO T 240, *Standard Method of Test for Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test).*

**Rotational Viscometer** – a testing device used to measure the viscosity of the asphalt binder for the purpose of selecting mixing and compaction temperatures. See AASHTO T 316*, Standard Method of Test for Viscosity Determination of Asphalt Binder Using Rotational Viscometer.*

**Roughness** – the deviation of a surface from a true planar surface with characteristic dimensions that affect vehicle dynamics and ride quality. In this practice, the term roughness is the average of two IRI statistics calculated from longitudinal profile measurements, one in each pavement wheelpath. See also Smoothness.

**Roughness Profile** – A plot that shows the variation of roughness over a section of pavement.

**Router** – a mechanical device, with a rotary cutting system, that is used to widen, cut, and clean cracks in pavements prior to sealing.

**Routine Maintenance** – work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service.

**Rutting** – the longitudinal depression or wearing away of the pavement in wheel paths under load.

**R-value** – a measure of the response of a compacted sample of [soil](http://en.wikipedia.org/wiki/Soil) or [aggregate](http://en.wikipedia.org/wiki/Construction_aggregate) to a vertically applied pressure under specific conditions. See AASHTO T 190, *Standard Method of Test for Resistance R-Value and Expansion Pressure of Compacted Soils.*

**S**

**Salvage Value** – represents the value of an investment alternative at the end of the analysis period.

**Sand Equivalency** – measure of the clay content in fine aggregate, conducted in accordance with AASHTO T 176, *Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.*

**Sand Seal** – an application of asphalt binder, normally an emulsion, covered with a fine aggregate. It may be used to improve the skid resistance of slippery pavements and to seal against air and water intrusion.

**Sandblasting** – a procedure in which sand particles are blown with compressed air at a pavement surface to abrade and clean the surface.

**Sandwich Seal** – a surface treatment that consists of application of asphalt emulsion and a large aggregate, followed by a second application of asphalt emulsion that is in turn covered with smaller aggregate and compacted. Sandwich seals are used to seal the surface and improve skid resistance, especially on asphalt pavement surfaces that are bleeding or flushing.

**Saturated Surface Dry** – aggregate condition in which the pores of each aggregate particle are filled with water and no excess water is on the aggregate surface.

**Scrub Seal** – an application of a polymer modified asphalt to the pavement surface followed by the broom scrubbing of the asphalt into cracks and voids, then the application of an even coat of sand or small aggregate, and a second brooming of the aggregate and asphalt mixture. This seal is then rolled with a pneumatic tire roller.

**Seal Coats** – collective term used for several different kinds of thin surface treatments used to improve the surface texture and protect an asphalt surface. Seal coats include [fog seals](http://pavementinteractive.org/index.php?title=Fog_Seals), [slurry seals](http://pavementinteractive.org/index.php?title=Slurry_Seals), microsurfacing, and [bituminous](http://pavementinteractive.org/index.php?title=BST) surface treatments.

**Seismic Analysis of Surface Waves (SASW)** – a nondestructive testing procedure that consists of measuring the surface wave dispersion curve and interpreting the corresponding shear wave velocity profile. Used to determine layer thickness, layer stiffness, and void detection.

**Seismic Waves** – physical waves in the form of vibrating molecules which can travel through all matter.

**Self-Assessment** – Process by which an agency self-evaluates its compliance with established standards, guidelines, and procedures.

**Self-Consolidating Concrete** – Highly flowable, non-segregating concrete mix that can spread and consolidate without the need for mechanical vibration.

**Semi-Rigid Pavement** – a pavement structure consisting of an asphalt layer over a cementitiously stabilized or treated layer.

**Separator Layer** – a layer of treated or untreated aggregate or geotextile used to mitigate the movement of fines from underlying layers (e.g., subgrade) into a permeable base.

**Service Life** – time from initial construction until the structural and/or functional integrity of the pavement is deemed unacceptable and rehabilitation or replacement is required.

**Serviceability** – the ability at time of observation of a pavement to serve traffic that uses the facility.

[**Short-Term Oven Conditioning**](http://pavementinteractive.org/index.php?title=Corrugation_and_Shoving) – asphalt mixture sample conditioning to simulate aging due to mixture production and construction (see AASHTO R 30, *Standard Practice for Mixture Conditioning of Hot Mix Asphalt (HMA)*).

[**Shoving**](http://pavementinteractive.org/index.php?title=Corrugation_and_Shoving) – form of plastic movement typified by an abrupt wave across the pavement surface. The distortion is perpendicular to the traffic direction.

[**Shrinkage Cracking**](http://pavementinteractive.org/index.php?title=Shrinkage_Cracking) – cracks formed due to material contraction either from temperature drops (both asphalt and concrete) or water loss during setting and curing (concrete).

**Shrinkage Limit** – used to determine the shrinkage potential of cohesive soils.

**Silicone Sealant** – a type of joint or crack sealant compound either self leveling or non-sag in application characteristics, that is based on polymers of polysiloxane structures and cures through a chemical reaction when exposed to air.

**Simple Performance Test (SPT)** – see Asphalt Mixture Performance Test (AMPT).

**Single Axle Load** – the total load transmitted by all wheels onto a single axle, extending across the full width of the vehicle.

**Single-Spot Laser** – lasers with a circular footprint with diameters ranging from 0.04 to 0.12 in.

[**Slippage Cracking**](http://pavementinteractive.org/index.php?title=Slippage_Cracking) – in asphalt pavements, crescent or half-moon shaped cracks generally having two ends pointed into the direction of traffic caused by breaking or turning wheels.

**Slurry** – mixture of a liquid and fine solid particles that together are denser than water.

**Slurry Seal** – a mixture of slow setting emulsified asphalt, well graded fine aggregate, mineral filler, and water. It is used to fill cracks and seal areas of old pavements, to restore a uniform surface texture, to seal the surface to prevent moisture and air intrusion into the pavement, and to improve skid resistance.

**Smoothness** – According to ASTM E 867, the deviation of a surface from a true planar surface with characteristic dimensions that affect vehicle dynamics and ride quality. In this practice, the term roughness is the average of two IRI statistics calculated from longitudinal profile measurements, one in each pavement wheelpath. See also Roughness.

**Smoothness Indices** – measure different ranges of wavelengths based on specific profilers. IRI and PI are among the two most common pavement smoothness indices.

**Soil Cement** – a mechanically compacted mixture of soil, portland cement, and water used as a layer in a pavement system to reinforce and protect the subgrade or base.

**Sonic Waves** – P-waves with frequencies within the range of human hearing.

**Sound Frequency** – speed, measured in cycles per second or hertz (Hz), at which small air pressure changes are occurring. A person with good hearing can hear frequencies ranging from 20 to 20,000 Hz. The human ear is most sensitive to frequencies ranging from 1,000 to 4,000 Hz.

**Spalling** – the cracking, breaking, or chipping of pavement edges in the vicinity of a joint or crack.

**Specific Gravity of Solids, Gs** – the weight per unit volume of material. See AASHTO T 84, *Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate* and AASHTO T 85, *Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate*, AASHTO T 100, *Standard Method of Test for Specific Gravity of Soils.*

**Splash/Spray** – Water from a wet road that is thrown from the tire tread and/or squeezed out from the pavement-tire contact patch, resulting in either an airborne mist of tiny, generally <0.02 in. water droplets (spray) or an airborne jet of large, generally >0.04 in. water droplets (splash).

**Stabilized Aggregate or Soil** – Aggregate or soil to which a stabilizing agent has been added in order to bind otherwise loose particles to one another, providing strength and cohesion. The stabilizing agent is usually some sort of cementitious or asphalt material.

**Stakeholders** – A person, group, or organization that affects or can be affected by an agencies actions.

**Standard Proctor Test** – testing method used to determine the relation between the moisture content and density of a soil. See AASHTO T 99, *Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.*

**Statistical Pass-By Method –** measures sound levels and vehicle speeds for vehicles traveling in a selected traffic stream and consists of a microphone placed at a height of 5 ft and at a distance of 50 ft from the center of the measured lane.

**Steel Reinforcement** – Includes dowel bars and tie bars for JPCP and JRCP, and reinforcing steel for CRCP.

**Stiffness** – the resistance of a material to a load. Usually transformed into a modulus value for modeling and design purposes.

**Stone Matrix Asphalt (SMA)** – asphalt mixture designed to maximize the aggregate-to-aggregate contact, thus transferring deformation from the binder to the aggregate, consisting of high quality gap-graded coarse aggregate, manufactured sands, and mineral filler. To maintain film thickness, the binder is often modified with polymers and/or fibers.

**Strategic** – A view of assets that are policy-based, performance-driven, long-term, and comprehensive.

**Strategic level** – One of three decision levels used in pavement management (with network and project levels). Strategic decisions typically include policy and investment decisions made by upper level management.

**Stress Sensitive** – resilient modulus of a material changes as the stress state is varied.

[**Stripping**](http://pavementinteractive.org/index.php?title=Stripping) **–** in asphalt pavements, the loss of bond between aggregates and asphalt binder that typically begins at the bottom of the asphalt layer and progresses upward.

**Subbase** – a layer or layers of specified or selected materials of designed thickness placed on a subgrade to support the base course.

**Subbase Course** – the portion of the pavement structure between the subgrade and the base course. A subbase course is not always needed or used.

**Subgrade** – an existing soil material upon which the pavement structure is constructed.

**Superpave Shear Tester** – test to evaluate an asphalt mixtures rut resistance using a repeater shear at constant height test (see AASHTO T 320, *Standard Method of Test for Determining the Permanent Shear Strain and Stiffness of Asphalt Mixtures Using the Superpave Shear Tester (SST)*).

**Supplemental Costs** – include costs for administrative, engineering, and traffic control related to construction, maintenance, and rehabilitation activities.

**Supplementary Cementitious Materials** – generally by-products of other process or natural materials and consist of such materials as fly ash, slag cement, silica fume, metakaolin, or other pozzolanic materials.

**Surface Course** **(a.k.a. wearing course)** – the top layer of a pavement structure that comes in contact with the traffic load. The surface course, in most cases, minimizes the infiltration of surface water, provides a smooth, uniform, and skid-resistant riding surface, and offers durability against traffic abrasion and the climate.

**Surface Shortwave Absorptivity** – a measure of the amount of available solar energy that is absorbed by the pavement surface. The lighter and more reflective the surface, the lower the surface shortwave absorptivity.

**Surface Texture** – The deviations of a pavement surface from a true planar surface, which occur at three distinct levels of scale (microtexture, macrotexture, and megatexture), each defined by the wavelength (λ) and peak-to-peak amplitudes (A) of its components.

**Surface Treatment** – any application applied to an asphalt pavement surface to restore or protect the surface characteristics. Surface treatments include a spray application of asphalt binder (cement, cutback, or emulsion) and may or may not include the application of aggregate cover. They may also be referred to as surface seals, or seal coats or chip seals.

**S-Waves** – the shear or secondary component of seismic waves, representing side-to-side motion. They travel only through solids.

**T**

**Tack Coat** – Thin liquid asphalt coating applied to the surface of a stabilized base layer and between lifts in thick asphalt concrete surface layers to promote bonding of the layers.

**Tactical** – Strategy for achieving a specific objective or goal.

**Tandem Axle Load** – the total load transmitted to the pavement by two consecutive axles that are spaced more than 40 inches apart and no more than 8 feet apart, extending across the full width of the vehicle.

**Terminal Serviceability, pt** – the lowest acceptable condition level prior to resurfacing or reconstruction.

**Texture Profiler** – Low- or high-speed, non-contact laser-based testing device capable of collecting detailed surface profile measurements and computing key macrotexture parameters.

**Thaw-Weakening** – a reduction in bearing capacity (e.g., resilient modulus) of existing unbound layers and subgrades due to the presence of excessive moisture as a result of thawing temperatures.

**Theoretical Maximum Specific Gravity (Gmm)** (aka “Rice Density”) – theoretically, the maximum density of an asphalt mixture if it contained zero air voids; determined in accordance with AASHTO T 209*, Standard Method of Test for Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA).*

**Thermal Conductivity, K** – the quantity of heat that flows normally across a surface of unit area per unit of time and per unit of temperature gradient.

**Thermal Cracking** – cracks in an asphalt pavement surface, that usually extend full width across the pavement width, as a result of seasonal or diurnal volume changes of the pavement due to restrained friction with the underlying layer. Also referred to as transverse cracking.

**Thin Overlay** – an asphalt overlay with one lift of surface course generally a thickness of 1.5 in. or less.

**Tie Bars** – Deformed steel bars or connectors used to hold the faces of abutting slabs in contact.

**Time Delay Costs** –costs incurred as a result of travel delays due to work zones (i.e., lane restrictions, road closures). Time delay costs represent the value of other activities that cannot be completed because of the extra time taken traveling.

**Tining** – Grooving concrete pavement surface perpendicular (transverse) or in (longitudinal) the direction of travel.

**Tire Wear** – The rate of abrasion/wear of a vehicle tire as it rolls (or slides) along a pavement surface.

**Tire-Pavement Noise** –noise between the tire-pavement interface is due to vibration and tire aerodynamic related mechanism.

**Traffic Noise** – the sound generated from all vehicles traveling on the roadway and include propulsion, aerodynamic, and tire-pavement noise.

**Transfer Function** – a factor that relates the theoretical calculation of damage to actual measured distress.

**Transverse (Pavement) Profile** – the elevation profile of a highway pavement in a vertical plane perpendicular to traffic flow. Transverse profile encompasses both cross-slope (rate of elevation drop across the pavement surface) and evenness (degree of uniformity to or the lack of deviation from a design transverse profile).

**Transverse Cracking** – see thermal cracking.

**Tridem Axle Load** – the total load transmitted to the pavement by three consecutive axles, that are spaced more than 40 inches apart and no more than 8 feet apart, extending across the full width of the vehicle.

**Truck Traffic Classification (TTC)** – a factor describing the proportion of trucks in a given class on a given roadway.

**True Profile** – The undistorted shape of a pavement surface.

**U**

**Ultimate Shrinkage** – the shrinkage strain that the concrete material undergoes during prolonged exposure to drying conditions and is defined at 40 percent relative humidity. Ultimate shrinkage is calculated internally in the AASHTOWare Pavement ME DesignTM software and is dependent on aggregate type.

**Ultrasonic Waves** – P-waves with frequencies above the range of human hearing.

**Ultrathin Overlay** – an asphalt overlay over an existing asphalt or concrete pavement, generally less than 1 in. in thickness.

**Ultra-thin Whitetopping (UTW)** – a thin 2 to 4 in. concrete overlay over an existing asphalt pavement.

**Unbonded Concrete Overlay** – a layer of concrete, ranging in thickness from 6 to 12 in., placed over (with an appropriate separation layer, typically 1 to 2 in. asphalt pavement) existing concrete and asphalt pavements and fractured concrete pavements. Unbonded concrete overlays require minimal pre-overlay repair.

**Unbound Granular Base** – see aggregate base.

**Unbound Granular Subbase** – see aggregate subbase.

**Unit Weight, ρ** – the weight per unit volume of a loose or compacted material (lb/ ft3). See AASHTO T 99, *Moisture-Density Relations of Soils Using a 5.5 lb Rammer and a 12-in. Drop,* AASHTO T 121, *Mass per Cubic Meter (Cubic Foot), Yield, and Air Content (Gravimetric) of Concrete*, AASHTO T 166, *Standard Method of Test for Bulk Specific Gravity of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens* and AASHTO T 209, *Standard Method of Test Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)*, and AASHTO T 271, *Density of Plastic and Hardened Concrete In-Place by Nuclear Method.*

**Usable Project Segment** – is defined as a portion of a highway that, when completed, could be opened to traffic independent of some larger overall project.

**User Benefits** – Economic gains to the transportation users resulting from a project or investment strategy; may include monetary value of travel time savings, accident reductions, reduced costs of vehicle operation, and savings or advantages gained from more reliable transportation services.

**User Costs** – costs incurred by highway users traveling on the facility and the excess costs incurred by those who cannot use the facility because of either agency or self-imposed detour requirements. User costs typically are an aggregation of three separate components: vehicle operating costs, crash costs, and time delay costs.

**Utilization** – Process of applying labor, funds, information, and other resources to implement projects and services for the transportation system.

**V**

**Validation** – the mathematical comparison of two independently obtained sets of data (e.g., agency acceptance data versus contractor data) to determine whether it can be assumed they came from the same population (AASHTO 2011).

**Vehicle Classification** – an identification, summarization, and reporting of traffic volume by vehicle type.

**Vehicle Operating Costs (VOC)** – costs associated with fuel and oil consumption, tire wear, emissions, maintenance and repair, and depreciation due to work zone-related delay and/or significantly rough roads. VOCs typically involve the out-of-pocket expenses associated with owning, operating, and maintaining a vehicle.

**Visco-Elastic** – a material that possess both viscous (relatively high resistance to flow) and elastic (resumes original shape after being stretched or expanded) properties.

**Visual Assessment –** the process of collecting all available information from a pavement from only a visual study, usually in a consistent and repeatable manner. Many standardized testing methods exist for collecting distress data through a visual assessment.

**Voids Filled with Asphalt (VFA)** – the percent of intergranular void space between the aggregate particles that contain or are filled with asphalt.

**Voids in Mineral Aggregate (VMA)** – the volume of intergranular void space between the aggregate particles of a compacted paving mixture that includes the air voids and the effective asphalt content, expressed as a percent of the total volume of the specimen.

**Voids in Total Mix (VTM)** – see air voids (Va).

**Volatile Organic Carbon (VOC)** – an organic chemical compounds that can affect the environment and human health.

**Volumetrics** – the relationship between the volume and mass of the various mixture components (aggregate, binder, and air).

**W**

**Warm Mix Asphalt (WMA)** – a generic term for a variety of technologies for producing hot mix asphalt mixtures at lower temperatures.

**Warping** – the deformation of a concrete slab caused by a moisture differential between the upper and lower surfaces.

**Warranty Contract** – requires contractors to guarantee all or portions of a construction project to be free of defects in materials and workmanship over a specified period of time. Warranty specifications measure quality based on the pavement performance and not on the construction materials or operations.

**Water Film Thickness (WFT)** – the thickness or depth of the layer of water that accumulates on top of a pavement surface as a result of many variables, including the rainfall rate, the drainage path length (which is a function of pavement cross-slope, longitudinal grade, and drainage width), the slope of the drainage path, Manning’s hydraulic roughness coefficient, and the pavement surface macrotexture and porosity. WFT is a key variable in determining the potential for hydroplaning on a pavement and the splash/spray characteristics of the pavement.

**Waterblasting** – the use of a high-pressure water stream (8500 to 10,000 psi) to clean concrete. It may be used in concrete joint resealing to remove sawing laitance or in patching to produce a clean surface prior to placement of the sealer or patch material. Also referred to as hydroblasting.

**Wearing Course** – see surface course.

**Weigh-In-Motion (WIM)** – the process of estimating a moving vehicle’s gross weight and the portion of that weight that is carried by each wheel, axle, or axle group by measurement and analysis of dynamic forces.

**Wheel Load** – the sum of the tire loads on all tires included in the wheel assembly comprising a half axle.

**Wheelpath** – the portion of a pavement that is contacted by the wheels/tires of vehicles in a typical traffic stream. There are generally two wheelpaths per lane.

**Wide-Spot Laser** – a laser with typical footprint dimensions of 0.5 to 0.7 in. in length and approximately 0.04 in. wide. The laser is mounted such that the longer dimension is orientated perpendicular to the direction of travel.

**Work Zone** – an area of reduced roadway capacity due to agency construction, maintenance, and/or rehabilitation activities.

**Working Crack** – a crack in a pavement that undergoes significant deflection and thermal opening and closing movements greater than 1/16 in., typically oriented transverse to the pavement centerline.

**Y**

**Young’s Modulus** – see elastic modulus.

**Z**

**Zero-Stress Temperature** – a temperature (after placement and during curing) at which the concrete layer exhibits zero thermal stress. Concrete exhibits tensile stress at temperature below the zero-stress temperature.