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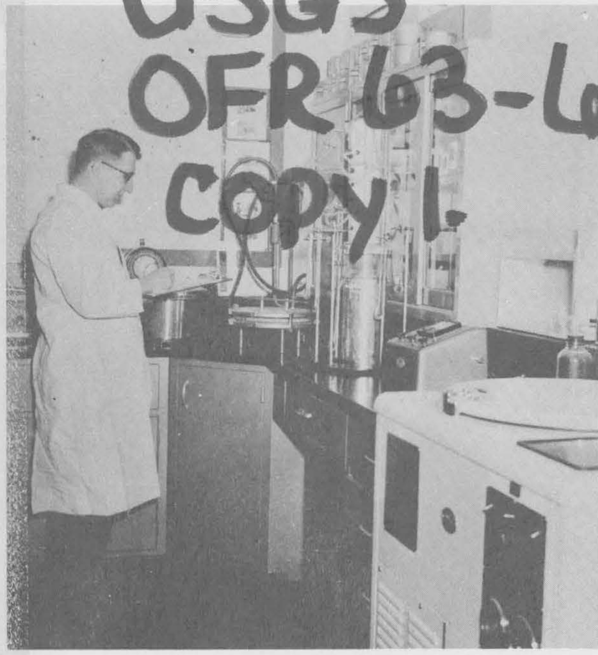

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
GROUND WATER BRANCH

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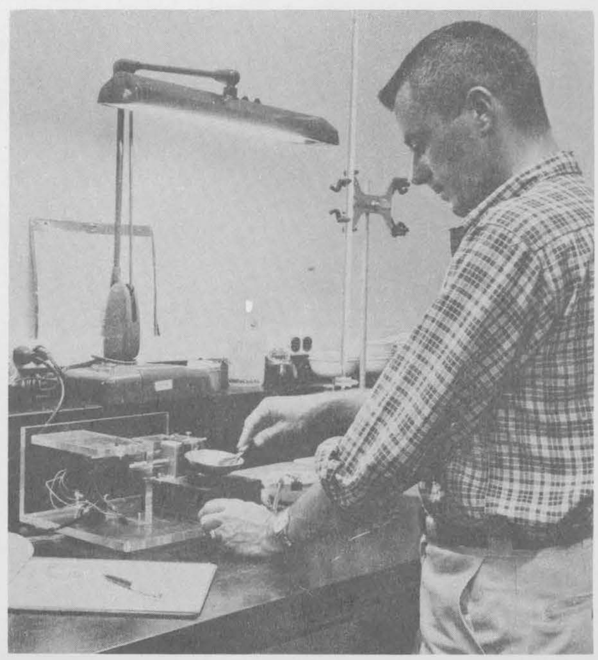
Symbols And Definitions From Soil Mechanics And Soil Physics

HYDROLOGIC LABORATORY
Denver, Colorado

For Distribution in
Ground Water Branch



U. S. DEPT. OF INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
GROUND WATER BRANCH

SYMBOLS AND DEFINITIONS FROM SOIL MECHANICS AND SOIL PHYSICS

Compiled by
A. I. Johnson
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Hydrologic Laboratory
Denver, Colorado
1958

SYMBOLS AND DEFINITIONS FROM SOIL MECHANICS AND SOIL PHYSICS

Introduction

The symbols and definitions presented in this paper were taken from published standards or dictionaries of technical societies or from recent publications of recognized authorities in the fields of soil mechanics or soil physics. The source is indicated for each symbol or definition, and the sources are listed at the end of the paper. Comments of the writer are enclosed in brackets.

Symbols

A = area. (ASCE, 1941; ASTM, 1950)

b = breadth, or width. (ASCE, 1941; ASTM, 1950)

C_u = uniformity coefficient (Hazen). (ASCE, 1941; ASTM, 1950)

D = diameter, or grain diameter. (ASCE, 1941; ASTM, 1950)

D_{10} = effective size (Hazen). (ASCE, 1941; ASTM, 1950)

D_d = density, degree of; or compaction, degree of. (ASCE, 1941; ASTM, 1950)

E = modulus of elasticity. (ASCE, 1941; ASTM, 1950)

e = base of natural logarithms, or void ratio. (ASCE, 1941; ASTM, 1950)

e_f = flocculation ratio. (ASCE, 1941; ASTM, 1950)

G = specific gravity. (ASCE, 1941; ASTM, 1950)

g = gravity, acceleration of. (ASCE, 1941; ASTM, 1950)

H = height, depth, or thickness. (ASCE, 1941; ASTM, 1950)

I_c = consistency index. (ASCE, 1941; ASTM, 1950)

I_f = flow index. (ASCE, 1941; ASTM, 1950)

I_P = plasticity index. (ASCE, 1941; ASTM, 1950)

I_T = toughness index. (ASCE, 1941; ASTM, 1950)

I_w = moisture index. (ASCE, 1941; ASTM, 1950)

i = hydraulic gradient. (ASCE, 1941; ASTM, 1950)

k = permeability, coefficient of. (ASCE, 1941; ASTM, 1950)

L = distance, or length. (ASCE, 1941; ASTM, 1950)

L_{LS} = lineal shrinkage limit. (ASCE, 1941; ASTM, 1950)

L_S = lineal shrinkage. (ASCE, 1941; ASTM, 1950)

n = porosity, or developed pressure. (ASCE, 1941; ASTM, 1950)

Q = discharge, rate of, or resistance, total or resultant. (ASCE, 1941; ASTM, 1950)

q = discharge, rate of, per unit length or per unit area, or resistance per unit area or length. (ASCE, 1941; ASTM, 1950)

R = reading. (ASCE, 1941; ASTM, 1950)

R_s = shrinkage ratio. (ASCE, 1941; ASTM, 1950)

r = radius. (ASCE, 1941; ASTM, 1950)

S = hydraulic gradient; or saturation, degree of. (ASCE, 1941; ASTM, 1950)

T = temperature. (ASCE, 1941; ASTM, 1950)

t = time. (ASCE, 1941; ASTM, 1950)

V = volume. (ASCE, 1941; ASTM, 1950)

V_c = volume of sample container. (ASTM, 1950)

V_g = volume of gas-filled voids [pores]. (ASTM, 1950)

V_s = volume of oven-dry soil particles. (ASTM, 1950)

V_t = total volume of soil particles plus gas and water-filled voids [pores]. (ASTM, 1950)

V_v = volume of voids [pores]. (ASTM, 1950)

V_w = volume of water in voids [pores]. (ASTM, 1950)

V_S = volumetric shrinkage. (ASCE, 1941; ASTM, 1950)

V_{SL} = volumetric shrinkage limit. (ASCE, 1941; ASTM, 1950)

v = velocity. (ASCE, 1941; ASTM, 1950)

W = weight or load, total. (ASCE, 1941; ASTM, 1950)

W_c = weight of sample container. (ASTM, 1950)

W_s = weight of oven-dry soil particles. (ASTM, 1950)

W_{sc} = weight of oven-dry soil particles plus container. (ASTM, 1950)

W_t = total weight of soil particles plus gas and water-filled voids [pores]. (ASTM, 1950)

W_{ws} = weight of wet soil [water plus soil particles]. (ASTM, 1950)

W_{wsc} = weight of wet soil plus container. (ASTM, 1950)

W% = percent finer in mechanical analysis plot. (ASCE, 1941)

W% = percentage finer matter in mechanical analysis plot. (ASTM, 1950)

w = water content (moisture content). (ASCE, 1941; ASTM, 1950)

w_{cme} = centrifuge moisture equivalent. (ASCE, 1941; ASTM, 1950)

w_f = flocculation limit. (ASCE, 1941; ASTM, 1950)

w_{fme} = field moisture equivalent. (ASCE, 1941; ASTM, 1950)

w_L = liquid limit. (ASCE, 1941)

w_l = liquid limit. (ASTM, 1950)

w_p = plastic limit. (ASCE, 1941; ASTM, 1950)

w_s = shrinkage limit. (ASCE, 1941; ASTM, 1950)

α = angle. (ASCE, 1941; ASTM, 1950)

β = angle. (ASCE, 1941; ASTM, 1950)

γ = unit weight. (ASCE, 1941; ASTM, 1950)

γ_w = unit weight of water, equal to 1 in the metric system. (ASCE, 1941; ASTM, 1950)

ϵ = base of natural logarithms; deformation per unit length; strain. (ASCE, 1941; ASTM, 1950)

θ = angle. (ASCE, 1941; ASTM, 1950)

μ = coefficient of absolute viscosity. (ASCE, 1941; ASTM, 1950)

ν = coefficient of kinematic viscosity; or concentration factor. (ASCE, 1941; ASTM, 1950)

ψ = angle. (ASCE, 1941; ASTM, 1950)

Greek Alphabet

Α	α	Alpha	Ν	ν	Nu
Β	β	Beta	Ξ	ξ	Xi
Γ	γ	Gamma	Ο	ο	Omicron
Δ	δ	Delta	Π	π	Pi
Ε	ϵ	Epsilon	Ρ	ρ	Rho
Ζ	ζ	Zeta	Σ	σ	Sigma
Η	η	Eta	Τ	τ	Tau
Θ	θ	Theta	Υ	υ	Upsilon
Ι	ι	Iota	Φ	ϕ	Phi
Κ	κ	Kappa	Χ	χ	Chi
Λ	λ	Lambda	Ψ	ψ	Psi
Μ	μ	Mu	Ω	ω	Omega

Definitions

Acceleration of gravity, g. (ASCE, 1941; ASTM, 1950)

Angle, α, β, θ, ψ. Angles are generally best designated by Greek letters. These four letters have no specific application in this list, and are therefore convenient for designating angles. (ASCE, 1941; ASTM, 1950)

Apparent density - obsolete. See bulk density. (SSSA, 1956)

Apparent specific gravity - obsolete. See bulk specific gravity. (SSSA, 1956)

Area, A. (ASCE, 1941; ASTM, 1950)

Base of natural logarithms, e or ϵ. The symbol, e, is preferred, but where its use might cause confusion with its use designating void ratio, the symbol, ϵ, should be used. (ASCE, 1941; ASTM, 1950)

Breadth, b. (ASCE, 1941; ASTM, 1950)

Bulk density, soil. Mass per unit bulk volume of soil that has been dried to constant weight at 105°C. Symbol - D_b. (SSSA, 1956)

Bulk specific gravity. The ratio of the mass of a dry bulk volume of oven dried (105°C.) soil to the mass of an equal volume of water. (SSSA, 1956)

Capillary conductivity -

1. Qualitative. The physical property relating to the readiness with which unsaturated soils transmit water.
2. Quantitative. The ratio of the water flow velocity to the driving force in unsaturated soil. The calculation is valid under conditions where flow velocity is proportional to driving force. For example, in practical units when the driving force is expressed in terms of the hydraulic gradient, capillary conductivity is the ratio of flow velocity to hydraulic gradient and has the dimensions of velocity. As saturation is approached, capillary conductivity approaches the hydraulic conductivity. (SSSA, 1956)

Centrifuge moisture equivalent, w_{cme}. In most uses the abbreviation CME may be used. When, as rarely, a symbol is desired, w_{cme} should be used. The CME is the water content retained by a soil which has been first saturated with water and then subjected to a force equal to one thousand times the force of gravity for one hour. (ASCE, 1941; ASTM, 1950)

Coefficient of absolute viscosity, μ. (ASCE, 1941; ASTM, 1950)

Coefficient of dynamic viscosity, ν. Defined by the equation, $\nu = \frac{\mu}{\gamma_f}$ where γ_f = the unit weight of the fluid in question. (ASTM, 1950)

Compaction, degree of, D_d. Also called degree of density. Defined by the equation:

$$D_d = \frac{\text{(Void ratio in loosest state) - (Void ratio of sample)}}{\text{(Void ratio in loosest state) - (Void ratio in densest state)}}$$

Consistency index, I_c. The ratio of the difference between the liquid limit and the natural water content to the difference between the liquid limit and the plastic limit.

$$I_c = \frac{w_L - w}{I_p}$$

Darcy's Law -

1. Historical. The volume of water passing downward through a sand filter bed in unit time is proportional to the area of the bed and to the difference in hydraulic head, and is inversely proportional to the thickness of the bed.
2. Generalization for three dimensions. The rate of viscous flow of water in isotropic porous media is proportional to, and in the direction of, the hydraulic gradient.
3. Generalization for other fluids. The rate of viscous flow of homogeneous fluids through isotropic porous media is proportional to, and in the direction of, the driving force. (SSSA, 1956)

Depth, H. (ASCE, 1941; ASTM, 1950)

Diameter, D. (ASCE, 1941; ASTM, 1950)

Diameter, grain, D. Also called grain size, or particle size. The size of grain, usually in millimeters, as determined by sieve analysis or wet mechanical analysis; hence not a true grain size except for spherical grains. (ASCE, 1941; ASTM, 1950)

Discharge, rate of, Q. In soil mechanics literature this usually refers to the rate at which water is discharged through a given area of soil. Dimensionally, Q = volume/time. In Darcy's familiar equation for liminar flow, Q = kSA. (ASCE, 1941; ASTM, 1950)

Discharge, rate of per unit length or per unit area, q. Dimensionally, q = volume/(time X area), or q = volume/(time X length). In Darcy's equation as used above, q = kS. (ASCE, 1941; ASTM, 1950)

Distance, L. (ASCE, 1941; ASTM, 1950)

Effective size (Hazen), D_{10}. The grain size on a mechanical analysis curve corresponding to W% = 10. (ASCE, 1941; ASTM, 1950)

Equivalent volumetric change. See volumetric shrinkage limit. (ASCE, 1941; ASTM, 1950)

Evapo-transpiration. The sum of water removed by vegetation and that lost by evaporation for a particular area during a specified time. (SSSA, 1956)

Field capacity -(Field moisture capacity). Amount of water remaining in a well-drained soil when the velocity of downward flow into unsaturated soil has become small. It is expressed as a percentage of weight of over-dry soil. (SSSA, 1956)

Field moisture equivalent, w_{fme}. In most uses the abbreviation FME may be used. When, as rarely, a symbol is desired, w_{fme} should be used. The FME is the minimum water content at which a drop of water placed on a smoothed surface of a soil will not immediately be absorbed by the soil, but will spread over the surface and give it a shiny appearance. (ASCE, 1941; ASTM, 1950)

Film water. Tightly bound water adsorbed on the surface of particles in unsaturated soil. (SSSA, 1956)

Flocculation limit, w_f. The water content of a soil, when it is in the condition of a deflocculated sediment.

Flocculation ratio, e_f. The void ratio of a soil when it is in the condition of a deflocculated sediment.

Flow index, I_f. The slope of the flow curve. The flow curve is the locus of points obtained from a standard liquid limit test and plotted on a graph representing water content as ordinate on an arithmetic scale and number of blows as abscissas on a logarithmic scale. Thus, the flow index is numerically equal to the difference between the water content at 10 and at 100 blows, or at 1 and at 10 blows. (ASCE, 1941; ASTM, 1950)

Flow velocity (Water in soil). A vector point function used for indicating the rate and direction of movement of water through the soil. It is an effective or macroscopic velocity and may not be equal to the particle velocity of the water at any point. Flow velocity is defined as the volume of water transferred per unit of time and per unit of area normal to the direction of the net flow. (SSSA, 1956)

Height, H. (ASCE, 1941; ASTM, 1950)

Hydraulic conductivity -

1. The ratio of the flow velocity to the driving force for the viscous flow under saturated conditions of a specified liquid in a porous medium. Physical dimensions will depend on the equation selected to express the flow.

2. (practical units). The ratio, $v/i = k$, where v is the flow velocity of a specified liquid under saturated conditions, and i is the hydraulic gradient in the Darcy equation, $v = ki$. In this case ($k = LT^{-1}$). (SSSA, 1956)

Hydraulic gradient, S or i. The symbol, S, is preferred because of its wide-spread use in literature on hydraulics. The symbol, i, is included because it has been almost exclusively used to designate hydraulic gradient in soil mechanics literature. (ASCE, 1941; ASTM, 1950)

Hydraulic gradient (Water in soil). A vector (macroscopic) point function which is equal to the decrease in the hydraulic head per unit distance through the soil in the direction of the greatest rate of decrease. In isotropic soils, this will be in the direction of the flow velocity. The water-moving force per unit of mass of water is represented both in direction and magnitude by the hydraulic gradient. This force is 980 dynes per gram, or 1 gram weight per gram, when $i = L$. The hydraulic gradient is dimensionless, i. e., ($i = LL^{-1} = 1$). (SSSA, 1956)

Hydraulic head (Water in soil), h. The elevation with respect to a standard datum at which water stands in a riser or manometer connected to the point in question in the soil. This will include gravitational head, pressure head, and velocity head, if the terminal opening of the sensing element is pointed upstream. For nonturbulent flow of water in soil, the velocity head is negligible. In unsaturated soil, a porous cup must be used for establishing hydraulic contact between the soil water and water in the manometer. Dimensionally, hydraulic head is a length, ($h = L$). (SSSA, 1956)

Hygroscopic coefficient. The moisture content of the soil in equilibrium with an atmosphere of known relative humidity - usually a nearly saturated atmosphere. [not widely used at present] (Kramer, 1949)

Infiltration. The downward entry of water into soil. (SSSA, 1956)

Infiltration rate. The maximum rate at which a soil, in a given condition at a given time, can adsorb water. Also, the maximum rate at which a soil will absorb water impounded on the surface at a shallow depth when adequate precautions are taken regarding border or fringe effects. Defined as the volume of water passing into the soil per unit of area per unit of time, it has dimensions of velocity (LT^{-1}). (SSSA, 1956)

Infiltration velocity. The volume of water moving downward into the soil surface per unit of area per unit of time. The local instantaneous volume is the limit approached as the area and time interval are made small. The maximum infiltration velocity is the infiltration rate. (SSSA, 1956)

Infiltrometer. A device for measuring the rate of entry of a fluid into a porous body (e.g., water into soil). (SSSA, 1956)

Length, L. (ASCE, 1941; ASTM, 1950)

Lineal expansion, L_E. The increase in one dimension, expressed as a percentage of that dimension at the shrinkage limit, of a soil mass when the water content is increased from the shrinkage limit to any given water content.

Lineal expansion limit, L_{LE}. The increase in one dimension, expressed as a percentage of that dimension at the shrinkage limit, of a soil mass when the water content is increased from the shrinkage limit to the field moisture equivalent.

Lineal shrinkage, L_S. The decrease in one dimension, expressed as a percentage of that dimension originally, of a soil mass when the water content is reduced from the original percentage to the shrinkage limit. (ASCE, 1941; ASTM, 1950)

Lineal shrinkage limit, L_{LS}. The decrease in one dimension, expressed as a percentage of that dimension at the field moisture equivalent, of a soil mass when the water content is reduced from the field moisture equivalent to the shrinkage limit. (ASCE, 1941; ASTM, 1950)

Liquid limit, w_L. In most cases the abbreviation LL may be used. When, as rarely, a symbol is desired, w_L should be used. The LL is the upper limit of the plastic state, expressed as the water content at which the flow curve (see Flow index) intersects the "25 blows" ordinate. (ASCE, 1941; ASTM, 1950)

Modulus of elasticity, E. The ratio of stress to strain for a given material under given load conditions. Subscripts may be used to differentiate moduli under different load conditions. (ASCE, 1941; ASTM, 1950)

Moisture content. See Water content. (ASCE, 1941; ASTM, 1950)

Moisture index, I_w. The ratio of the plasticity index to the difference between the natural water content and the plastic limit, expressed by the equation:

$$I_w = \frac{I_p}{w - w_p}$$ (ASCE, 1941; ASTM, 1950)

Moisture tension. The equivalent negative gauge pressure, or suction, in the soil moisture. Soil moisture tension is equal to the equivalent negative or gauge pressure to which water must be subjected in order to be in hydraulic equilibrium, through a porous permeable wall or membrane, with the water in the soil. (SSSA, 1956)

Oven-dry soil. A soil dried at 105°C. to 110°C. until it is in moisture equilibrium at that temperature. (SSSA, 1956)

Particle density. The average density of the soil particles not including fluid space. Particle density is usually expressed in grams per cubic centimeter and is sometimes referred to as "real density or grain density". (SSSA, 1956)

Per cent finer, W%. The ordinate of the mechanical analysis curve, representing, for a given soil, the percentage of particles by weight having diameters smaller than the value of D corresponding to W%. (ASCE, 1941)

Percentage finer, W%. The ordinate of the mechanical analysis curve, representing, for a given soil, the percentage of particles by weight having diameters smaller than the value of D corresponding to W%. (ASTM, 1950)

Percolation (soil water). A qualitative term applying to the downward movement of water through soil. Especially, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1 or less. (SSSA, 1956)

Permanent-wilting percentage. The moisture content of the soil at the time when the leaves of plants growing in that soil first become permanently wilted. [Has been designated as the wilting point, wilting coefficient and wilting percentage, but permanent-wilting percentage is presently accepted.] (Kramer, 1949)

Permeability -

1. Soil. Permeability as used in describing soils refers to the readiness with which air, water, or plant roots penetrate into or pass through its pores. The portion of the soil being discussed should be designated, e.g., "the permeability of the A horizon".
2. Qualitative. The quality or state of a porous medium relating to the readiness with which it conducts or transmits fluids.
3. Quantitative. The specific property designating the rate or readiness with which a porous medium transmits fluids under standard conditions. The equation used for expressing the flow will take into account the properties of the fluid so that proper measurements on a given medium will give the same permeability value for all fluids which do not alter the medium. The physical dimensions of the permeability unit will be determined by the equation used to express the flow. (SSSA, 1956)

Permeability, coefficient of, k. The discharge velocity of flow of a fluid through a porous mass under a unit hydraulic gradient. Thus, in Darcy's equation, $V = kSAt$; for laminar flow: $k = V/A - t$, in which A is the gross area of the soil mass. (ASCE, 1941; ASTM, 1950)

pF. A simple expression of the energy necessary to produce a given pull or suction, in terms of the logarithm of the height in centimeters of a unit column of water. Thus, the force equivalent to the weight of 1000 centimeters of water corresponds to a pF of 2 (see table below). The moisture equivalent is at a pF of about 2.7 and the wilting percentage at about 4.2. [Not widely used at present] (Lyon & Buckman, 1947)

pF Values	Height of a Unit Column of water in centimeters	Approximate Atmospheres of Pressure*
0	1	1/1000 (.0009)
1	10	1/100 (.0096)
2	100	1/10 (.0968)
2.7	501	1/2 (.485)
3	1,000	1 (.968)
4	10,000	10 (9.68)
4.2	15,849	15 (15.3)
4.5	31,623	31 (30.6)
5	100,000	100 (96.8)
6	1,000,000	1,000 (968.0)
7	10,000,000	10,000 (9680.0)

*The actual atmospheric equivalents are given in parenthesis.

pH (soil). The negative logarithm of the hydrogen-ion activity of a soil. The degree of acidity (or alkalinity) of a soil as determined by means of a glass-, quinhydrone-, or other suitable electrode or indicator at a specified moisture content of soil: water ratio, and expressed in terms of the pH scale. (SSSA, 1956)

Plasticity index, I. In most cases the abbreviation PI may be used. When, as rarely, a symbol is desired, I_p should be used. The PI is the numerical difference between the water content at the liquid limit and the water content at the plastic limit. $I_p = w_L - w_p$. (ASCE, 1941; ASTM, 1950)

Plastic limit, w. In most cases the abbreviation PL may be used. When, as rarely, a symbol is desired, w_p should be used. The PL is the lower limit of the plastic state, expressed as the minimum water content at which a soil can be rolled into a thread one-eighth inch in diameter without crumbling. (ASCE, 1941; ASTM, 1950)

Pore space. Total space not occupied by solid soil particles. (SSSA, 1956)

Porosity, n. The ratio, expressed as a percentage, of the intergranular space in a given soil mass to the total volume of the soil mass. Porosity must be clearly differentiated from void ratio, e. The relation between the two terms is expressed by the equation: $n = e/(1+e)$. (ASCE, 1941; ASTM, 1950)

Pressure membrane. A membrane, permeable to water and only very slightly permeable to gas when wet, through which water can escape from a soil sample in response to pressure gradients. (SSSA, 1956)

Radius, r. (ASCE, 1941; ASTM, 1950)

Reaction, soil. The degree of acidity or alkalinity of a soil, usually expressed in terms of pH value. Descriptive terms commonly used are as follows: extremely acid, below 4.5; very strongly acid, 4.5 to 5.0; strongly acid, 5.1 to 5.5; medium acid, 5.6 to 6.0; slightly acid, 6.1 to 6.5; neutral, 6.6 to 7.3; mildly alkaline, 7.4 to 7.8; moderately alkaline, 7.9 to 8.4; strongly alkaline, 8.5 to 9.0; very strongly alkaline, 9.1 and higher. (SSSA, 1956)

Reading, R. For example, reading of a deflection dial, hydrometer, and similar apparatus. (ASCE, 1941; ASTM, 1950)

Retentivity profile (soil). A group showing retentivity values such as 15-atmosphere percentage or 1/10-atmosphere percentage in relation to depth in field soil. (SSSA, 1956)

Saturate -

1. To fill all the voids between soil particles with liquid.
2. To form the most concentrated solution possible under a given set of physical conditions in the presence of an excess of the substance. (SSSA, 1956)

Saturation, degree of, S. The ratio, expressed as a percentage, of the volume of water in a given soil mass to the total volume of intergranular space (voids). Thus, $S = (V_w/V_v) \times 100$. (ASCE, 1941; ASTM, 1950)

Shrinkage limit, w_s. In most cases the abbreviation S L may be used. When, as rarely, a symbol is desired, w_s should be used. The S L is the maximum water content at which a reduction in water content will not cause a decrease in volume of the soil mass. (ASCE, 1941; ASTM, 1950)

Shrinkage ratio, R_s. In most cases the abbreviation S R may be used. When, as rarely, a symbol is desired, R_s should be used. The S R is the ratio between a given volume change, expressed as a percentage of the dry volume, and the corresponding change in water content above the shrinkage limit, expressed as a percentage of the weight of the oven-dried soil. (ASCE, 1941; ASTM, 1950)

Soil -

1. In pedology, that earth material which has been so modified and acted upon by physical, chemical and biological agents that it will support rooted plants.
2. In engineering geology, the term soil is equivalent to Rogolith, q. v.
3. The term is also loosely applied to all unconsolidated material above the bedrock that has been in any way altered or weathered. (After Stokes and Varnes, p. 139, 1955)
4. In military geology, "soil" is used in the sense of regolith or mantle rock in discussion of engineering problems, and in the standard pedologic sense in discussion of cross-country movement problems. (AGI, 1957)

Soil formation factor. The independent variables that define the soil system. Five main groups of soil formation factors are generally recognized by soil scientists, viz., parent rock, climate, organisms, topography, and time. (SSSA, 1956)

Soil horizon. A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in properties such as color, structure, texture, consistence, biological and chemical characteristics. (SSSA, 1956)

Soil moisture tension. See Moisture tension. (SSSA, 1956)

Specific gravity, G. The ratio of the weight in air of a given volume of a material at a stated temperature to the weight in air of an equal volume of distilled water at a stated temperature, usually 4^oC. (ASCE, 1941; ASTM, 1950)

Sticky point. The moisture content of well-mixed, kneaded soil material that barely fails to adhere to a polished nickel or stainless steel surface when the shearing speed is 5 cm. per second. It is a property of plastic soils. (SSSA, 1956)

Temperature, T. (ASCE, 1941; ASTM, 1950)

Thickness, H. (ASCE, 1941; ASTM, 1950)

Time, t. (ASCE, 1941; ASTM, 1950)

Toughness index, I_T. In most cases the abbreviation TI may be used. When, as rarely, a symbol is desired, I_T should be used. The TI is the ratio of the plasticity index to the flow index. Thus, $I_T = I_p/I_f$. (ASCE, 1941; ASTM, 1950)

Uniformity Coefficient (Hazen), C_u. The ratio of D_{60} to D_{10} as determined in a mechanical analysis.

Unit weight, γ. Weight per unit volume, such as grams per cubic centimeter and pounds per cubic foot. (ASCE, 1941; ASTM, 1950)

Unsaturated flow. The movement of liquid water in an unsaturated soil. (SSSA, 1956)

Velocity, v. (ASCE, 1941; ASTM, 1950)

Void ratio, e. The ratio of the volume of intergranular space to the volume of solid particles in a given soil mass without regard to the proportions of liquid, air, or gas which may occupy the space.

Volume, V. (ASCE, 1941; ASTM, 1950)

Volumetric shrinkage, V_S. Also called volumetric change. The decrease in volume, expressed as a percentage of the dry volume, of a soil mass, when the water content is reduced from a given percentage to the shrinkage limit. (ASCE, 1941; ASTM, 1950)

Volumetric shrinkage limit, V_{SL}. The decrease in volume, expressed as a percentage of the dry volume, of a soil mass when the water content is reduced from the field moisture equivalent to the shrinkage limit. (ASCE, 1941; ASTM, 1950)

Water content, w. The ratio, expressed as a percentage, of the weight of water in a given soil mass to the weight of solid particles. (ASCE, 1941; ASTM, 1950)

Water content, optimum, w_o. The water content at which the maximum density is produced in a soil by a specific amount of compaction. (ASCE, 1941; ASTM, 1950)

Water conductivity. Hydraulic conductivity as measured with water. (SSSA, 1956)

Water table. The upper surface of ground water; locus of points in soil water at which the hydraulic pressure is equal to atmospheric pressure. (SSSA, 1956)

Water table, perched. The upper surface of a body of free ground water in a zone of saturation separated, by unsaturated material, from an underlying body of ground water in a different zone of saturation. (SSSA, 1956)

Weight, W. (ASCE, 1941; ASTM, 1950)

Width, b. (ASCE, 1941; ASTM, 1950)

Wilting coefficient. See Permanent wilting percentage.

Wilting percentage. See Permanent wilting percentage.

Wilting Point. See Permanent wilting percentage.

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