

Glossary

\geq greater than or equal to

\leq less than or equal to

γ unit weight

γ_m wet unit weight

γ_d dry unit weight

A horizon The upper layer of a typical soil. It contains a zone of accumulation of organic materials in its upper portion and a lower portion of lighter color from which soil colloids and other soluble constituents have been removed.

AASHTO American Association of State Highway and Transportation Officials

abrasion Occurs when hard particles are blown against a rock face causing the rocks to break down. As they are broken off, the resulting fragments are carried away by wind. Abrasion also occurs due to water and glacial action.

acid test Used to determine the presence of carbonates and is performed by placing a few drops of hydrochloric acid on the surface of a rock.

adobe Calcareous silts and sandy-silty clays, usually high in colloidal clay content, found in the semiarid regions of the southwestern United States and North Africa.

adsorbed water Thin films of water that adhere to the separate soil particles.

AFM Air Force manual

AFP Air Force publication

agronomic dust control This method consists of establishing, promoting, or preserving vegetative cover to prevent or reduce dust generation from exposed soil surfaces.

AI Airfield Index

airfield cone penetrometer Used by engineering personnel to determine an index of soil strengths (airfield index) for various military applications. It serves as an aid in maintaining field control during construction operations.

airfield index An index used to describe subgrade soil strength, based on data from the airfield cone penetrometer.

alluvial fan A dry-land counterpart of deltas.

alluvium Deposits of mud, silt, and other material commonly found on the flatlands along the lower courses of streams.

Alpine glaciation Takes place in mountainous areas and generally results in the creation of mainly erosional forms. Features are very distinctive and easy to recognize such as a U-shaped profile in contrast to the V-shaped profile produced by fluvial erosion.

amphiboles Hard, dense, glassy to silky minerals found chiefly in intermediate to dark igneous rocks and gneisses and schists. They generally occur as short to long prismatic crystals with a nearly diamond-shaped cross section.

angular particles Grains, or particles, with shapes that are characterized by jagged projections, sharp ridges, and flat surfaces.

annular drainage pattern A ringlike drainage pattern formed in areas where sedimentary rocks are upturned by a dome structure.

anthracite A hard natural coal of high luster differing from bituminous coal in containing little volatile matter.

anticline fold Upfolds.

AOS apparent opening size

APSB asphalt penetration surface binder

AR Army regulation

arcuate delta Arc- or fan-shaped deltas formed when wave action is the primary force acting on the deposited material.

argillaceous Soils which are predominantly clay or abounding in clays or claylike materials.

asphalt emulsions A blend of asphalt, water, and an emulsifying agent and is available either as anionic or cationic emulsions.

asphalt penetration surface binder A special liquid asphalt composed of high penetration-grade asphalt and a solvent blend of kerosene and naphtha.

ASTM American Society of Testing and Materials

asymmetrical fold A fold with an inclined axial plane.

augite The most common of the pyroxenes.

B horizon The layer containing soluble materials washed out of the A horizon. This layer frequently contains much clay and may be several feet thick.

backfill To refill (as an excavated area) usually with excavated material.

- barchan dune** The simplest and most common of dunes. Usually crescent-shaped. The windward side has a gentle slope rising to a broad dome that is cut off abruptly on the leeward side.
- basalt** Very fine-grained, hard, dense, dark-colored extrusive rock which occurs widely in lava flows around the world.
- base exchange** The process of replacing cations of one type with cations of another type in the surface of an adsorbed layer.
- batholith** A great mass of intruded igneous rock that for the most part stopped in its rise to the earth's surface at a considerable distance below the surface.
- batter** A receding upward slope of the outer face of a structure.
- batter piles** Those piles that are driven at an angle with the vertical. They may be used to support inclined loads or to provide lateral loads.
- bearing capacity** The soil's ability to support loads which may be applied to it by an engineering structure.
- bearing pile** A pile driven into the ground so as to carry a vertical load.
- bedded sediments** Parallel layers of sediment lying one on top of the other.
- bedding planes** The surface that separates each successive layer of a stratified rock from its preceding layer, a depositional plane, or a plane of stratification.
- bed load** Material too heavy to be suspended by erosional agents for great distances at any one period of time. Consists mainly of coarse particles that roll along the ground.
- bentonite** A clay of high plasticity formed by the decomposition of volcanic ash, which has high swelling characteristics.
- bird's-foot delta** Resembles a bird's foot from the air and is formed in instances where fluvial processes have a major influence on deposited sediments.
- bite test** A quick and useful method of distinguishing among sand, silt, or clay. In this test, a small pinch of the soil material is ground lightly between the teeth and the grittiness determined.
- bitumen-lime blend** A system in which small percentages of lime are blended with fine-grained soils to facilitate the penetration and mixing of bitumens into the soil.
- blanket cover** Any material that forms a (semi) permanent cover and is immovable by the wind it serves to control dust.
- blind drainage** Sections of a stream channel which are blocked at both ends.
- boulder clay** Another name, used widely in Canada and England, for glacial till.

braided drainage pattern A drainage pattern resulting from the dividing and reuniting of stream channels. The pattern commonly forms in arid areas during flash flooding or from the meltwater of a glacier. The stream has attempted to carry more material than it is capable of handling.

breccia A rock consisting of sharp fragments cemented by finer-grained material.

breaking test Performed only on material passing the number 40 sieve. Used to measure the cohesive and plastic characteristics of the soil.

buckshot clay Clay of the southern and southwestern United States which, upon drying, crack into small, hard lumps of more or less uniform size.

bulking of sands The volumetric increase in a dry or nearly dry sand caused by the introduction of a slight amount of moisture and disturbance of the soil.

buttress A projecting structure of masonry or wood for supporting or giving stability to a wall or building; a projecting part of a mountain or hill; a broadened base of a tree trunk or a thickened vertical part of it; something that supports or strengthens.

C celsius; centigrade; clay

C horizon The weathered parent material.

calcareous Soils which contain an appreciable amount of calcium carbonate, usually derived from limestone.

calcite A soft, usually colorless to white mineral distinguished by a rapid bubbling or fizzing reaction with dilute hydrochloric acid. It is the major component of sea shells and coral skeletons and often occurs as well-formed, glassy to dull, blocky crystals.

caliche The nitrate-bearing gravel or rock of the sodium nitrate deposits of Chile and Peru; a crust of calcium carbonate that forms on the stony soil of arid regions.

California Bearing Ratio A measure of the shearing resistance of a soil under carefully controlled conditions of density and moisture.

capillary fringe Capillary action in a soil above the ground water table.

capillary moisture When dry soil grains attract moisture in a manner somewhat similar to the way clean glass does.

capillary saturation When the soil is essentially saturated.

carbonation The chemical process in which carbon dioxide from the air unites with various minerals to form carbonates.

carbonic acid A weak dibasic acid H_2CO_3 known only in solution that acts to dissolve carbonate rocks.

cavern An underground chamber often of large or indefinite extent.

CBR California Bearing Ratio

C_c coefficient of curvature

CE compactive effort

CE 55 compactive effort, 55 blows per layer

cementation This occurs when precipitates of mineral-rich waters, circulating through the pores of sediments, fill the pores and bind the grains together.

CH clays, highly compressive (LL>50)

chemical stabilization Relies on the admixture to alter the chemical properties of the soil to achieve the desired effect, such as using lime to reduce a soil's plasticity.

chemical weathering The decomposition of rock through chemical processes. Chemical reactions take place between the minerals of the rock and the air, water, or atmosphere.

chert A rock resembling flint and consisting essentially of cryptocrystalline quartz or amorphous silica.

chlorite A very soft, grayish-green to dark green mineral with a pearly luster. It occurs most often as crusts, masses, or thin sheets or flakes in metamorphic rocks, particularly schists and greenstone.

cinder The slag from a metal furnace; a fragment of ash; a partly burned combustible in which fire is extinct; a hot coal without flame; a partly burned coal capable of further burning without flame; a fragment of lava from an erupting volcano.

CL clay, low compressibility (LL<50)

Class C fly ash Has a high CaO content (12 percent or more) and originates from sub-bituminous and lignite (soft) coal.

Class F fly ash Has a low CaO content (less than 12 percent) and originates from anthracite and bituminous coal.

elastic sediments Deposit of rock particles dropped from suspension in air, water, or ice.

clay mineral Form soft microscopic flakes which are usually mixed with impurities of various types (particularly quartz, limonite, and calcite). When barely moistened, as by the breath or tongue, clays give off a characteristic somewhat musty "clay" odor.

clay stone A calcareous concretion formed in a bed of clays; a dull earthy feldspathic rock containing clay.

- cleavage** The tendency of a mineral to split *or* separate along preferred planes when broken.
- cm** centimeter(s)
- c m³** cubic centimeter(s)
- CMS** concrete-modified cement
- coal** An accumulation and conversion of the organic remains of plants and animals under certain environments.
- coarse-grained rocks** Those rocks that have either crystals or cemented particles that are large enough to be readily seen with the unaided eye.
- coarse-grained soil** Those soils in which half or more of the material is retained on a Number 200 sieve.
- compaction** The reduction of volume and increase in density that results from the application of downward stress to a material. The stress moves the particles closer together, reducing the volume of air voids and increasing the unit weight. (density) of the material.
- competence** The maximum size of particles capable of being moved b-y a stream.
- complex dunes** Dunes which lack a distinct form and develop where wind directions vary, sand is abundant, and vegetation may interfere. They occur locally when other dune types become overcrowded and overlap.
- compressibility** That property of a soil which permits it to deform under the action of an external compressive load.
- conchoidal fracture** A fracture surface that exhibits concentric, bowl-shaped structures like the inside of a clam shell.
- conglomerates** Rocks composed of rounded fragments varying from small pebbles to large boulders held together by a natural cement.
- contact moisture** When water is brought into the capillary zone from the water table by evaporation and condensation.
- continental glaciation** Occurs on a large, regional scale affecting vast areas. Characterized by the occurrences of more depositional features than erosional features. The glaciers can be of tremendous thickness and extent.
- coquina** Consists essentially of marine shells held together by a small amount of calcium carbonate to form a fairly hard rock. Coquina is widely used for the granular stabilization of soils along the Gulf Coast of the United States.
- coral** Calcareous, rocklike material formed by secretions of corals and coralline algae. The white type is very hard, while the gray type tends to be soft, brittle, and extremely porous.

coral sand Consists of decomposed coral which may be combined with washed and sorted beach sands.

crevasse filling A material contained within a deep crevice, or fissure, in a glacier or the earth.

cross-beds Individual layers within a bed that lie at an angle to the layers of adjacent beds, typical of sand dune and delta front deposits.

CSS cationic slow-setting

cu cubic

c_u coefficient of uniformity

cutback asphalt A blend of an asphalt cement and a petroleum solvent.

d desirable base and subbase material

daily mean temperature An average of the maximum and minimum temperatures for one day or an average of several temperature readings taken at equal time intervals during the day, generally hourly.

DA Department of the Army

DBST double bituminous surface treatment

DCA 70 a polyvinyl acetate emulsion

DD Department of Defense

debris avalanche The rapid downslope flowage of masses of incoherent soil, rock, and forest debris with varying water content. They are shallow landslides resulting from frictional failure along a slip surface, essentially parallel to the topographic surface, formed where the accumulated stresses exceed the resistance to shear.

debris flows Occur when a debris avalanche increases in water content. They are caused most frequently when a sudden influx of water reduces the shear strength of earth material on a steep slope, and they typically follow heavy rainfall.

deflation Occurs when loose particles are lifted and removed by the wind. This results in a lowering of the land surface as materials are carried away.

degree days (As used in this FM) the difference between the average daily air temperature and 32 degrees Fahrenheit. The degree days are minus when the average daily temperature is below 32 degrees Fahrenheit (freezing degree days) and plus when above (thawing degree days).

delta The alluvial deposit at the mouth of a river.

delta kame Well-sorted glacial deposits made up of gravels and sands.

dendritic drainage pattern A treelike pattern composed of branching tributaries to a main stream. It is characteristic of essentially flat lying and/or relatively homogeneous rocks.

density The weight per unit volume.

desert pavement See “lag deposits.”

design freezing index The freezing index of the average of the three coldest winters in 30 years of record, or of the coldest winter in a 10-year period, if 30-year data are unavailable.

diatomaceous earth Composed essentially of the siliceous skeletons of diatoms (extremely small unicelled organisms). It is composed principally of silica, is white or light gray in color, and is extremely porous.

diorite A granular crystalline igneous rock commonly composed of plagioclase and hornblende, pyroxene, or biotite.

dip The inclination of a bedding plane.

dirty sand A slightly silty or clayey sand.

DM draft manual

dolomite A mineral consisting of a calcium magnesium carbonate found in crystals, as well as in extensive beds, as a compact limestone.

dome An upfold that plunges in all directions.

D_r relative density

drag Folding of rock beds adjacent to a fault.

drumlins Asymmetrical streamlined hills of gravel till deposited at the base of a glacier and oriented in a direction parallel to ice flow.

dry density Weight of solid fraction of a soil material divided by the volume of the soil material. Synonymous with dry unit weight.

dry strength test See “breaking test.”

durability The resistance to slaking or disintegration due to alternating cycles of wetting and drying or freezing and thawing.

dust palliative Material used to prevent soil particles from becoming airborne.

e void ratio

E east

earthflow A landslide consisting of unconsolidated surface material that moves down a slope when saturated with water.

earth-retaining structure Used to restrain a mass of earth which will not stand unsupported.

earthquake A shaking or trembling of the earth that is tectonic in origin; movement along a fault.

elongate delta Long, relatively narrow delta formed where tidal currents have a major impact on sediment deposition.

EM engineer manual

e_{max} void ratio in the loosest condition possible

e_{min} void ratio in the most dense condition possible

e_n natural void ratio

end moraines Ridges of till material pushed to their locations at the limit of the glacier's advance by the forceful action of the ice sheet.

eolian Descriptive term implying action by wind.

EOS equivalent opening size

EPA Environmental Protection Agency

erosion The transportation of weathered materials by wind or water.

eskers Winding ridges of irregularly stratified sand and gravel that are found within the area of the ground moraine created by continental glaciation.

evaporates Sedimentary rocks (as gypsum) that originated by evaporation of seawater in an enclosed basin.

exfoliation A type of weathering that involves the breaking loose of thin concentric shells, slabs, spans, or flakes from rock surfaces.

extrusive igneous rock Those rocks formed by extrusion from the earth in a molten state or as volcanic ash.

F Fahrenheit; frictional resistance to sliding

FAA Federal Aviation Administration

fat clay Fine, colloidal clay of high plasticity; classified as (CH) by the USCS.

faults Fractures along which there is displacement of the rock parallel to the fracture plane. Once-continuous rock bodies that have been displaced by movement in the earth's crust.

fault scarp A cliff or escarpment directly resulting from an uplift along one side of a fault.

fault zone An area in which there are several closely spaced faults.

feldspars Any of a group of crystalline minerals that consist of aluminum silicates with either potassium, sodium, calcium, or barium; essential constituents of nearly all crystalline rocks.

felsite A very fine-grained, usually extrusive igneous equivalent of granite.

FHWA Federal Highway Administration

fill saddles Narrow saddles used to hold hauled material.

filtration geotextiles Used when soils may migrate into drainage aggregate or pipe. It prevents the soil migration and thus maintains water flow through the drainage system.

fine-grained soil Those soils in which more than half the material passes a Number 200 sieve.

fissility Capable of being split or divided in the direction of the grain or along natural planes of cleavage.

FLS forward landing strips

fly ash Fine solid particles of ashes, dust, and soot carried out from burning fuel (as coal or oil) by a draft. This pozzolanic material consists mainly of silicon and aluminum compounds that, when mixed with lime and water, forms a hardened cementitious mass capable of obtaining high compression strengths.

FM field manual

foliated Metamorphic rocks that display a pronounced banded structure as a result of the reformational pressures to which they have been subjected.

footwall The block below a fault plane.

fracture The way in which a mineral breaks when it does not cleave along cleavage planes.

fragipan See "hardpan."

free water When the zone of saturation is under no pressure except from the atmosphere.

freezing index The number of degree days between the highest and lowest points on a curve of cumulative degree days versus time for one freezing season. It is used as a measure of the combined duration and magnitude of below-freezing temperature occurring during any given freezing season. The index determined for air temperatures at 4.5 ft above the ground is commonly designated as the "air freezing index," while that determined for temperatures immediately below a surface is known as the "surface freezing index."

frost action Processes which affect the ability of soil to support a structure when accumulated water in the form of ice lenses in the soil is subjected to natural freezing conditions.

frost boil The breaking up of a localized section of a highway or airfield pavement when subjected to traffic. During the process of thawing, the melted water produces a supersaturated or fluid subgrade condition with very limited or no supporting capacity. The traffic imposes a force on the pavement and thus on the excess water in the subgrade, which in turn exerts an equalizing pressure in all directions. This pressure is relieved through the point of least resistance (up through the pavement surface) and produces a small mound similar in appearance to an oversized boil.

frost heave An upthrust of ground caused by freezing of moist soil (as under a footing or pavement).

frost-melting period An interval of the year during which the ice in the foundation materials is returning to a liquid state. It ends when all the ice in the ground is melted or when freezing is resumed. Although there is generally only one frost-melting period, beginning during the general rise of air temperature in the spring, one or more significant frost-melting intervals may occur during a winter season.

frost-susceptible soil Soil in which significant ice segregation will occur when the necessary moisture and freezing conditions are present.

frothy A sample that appears pitted or spongy.

ft foot; feet

Fuller's earth Unusually highly plastic clays of sedimentary origin, white to brown in color. Used commercially to absorb fats or dyes.

g gram(s)

G specific gravity; gravel

gabbro A granular igneous rock composed essentially of calcic plagioclase, a ferromagnesian mineral, and accessory minerals.

gabbro-diorite A series of dense, coarsely crystalline, hard, dark-colored intrusive rocks composed mainly of one or more dark minerals along with plagioclase feldspar.

gabion Large, steel wire-mesh baskets usually rectangular in shape and variable in size. They are designed to solve the problem of erosion.

gal gallon(s)

galena A bluish gray mineral (PbS) with metallic luster consisting of lead sulfide, showing highly perfect cubic cleavage, and constituting the principal ore of lead.

gap-graded Soil contains both large and small particles, but the gradation continuity is broken by the absences of some particle sizes.

garnet A brittle and more or less transparent usually red silicate mineral that has a vitreous luster, occurs mainly in crystals but also in massive form and in grains, is found commonly in gneiss and mica schist, and is used as a semi-precious stone and as an abrasive.

GC clayey gravel

geogrid A geotextile that is constructed with relatively large openings that act to lock soil particles in place (confining them) and adding strength to the soil.

glacial lake deposit Occurs during the melting of the glacier. Many lakes and ponds are created by meltwater in the outwash areas.

glaciofluvial Relating to, or coming from streams deriving much or all of their water from the melting of a glacier.

glassy Fine-grained rocks with a shiny smooth texture showing conchoidal fracture. An example is obsidian, a black volcanic glass.

GM silty gravel

gneiss A foliated metamorphic rock corresponding in composition to granite or some other feldspathic plutonic rock. It is medium- to coarse-grained and consists of alternating streaks or bands.

gouge Crushed and altered rock.

GP poorly graded g-ravel

graben A block that is downthrown between two faults to form a depression.

gradation The distribution of particle sizes in the soil.

grain size See "particle size."

granite A coarsely crystalline, hard, massive, light-colored rock composed mainly of feldspar and quartz, usually with mica and/or hornblende.

gravitational water See "free water."

gravity fault See "normal fault."

grit test See "bite test."

ground moraine Glacial deposits that are laid down as the ice sheet recedes.

groundwater table The upper limit of the saturated zone of free water.

gumbo Peculiar, fine-grained, highly plastic, silt-clay soils which become pervious and soapy, or waxy and sticky, when saturated.

GW well-graded gravel

H high compressibility

halite Rock salt.

hanging wall The block above a fault plane.

hardness The resistance to scratching or abrasion by other minerals or by an object of known hardness.

handpan A general term used to describe a hard, cemented soil layer which does not soften when wet and may be impervious to water.

h_c height of capillary rise

HCl hydrochloric acid

headwalls Bowl-shaped areas with slope gradients often 100 percent or greater. It is usually the junction for several intermittent streams that can cause sharp rises in the groundwater levels in the soil mantle during winter storms.

hematite A mineral (Fe_2O_3) constituting an important iron ore and occurring in crystals or in a red earthy form.

homocline fold A rock body that dips uniformly in one direction (at least locally).

hornblende A mineral that is the common dark variety of aluminous amphibole.

horst An upthrown block between two faults.

hummocky terrain Terrain composed of many depressions and uneven ground.

hydration The chemical union of a compound with water.

hydrolysis A chemical process of decomposition involving splitting of water molecules and subsequent reaction with various minerals.

hydrophytes A vascular plant growing wholly or partly in water especially a perennial aquatic plant having its overwintering bulbs underwater.

hygroscopic moisture The water adsorbed from atmospheric moisture when the soil is in an air-dry condition.

igneous rocks Those rocks that have solidified from molten material which originated deep within the earth's mantle. This occurred either from magma in the subsurface or from lava extruded onto the earth's surface during volcanic eruptions.

impervious soils Fine-grained, homogeneous, plastic soils, and coarse-grained soils that contain plastic fines. Soils that do not allow for the transmission of significant amounts of water.

intrusive igneous rocks Those rocks that have cooled from magma beneath the earth's surface.

Ip plasticity index

joints Rock fractures along which there has been little or no displacement parallel to the fractured surface.

k coefficient of permeability; subgrade reaction

kames Conical hills of sand and gravel that were deposited by heavily laden glacial streams that flowed on top of or off of the glacier.

kame terraces Roughly linear deposit of sand and gravel associated with alpine glaciation.

kaolin A fine, usually white clay that is used in ceramics and refractories as a filler or extender.

kettle holes Pits formed by the melting of ice which had been surrounded by or embedded in the moraine material.

kip kilopound (1,000 pounds)

L low compressibility

lag deposits Gravel and pebbles that, are too large to be carried by the wind and so accumulate on the earth's surface in the form of a sheet. They ultimately cover the finer-grained material beneath and protect it from further deflation.

laterites A residual product that is red in color and has a high content of the oxides of iron and hydroxides of aluminum.

laterite soils Residual soils which are found in tropic regions. Many different soils are included in this category and they occur in many sections of the world. They are frequently red in color and in their natural state have a granular structure with low plasticity and good trainability. When moistened with water and remolded, they often become plastic and clayey to the depth disturbed.

latosols A leached red and yellow tropical soil.

lava A viscous liquid that flows out a volcanic vent or from fissures along the flanks of a volcano. It can flow many miles from the crater vent. Molten material at the earth's surface.

lb pound(s)

LCF lime-cement-fly ash

lean clay Silty clays and clayey silts, generally of low to medium plasticity.

lignin A by-product of the manufacture of wood pulp.

limbs The sides of a fold as divided by the axial plane.

lime A dry white powder consisting essentially of calcium hydroxide.

lime-cement-fly ash A mixture of lime, cement, and fly ash used as a soil stabilization admixture.

limestone A soft to moderately hard rock that is formed chiefly by accumulation of organic remains (as shells or coral), consists mainly of calcium carbonate, is extensively used in building, and yields lime when burned.

linonite A native hydrous ferric oxide of variable composition that is a major ore of iron. Occurs most often as soft, yellowish-brown to reddish-brown fine-grained earthy masses or compact lumps or pellets. It is a common and durable cementing agent in sedimentary rocks and the major component of laterite.

LL liquid limit

LM light duty mat

LMS lime-modified soil

loam A general agricultural term, applied most frequently to sandy-silty topsoils which contain a trace of clay, are easily worked, and support plant life.

loess Thick accumulations of yellowish-brown material composed primarily of windblown silt. The silty soil is of eolian origin characterized by a loose, porous structure, and vertical slope. It covers extensive areas in North America (especially in the Mississippi Basin), Europe, and Asia (especially north-central Europe, Russia, and China).

longitudinal dune A dune elongated in the direction of the prevailing winds.

LOTS logistics-over-the-shore

luster The appearance of a mineral specimen in reflected light. It is either metallic or non-metallic.

M silt

M2 a type of compass

magma Molten rock material within the earth.

magnetite A black isometric mineral of the spinel group that is an oxide of iron and an important iron ore.

marble A soft, fine to coarsely crystalline, massive metamorphic rock which forms from limestone or dolomite. It is distinguished by its softness, acid reaction, lack of fossils, and sugary appearance on freshly broken surfaces.

marl A soft, calcareous deposit mixed with clays, silts, and sands, often containing shells or organic remains. It is common in the Gulf Coast area of the United States.

mature stream Has a developed floodplain and, while the stream, no longer fills the entire valley floor, it meanders to both edges of the valley.

max maximum

MB mechanical blending

MBST multiple bituminous surface treatment

MC medium curing

mean freezing index The freezing index determined on the basis of mean temperatures. Temperatures are usually averaged over a minimum of 10 years and preferably 30 years.

mean temperature The average temperature for a given time period, usually a day, a month, or a year.

mechanical stabilization Relies on physical processes to stabilize the soil, either altering the physical composition of the soil (soil blending) or placing a barrier in or on the soil to obtain the desired effect (such as establishing a Sod cover to prevent dust generation).

meniscus Curved upper surface of a water column.

metamorphic rock Those rocks that have been altered in appearance and physical properties by heat, pressure, or permeation by gases or fluids.

METT-T mission, enemy, troops, terrain, and time available

MH silt, highly compressible (LL<50)

mica Any of various colored or transparent mineral silicates crystallizing in monoclinic forms that readily separate into very thin sheets.

micaceous soil Soil that contains a sufficient amount of mica to give it distinctive appearance and characteristics.

MIL-STD military standard

min minimum

mineral A naturally occurring, inorganically formed substance having an ordered internal arrangement of atoms. It is a compound and can be expressed by a chemical formula.

ML silts, low compressibility ($LL < 50$)

mm millimeter(s)

MM medium duty mat

MMC minimum moisture content

Mohs' Hardness Scale A simple scale used to measure the hardness of a mineral.

MO-MAT A commercial material used as an expedient surface.

monocline fold A rock body that exhibits local step-like slopes in otherwise flat or gently inclined rock layers. Common in plateau areas where beds may locally assume dips up to 90 degrees.

mountain glaciation See "Alpine glaciation."

moraine An accumulation of earth and stones carried and finally deposited by a glacier.

MSDS Material Safety Data Sheet

muck (mud) The very soft, slimy silt or organic silt frequently found on lake or river bottoms.

mud cracks Polygonal cracks in the surface of dried-out mud flats.

mudstone An indurated shale produced by the consolidation of mud. Primarily a field term used to temporarily identify fine-grained sedimentary rocks of unknown mineral content.

mulch A protective covering (as of sawdust, compost, or paper) spread or left on the ground especially to reduce evaporation, maintain even soil temperature, prevent erosion, control weeds, or enrich the soil.

multilayer pavement A pavement that consists of at least two layers, such as a base and wearing course, or three layers, such as a subbase, base, and wearing course.

muskeg Peat deposits found in northwestern Canada and Alaska.

N north; normal force or interlocking force. The fraction of the weight of an object that rests on a surface.

naphtha Any of various volatile often flammable liquid hydrocarbon mixtures used chiefly as solvents and diluents.

NAVFAC Naval Facilities Engineering Command

NE northeast

NIOSH National Institute of occupational Safety and Health

- no** number
- nonfoliated** Massive metamorphic rocks that exhibit no directional structural features.
- nonfrost-susceptible materials** Crushed rock, clean sandy gravel, slag, cinders, or any other cohesionless material in which ice segregation does not occur under natural freezing conditions. Uniformly graded soils, containing less than 10 percent of grains smaller than 0.02 mm are nonfrost-susceptible. Well-graded soils containing less than 3 percent by weight smaller than 0.02 mm are nonfrost-susceptible. In soils with less than 1 percent of grains smaller than 0.02 mm, ice lenses will not form under field conditions.
- normal fault** Faults along which the hanging wall has been displaced downward relative to the foot wall. Common where the earth's surface is under tensional stress so the rocks are pulled apart. Characterized by high angle (near vertical) fault planes.
- NSN** national stock number
- nuclear moisture density tester** An instrument that provides real-time, in-place moisture content and density measurements of a soil.
- NW** northwest
- o** organic soil
- obsidian** A hard, shiny, usually black, brown, or reddish volcanic glass which may contain scattered gas bubbles or visible crystals.
- odor test** A test used to determine if a soil is organic. A strong odor indicates an organic soil.
- off-site admixing** This is done when in-place admixing is not desirable and/or soil from another source provides a more satisfactory treated surface. This can be accomplished with a stationary mixing plant, or by windrow-mixing with graders in a central working area.
- OH** organic soil, highly compressible ($LL > 50$)
- oiled earth** An earth-road system made resistant to water absorption and abrasion by means of a sprayed application of slow-or medium-curing liquid asphalts.
- OL** organic soil, low compressibility ($LL \leq 50$)
- old-age stream** A stream in which the gradient is very gentle, the water velocity is low, there is little downcutting, and lateral meandering produces an extensive floodplain.
- olivine** A very hard, dense mineral which forms yellowish-green to dark olive-green or brown glassy grains or granular masses. It is often found in very dark, iron-rich rocks, particularly gabbro and basalt.

OMC optimum moisture content

organisms Living creatures, plants, animals, and microorganisms. The acids produced by their life processes hasten the decomposition of rock masses near the surface. The wedging action caused by plant root growth hastens the disintegration process.

outwash plains Result when melting ice at the edge of the glacier creates a great volume of water that flows through the end moraine as a number of streams rather than a continuous sheet of water.

overthrust fault Low-angle (near horizontal) reverse faults.

oxidation The chemical union of a compound with oxygen.

paneling Solid barrier fences of metal, wood, plastic, or masonry used to stop or divert sand movement.

parabolic-shaped dunes Crescent-shaped dunes with two tips that point upwind. They typically form along coastlines where the vegetation partially covers the sand or behind a gap in an obstructing ridge.

parallel drainage pattern Drainage pattern characterized by major streams trending in the same direction. They indicate gently dipping beds or uniformly sloping topography.

particle size Sizes of individual grains as determined by the use of sieves.

PBS prefabricated bituminous surfacing

pcf pound(s) per cubic foot

peat A term which is frequently applied to fibrous, partially decayed organic matter or a soil which contains a large proportion of such materials. Large and small deposits of peat occur in many areas and present many construction difficulties. Peat is extremely loose and compressible.

pedology The study of the maturing of soils and the relationship of the soil profile to the parent material and its environment.

pegmatite A coarse variety of granite occurring in dikes or veins.

PEL permissible exposure limit

perched water table A localized zone of saturated soil above the normal ground water table; created by the localized presence of relatively impervious soil layers.

period of weakening An interval of the year which starts at the beginning of the frost-melting period and ends when the subgrade strength has returned to normal period values.

peridotite Any of a group of granitoid igneous rocks composed of ferromagnesian minerals, especially olivine.

permeability The property of soil which permits water to flow through it.

PF permafrost

physical weathering The disintegration of rock. Rock masses are broken into smaller and smaller pieces without altering the chemical composition of the pieces.

PI plasticity index

pier foundation A type of support normally used only for very heavy loads.

pile foundation A load-bearing member which may be made of timber, concrete, or steel. It is generally forced into the ground.

pistol-butted trees Downslope-tipped trees that are small as a result of sliding soil or debris or as a result of active soil creep. They are a good indicator of slope instability for areas where rain is a major component of winter precipitation.

pit-run coral Consists of fragmental coral in conjunction with sands and marine shells.

PL plastic limit

plagioclase A triclinic feldspar.

plasticity The ability of a soil to deform without cracking or breaking.

plasticity index The difference between the liquid and plastic limits.

plastic limit The lowest moisture content at which a soil can be rolled into a thread 1/8 inch in diameter without crushing or breaking.

platy grains Extremely thin grains, compared to their lengths and widths. They have the general shape of a flake of mica or a sheet of paper.

plunging fold Folds that dip back into the ground at one or both ends.

POL petroleum, oils, and lubricants

precipitates Salts that have become insoluble, separated from solution, and been deposited.

prefabricated mesh Heavy woven jute mesh, such as commonly used in conjunction with grass seed operations; can be used for dust control of nontraffic areas.

psi pounds per square inch

Pt peat soil

pumice A volcanic rock full of cavities and very light in weight; used especially in powder form for smoothing and polishing.

pyrite A common mineral that consists of iron disulfide (FeS_2), has a pale brass-yellow color and metallic luster, and is burned for the manufacture of sulfur dioxide and sulfuric acid.

pyroclastics Volcanic materials that have been explosively ejected from a vent.

pyroxene Hard, dense, glassy to resinous minerals found chiefly in dark igneous rocks and, less often, in dark gneisses and schists. They usually occur as well-formed short, stout, columnar crystals that appear almost square in cross section.

quarry An open excavation made into rock masses by drilling, cutting, or blasting.

quartz An extremely hard, transparent to translucent mineral with a glassy or waxy luster.

quartzite A compact granular rock composed of quartz and derived from sandstone by metamorphism. It is an extremely hard, fine- to coarse-grained massive rock that forms from sandstone.

quick silts Very fine sands and silts that are compacted in the presence of a high water table that pump water to the surface.

radial drainage pattern A drainage pattern in which streams flow outward from a high central area. Normally found on domes, volcanic cones, or rounded hills.

rakes Inclined braces used to support wales.

RC rapid curing

recessional moraines Sediments deposited when a receding glacier halts for a considerable period of time.

recrystallization To recrystallize again or repeatedly.

rectangular drainage pattern A drainage pattern characterized by abrupt 90-degree changes in stream directions. It is caused by faulting or jointing of the underlying bedrock.

recumbent fold A fold with an axial plane that has been inclined to the point that it is horizontal.

residual soil Unconsolidated deposits resulting from the weathering of rock material in place.

resins Dust palliative used as either surface penetrants or surface blankets; usually lignin based.

- retaining walls** Constructed for the purpose of supporting a vertical or nearly vertical earth bank that, in turn, may support vertical loads.
- reverse fault** Results when the hanging wall of a fault becomes displaced upward relative to the foot wall. These are frequently associated with compressional forces which accompany folding.
- ripple marks** Parallel ridges formed in some sediments. They may indicate the direction of wind or water movement during deposition.
- road tar** Viscous liquids obtained by distillation of crude tars extracted from coal.
- rockfall** A mass of falling or fallen rocks.
- rock flour** Finely ground rock particles, chiefly silt-sized, resulting from glacial abrasion.
- rock riprap** A foundation or sustaining wall of stones or chunks of concrete thrown together without order (as in deep water); a layer of this or similar material on an embankment slope to prevent erosion.
- rockslide** A usually rapid downward movement of rock fragments that slide over an inclined surface.
- rounded particles** Those in which all projections have been removed and few irregularities in shape remain. They approach spheres of varying sizes.
- rough tillage** Uses chisel, luster, or turning plows to till strips across nontraffic areas. This method works best with cohesive soils that form clods.
- RS** rapid setting
- RT** road tar
- RTCB** road tar cutback
- S** south; degree of saturation; sand; permissible stress
- SA** soil-asphalt
- saddles** Low points on a ridge or crest line, generally a divide between the heads of streams flowing in opposite directions.
- sag pond** A slump block depression that fills with water during the rainy season.
- salt solutions** Water saturated with sodium chloride or other salts applied to sand dunes to control dust.
- sand dune** A hill or ridge of sand piled up by the wind commonly found along shores, along some river valleys, and generally where there is dry surface sand during some part of the year.

- sand grid** A honeycomb shaped geotextile measuring 20 feet by 8 feet by 8 inches deep when fully expanded. It is used to develop a beachhead for logistics-over-the-shore operations. It is also useful in expedient revetment construction.
- sandstone** A hard elastic sedimentary rock composed mainly of sand-size (1/26 mm to 2 mm) quartz grains, often with feldspar, calcite, or clay.
- SBST** single bituminous surface treatment
- SC** slow curing; soil-cement
- schist** Metamorphic crystalline rock having a closely foliated structure allowing division along approximately parallel planes. It is a fine- to coarse-grained rock composed of discontinuous thin layers of parallel mica, chlorite, hornblende, or other crystals.
- SCIP** scarify/compact in-place
- scoria** Rough vesicular cindery lava, common in volcanic regions and generally forms over basaltic lava flows. It is somewhat denser and tougher than pumice, and the gas bubbles which give it its spongy or frothy appearance are generally larger and more widely spaced than those in pumice.
- SCS** Soil Conservation Service
- SE** southeast
- sedimentary rock** Formed of mechanical, chemical, or organic sediment, such as rock formed of fragments transported from their source and deposited elsewhere by water (as sandstone or shale); rock formed by precipitation from solution (as rock salt or gypsum); rock formed from inorganic remains of organisms (as limestone comprised of shells and skeletons)
- seepage force** The drag force that moving water exerts on each individual soil particle in its path.
- shale** A fissile rock that is formed by the consolidation of clay, mud, or silt, has a finely stratified or laminated structure, and is composed of minerals essentially unaltered since deposition.
- shearing** When one portion of a block of uniform soil fails, or slides, past another portion in a parallel direction.
- shear planes or plane of failure** The surface along which shearing action takes place.
- shear strength** The resistance to shearing.
- shelter belts** Barriers formed from hedges, shrubs, or trees which are high and dense enough to significantly reduce wind velocities on the leeward side.
- shrinkage** Reduction in volume when the moisture content of a soil is reduced.

shrinkage limit The moisture content at which a soil occupies the boundary between the semisolid and solid states.

sieve A device with meshes or perforations through which finer particles of a mixture (as of ashes, flour, or sand) of various sizes are passed to separate them from coarser ones, through which the liquid is drained from liquid-containing material, or through which soft materials are forced for reduction to fine particles.

silicon dioxide See “quartz.”

single-layer pavement A stabilized soil structure on a natural subgrade.

siltstone A rock composed chiefly of indurated silt.

sinkhole A depression in which drainage collects and communicates with a cavern or passage. Normally located in regions underlain by limestone.

SL soil lime

slaking test Used to assist in determining the quality of certain shales and other soft rock-like materials. The test is performed by placing the soil in the sun or in an oven to dry and then allowing it to soak in water for a period of at least 24 hours. The strength of the soil is then examined. Certain types of soil will completely disintegrate, losing all strength.

slate A dense fine-grained metamorphic rock produced by heat and pressure action on shales so as to develop a characteristic cleavage.

Slumps Slope failures where one or more blocks of soil have failed on a hemispherical, or bowl-shaped, slip surface; they may show varying amounts of backward rotation into the hill in addition to downslope movement. They usually occur in deep, moderately fine or fine-textured soils that contain a significant amount of silt or clay.

slurry A watery mixture of insoluble matter (as mud, lime, or plaster of paris).

SM silty sands and poorly graded sand-silt mixture

SP poorly graded sand

soil The entire unconsolidated material that overlies and is distinguishable from bedrock. It is composed principally of the disintegrated and decomposed articles of rock.

soil creep A relatively slow-moving type of slope failure.

spall To break up (ore) with a hammer usually preparatory to crushing; to reduce (as irregular stone blocks) approximately to size by chipping with a hammer; to cause to break off in spans; to break off chips, scales, or slabs from the surface or edge often as the result of a rapid change of temperature; to split off particles as the result of bombardment in such a manner that a large part

remains used of a surface, target, or nucleus. A fragment removed from a rock surface by weathering (few exfoliation detach themselves from the parent mass in the form of lenses).

specific gravity The ratio of a substance weight (*or* mass) to the weight (or mass) of an equal volume of water.

“speedy” moisture content test An accurate test providing a very rapid moisture content determination.

S-S silica-sesquioxide ratio

SS slow setting

stability The ability of a soil to support loads.

stoss side The side from which ice flows.

stratified glacial deposit A glacial deposit consisting of layered sediments.

stratified rock See “sedimentary rock”

strike The trend of the line of intersection formed between a horizontal plane and the bedding plane being measured.

strike slip fault A fault that is characterized by one block being displaced laterally with respect to the other; there is little or no vertical displacement.

subangular particles Those particles that have been weathered until the sharper points and ridges of the original angular shape have been worn off.

surrounded particles Those particles that have undergone considerable weathering so that they are somewhat irregular in shape and have no sharp corners and few flat areas.

surface blanket A blanket cover over the soil surface to control dust. Materials used to form the blanket include aggregates, prefabricated membranes and mesh, bituminous surface treatments, polyvinyl acetates (with or without fiberglass scrim reinforcements) and polypropylene - asphalt membranes.

suspended load That portion of material within a transporting medium that is lifted far from the earth’s surface, is sustained for long periods of time, and is distributed through the entire body of the current.

symmetrical fold A fold with a vertical or near-vertical axial plane.

synclinal fold Downfolds.

SW well-graded sand; southwest

talus A fan-shaped accumulation of mixed fragments of rock that have fallen because of weathering of a cliff or steep mountainside.

tension cracks Those cracks that relieve stress in the soil mantle.

terminal moraines See “end moraines.”

texture The relative size and arrangement of the mineral grains making up a rock.

throw The vertical displacement along a fault.

thrust fault Reverse faults that dip at low angles (less than 15 degrees) and have stratigraphic displacements commonly measured in kilometers.

till Unstratified glacial drift consisting of clay, sand, g-ravel, and boulders intermingled.

till plains See “ground moraine.”

TLV threshold limit value

TM technical manual

TO theater of operations

topsoil A general term applied to the top few inches of soil deposits. Topsoils usually contain considerable organic matter and produce plant life.

toughness A rock's resistance to crushing or breaking.

transported soil Materials that have been transported and deposited at a new location by glacial ice, water, or wind.

tranverse dune Wavelike ridges formed perpendicular to prevailing wind direction and separated by troughs. They resemble sea waves during a storm.

trellis drainage pattern A drainage pattern in which tributaries generally flow parallel to the main streams, eventually joining them at right angles.

trenching The cutting of a trench either transversely or longitudinally across a dune to destroy its symmetry.

tuff A term applied to compacted deposits of the fine materials ejected from volcanoes, such as more or less cemented dust and cinders. Tuffs are more or less stratified and in various states of consolidation. They are prevalent in the Mediterranean area.

u undesirable base and subbase material

uniformly graded soils Soil consists primarily of particles of nearly the same size.

unloading A form of physical weathering that results from the relief of pressure on a rock unit due to the removal of overlying materials.

unstratified glacial deposit Heterogeneous mixtures of different particle types and sizes ranging from clays to boulders that were directly deposited by glacial ice.

- u s** United States
- USCX** Unified Soil Classification System
- v** total volume; unit weight
- V_a** volume of air
- varved clay** A sedimentary deposit which consists of alternating thin layers of silt and clay.
- vegetative treatment** Method of soil stabilization.
- Vol** volume
- volcanic ash** Uncemented volcanic debris, usually made up of particles less than 4 mm in diameter. Upon weathering, a volcanic clay of high compressibility is frequently formed. Some volcanic clays present unusually difficult construction problems, as do those in the area of Mexico City and along the eastern shores of Hawaii.
- V_m** wet unit weight; wet density
- V_s** volume of solids
- V_v** volume of voids
- V_w** volume of water
- w** moisture content
- W** total weight; west
- wales** A horizontal constructional member (as of timber or steel) used for bracing vertical members.
- w_d** dry weight
- weathering** The physical or chemical breakdown of rock. It is the process by which rock is converted into soil.
- well-drained soil** Soils that allow for the significant transmission of water (essentially clean sands and gravels).
- well-graded soil** Has a good representation of all particle sizes from the largest to the smallest and the shape of the grain-size distribution curve is considered "smooth."
- wet density** The weight of a soil material (including moisture fraction) divided by the volume of the soil material. Synonymous with wet unit weight and field density.

WL	liquid limit
Wp	plastic limit
w_s	weight of solids
w_w	weight of water
yd	yard(s)