



*MADA Design Guide  
Glossary*

## A

**AASHTO** – The American Association of State Highway and Transportation Officials. An organization of highway engineers from the 50 states that develops guides and standards.

**AGGREGATE** – Any hard, inert, mineral material used for mixing in graduated fragments. It includes sand, gravel, crushed stone, or slag.

**ALLIGATOR CRACKING** – A series of interconnected cracks caused by failure of the HMA surface under repeated loads.

**ASPHALT** – A dark brown to black cementitious material that can be solid, semi-solid, or liquid in consistency, in which the predominant constituents are bitumens that occur in nature as such or are obtained as residue in refining petroleum. Asphalt is a constituent in varying proportions of most crude petroleums.

**ASPHALT CEMENT BINDER (AC)**— Asphalt that is refined to meet specifications for paving, industrial, and special purposes. Its penetration is usually between 40 and 300.

**ASPHALT JOINT FILLER** – An asphaltic product used for filling cracks and joints in pavement and other structures.

**ASPHALT PLANT** – A manufacturing facility that produces HMA mixtures.

**ASTM** – The American Society for Testing and Materials. A national organization of users and producers of materials that establishes standards.

**ASPHALT SURFACE TREATMENTS** – Applications of asphaltic materials to any type of road or pavement surface, with or without a cover of mineral aggregate that produces an increase in thickness of less than 1 inch.

## B

**BATCH PLANT** – a manufacturing facility that produces HMA mixtures in batches.

**BASE COURSE** – The layer of material immediately beneath the surface or intermediate course. It may be composed of crushed stone; crushed slag; crushed or uncrushed gravel and sand; or combinations of these materials. It also may be bound with asphalt (HMA base course).

**BINDER COURSE** – A transitional layer of HMA paving between the base and the surface course.

**BITUMINOUS ( or Asphalt) CONCRETE** –  
Other terms for HMA

**BLEEDING** – A film of asphalt binder on the pavement surface caused by the upward migration of asphalt binder in an HMA pavement resulting from a lack of air voids in the mixture or stripping in lower lying layers. Same as flushing.

**BORROW** – Suitable material from sources outside the roadway prism used primarily for embankments.

**BREAK & SEAT** – A process used to prevent joint reflective cracking in an HMA overlay over old PCC pavement. It involves breaking up the underlying rigid pavement into relatively small pieces by repeatedly dropping a heavy weight or hammer and then seating the broken slab with a roller.

## C

**CBR (California Bearing Ratio)** – A measurement of the strength and support value of a crushed stone base or subgrade soil.



**CAPILLARY ACTION** – The rise or movement of water in the voids of a soil caused by capillary forces.

**CEMENT-TREATED BASE** – Cement-treated base consists of specified soil aggregates and Portland Cement Concrete mixed in a pug mill and deposited on the subgrade to the specified thickness.

**CHECKING** – Hairline surface cracks in an HMA mat caused by steel-wheeled rollers.

**COARSE AGGREGATE** – Aggregate particles retained on a No. 8 sieve.

**COARSE GRADED AGGREGATE** – An aggregate having a continuous grading in size of particles from coarse through fine with a predominance of coarse sizes.

**COMPACTION** – The densification of crushed stone base, subgrade soil, or HMA material by means of vibration or rolling.

**COMPACTIVE EFFORT** – The combined effort of (1) applying weight to an HMA surface with a roller and compressing the material underneath the ground contact area and (2) creating a shear stress between the compressed material underneath the ground contact area and the adjacent uncompressed material.

**CONTRACT** – The written agreement executed between the contractor and other parties, setting forth the obligations of the parties thereunder; including, but not limited to the performance of the work, the furnishing of labor and materials, and a basis of payment.

**CONTRACTOR** – The individual, partnership, corporation, or joint venture contracting for performance of prescribed work.

**CRUDE OIL** – Unrefined petroleum.

**CRUSHED STONE** – The product resulting from the artificial crushing of rocks, boulders,

or large cobblestones with the particles resulting from the crushing operation having all faces fractured.

**CRUSHER RUN** – Aggregates that have received little or no screening after initial crushing operations. Crusher run aggregates are generally more economical than screened aggregates.

**CUL-DE-SAC** – An area at the terminus of a dead-end street or road constructed for the purpose of allowing a vehicle to turn around.

**CULVERT** – Any structure that is not classified as a bridge and that provides an opening under any roadway.

**CUT** – The portion of the roadway formed by excavation below the surface of the earth.

**CUTBACK ASPHALT** – Asphalt cement that has been liquefied by blending with petroleum solvents. Upon exposure to atmospheric conditions, the solvents evaporate, leaving the asphalt cement to perform its function.

D

**DESIGN THICKNESS** – The total pavement structure thickness above the subgrade.

**DENSE GRADED AGGREGATE** – A mineral aggregate uniformly graded from the maximum size down to and including sufficient mineral dust to reduce the void space in the compacted aggregate to exceedingly small dimensions approximating the size of voids in the dust itself.

**DRAINAGE** – Structures and facilities for collecting and carrying away water.

**DRUM PLANT** – A manufacturing facility that produces HMA mixtures in the dryer drum on a continuous basis.



**E**

**EARTHWORK** – The work consisting of the construction of the roadway, excluding bridges, pavement structure, and selected or capping material.

**EMBANKMENT** – A structure of soil, soil aggregate, or broken rock between the embankment foundation and the subgrade.

**EMULSIFIED ASPHALT** – An emulsion of asphalt cement and water that contains a small amount of an emulsifying agent, a heterogeneous system containing two normally immiscible phases (asphalt and water), in which the water forms the continuous phase of the emulsion and minute globules of asphalt form the discontinuous phase. Emulsified asphalts may be either anionic, electro-negatively-charged asphalt globules or cationic, electro-positively-charged asphalt globules, depending upon the emulsifying agent.

**EQUIPMENT** – All machinery, tools, and other apparatus, together with the necessary supplies for upkeep and maintenance, needed for the proper construction and acceptable completion of the work.

**EROSION** – Removal and transportation of soil by the action of water or wind.

**ESAL** – Equivalent single axle load. Based on the AASHTO Road Test, the most common approach to determining traffic loading is to convert wheel loads of various magnitudes and repetitions to an equivalent number of “standard” or “equivalent” loads. The most commonly used equivalent load in the U.S. is the 18,000-lbs. Single-axle Load.

**F**

**FATIGUE CRACKING** – Cracks caused by fatigue failure of an HMA surface under repeated loads.

**FINE AGGREGATE** – Aggregate particles passing a No. 8 sieve.

**FINE GRADED AGGREGATE** – An aggregate having a continuous grading in sizes of particles from coarse through fine with predominance of fine sizes.

**FHWA** – Federal Highway Administration, part of the U.S. Department of Transportation.

**FLEXIBLE PAVEMENT** – A pavement structure that maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability. HMA pavements are flexible pavements; PCC concrete is not.

**FLUSHING** – A film of asphalt binder on the pavement surface caused by the upward migration of asphalt binder in an HMA pavement resulting from a lack of air voids in the mixture or stripping in lower lying layers. Same as bleeding.

**FOG SEAL** – A light application of liquid asphalt without mineral aggregate cover. Slow-setting asphalt emulsion diluted with water is the preferred type.

**FREE WATER (GROUNDWATER)** – Water that is free to move through a soil mass under the influence of gravity.

**FRENCH DRAIN** – A trench loosely backfilled with stones, the largest being placed on the bottom with the size decreasing toward the top.

**FULL-DEPTH ASPHALT PAVEMENT** – An asphalt pavement in which HMA mixtures are employed for all courses above the subgrade or improved subgrade. A full-depth asphalt pavement is laid directly on the prepared subgrade.



**FWD** – Falling Weight Deflectometer. The FWD is an impact load device used to deliver a transient impulse load to the pavement surface and measure the resultant pavement response (deflection) by a series of sensors.

G

**GEOTEXTILES** – Fabric-like materials used in some pavement construction applications. Uses include stabilization of base materials to prevent migration into subgrades.

**GRAVEL** – A coarse granular material (usually larger than 1/4 inch in diameter) resulting from the natural erosion and disintegration of rock. In Minnesota, most gravel is of glacial origin. Crushed gravel is the result of artificial crushing with most fragments having at least one face resulting from fracture.

**GRANULAR BORROW** – Granular Material used to replace undesirable materials in the grade for a pavement.

H

**HMA (Hot-Mix Asphalt)** – High quality, thoroughly controlled hot mixture of asphalt cement and well-graded, high-quality aggregate, thoroughly compacted into a uniform dense mass.

**HMA BASE COURSE** – A foundation course consisting of mineral aggregate, bound together with asphaltic material.

**HMA INTERMEDIATE COURSE** – A course between a base course and asphalt surface course. Sometimes called a binder course.

**HMA BINDER COURSE** – An intermediate course between a base course and an asphalt surface course.

**HMA OVERLAY** – One or more courses of HMA construction on an existing pavement. The overlay generally includes a leveling course to correct the contour of the old pavement, followed by a uniform course or courses to provide needed thickness.

**HMA (ASPHALT) PAVEMENTS** – Pavements consisting of a surface course of mineral aggregate coated and cemented together with asphalt cement on supporting courses such as asphalt bases, crushed stone, slag, or gravel.

**HYDROSTATIC PRESSURE** – The pressure in a liquid under static conditions; the product of the unit weight of the liquid and the difference in elevation between the given points and the free water elevation.

I

**ICE LENS** – Subsurface ice crystals that form in the plane of freezing temperatures of a pavement. Water migrates from below (where the temperature is above freezing) and freezes. Heaving of the pavement surface can result if the creation of an ice lens is significant.

**IMPROVED SUBGRADE** – Any course or courses of select or improved material between the foundation soil and the subbase is usually referred to as the improved subgrade. The improved subgrade can be made up of two or more courses of different quality materials.

**IN SITU** – In place, or in it's original location.

J

**JMF** – Job-mix formula. A recommended/ approved proportion of aggregate & asphalt used for field Quality control/Quality Assurance of HMA mixture production.



## L

**LIFT** – A layer or course of HMA paving material.

**LEVELING COURSE** – An asphalt/aggregate mixture of variable thickness used to eliminate irregularities in the contour of an existing surface before superimposed treatment or construction.

**LIQUID ASPHALT** – An asphalt material having a soft or fluid consistency that is beyond the range of measurement by the normal penetration test, the limit of which is 300 maximum. Liquid asphalts include cutback asphalt and emulsified asphalts.

## M

**MAPA** – The Minnesota Asphalt Pavement Association.

**MAT** – A term used to describe the fresh HMA surface behind the paving machine. Most commonly used to refer to the HMA layer during the laydown and compaction phase of construction.

**MATERIALS** – Any substances specified for use in the construction of the project and its appurtenances.

**MEDIUM CURING ASPHALT (MC)** – Liquid asphalt composed of asphalt cement and a kerosene-type diluent of medium volatility.

**MINERAL DUST** – The portion of the fine aggregate passing a No. 200 sieve.

**MINERAL FILLER** – A finely divided mineral product at least 65 percent of which will pass a No. 200 sieve. Pulverized limestone is the most common manufactured filler, although other stone dust, hydrated lime, Portland cement, and certain natural deposits of finely divided mineral matter are also used.

## N

**NAPA** – The National Asphalt Pavement Association.

**NATURAL ASPHALT** – Asphalt occurring in nature that has been derived from petroleum by natural processes of evaporation of volatile fractions leaving the asphalt fractions. The native asphalts of most importance are found in the Trinidad and Bermudez Lake deposits. Asphalt from these sources is called Lake Asphalt.

**NCAT** - the National Center for Asphalt Research and Technology located at Auburn University in Auburn, Alabama.

## O

**OPEN GRADED AGGREGATE** – An aggregate containing little or no mineral filler or in which the void spaces in the compacted aggregate are relatively large.

**OPTIMUM MOISTURE CONTENT** – In a soil, the moisture content at which maximum density can be achieved.

## P

**PAVEMENT STRUCTURE (COMBINATION OR COMPOSITE)** – All courses of selected material placed on the foundation or subgrade soil, other than any layers or courses constructed in grading operations. When the HMA pavement is on an old Portland Cement Concrete base or other rigid-type base, the pavement structure is referred to as a combination or composite-type pavement structure.

**PERCOLATION** – The movement of free water through soil.

**PERMEABILITY** – A measure of the rate or volume of flow of water through a soil or other material including HMA.



**PERPETUAL PAVEMENT** – A Long-lasting HMA pavement.

**PETROLEUM ASPHALT** – Asphalt refined from crude petroleum.

**PLANS** – The standard drawings current on the date bids are received; and the official approved plans, profiles, typical cross sections, electronic computer output listings, working drawings and supplemental drawings, or exact reproductions thereof, current on the date bids are received; and all subsequent approved revisions thereto, which show the location character, dimensions, and details of the work to be done.

**PLANT MIX** – An HMA mixture produced in an asphalt mixing plant, that consists of mineral aggregate uniformly coated with asphalt cement or liquid asphalt.

**PORTLAND CEMENT CONCRETE (PCC)** – A composite material that consists essentially of Portland cement and water as a binding medium in which is mixed coarse and fine particles of crushed stone.

**POTHOLE** – A bowl-shaped opening in the pavement surface resulting from localized disintegration.

**PSI** – Present Serviceability Index. A pavement condition index.

**PSR** – Present Serviceability Rating. A definition of pavement serviceability based on individual observation.

**PUMPING** – Pavement deflection at a joint or crack under traffic that results in a discharge of water and/or subgrade soils.

**PRIME COAT** – An application of low-viscosity liquid asphalt to an absorbent surface. It is used to prepare an untreated base for an asphalt surface.

**PROPOSAL** – The offer of a bidder, submitted on the approved official form, to perform the work and to furnish the labor and material at prices set forth therein, valid only when properly signed and guaranteed.

Q

**QUALITY ASSURANCE** – A system, including physical tests, that assures that the material being supplied to a construction project substantially complies with the contract requirements.

**QUALITY CONTROL** – A system, including physical tests, that is used by the contractor to control production operations to ensure contract compliance.

**QUALITY MANAGEMENT** – A system incorporating QC & QA that was developed in Minnesota to control the production of and to facilitate acceptance of HMA pavements.

R

**RAPID CURING ASPHALT (RC)** – Liquid asphalt composed of asphalt cement and a naphtha- or gasoline-type diluent of high volatility.

**REHABILITATION** – The renewal of an existing surface or pavement structure by repair, recycling, or overlay techniques.

**RECLAIMED ASPHALT PAVEMENT (RAP)** – Removed and/or reprocessed pavement materials containing asphalt and aggregates.

**REFLECTIVE CRACKING** – Cracks in an HMA overlay caused by cracks in the existing pavement “reflecting” up through the overlay.

**RESILIENT MODULUS** – An estimate of a materials elastic modulus based on the stress and strain measurements from rapidly applied loads – like those that pavement materials experience from wheel loads.



## S

**RESURFACING** – Existing surfaces may be improved by resurfacing (or overlaying) with a HMA mat of varying thicknesses. It may be considered in two categories: (1) overlays to provide smooth, skid- and water resistant surfaces or to make improvements in grade and/or cross section; and (2) overlays to strengthen existing pavements to handle heavier loads or increased traffic. Sometimes called overlays.

**RICE TEST** – Rice Density or Rice Specific Gravity. A test used to determine the maximum specific gravity or the zero voids density of a mixture used in calculating the volume of air voids in a compacted HMA mixture.

**RIGID PAVEMENT** – A pavement structure that distributes loads to the subgrade by slab action, having as one course a Portland Cement Concrete slab of relatively high bending resistance.

**ROAD** – A general term denoting a public way for purpose of vehicular travel, including the entire area within the right-of-way.

**ROADBED** – The graded portion of a highway within the top and side slopes, prepared as a foundation for the pavement structure and shoulders.

**ROCK** – From which crushed stone, sand, and gravel are made; the rock most suitable for making good aggregates.

**RUBBLIZATION** – Reducing a material or structure to rubble. Regarding pavements, rubblization usually refers to reducing an existing rigid pavement to rubble in preparation for an HMA overlay to prevent reflective cracks.

**RUTTING** – Surface depressions in the wheelpath of a pavement.

**SCREED** – The part of a paving machine that spreads, smooths and provides initial compaction of the HMA mat.

**SEAL COAT** – A thin asphalt surface treatment used to waterproof and improve the texture of an asphalt wearing surface. Depending on the purpose, seal coats may or may not be covered with aggregate. The main types of seal coats are aggregate seals, fog seals, emulsion slurry seals, and sand seals.

**SEGREGATION** – Regarding HMA, the broad definition is “a lack of homogeneity in the constituents in the HMA mat being placed of such a magnitude that there is a reasonable expectation of accelerated pavement distress. Typically though, “segregation” refers to aggregate segregation, which is “the non-uniform distribution of coarse and fine aggregate components within the HMA mixture”.

**SELECT MATERIAL** – Suitable material obtained from roadway cuts, borrow areas, or commercial sources and designated or reserved for use as foundation for the subbase, for subbase material, shoulder surfacing, or other specific purposes.

**SHOULDER** – The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

**SHOVING** – A form of plastic movement or flow typified by an abrupt wave across the pavement surface. The distortion is perpendicular to the traffic direction.

**SHRP** – Strategic Highway Research Program.



**SKID RESISTANCE** – The ability of a pavement surface to offer resistance to slipping or skidding, such as for vehicle tires.

**SLOW CURING ASPHALT (SC)** – Liquid asphalt composed of asphalt cement and oils of low volatility.

**SLAG** – The air-cooled, non-metallic by-product of a blast furnace operation consisting essentially of silicates and alumino-silicates of lime and other bases that is developed simultaneously with iron in a blast furnace. Naturally it is only available in those localities where pig iron is produced. Crushed slag weighs about 80 pounds per cubic foot.

**SOIL AGGREGATE** – Natural or prepared mixtures consisting predominantly of hard, durable particles or fragments of stone, slag, gravel, or sand, that contain some soil-clay or stone dust conforming to specified requirements.

**SOIL CEMENT BASE** – Consists of a mixture of the natural subgrade material and Portland cement in the proper amounts. After thorough mixing, the proper amount of water is added, and the material is compacted to the required thickness.

**SOIL SUPPORT** – A term expressing the ability of the roadbed material, or subgrade soil, to support the traffic loads transmitted through a flexible pavement structure.

**SPECIAL PROVISIONS** – Special directions, provisions, or requirements peculiar to the project under consideration and not otherwise thoroughly or satisfactorily detailed or set forth in the specifications. Special provisions set forth the final contractual intent in the matter involved.

**STAGE CONSTRUCTION** – The construction of roads and streets by applying successive layers of HMA according to design and a predetermined time schedule.

**STREET** – A general term denoting a public way for purpose of vehicular travel, including the entire area within the right-of-way.

**SUBBASE** – The course in the asphalt pavement structure immediately below the base course is the subbase. If the subgrade soil is of adequate quality, it may serve as the subbase.

**SUBCONTRACTOR** – Any individual, partnership, or corporation to whom the contractor sublets part of the contract.

**SUBDRAIN** – A structure placed beneath the ground surface to collect and carry away underground water.

**SUBGRADE** – The uppermost material placed in embankments or unmoved from cuts in the normal grading of the roadbed. It is the foundation for the pavement structure. The subgrade soil sometimes is called base-ment soil or foundation soil.

**SUBGRADE STABILIZATION** – Modification of roadbed soils by admixing with stabilizing or chemical agents that will increase load-bearing capacity, firmness, and resistance to weathering or displacement.

**SURFACE COURSE** – One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is some-times called the ‘wearing course.’



**SUBSURFACE DRAINAGE** – Removal of free water from various structural components of the pavement or the surrounding soil.

**SUPERPAVE** – Superior Performing Asphalt Pavements. An overarching term for the results of the asphalt research portion of the 1987-1993 Strategic Highway Research Program (SHRP). Superpave consists of (1) an asphalt binder specification, (2) an HMA mixture design method and (3) HMA tests and performance prediction models. Each one of these components is referred to by the term “Superpave”

T

**TACK COAT** – Asphalt material, usually an emulsion, applied to an existing pavement surface prior to repair or the placement of subsequent layers of HMA to create a bond between the old and the new mixtures.

**TEST STRIP** – A small section of mat laid at the beginning of a project with the purpose of determining the best roller type, sequence number of passes and rolling pattern to use.

**THERMAL CRACKING** – Cracking caused by shrinkage of the pavement structure due to low temperatures.

U

**UNDERDRAIN** – A perforated or porous-walled pipe placed with suitable pervious backfill beneath the ground surface to collect and carry away underground water.

V

**VISCOSITY** – This is a measure of the resistance to flow. The term is used as “high viscosity” or “low viscosity.” A high viscosity material refers to a heavy or still material that will not flow easily. A low viscosity material is the opposite. Viscosity is measured in absolute units called poises. It was formerly measured in empirical values of time, distance, and temperature. This method was called Saybolt Furol Viscosity.

**VMA** – The volume of intergranular void space between the aggregate particles of a compacted paving mixture that includes the volume of air voids and the volume of the effective asphalt content, expressed as a percentage of the total volume of the specimen.

W

**WEARING COURSE** – The top course of asphalt pavements, also called the surface course.

**WHEELPATH** – That 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.

**WORKABILITY** – Regarding HMA, a term that refers to an HMA’s ability to be placed and compacted. Workable mixes are easy to place and compact and are generally more viscous than mixes with poor workability.



# MADA Design Guide List of Web Sites References

American Association of State Highway and Transportation Officials (AASHTO)  
[www.aashto.org](http://www.aashto.org)

American Public Works Association (APWA)  
[www.pubworks.org](http://www.pubworks.org)

American Road & Transportation Builders Association (ARTBA) [www.artba.org](http://www.artba.org)

American Society for Testing Materials (ASTM) [www.astm.org](http://www.astm.org)

American Traffic Safety Association  
[www.atssa.com](http://www.atssa.com)

Asphalt Institute [www.asphaltinstitute.org](http://www.asphaltinstitute.org)

Asphalt Pavement Alliance  
[www.asphaltalliance.com](http://www.asphaltalliance.com)

Asphalt Paving Association of Iowa  
[www.apai.net](http://www.apai.net)

Center for Transportation Studies, University of Minnesota [www.cts.umn.edu](http://www.cts.umn.edu)

Dakota Asphalt Pavement Association (DAPA) [www.dakota-asphalt.org](http://www.dakota-asphalt.org)

Local Road Research Board (LRRB)  
[www.lrrb.gen.mn.us](http://www.lrrb.gen.mn.us)

Minnesota County Engineers Association (MCEA) [www.mcea.gen.mn.us](http://www.mcea.gen.mn.us)

Minnesota Asphalt Pavement Association  
[www.asphaltsbest.com](http://www.asphaltsbest.com)

Minnesota Department of Transportation  
[www.dot.state.mn.us](http://www.dot.state.mn.us)

Minnesota Pollution Control Agency (MPCA)  
[www.pca.state.mn.us](http://www.pca.state.mn.us)

National Asphalt Pavement Association  
[www.hotmix.org](http://www.hotmix.org)

National Center for Asphalt Technology  
[www.eng.auburn.edu/center/ncat/](http://www.eng.auburn.edu/center/ncat/)

North Central Superpave Center  
<http://ce.ecn.purdue.edu/~spave/Index>

Occupational Health & Safety Administration (OSHA) [www.osha.gov](http://www.osha.gov)

Transportation Research Board  
[www.nas.edu/trb/](http://www.nas.edu/trb/)

U.S. Department of Transportation (USDOT)  
[www.dot.gov](http://www.dot.gov)

USDOT Transportation Safety Institute  
[www.tsi.dot.gov](http://www.tsi.dot.gov)

USDOT Federal Highway Administration (FHWA) [www.fhwa.dot.gov](http://www.fhwa.dot.gov)

United States Tennis Association  
[www.usta.com](http://www.usta.com)

United States Tennis Court & Track Builders Association [www.ustctba.com](http://www.ustctba.com)

Wisconsin Asphalt Pavement Association (WAPA) [www.wispave.org](http://www.wispave.org)

