

UNI-GROUP U.S.A.

Glossary of Terms

AASHTO - The American Association of State Highway and Transportation Officials is the governing body for roadway construction standards in the United States.

ABSORPTION - Weight of water incorporated by a concrete paver during immersion under prescribed conditions, expressed as a percentage in relation to the dry weight of the paver.

ASPECT RATIO - Overall length of a paver, divided by its thickness. A ratio of 4:1 is the maximum recommended for vehicular pavement applications.

ASTM C 936 - American Society for Testing and Materials, Standard Specification for Solid Interlocking Concrete Pavers. The product industry standard for interlocking concrete pavers that defines dimensions, dimensional tolerances, maximum absorption, minimum compressive strength, maximum abrasion, and freeze-thaw durability performance through various test methods.

AGGREGATE - Sand, gravel, shell, slag, or crushed stone used in base materials or mixed with cement to make concrete.

BASE COURSE - A material of a designed thickness placed on a subbase or subgrade to support a surface course. A base course can be compacted aggregate, cement or asphalt-stabilized aggregate, asphalt, concrete, or flowable fill.

BEDDING SAND - The layer of coarse, clean, sharp sand conforming to the grading requirements of ASTM C33 that is screeded to a uniform depth of 1-1 1/2 inches (25-38mm). The sand can be natural or manufactured.

BITUMEN - A class of asphalt that is combined with neoprene and used as an adhesive under paving units.

CBR - The California Bearing Ratio provides an index of strength for the subgrade soil which has been measured for its ability to take loads under a pavement structure. It is expressed as a percentage of the load required to penetrate crushed aggregate road base material.

CHAMFER - 45-degree beveled edge around the top of a paver unit, usually 1/16 to 1/8 inch (2-3mm) wide. It helps water drain from the surface, facilitates snow removal, helps to prevent chipping and spalling, and delineates the individual pavers.

CLAY - A cohesive soil made up of decomposed rock and microscopic fines, with putty-like properties. It is plastic (sticky) to the touch when wet.

COARSE AGGREGATE - Aggregate that is predominantly retained on the US Standard No. 4 sieve, or that portion of an aggregate retained on the No. 4 sieve.

COMPRESSIVE STRENGTH - The measured maximum resistance of a concrete paver to loading, expressed as force per unit cross-sectional area (in pounds per square inch).

CONCRETE GRID PAVERS - Concrete units that have up to 50 percent open area. They are usually a maximum of 16 by 24 inches. The openings can be filled with turf or aggregate to promote infiltration of stormwater. They are usually used for intermittent parking areas, access lanes, or for erosion control on embankments.

CONCRETE SAND - A coarse, washed sand conforming to the gradation requirements of ASTM C33.

COLOR BLEND - A paver with two or more colors created by blending pigments during the manufacturing process to produce a variegated appearance.

CREEP - Slow, virtually imperceptible lateral movement of pavers from horizontal forces such as braking tires.

CROWN - The slightly convex shape of a road cross section which allows for surface drainage and benefits interlock.

CRUSHED STONE - A pavement base material that is made from mechanically crushing rocks, boulders, or large cobblestones at a quarry. All faces of each aggregate have well-defined edges resulting from the crushing operation.

CRUSHER RUN - The total unscreened product of a stone crusher.

CUBE - Factory-stacked pavers which are strapped or wrapped, with or without a pallet for shipping to a site. The number of pavers in a cube varies with their thickness and shape.

DEFLECTION - A temporary movement of the pavement structure due to traffic loads.

DEFORMATION - A change in the shape of the pavement.

DENSE-GRADED AGGREGATE - An aggregate that has a particle size distribution, that when compacted, yields very small voids between them.

DENSITY - Usually expressed in pounds per cubic foot. Density describes how closely the particles of a soil are compacted. Also, density in reference to paver units themselves is the mass per unit volume.

DENTATED PAVER - A paver that is not rectangular or square in shape.

DUMMY GROOVES - False joints in concrete pavers that add to the installed pattern. They can enhance the appearance of the pattern and speed installation when compared to installing individual sub-units.

EDGE PAVERS - A paving stone that is produced with a straight, flush edge, or a unit cut straight for placement against an edge restraint.

EDGE RESTRAINT - A curb, edging, foundation, or other stationary object that contains the sand bedding layer and pavers so they do not spread and lose interlock.

EFFLORESCENCE - A naturally-occurring white deposit of calcium carbonate that can form on any concrete surface. It results from the reaction of calcium hydroxide with carbon dioxide from the air and is a byproduct of cement hydration. It does not affect structural integrity and will dissipate over time. Efflorescence is not indicative of a flawed product. If desired, it may be removed by washing the surface with a special detergent cleaner.

ELASTICITY - A soil's ability to return to its original state after a load is removed.

EQUIVALENT SINGLE AXLE LOADS (ESALs) - Summation of equivalent 18,000 lb force single-axle loads used to combine mixed traffic to design traffic for the design period.

EQUIVALENT THICKNESS - A comparison of the concrete paver and sand bed layer to the required thickness of asphalt to achieve an equivalent strength. A conservative design assumes this to be 6 1/2 inches (165mm).

FLEXIBLE PAVEMENT - A pavement structure which maintains contact with and distributes loads to the subgrade. The base course materials rely on aggregate interlock, particle friction, and cohesion for stability.

FLEXURAL STRENGTH - The property of a concrete paver that indicates its ability to resist failure in bending.

FLOWABLE FILL - A self-leveling, low-density cementitious back-fill material that attains 100% compaction without tamping or vibrating. It replaces compacted soil or conventional back-fill as a structural fill that drains and is no stronger than the surrounding soil after it has obtained its ultimate strength.

FROST HEAVE - The raising of a pavement surface due to water infiltration, which when allowed to accumulate, forms into ice in freezing climates.

GEOGRIDS - Geogrids are two dimensional or three dimensional. The two dimensional type are flat and have small "TV screen" openings. It is usually placed between the soil and the base to reduce rutting. Three dimensional geogrids are 4 to 8 inches (100-200mm) high and provide stability under loads for cohesion-less soils.

GRADATION - Soil or aggregate distributed by mass in specified particle-size ranges. It is usually expressed in percent of mass of sample passing a range of sieve sizes.

GRANULAR BASES - Crushed or quarried stone material that generally ranges in size from 3/4 inch (19mm) maximum for crushed stone to 1 1/2 inch (38mm) maximum for quarried stone down to small sand-sized particles. The sizes must be uniformly graded in various proportions that create a dense material when compacted.

GRAVEL - Rounded or semi-rounded particles of rock that will pass a 3 inch (75mm) and be retained on a No. 4 sieve. Gravel is one type of aggregate.

HERRINGBONE PATTERN - A pattern where joints are no longer than the length of 1 1/2 pavers. Herringbone patterns can be 45 or 90 degrees depending on the orientation of the joints to the direction of traffic.

INTERLOCK - There are three kinds of forces in a segmental pavement - vertical loads, horizontal loads, and rotational loads. Paving stones are designed to withstand these stresses by "interlocking". Certain shapes are proven to substantially strengthen this interlock to better withstand such loads and forces. Generally, vertical interlock is achieved by shear transfer of loads to surrounding units through sand in the joints. Horizontal interlock is best achieved through the

use of laying patterns and dentated shapes that disperse forces from braking and accelerating vehicles on both axes. Rotational interlock is again largely maintained by paver shape, the sufficient thickness of the units, their close placement and restraint by a stationary edge.

JOINT SAND - Sand swept into the joints between the pavers.

LAYING FACE - The exposed vertical face of a row of pavers during placement on the bedding sand layer.

LAYING PATTERN - The repetitive geometry created by the installed pavers. Laying patterns may be selected for their visual or structural benefits.

LIFE-CYCLE COST - An analysis tool to calculate all costs anticipated over the life of a pavement. Initial costs, maintenance estimates, periodic rehabilitation, pavement user and delay costs, salvage value, inflation, discount rate, and the analysis period are all factors that influence the life-cycle costs.

LIFT - A layer of newly deposited material to be compacted.

LIMESTONE SCREENINGS - A residual byproduct of crushed rock containing particles small enough to pass a No. 200 sieve. It is *not* suitable for use as bedding sand.

LOCKPAVE PRO - Computer program for the structural design of interlocking concrete block pavements. LOCKPAVE has been developed to assist professional engineers and architects in the structural design of concrete block pavements for a variety of applications. LOCKPAVE features an easy to use Windows 95/98 graphical interface, context-sensitive help screens, and new design tools. It offers the ability to choose, analyze, and compare alternative pavement types, provides initial construction and life-cycle costs, analyzes most common types of pavement materials, allows selection of various paver shapes and installation patterns and it even provides a choice of design mode with either mechanistic or empirical (AASHTO) methodology.

LOCK UP - The initial settling period of concrete paver installations which progressively stiffen under traffic to a point that no further settling will occur unless failure develops in the base or subgrade.

MASON SAND - A fine washed sand conforming to the gradation requirements of ASTM C144.

MECHANICAL OR MECHANIZED INSTALLATION - The use of specially designed machines to lift and place layers of pavers onto screeded bedding sand in the final laying pattern. It is used to increase the rate of paver installation.

MECHANISTIC DESIGN - Mechanistic design uses elastic analysis to calculate the stresses and strains in the pavement caused by traffic. These are compared with models of material behavior at a chosen level of confidence to determine whether the pavement is capable of withstanding the full range of loads and traffic expected in service. It should not be confused with empirical methods of design such as the AASHTO method. Details of mechanistic methodologies applied to concrete block pavements can be found in the book "The Design and Construction of Interlocking Concrete Block Pavements" by B. Shackel, published by Elsevier, London, in 1990.

MODULUS OF ELASTICITY - The ratio of stress to strain for a material under given loading conditions.

MORTAR - Cement and lime, or masonry cement, mixed with fine sand.

NEO-ASPHALT - A rubberized neoprene asphalt adhesive for unit pavers which is cold-applied with a notched trowel.

NUCLEAR DENSITY TESTING - A method to accurately test soil density or moisture with a device that utilizes a probe inserted into the soil that emits radioactive rays which are measured by a Geiger counter.

OPEN-GRADED AGGREGATE - An aggregate which contains relatively few fines to leave fairly large spaces between particles when compacted. It can be used as a drainage course in base design.

PAVEMENT STRUCTURE - The combination of a subbase, base, and wearing surface placed on a subgrade to support traffic loads and distribute it to the road bed.

PAVER EXTRACTOR - A tool designed to grasp a paver and remove it from an installed surface.

PAVER SPLITTER (GUILLOTINE SPLITTER) - A hand-operated machine for cutting concrete pavers.

PAVING SLAB - A paving unit larger than an interlocking concrete paver. Maximum dimensions are generally 36 by 36 inches. Unlike concrete pavers, paving slabs do not rely on interlock as the primary means of load distribution.

PC-SWMM™ - PC-SWMM for Permeable Pavements is a computer program specifically intended for the hydraulic design of UNI ECO-STONE® permeable pavements. The processing engine for the program is the Runoff Module of the US

EPA's Stormwater Management Model (SWMM 4.30). It allows the user to develop a simple model of permeable pavement design, run the model with a specified design storm, and analyze the results of the model. Model results include graphs of the input function (design storm), surface runoff (if any), depth of water in the base material, and drainage of the base material for the duration of the model run. It was developed by Computational Hydraulics, Int.

PERFORMANCE PERIOD - The period of time that an initially constructed or rehabilitated pavement structure will perform (last) before reaching the end of its serviceability. This is also known as the design period, expressed in years. This is normally 20 years in North America.

PERMEABLE INTERLOCKING CONCRETE PAVERS (PICP) - Permeable pavers are an innovative, environmentally-beneficial pavement system designed to reduce stormwater runoff through infiltration. UNI ECO-STONE[®] permeable interlocking concrete block pavement can lessen or eliminate downstream flooding and stream bed and bank erosion, and mitigate pollution impact on surrounding surface waters. It decreases project costs by reducing or eliminating some drainage and retention systems that are necessary with impervious pavements, reduces costs of compliance with many stormwater regulatory requirements and permits better land-use planning.

PLATE COMPACTOR - Used to compact pavers into the bedding sand layer in order to promote interlock among the individual units. It is also known as a plate vibrator.

POISSON'S RATIO - The ratio of transverse (lateral) strain to the corresponding axial (longitudinal) strain resulting from uniformly distributed axial stress below the proportional limit of the material; the value will average about 0.2 for concrete.

PROCTOR DENSITY - Either the Standard or Modified method, this is a laboratory test used to determine the "ultimate" dry density and "optimum" moisture content for a soil sample. The results are compared to the actual density achieved in the field for the soil and are expressed as a percentage to the laboratory sample.

PUMPING - The ejection of bedding and joint sand, either wet or dry, through joints or cracks, or along edges of pavers when a load is applied.

RIGID BASE - Reinforced or non-reinforced concrete slab on grade.

RUNNING OR STRETCHER BOND - A pattern with continuous joint lines in one direction.

RUTTING - Permanent deformation from repetitive traffic loading that exceeds the ability of the pavement structure to maintain its original profile.

SAILOR COURSE - A single or double border course of rectangular pavers laid parallel (lengthwise) to the edge restraint.

SCREED BOARD - A rigid, straight piece of wood or metal used to level bedding sand to proper grade by pulling it across guides or rails set on the base course or edge restraints.

SCREED GUIDES - Grade guides, such as pipe, that will guide the screed in producing the desired elevation of the bedding sand.

SEALER - A material usually applied as a liquid that is used to enhance color, waterproof, or stabilize joint sand in interlocking concrete pavements.

SEGMENTAL PAVEMENT - Pavement constructed of interlocking concrete pavers.

SEMI-RIGID BASE - Asphaltic concrete commonly referred to as asphalt.

SHAPES (SHAPED PAVERS) - Numerous research and observations demonstrate that paver shapes do contribute largely to the structural performance of a concrete block pavement. Dentated shapes key optimally into each other and, by their plan geometry, interlock and resist the relative movement of joints parallel to both the longitudinal and transverse axes of the unit. Researchers have therefore divided paver shapes into three types:

- A - Fully interlocking on both axes
- B - Interlocking on one axes
- C - Non-dentated - basic square and rectangular shapes

It is strongly advised to use a Category A shape for frequently trafficked areas, while Category B and C shapes may be used for less trafficked areas or for pedestrian use. Additionally, various shapes were developed for certain specialized applications, such as water permeability, grass growth, noise reduction, mechanized installation, and so forth.

SILT - Material passing the No. 200 sieve.

SKID RESISTANCE - A measure of the frictional characteristics of a surface with respect to tires.

SOIL SEPARATION FABRIC - A layer of fabric typically placed between the subgrade and the base to reduce rutting. Also known as a geotextile.

SOIL STABILIZATION - Chemical or mechanical treatment designed to increase or maintain the stability of a mass of soil to improve its engineering properties. Lime, fly ash or cement are typical chemical stabilization materials. Geotextiles and geogrids are examples of mechanical types of soil stabilization.

SOLDIER COURSE - A border course where rectangular pavers are laid perpendicular to the edge restraint.

SPACERS, SPACER BARS, RIBS, OR NIBS - Small protrusions molded into the sides of pavers during manufacturing to keep them uniformly spaced during installation. Spacers help prevent chipping and spalling.

SPALL - A flake-like fragment that detaches from the edge or surface of a brick or paver by a blow, from severe weather or pressure from adjacent units. This is minimized with concrete pavers due to chamfers and spacer bars.

STABILIZED BASE - An aggregate base where either cement, asphalt, or other material is added to increase its structural capacity. The soil subgrade can be stabilized with cement, lime, fly ash or other materials.

STACK BOND - A laying pattern in which the joints in both directions are continuous.

STONE DUST - The small residual particles left from the crushing process of large quarried stone. The gradation can range from 1/8 inch (3mm) to as small as dust size.

STONE SAND - A byproduct from the crushing of rock, it is a granular aggregate which has been washed to remove dust-sized particles. It is generally graded 3/16 inch (5mm) to small granules.

SUBBASE - The layer or layers of specified material of designed thickness placed on a subgrade to support a base course.

SUBGRADE - The existing site soil upon which the pavement structure is constructed.

TENSILE STRENGTH - Maximum unit stress which a paver is capable of resisting under axial tensile loading, based on the cross-sectional area of the paver before loading.

TEXTURED OR ARCHITECTURAL FINISH - Aesthetic finishes for paver surfaces such as sand blasting, bush hammering, tumbling, grinding, polishing, or washing.

TOPSOIL - Surface soil, usually containing organic matter.

WATER-CEMENT RATIO - The weight of water, divided by the weight of cement in a concrete mixture. Concrete pavers usually have a water-cement ratio of 0.27 to 0.33, lower than ready-mix concrete, which contributes to strength and durability.

ZONING - Using different paver colors, textures, shapes, patterns, and surface elevations to delineate pedestrian and vehicular areas.

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