METHODS OF SAMPLING AND TESTING
MT 603-26
DEFINITIONS

1. SOIL ENGINEERING TERMS

Dust Ratio – The ratio of the portion passing the 200 mesh sieve to the portion passing the 40-mesh sieve and shall be no greater than two-thirds.

Degradation Value – A specification set for each project using aggregate and is defined as a value from 100 to 0 indicating the quality of fines produced by self-abrasion of aggregate in the presence of water. (100 is superior and below 35 is poor).

Gradation – A term used to describe the range and the relative distribution of particle sizes in a material.

Well-graded soils – Those soils, which have a good representation of all particle sizes from the largest to the smallest but with a very small percentage of fines.

Poorly-graded soils – Those soils in which the range of particle sizes is very small or soils having a deficiency in some of the intermediate sizes or soils containing excessive fines.

Liquid Limit – The moisture content, which is the boundary between the liquid and plastic states for the minus No. 40 fraction of a soil. For laboratory purposes it may be defined as the moisture content at which that soil fraction will close a standard groove for a length of 1/2 inch when subjected to 25 blows in a liquid limit device.

Moisture Content – The weight of water in a given soil mass divided by the oven dry weight of the soil and is expressed in percent.

Optimum Moisture – The moisture content, which will permit maximum-dry-unit weight to be obtained for a given comp active effort.

Plastic Limit – The moisture content, which is the boundary between the plastic and semi-solid states for the minus No. 40 fraction of the soil. For laboratory purposes, it may be defined as the minimum moisture content at which the soil fraction can be rolled into a thread 1/8 inch in diameter without crumbling.

Plastic Index – The numerical difference between the moisture content of the Liquid Limit and the moisture content of the Plastic Limit.

Wear Value – A specification set for each project using aggregate and is defined as the percentage of dry weight lost during the abrasion of coarse aggregate in a Los Angeles Machine with an abrasive charge.

2. DENSITY

Absolute (of solids and liquids) – The mass of a unit volume of a material at a specified temperature (grams per milliliter, grams per cubic centimeter, pounds per cubic foot, etc. at x temperature).

Absolute (of gases) – The mass of a unit volume of a gas at a stated temperature and pressure (grams per milliliter, grams per cubic centimeter, pounds per cubic foot, etc. at x temperature, y pressure).

Apparent (of solids and liquids) – The weight in air of a unit volume of a material at a specified temperature.

Bulk (of solids) – The weight in air of a unit volume of a permeable material (including both permeable and impermeable voids normal to the material) at a stated temperature.

3. SPECIFIC GRAVITY TERMS

Absolute – The ratio of the weight of a given volume of solids to the weight of an equal volume of water at a stated temperature.

Apparent – The ratio of the weight of a given volume of impermeable material (the solid matter including impermeable pores) to the weight of an equal volume of water.

Bulk – The ratio of the weight of a given volume of permeable material (including both permeable and impermeable voids) to the weight of an equal volume of water.

Permeability – A measure of the facility of a soil to transmit liquids, largely dependent upon grain size distribution.

"Rice" Gravity – Defined as the maximum specific gravity (absolute) of the uncompacted bituminous mixture.

4. HIGHWAY TERMS

Base – Foundation for pavement.

Base Course – A term used to include the layers of relatively high quality materials placed above the sub-grade as a stress distribution medium to insure that the stress induced in the sub-grade will not exceed its strength.

Binder Course – The course, in sheet asphalt and bituminous concrete pavements, placed between base and surface courses.

Bleeding – The upward migration of bituminous material resulting in a film of bitumen on the surface.

Blow-Up – Localized buckling or shattering of rigid pavement caused by excessive longitudinal pressure.

Cement Treated Base (CTB) – A mixture of a well graded aggregate and measured amounts of Portland cement and water, compacted to a high density to provide a durable base for paving.

Construction Joint – The vertical or notched plane of separation in pavement.

Contraction Joint – A full depth or weakened plane type joint designed to establish the position of any crack caused by contraction while providing no space for expansion of the pavement beyond its original length.

Corrugations – The regular transverse undulations in a pavement surface consisting of alternate valleys and crests.

Cracks – The approximately vertical cleavage due to natural causes or traffic action.

Crazing – A pattern of cracking extending only through the surface layer, a result of more drying shrinkage in the surface than the interior of plastic concrete.

"D" Lines – Disintegration characterized by successive formation of a series of fine cracks at rather close intervals paralleling edges, joints and cracks and usually curving across slab corners, initial cracks forming very close to slab edges and additional cracks progressively developing, ordinarily filled with calcareous deposits.

Disintegration – Deterioration into small fragments from any cause.

Distortion – Any deviation of pavement surface from the original shape.

Expansion Joints – A joint permitting the pavement to expand in length.

Faulting – The differential vertical displacement of slabs adjacent to joints or cracks.

Flecking – The dislodgement of a thin film of mortar from the outermost portion of occasional coarse aggregate particles on concrete surfaces, generally attributable to lack of bond between mortar and aggregate.

Flexible Base and Pavements – A bituminous pavement consisting of a well-graded aggregate combined with asphalt cement and with sufficiently low bending resistance to maintain intimate contact with the underlying structure and to distribute loads to the foundation by aggregate interlock, particle friction, or surface tension. Principle elements of flexible pavements are wearing surface, base, sub-base and sub-grades.

Frost Heave – The lifting and distortion of a surface due to internal action of frost resulting from subsurface ice formation; affects soil, rock, pavement, and other structures.

Joints – Constructed junctions between adjacent sections of pavement or between pavement and structures.

Leveling Course – A course of variable thickness constructed immediately on top of base material or existing pavement to remove large irregularities prior to super-imposed treatment or construction. (Binder course may function as leveling course and be called Binder course, Leveling course or Binder-Leveling course).

Longitudinal Joint – Either a full depth or weakened-plane type joint constructed parallel to or along the centerline to control longitudinal cracking.

Map Cracking – Disintegration in which cracking of the slab surface develops in a random pattern; may develop over the entire surface or localized areas.

Pitting – The displacement of aggregate particles from the pavement surface due to the action of traffic or disintegration, without major displacement of cementing material.

Plane of Failure – The depth at which the voids in the wheel path and/or between the wheel path are comparable to the voids in the passing lane.

Progressive Scale – Concrete disintegration that at first appears as surface scaling but gradually progresses deeper.

Pumping – Displacement and ejection of water and suspended fine particles at joints, cracks and edges.

Raveling – The progressive disintegration of aggregate particles, by dislodgement, from the surface downward or edges inward.

Resurfacing – Supplemental surface placed on existing pavement to improve surface conformation or increase strength.

Rigid base and Pavements – A term applied to that type of pavement that is constructed with Portland Cement Concrete. Those, which due to high bending resistance, distribute loads to foundations over comparatively large areas.

Rutting – The formation of longitudinal depressions by wheel tracking.

Scaling – The peeling away of the surface of Portland Cement Concrete.

Scratch or Wedge Course – A course, separate from the binder course, placed on the base to overcome deficiencies as lack of or too much crown, or to adjust grade or super-elevation.

Settlement – The reduction in elevation of short sections of pavement or structures.

Shoving – The displacement of bituminous pavement due to the action of traffic, generally resulting in bulging of the surface.

Shoulder – A portion of the roadbed between the traffic lane and the top of the ditch in cuts and the top of the slope in embankments.

Spalling – The breaking or chipping of rigid pavement at joints, cracks or edges, usually resulting in fragments with feather edges.

Stripping – The separation of asphalt from aggregate particles due to the presence of moisture in asphalt pavements.

Sub-base – Specified or select material, of a planned thickness, placed as a foundation for pavement.

Subgrade – The material in cuts, fills and fill foundations immediately below the first layer of sub-base, base ore pavement.

Subsealing or Undersealing – The placing of waterproof material under existing pavement to prevent the vertical flow of water or suspended solids that fill the voids under pavement.

Surface Course – The top course of a pavement providing a surface resistant to traffic abrasion or imparting structural value to pavement.

Surface Scale – A peeling away of the surface mortar of Portland Cement Concrete exposing sound concrete, even though the scale extends into the mortar surrounding coarse aggregate.

Surface Texture – The surface character of pavement that depends on size, shape, arrangement and distribution of aggregates and cement or binder.

Thrust – The pressure exerted by a rigid pavement against other pavements or structures.

Warping – The deviation of pavement surface from its original shape caused by temperature and moisture differentials within the slab.

Warping Joints – A joint permitting then warping of pavement slabs when moisture and temperature differentials occur in pavement, i.e., longitudinal or transverse joints with bonded steel or tie bars passing through them.

5. CONCRETE TERMS

Admixtures – Materials other than cement, aggregate and water in concrete used or entrain air, retard setting or accelerate setting.

Anchorage – That portion of a reinforcing bar, and any attachment thereto, designed to resist pulling out or slipping of the bar when subjected to stress.

Bleeding – The natural separation of a liquid from a liquid-solid or semisolid mixture; for example, water from freshly poured concrete.

Consistency – The degree of solidity or fluidity of freshly mixed concrete and commonly described as slump.

Curing Period – A period provided to prevent the formation of surface cracks due to the rapid loss of water while the concrete is plastic and to ensure attainment of the specified strength.

Fineness Modulus – The fineness modulus (FM) is an index of the fineness of an aggregate – the higher the FM, the coarser the aggregate. FM is the summation of the cumulative percentages of the material retained on the standard sieves divided by 100.

Honeycomb – A surface or interior defect in a concrete mass characterized by the lack of mortar between the coarse aggregate particles.

Laitance – Weak material, consisting principally of lime, which is formed on the surface of concrete, especially when excess water is mixed with the cement.

Saturated Surface Dry – A term used to describe the condition of an aggregate in which the pores of all the particles are completely filled with water, but their surfaces are free from moisture.

Slump – A measure of concrete consistency.

Yield – The cubic feet of concrete produced per sack of cement.

6. ASPHALT TERMS

Asphalt Cement – Fluxed or un-fluxed asphalt especially prepared for use in making bituminous pavements.

Batch – The quantity of mix discharged from the mixer in one complete operation of the plant before additional materials are introduced.

Bleeding – The presence of an excessive amount of asphalt on the surface due to either to an excessive amount of prime or tack coats or excessive asphalt in the mix.

C-Factor – Determined by the change in viscosity of asphalt cement during the mixing process relative to that during the Thin-Film Oven test and is used to determine whether incomplete combustion of or contamination by burner fuel is causing or could cause asphalt concrete pavement tenderness.

Cutback Asphalt – Asphalt cement that has been rendered liquid by fluxing with a petroleum distillate. (includes: RCs – Rapid Curing; MCs – Medium Curing; SCs – Slow Curing.)

Emulsion – An emulsion of asphalt cement and water with a small quantity of an emulsifying agent.

Prime Coat – The initial application of low viscosity liquid asphalt to an absorbent base prior to placing asphalt concrete.

Tack Coat – A thin layer of bitumen, road tar, or emulsion laid on a road to enhance adhesion of the course above it.

7. ASPHALT MIX DESIGN TERMS

Volume Swell – The increase in volume of compacted aggregate, soil, sand, or a combination of aggregates passing the 10 mesh sieve (2.0 mm) and stabilized with bituminous material, when soaked in water for a standard length of time.

Acceptance Samples and Tests – These are samples taken and tests made to ascertain on a day-to-day basis whether the quality of the materials being incorporated or proposed for incorporation into the construction conform to the plans and specifications.

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

Anti-Rutting Specification – Defined as a series of specifications to reduce rutting. It requires a minimum of 70% mechanical fracture on at least one face of the 4 mesh fraction of material, revised aggregate gradation specification to conform to maximum density gradation curve. It allows a 1.05 pay factor as an incentive to stay closer to maximum density line and maintain greater uniformity. The temperature of the mix upon discharge from all mixers including drum dryers id specified in the mix design memorandum. Also, a Quality Assurance Plan is required.

Coarse Aggregate Angularity – The percentage (by mass) of aggregates larger than 4 mesh (4.75 mm) with one or more fractured faces.

Final Record Samples and Tests – These samples and tests are taken at random from completed construction work or completed portions thereof. They are to provide an independent spot-check of the adequacy and the effectiveness of the results obtained in Acceptance sampling and testing and to supplement theses test results.

Fine Aggregate Angularity – The percent air voids present in loosely compacted aggregates smaller than No. 8 mesh (2.36 mm).

Flat and Elongated Particles – The percentage (by mass) of coarse aggregates that have a maximum to minimum dimension ratio greater than 5.

Immersion Compression – A method for measuring the loss of cohesion resulting from the action of water on compacted bituminous mixtures containing penetration graded asphalts.

Independent Assurance Samples and Tests – These are samples taken and tests made to provide an independent spot check of the adequacy and effectiveness of the results obtained in Acceptance sampling and testing and to supplement these test results. The samples are split in the field either into two or three portions that are tested by the field, district, or area, and the Materials Bureau in the case of a three-way split. These test results are used to compare testing procedures between the three laboratories.

Marshall Method of Asphalt Mix Design – A method that uses the measurement of resistance to plastic flow of cylindrical specimens of bituminous paving mixtures loaded on the lateral surface by means of the Marshall apparatus to achieve the following characteristics; sufficient asphalt, sufficient mix stability, sufficient voids and sufficient workability.

Marshall Stability – The stability measured during loading in the Marshall apparatus and is used to determine whether the compacted bituminous mixture will satisfy the demands of traffic without distortion or displacement.

Marshall Flow – The lateral deformation of the specimen at the point of maximum stability during loading in the Marshall apparatus, measured in hundredths of an inch and recorded as a whole number (0.15 inches becomes 15).

Quality Assurance – Defined as a contractual method used to monitor the quality of material incorporated into Plant Mix Surfacing and Portland Cement Concrete Pavement, and in the case of Plant Mix Surfacing, the density of the finished pavement. This is achieved by random sampling and or testing of contractor produced materials that will be used to establish price adjustments on a statistical basis.

Sand Equivalent (Clay Content) – Clay content is the percentage of clay material contained in the aggregate fraction that is finer than a 4 mesh (4.75 mm) sieve.

Superpave™ – Superior Performing Asphalt Pavements incorporates performance-based, asphalt materials characterization with the design environmental conditions to improve performance by controlling rutting, low temperature cracking and fatigue cracking.

Voids in the 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 sample.

Voids Filled with Asphalt (VFA) – The percentage portion of the volume of intergranular void space between the aggregate particles that is occupied by the effective asphalt.

8. ACRONYMS

The following are some of the more common symbols used in highway construction:

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Cement
ASTM	American Society for Testing Materials
BST	Bituminous Surface Treatment
BTB	Bituminous Treated Base
CAPAC	Corrugated Aluminum Pipe Arch Culvert
CAPC	Corrugated Aluminum Pipe Culvert
CSPAC	Corrugated Steel Pipe Arch Culvert
CSPC	Corrugated Steel Pipe Culvert
CTB	Cement Treated Base
FHPM	Federal-aid Highway Program Manual
FM	Fineness Modulus
FR	Final Record
HMA	Hot Mix Asphalt
IA	Independent Assurance
LTB	Lime Treated Base
MT	Montana Test
PC	Portland Cement
PCCP	Portland Cement Concrete Pavement
PG	Performance Grade
PMB	Plant Mix Base
PMS	Plant Mix Surfacing
PSI	Pounds Per Square Inch
QA	Quality Assurance
RCPAC	Reinforced Concrete Pipe Arch Culvert
RCPC	Reinforced Concrete Pipe Culvert
RMS	Road Mix Surfacing
SC	Seal Coat
SG	Specific Gravity
SPPAC	Structural (Sectional) Plate Pipe Arch Culvert
SPPC	Structural (Sectional) Plate Pipe Culvert

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