Recommended Descriptions of Geosynthetics Functions, Geosynthetics Terminology, Mathematical and Graphical Symbols

Foreword

This is the fifth edition of the IGS mathematical and graphical symbols document. Since publication of the fourth edition in August 2000 a number of evolutionary changes (rather than revolutionary changes) have been made to reflect the further development and refinement of geosynthetics terminology. This edition will also be placed on the IGS Web Site to provide IGS members with ready access to current geosynthetics descriptions, terminology and mathematical and graphical symbols.

Further updates will follow as the range of products, applications and related terminology expands.

International Geosynthetics Society

1. Geosynthetics Functions

Barrier	The use of a geosynthetic material to prevent the migration of liquids or gases.
Containment	The use of a geosynthetic material to contain soil or sediments to a specific geometry and prevent their loss. The contained fill takes the shape of the inflated at-rest geometry of the geosynthetic container.
Drainage (also known as transmission)	The use of a geosynthetic material to collect and transport fluids.
Filtration	The use of a geosynthetic material to allow passage of fluids from a soil while preventing the uncontrolled passage of soil particles.
Protection	The use of a geosynthetic material as a localised stress reduction layer to prevent or reduce damage to a given surface or layer.
Reinforcement	The use of the tensile properties of a geosynthetic material to resist stresses or contain deformations in geotechnical structures.
Separation	The use of a geosynthetic material between two dissimilar geotechnical materials to prevent intermixing.
Surficial erosion control	The use of a geosynthetic material to prevent the surface erosion of soil particles due to surface water run-off and/or wind forces.
Frictional interlayer	A layer introduced within an interface with the purpose of increasing or reducing friction across the interface.

2. Geosynthetics Terminology

Abnormal test result	A result that lies more than three standard deviations from the mean.
Abrasion	The wearing away of any part of a material by the action of friction or rubbing.
Abrasion resistance	The ability of a material to resist wear due to friction or rubbing.
Absorption	A mechanism by which a fluid is assimilated by or taken up into a material or its constituents or both.
Anisotropic	Having directionally variable properties.
Antioxidant	A substance designed to retard or prevent oxidative degradation of a material.
Apparent opening size	See: *opening size*
Barrier	A basic geosynthetic function. A term used by ISO 10318 to describe geosynthetics with main constituents of bituminous, clay and polymeric origin which perform barrier functions.
Bituminous geomembrane	See: *geomembrane, bituminous*
Bonded geogrid	See: *geogrid bonded*
Basecloth	A textile fabric, usually woven, which may be included in a needled felt to provide dimensional stability and strength and in some cases to facilitate the needle-punching operation
Batch	A defined quantity of a geosynthetic manufactured, produced, or stored under conditions presumed to be uniform, or a quantity purchased or offered for sale or for sampling at the one time. (See also order and sample.)
Batt	Single or multiple sheets of fibre used in non-woven fabric production.
Biaxial	Behaviour testing or performance that takes place in two orthogonal directions.
Binder	An additive used to bind fibres together. A binder may be of a chemical, adhesive, resinous, or fibrous nature.
Binder content	The mass of binder added as a percentage of the total mass of the geotextile.
Binder fibre	A fibre that has a relatively low softening point compared with other fibres in the web, and which, on the application of heat or pressure, acts as an adhesive.

Bonding	The process by means of which one or more sheets, webs, or batts of fibre are held together. Bonding may be accomplished by mechanical, chemical, thermal, or solvent means, or combinations thereof.
chemical bonding	A process that uses suitable chemical products to achieve bonding.
mechanical bonding	A process that uses suitable mechanical methods to achieve bonding.
resin bonding	A process that uses suitable resins or adhesives to achieve bonding.
spray bonding	A process that uses droplets of an adhesive sprayed on to the fibre web or batt to achieve bonding.
spun bonding /spun laid	A continuous method of making non-woven fabrics in which filaments are extruded and laid down in the form of a web and bonded.
stitch bonding	A process that uses suitable stitching techniques to achieve bonding. A stitch-bonded fabric is usually a multicomponent one in which one component is a series of interlooped stitches running along the fabric length, e.g., a fibre web bonded by stitching yarns.
heat bonding / thermal bonding	A process in which a web or batt of fibres containing heat-sensitive material is bonded by the application of heat with or without the application of pressure. The heat sensitive material may be in the form of fibres, bicomponent fibres, or powders.
Breaking stress	The stress developed in a test specimen at the point of rupture. The force applied is usually related to the cross-sectional area of the unstrained specimen.
Breaking tensile strength	See: *strength*
Bulk sample	See: *sample*
Bursting strength	See: *strength*
Calender	A machine in which heavy rollers rotate under mechanical or hydraulic pressure. The rollers may be unheated, or one may be a thick-walled steel shell heated internally. All rollers may rotate at the same speed or one highly polished and heated roller may rotate at a higher surface speed than the rest.
Calendering	A method of making a thermal bond in which calender rollers are used to apply heat and pressure, thus causing bonding by the softening or melting of the heat-sensitive material.
Capillary barrier	A material or layer that restricts liquid flow under unsaturated conditions through a difference in pore size

Characteristic value	The value of a material property which generally corresponds to a fractile of the assumed statistical distribution of the particular property of the material specified by relevant standards and tested under specific conditions.
Chemical bonding	See: *bonding*
Chemical resistance	Ability of a material to resist degradation through chemical action
Clogging	Blocking of material pores by physical, biological and chemical processes
Coefficient of permeability	See: *permeability*
Coefficient of variation	The standard deviation expressed as a percentage of the mean value.
Composite geotextile	See: *geotextile*
Conditioning	The process by which geotextile materials are permitted to come to hygroscopic and thermal equilibrium with the surrounding atmosphere or with the standard atmosphere for testing. (See also standard atmosphere for testing.)
Conductivity	Capacity to transmit fluids (liquid and gas)
Constant-rate-of-extension	A testing process in which the rate of extension of the specimen is constant with respect to time. Sometimes referred to as using a constant rate of extension (CRE) tensile testing machine.
Continuous filament	A fibre of indefinite length.
Continuous filament yarn	A yarn of one or more filaments that run essentially the whole length of the yarn. (See also: *filament*) NOTE: Yarns of one or more filaments are usually referred to as monofilament yarns or multifilament yarns respectively.
Course	A term applied to knitted fabrics describing a succession or row of knitted loops or stitches across the width of the fabric, usually perpendicular to the wales. (See also wales.)
Creep	The time-dependent deformation of a material due to the application of a continuing and constant force.
Creep rupture	Delayed rupture of a geosynthetic after a period of time under a constant stress (or load).
Cross-machine direction	See: *direction*
Cuspated	A sheet that has been indented by a deformation process to form a three dimensional sheet.
CRE testing machine	See: *constant-rate-of-extension*

Damage	Reduction in physical properties (e.g. during installation).
Degradation	The reduction, over a period of time, in one or more physical properties of a geotextile due to external agencies. Such agencies may include abrasion, heat, weathering, sunlight, ultraviolet light, chemicals, pollutants, soil burial, and various combinations thereof.
accelerated degradation	Degradation induced for testing purposes at a rate faster than that applying in normal in-service conditions.
actinic degradation	Degradation of fibres or fabrics due to exposure to solar radiation.
Denier	A unit of linear density, equal to the mass, in grams, of 9000 m of a filament or yarn. (See also: *linear density and tex*)
Diffusion	Flow of fluid due to a gradient of chemical concentration
Direction	
cross-machine direction	The direction in a machine-made fabric, perpendicular to the direction of motion of the material through the processing machine.
machine direction	The direction in a machine-made fabric, parallel to the direction of motion of the material through the processing machine.
normal direction	The direction perpendicular to the plane of the geotextile.
planar direction	Any direction in the plane of the geotextile.
Direct shear test	A test to determine shearing properties along a confined failure plane.
Drainage	The collecting and transporting of precipitation, ground water and/or other fluids.
Durability	The ability of a geosynthetic to retain its performance over a period of time. (See also degradation.)
Drainage composite	see Geocomposite drain.
Dynamic loads	Loads changing over time (e.g. seismic, compaction)
Earth pressure coefficient	Ratio between horizontal and vertical effective stresses in particulate materials
Elastic	Reversible relationship between stress and strain
Elastomeric geomembrane	See: *geomembrane, elastomeric*
Electrokinetic geosynthetic	A composite material which may provide one or several functions in addition to or in response to electrical conduction.

Electrical leakage detection	A family of methods used to locate perforations in continuous geomembrane sheets
Elongation	Extension expressed as a percentage of the original gauge length.
Elongation at break	The elongation at the breaking point.
Elongation at ultimate force	The elongation at the maximum applied force.
EPS foam	Expanded polystyrene foam (see Geofoam)
Equivalent opening size	See opening size.
Erosion control mat (ECM)	A permeable, biodegradable (synthetic or natural) structure placed over the soil for temporary erosion control applications, usually while vegetation is being established.
Extension	The increase of the gauge length with the applied force.
Extruded geogrid	See: *geogrid, extruded*
Fabric (see: Geotextile)	A manufactured assembly of fibres or yarns or combination of fibres and yarns that has substantial surface area in relation to its thickness and sufficient mechanical strength to give the assembly inherent cohesion.
Face surface	The surface of a geotextile fabric, which is normally laid face upwards in the ground, unless designated otherwise. The face surface of a fabric is normally designated by the manufacturer.
Fatigue	The phenomenon of change of physical or mechanical properties of a geotextile (usually leading to failure) under the repeated application of a cyclic force.
Fibre	A unit of matter characterized by flexibility, fineness, and high ratio of length to thickness.
Fibre blinding	The condition where soil particles or other substances accumulate on the surface of a geotextile, thereby reducing its hydraulic properties. (See also filter clogging.)
Fibre reinforced soil	A soil that has been mixed with fibres to produce a composite material with enhanced physical properties
Filter	A device or material that allows fluid to pass and restrains all or some solid particles from passing.
Fifth percentile	The value, calculated from the test results, which is expected to be exceeded by 95 percent of the population values.
Filament	See continuous filament.

Film	A polymeric material that is homogeneous, non-fibrous, continuous, thin, and flexible.
Filter cake	A layer of soil particles accumulated adjacent to or on the surface of a geotextile.
Filtration	See: *functions*. The use of a geosynthetic material to allow passage of fluids from a soil while preventing the uncontrolled passage of soil particles.
Fines	The fraction of a soil passing through a 75µm sieve.
Flexural modulus	Ratio of the stress difference to the corresponding strain difference during a bending test. Unit: Megapascals (MPa)
Flexural strength	Maximum flexural stress sustained by the test specimen during a bending test. Unit: Megapascals (MPa)
Flexural stress	Nominal stress of the outer surface of the test specimen at midspan. Unit: Megapascals (MPa)
Flow rate	The flow rate per unit area normal to the plane of the product at a defined head. Unit: litres per square metre second (L/m 2.s)
Formulation	A specific mixture of components used to create a polymer or a polymer blend used to make a geosynthetic.
Force	That which can alter the state of rest or motion of a body.

Unit: newton (N), kilonewton (kN) NOTE: 1 N = 1 kg.m/s2. Thus, at the surface of the earth, a mass of 100 kg exerts a force of approximately 980 N. |
breaking force	The maximum force applied to a test specimen at the point of rupture.
peak force	The force at which strain first increases with no increase in force. (See point P on Figure A4, Appendix A.)
ultimate force	The maximum force applied to the test specimen in a tensile test carried out to failure. (See point U on Figure A4, Appendix A.)
Friction	Resistance to shear deformation from surface interaction.
Friction coefficient	The ratio of the friction force per unit area to the normal stress between two materials. It is said to be the tangent of the interface friction angle.
Gauge length	In tensile testing, the initial length of a test specimen measured between the specimen clamps.
Geoarmour	A permeable geosynthetic material placed over the surface of the soil, in conjunction with pattern-placed block armour units, to prevent erosion.

Geoblanket	A permeable, biodegradable (synthetic or natural) structure placed over the soil for temporary erosion control applications, usually while vegetation is being established
Geocell	A three-dimensional, permeable, polymeric (synthetic or natural) honeycomb or web structure, made of strips of geotextiles, geogrids or geomembranes linked alternatingly and used in contact with soil/rock and/or any other geotechnical material in civil engineering applications
Geocomposite	A manufactured or assembled material using at least one geosynthetic product among the components, used in contact with soil/rock and/or any other geotechnical material in civil engineering applications
Geocomposite clay liner	An assembled structure of geosynthetic materials and low hydraulic conductivity earth materials (clay or bentonite), in the form of a manufactured sheet, used in civil engineering applications.
Geocomposite drain	A prefabricated subsurface drainage product which consists of a geotextile filter skin supported by a geonet or a geospacer
Geocomposite reinforcement	An assembled structure of dissimilar geosynthetic materials used for soil reinforcement
Geofoam	A polymeric material which has been formed by the application of the polymer in semi-liquid form, through the use of a foaming agent, and results in a lightweight material with high void content, used in civil engineering applications.
Geoform	A three-dimensional, permeable geosynthetic structure, filled with soil or sediment waste such that the fill takes the shape of the inflated geoform
Geogrid	A planar, polymeric structure consisting of a regular open network of integrally connected tensile elements, which may be linked by extrusion, bonding or interlacing, whose openings are larger than the constituents, used civil engineering applications (primarily for reinforcement applications).
geogrid, bonded	A geogrid manufactured by bonding, usually at right angles, two or more sets of strands or elements.
geogrid, extruded	A geogrid manufactured by extruding polymers and drawing in a sheet form.
geogrid, knitted	A geogrid manufactured by knitting together yarns or elements, usually at right angles to each other.
geogrid, woven	A geogrid manufactured by weaving yarns or elements, usually at right angles to each other.

Geomat
(See also: erosion control mat and turf reinforcement mat)

A three-dimensional, permeable, polymeric structure, made of bonded filaments, used to reinforce roots of grass and small plants and extend the erosion-control limits of vegetation for permanent erosion control applications.

Geomattress

A three-dimensional, permeable geosynthetic structure, placed over the surface of a soil, and then filled with concrete mortar or soil.

Geomembrane

A planar, relatively impermeable, polymeric (synthetic or natural) sheet used in civil engineering applications.

geomembrane, bituminous

A geomembrane manufactured from natural bituminous materials.

geomembrane, elastomeric

A geomembrane manufactured from elastomeric polymers.

geomembrane, plastomeric

A geomembrane manufactured from plastomeric polymers.

Geonet

A planar, polymeric structure consisting of a regular dense network, whose constituent elements are linked by knots or extrusions and whose openings are much larger than the constituents, used in civil engineering applications.

Geopipe

A buried pipe made from polymeric material

Geospacer

A three-dimensional polymeric structure with large void spaces, used in civil engineering applications.

Geostrip

A polymeric material in the form of a strip, used in civil engineering applications.

Geosynthetic

A polymeric (synthetic or natural) material used in contact with soil/rock and/or any other geotechnical material in civil engineering applications.

Geosynthetic clay liner (GCL)

An assembled structure of geosynthetic materials and low hydraulic conductivity earth material (clay), in the form of a manufactured sheet, used in civil engineering applications.

Geotechnical engineering

The engineering applications of geotechnics.

Geotechnics

The application of scientific methods and engineering principles to the acquisition, interpretation, and use of knowledge of materials of the earth's crust to the solution of engineering problems.

NOTE: Geotechnics embraces the fields of soil mechanics and rock mechanics, and many of the engineering aspects of geology, geophysics, hydrology, and related sciences.

Geotextile	A planar, permeable, polymeric (synthetic or natural) textile material, which may be nonwoven, knitted or woven, used in contact with soil/rock and/or any other geotechnical material in civil engineering applications.
geotextile, knitted	A geotextile produced by interlooping one or more yarns, fibres, filaments or other elements.
geotextile, nonwoven	A geotextile in the form of a manufactured sheet, web or batt of directionally or randomly orientated fibres, filaments or other elements, mechanically and/or thermally and/or chemically bonded.
geotextile, woven	A geotextile produced by interlacing, usually at right angles, two or more sets of yarns, fibres, filaments, tapes or other elements.
Geotextile bags	See Geocontainers
Geocontainers	A geosynthetic container filled with soil or other material
Geotubes	See Geocontainer
Hydration	Absorption of liquid
Hydraulic gradient	The ratio of the total head loss (Δh) across the specimen to its length (l) in the flow direction.
Hydrolysis	The cleavage of chemical bonds in polymers by reaction with water, including moisture or steam. NOTE: Polar linkages in polymers such as ester, amide and urethane bridges are particularly susceptible to hydrolysis. For this reason polyesters, polyamides and polyurethanes are all sensitive to hydrolysis in moist, warm environments. Hydrolysis is generally acid or base catalyzed.
Inclined plane test	A shear test performed by increasing the inclination of the plane
Interface shear strength	The shear strength at a given interface generated by a combination of cohesion (adhesion) and friction forces. The interface may be internal (e.g. for a soil) or it may be at an external interface with another material.
Interface adhesion	Shear strength at an interface at zero normal stress
Interface friction angle	An angle, the tangent of which is equal to the ratio of the friction force per unit area to the normal stress between two materials.
Interface peak shear strength	Maximum values of the curve of interface shear strength obtained as a function of deformation.

Interface residual shear strength	Interface shear strength obtained at large deformation.
Isochronous curve	The result of re-plotting a series of standardised load-dependent geosynthetic strain versus time curves into a series of time-dependent load versus strain curves, demonstrating the achieved strain specific to a given time.
Isotropic	Having the same physical properties in every direction in the plane of the geosynthetic.
Limit state design	Design that meets requirements to guarantee the limit state performance (see ultimate and serviceability limit states).
Linear density	The mass per unit length of linear textile material (yarn or fibre). (See also tex.)
Locknit	A fabric made on a warp knitting machine in which the stitches are interlocked in a manner that resists runs in the fabric.
Lot	Group of items of a single type with specific characteristics and dimensions, presented for sampling at the same time.
Knitted geogrid	See: *geogrid, knitted*
Knitted geotextile	See: *geotextile, knitted*
Mass per unit area	The ratio of the mass of a specimen of specified dimensions to its area. Unit: grams per square metre (g/m^2).
Mean value	The arithmetic mean of a set of test results.
Man-made fibre	A fibre manufactured by man as distinct from a fibre that occurs naturally.
MARV (minimum average roll value)	A statistical value defined as the mean minus two standard deviations.
Monofilament	A single relatively thin and flexible continuous strand of polymer or polymers. (See also: *fibre*)
Multifilament	A yarn composed of more than one continuous filament or strand.
Needle felt	A non-woven structure formed by the mechanical bonding of a fibre web or batt by needling. (See also: *bonding—needle bonding*)
Ninety-fifth percentile	The value, calculated from the test results, which 95 percent of population values are expected to exceed.
Nonwoven geotextile	See: *geotextile, nonwoven*

Nominal value	The value of a material property as declared, rather than measured, by the producer/supplier of the material.
OIT test	Oxidation induction time test which is used to measure relative resistance to oxidation
Open area	That percentage of the total area of the geotextile measured in the plane of the geotextile in which there are no fibres, filaments, or films between its upper and lower surfaces.

Opening size

apparent opening size — The particle size of a standard sand fraction for which a specified percentage by mass would be retained as determined by the dry sieving method.
NOTE: The quantity symbol is O_n, where n is the specified percentage.
Abbreviation: AOS Unit: micrometre (µm)

equivalent opening size — The particle size of a standard sand fraction for which 95% by mass would be retained as determined by the dry sieving method.

Abbreviation: EOS. Quantity symbol: O_{95}

Unit: micrometre (µm)

Order	A quantity of geosynthetic, of the same material and grade, ordered on one occasion for the one project.
Oriented tape slit film	A tape produced by extruding a thermoplastic polymer in the form of a sheet or film, slitting the film into tapes and hot stretching to induce molecular orientation and, hence, high longitudinal strength.
Overlay	A material that is laid over another material to provide enhanced performance or protection
Oxidation	The chemical reaction of oxygen with polymers due to exposure of the polymer to oxidizing chemicals (e.g., oxidizing acids or peroxides), or to oxygen plus elevated temperatures, UV light or ionizing radiation (or combination thereof, such as in weathering). Note: Oxidation proceeds by a free radical mechanism and ultimately leads to degradation of the polymer (either by lowering of the molecular weight or by cross-linking) and consequently loss of useful mechanical properties.
Partial factors	Application of factors to determine increased loads or decreased resistances (e.g. reduction of a soils properties)

Coefficient of permeability	A measure of the permeability of a geotextile to water. For uniform laminar flow, it is equal to the ratio of the outflow velocity to the average hydraulic gradient at a standard fluid temperature. Unit: metre per second (m/s).
Permittivity	The volumetric flow rate of water per unit cross-sectional area per unit head, under laminar conditions of flow, in the normal direction through a geotextile. (See also transmissivity.) Unit: reciprocal second (s−1).
Piezometric tube	A vertical tube, open to the atmosphere, used to measure hydrostatic pressure.
Piping	The process whereby soil particles migrate through a filter owing to the passage of water.
Plane strain	A strain condition of a material in which the strain in the orthogonal direction is zero (i.e. used in modeling two-dimensional situations)
Plastic behaviour	Mechanical behaviour characterised by irreversible relationship between stress and strain
Polymer	A large molecule built up by the repetition of small simple chemical units called monomers. In man-made fibres, a chain-like structure of high molecular mass produced by linking together monomeric units consisting predominantly of non-metallic elements or compounds.
Pores	The voids in a geotextile.
Pore size distribution	The distribution of pore sizes in a geotextile. Often stated in terms of opening sizes determined by a standard test for the diameter of particles passing through. (See also opening size.)
Porometry	Measurement of sizes of pores and study of their distribution.
Plastomeric geomembrane	See: *geomembrane, plastomeric*
Porosity	The ratio of the volume of void spaces to the total volume of a geotextile. NOTE: Porosity is usually expressed as a percentage.
Preload	A small load equal to 1% of the expected maximum load, enabling initial gauge length and strain zero to be determined under reproducible conditions.
Protection	The preventing or limiting of local damage to a given element or material by the use of a geotextile or a geotextile-related product.

Pull-out test	A test to quantify interaction between a geosynthetic and a confining soil under pull-out conditions
Puncture	The rupture of a geotextile by a localized force normal to the plane of the geotextile while the geotextile is constrained in all directions in that plane.
PVD	Prefabricated vertical drain. See vertical drain
RECP (rolled erosion control product)	See: *erosion control mat (ECM)*
Reduction factor	A factor applied to reduce a design property in the face of potential uncertainty over its measurement or assessment.
Regenerated fibre	A man-made fibre produced from a naturally occurring fibre-forming polymer by a process that includes regeneration of the original polymer structure.
Reinforcement	The use of the stress-strain behaviour of a geosynthetic to improve the mechanical properties of soil or other construction materials.
Representative values	Values for material properties obtained from a number of individual specimens. Unless otherwise stated, these include the sample mean and standard deviation, and may include the fifth or ninety-fifth percentile value.
Resilient modulus	Modulus of soil obtained after a large number of loading cycles
Roll	A unit of production.
Sample	One or more items taken as representative of a population, or portion of material taken without bias from a bulk material for assessment.
bulk sample	A random selection of one or more rolls of geotextile taken from the batch or order in accordance with the batch or order size.
laboratory sample	A portion of material taken to represent the bulk sample or the bulk sample itself and used in the laboratory as a source of test samples or test specimens.
test sample	A sample as prepared for testing. It may consist of one or more test specimens. NOTE: As a general rule this is a part of the laboratory sample, prepared in such a manner as to retain its representative character; however, in certain cases it may consist of the whole laboratory sample.
Seam	The joint between sections of geosynthetics produced by means of sewing, welding, gluing or other means.

Scrim	A general term, irrespective of structure, for a lightweight basecloth included in a non-woven fabric. (See also basecloth.)
Separation	That function of a geotextile by which adjacent dissimilar materials are prevented from intermixing.
Serviceability limit state	Limit state related to the function of the structure under normal use (see limit state design)
Service life	The period of time after which the material or structure ceases to provide its intended function at the required level of safety
Shrinkage	A reduction in dimension
Soil-filter zone	A zone Of Soil Stratification Adjacent To A Geotextile Created By Fluid Flow Through The Soil-Geotextile System.
Soil-geosynthetic friction	A measure of the shear force per unit area required to cause slippage of a geosynthetic over one layer or from between several layers of soil.
Specimen	
test specimen	A specific portion of a material or a laboratory specimen upon which a test is performed or which is selected for that purpose.
Standard atmosphere for testing	An atmosphere at the prevailing barometric pressure with a relative humidity of 65 ±3% at a temperature of 23 ±5°C.
Standard Deviation	A statistical measure of the variability of a set of results.
Staple fibre	A man-made fibre of predetermined short length. The fibre is usually prepared by cutting or breaking filaments of the material into lengths suitable for the processing system in question. Lengths usually range from 5 mm to 500 mm.
Stepped isothermal method	A method of exposure that uses temperature steps and dwell times to accelerate creep response of a material being tested under load.
Stiffness	Relationship between strain and stress for a material.
Strain	The ratio of extension to original gauge length. (See also elongation.)
Strength	
breaking tensile strength	The force per unit specimen width applied in the plane of the geotextile at the point of rupture or breaking point. Unit: newton/unit width (N/unit width), kilonewton/unit width (kN/unit width.)
peak tensile strength	The tensile strength corresponding to the first peak on the force/elongation curve of a tensile strength test. (See point P on Figure A4, Appendix A.)

tearing strength	The force required to continue or propagate a tear in a geosynthetic material.
	Unit: newton (N), kilonewton (kN)
tensile strength	The force per unit specimen width applied in the plane of the geosynthetic.
	Unit: newton (N), kilonewton (kN)
ultimate tensile strength	The maximum tensile strength corresponding to the highest peak on the force/elongation curve of a tensile strength test. (See point U on Figure A4, Appendix A.)
yield tensile strength	The tensile strength corresponding to the yield point on the force/elongation curve of a tensile strength test.
Stress crack	Crack initialisation in a crystalline polymeric material
Surface erosion control	The use of a geosynthetic to prevent or limit soil or other particle movements at the surface of, for example, a slope.
Synthetic fibre	A man-made fibre produced from a polymer built up by man from chemical elements or compounds, in contrast to fibres made from naturally occurring fibre-forming polymers.
Tape (thin slit film) (See: fibre.)	A yarn having a very large width-to-thickness ratio, and usually formed by slitting a wide film into individual tapes with hot stretching either before or after slitting.
Tenacity	The ultimate tensile strength of a fibre or yarn expressed as force per unit linear density of the unstrained specimen. (See also linear density.)
	Unit: millinewton per tex (mN/tex)
Tensile stress, related to the cross-sectional area of specimen	The tensile force per cross-sectional area of the specimen prior to loading (typically MPa), carried by a specimen at any given time in a short-term test.
Tensile test	A test in which a geotextile material is loaded to determine its force/elongation characteristics.
grab tensile test	A uniaxial tensile test in which only the central portion of the specimen is gripped in the jaws.
plane-strain tensile test	A uniaxial tensile test in which the entire width of the specimen is gripped in the jaws with the specimen being restrained from deforming laterally.

wide strip tensile test	A uniaxial tensile test in which the entire width of the specimen is gripped in the jaws and in which the specimen width is greater than the gauge length.
tensile modulus	The ratio of the change in tensile force per unit width of the geotextile to the change in corresponding elongation. Unit: kilonewton per metre (kN/m)
initial tensile modulus	The slope of the initial portion of a force per unit width/elongation curve. (See line AG in Figure A1, Appendix A.)
offset tensile modulus	The maximum value of the tangent modulus. (See line BD in Figure A1, Appendix A.)
secant tensile modulus	The ratio of change in force per unit width to change in elongation between two points on a force per unit width/elongation curve, particularly the points of zero force and a specified percent elongation. (See lines QR and AM in Figure A3, Appendix A.)
tangent tensile modulus	The slope of the force/elongation curve at any given elongation.
Test result	The result from a single measurement on one specimen.
Tex	The unit of linear density used in the textile industry. 1 tex = 10^{-6} kg/m = 1 g/km (See also linear density.)
Textile	Man-made fabric, produced by either weaving, needle punching or bonding fibres or filaments. NOTE: Examples of textiles are threads, cords, ropes, braids, lace, embroidery, nets, and fabrics mad e by weaving, knitting, felting, bonding, and tufting are all textiles.
Texture	Roughness of a geosynthetic surface
Thermal degradation	Reduction in physical properties resulting from thermal effects
Thermal stress	Stress change induced by thermal strain
Thermo-oxidation	Accelerated oxidation due to thermal effects
Thickness	The distance between the upper and lower surfaces of a geosynthetic, measured normal to the surfaces and under a specified pressure.
Toughness	The property of a geotextile by virtue of which it can absorb energy. It is expressed as the actual work-to-break per unit surface area and is proportional to the area under the force/elongation curve from origin to rupture point.

Transmissivity	The ability of a geosynthetic to conduct a fluid within its plane . It is expressed as the product of the coefficient of permeability in the geosynthetic plane and the thickness of the geosynthetic. (See also permittivity.) Unit: square metre per second (m^2/s)
Turf reinforcement mat (TRM)	A three-dimensional, permeable, polymeric structure made of bonded filaments, used to reinforce roots of grass and small plants and extend the erosion-control limits of vegetation for permanent erosion control applications.
Ulitimate limit state	The limit state of a structure that concerns safety of people and/or the safety of the structure
Uniaxial	Testing or performance that takes place in one direction
Vertical drain	A drain inserted vertically into a soil to provide drainage in order to accelerate consolidation.
Viscosity	Measure of resistance of a liquid to being deformed by stress
Void ratio	The ratio of the volume of void space to the volume of solids in a geotextile. NOTE: In a geotextile, the solids are considered to be incompressible, and include fibres, yarns, binders, and combinations thereof, if present.
Wale	In knitted fabrics, a column of loops in successive courses and perpendicular to them. (See also course.)
Warp	Yarns, filaments, or tapes running in the machine direction of the weaving machine or loom.
Weft	Yarns, filaments, or tapes running at 90° to the machine direction of the weaving machine or loom.
Woven geogrid	See: *geogrid, woven*
Woven geotextile	See: *geotextile, woven*
Wrinkle	Deviation from planarity of a sheet (e.g. a small ridge) typically by shrinkage and contraction
Yarn	A generic term for a continuous strand of textile fibres, filaments,or other materials in a form suitable for weaving or otherwise intertwining to form a textile fabric.

3. Mathematical Symbols

3.1 General symbols

3.1.1 Dimensions

Symbols used for dimensions are:

L	Length
M	Mass
t	Time
T	Temperature
-	Dimensionless

3.1.2 Units

m	Metre
m^2	square metre
m^3	cubic metre
km	kilometre = 10^3 m
mm	millimetre = 10^{-3} m
μm	micrometre or micron = 10^{-6} m
g	Gram
mg	milligram = 10^{-3} g
kg	kilogram = 10^3 g
Mg	megagram = 10^6 g = tonne
s	Second
N	Newton
kN	kilonewton = 10^3 N
Pa	pascal = N/m^2
kPa	kilopascal = kN/m^2
MPa	megapascal = MN/m^2
j	joule = Nm
tex	tex = 10^{-6} kg/m = mg/m
j/kg	tenacity = 10^{-6} N/tex
$^\circ$	Degree
%	Percent
-	pure number

3.1.3 Prefixes for units

G	giga = 10^9
M	mega = 10^6
k	kilo = 10^3

c	centi = 10^{-2}
m	milli = 10^{-3}
μ	micro = 10^{-6}
n	nano = 10^{-9}

3.1.4 Recommended subscripts

a	air, active (earth pressure), allowed
B	Base
cr	creep reduction
cv	constant volume or critical state
d	dry state, diameter, design
f	failure, fibre, filament, final
GSY	geosynthetic material, e.g. t_{GSY} is thickness of geosynthetic material
GBA	Geobar
GBL	Geoblanket
GCE	Geocell
GCD	geocomposite drain
GCL	geocomposite clay liner
GEC	geosynthetic erosion control material
GEK	electrokinetic geosynthetic
GFO	Geofoam
GFR	Geoform
GGR	Geogrid
GMA	Geomat
GMB	Geomembrane
GMT	Geomattress
GNT	Geonet
GSP	Geospacer
GST	Geostrip
GTX	Geotextile
GTXw	woven geotextile
GTXnw	nonwoven geotextile
h	horizontal
i	immediate, initial
j	Joint
k	characteristic, e.g. $T_{max,k}$ is characteristic maximum tensile strength
m	Material
max	Maximum
min	Minimum
mr	material reduction

n			normal, number
p			passive (earth pressure), planar, pullout
r			radial, resistance, residual
req			Required
s			solid particles, sliding
sat			Saturated
sec			Secant
u			undrained conditions
v			Vertical
w			Water
x, y			two orthogonal horizontal axes
z			vertical axis
ε			at specific strain or elongation
0			at rest (earth pressure), zero
1,2,3			principal directions

3.1.5 Geometry and kinetics

A	L^2	(m²)	Area
b, B	L	(m)	breadth or width
d	L	(m)	Diameter
D	L	(m)	Depth
g	Lt^{-2}	(m/s²)	acceleration due to gravity $g = 9.8$ m/s²
H	L	(m)	Height
l, L	L	(m)	Length
t	t	(s)	Time
v	Lt^{-1}	(m/s)	Velocity
V	L^3	(m³)	Volume

3.2 Properties related to geosynthetics

3.2.1 Physical properties

t_{GTX}	L	(mm)	thickness of GTX, etc.
b_{GTX}	L	(m)	width of GTX, etc.
ρ_f	ML^{-3}	(Mg/m³)	density of fibres or filaments (mass per unit volume)
μ_A	ML^{-2}	(g/m²)	mass per unit area
d_f	L	(μm)	diameter of fibres or filaments
λ	ML	(tex)	linear density of yarns, fibres, filaments
A	-	(%)	percent open area for wovens or geogrids
n_{GTX}	-		porosity (ratio between volume of voids & total volume) of a GTX

3.2.2 Hydraulic properties

Symbol	Dimension	Units	Description
O_n	L	(mm, μm)	n percent opening size of a GTX - generic term
$O_{n,d}$	L	(mm, μm)	n percent opening size as measured by a dry sieving test, e.g. $O_{90,d}$, $O_{95,d}$. Sometimes referred to AOS or EOS
$O_{95,d}$	L	(mm, μm)	Equivalent Opening Size (EOS) corresponding to the 95% opening size measured by a dry sieving test
$O_{n,w}$	L	(mm, μm)	n percent opening size as measured by a wet sieving test, e.g. $O_{90,w}$, $O_{95,w}$. Sometimes referred to D_w or d_{95}
q_n	LT^{-1}	(litres/m².s)	flow capacity normal to the plane of a GTX - generic term.
$q_{n,h}$	LT^{-1}	(litres/m².s)	flow capacity normal to the plane of a GTX under water head h (in mm), e.g. $q_{n,100}$ is flow capacity normal to the plane under water head of 100mm.
q_p	L^2T^{-1}	(litres/m.s)	flow capacity within the plane of a GTX, GNE or GCD - generic term.
$q_{p,i}$	L^2T^{-1}	(litres/m.s)	flow capacity within the plane of a GTX, GNE or GCD under hydraulic gradient i, e.g. $q_{p,1}$ is flow capacity within the plane under hydraulic gradient of 1.
k_n	Lt^{-1}	(m/s)	Coefficient of permeability normal to the plane
k_p	Lt^{-1}	(m/s)	Coefficient of permeability in the plane of a GTX or GCD
ψ	t^{-1}	(s⁻¹)	permittivity of a GTX. $\psi = k_n/t_{GTX}$
θ	L^2t^{-1}	(m²/s)	transmissivity of a GTX or GCD. $\theta = k_p\, t_{GTX}$
ψ'	t^{-1}	(s⁻¹)	permittivity of a GMB to vapour flow (permeance). It is the rate of vapour transmission divided by the vapour pressure difference across the GMB.
k'_n	Lt^{-1}	(m/s)	vapour permeability of a GMB normal to its plane. $k'_n = \psi'\, t_{GMB}$

3.2.3 Mechanical properties

Symbol	Dimension	Units	Description
ε	-	(%)	strain or elongation
ε'	t^{-1}	(%/s)	strain rate
ε_f	-	(%)	strain or elongation at failure
ε_{max}	-	(%)	maximum strain or elongation
T	Mt^{-2}	(kN/m)	tension (tensile strength per unit width)
T_ε	Mt^{-2}	(kN/m)	tension at a given elongation ε; e.g. T_{30} is the tension at 30% elongation
T_f	Mt^{-2}	(kN/m)	tension at failure
T_{max}	Mt^{-2}	(kN/m)	maximum tension
T_a	Mt^{-2}	(kN/m)	allowable tension
T_B	Mt^{-2}	(kN/m)	base tension in a geosynthetic reinforcement after allowing for the effects of creep. Sometimes referred to as creep-limited strength
T_{req}	Mt^{-2}	(kN/m)	Required tension
J	Mt^{-2}	(kN/m)	tensile stiffness
J_ε	Mt^{-2}	(kN/m)	tangential tensile stiffness at elongation ε

J_i	Mt^{-2}	(kN/m)	initial tensile stiffness (at $\varepsilon = 0\%$)
$J_{sec\ \varepsilon}$	Mt^{-2}	(kN/m)	secant tensile stiffness between the origin and elongation ε; e.g. J_{sec30} is the secant tensile stiffness between elongation $\varepsilon = 0$ and $\varepsilon = 30\%$
$J_{secn,m}$	Mt^{-2}	(kN/m)	secant tensile stiffness between $\varepsilon = n\%$ and $\varepsilon = m\%$ elongation.
σ_ε	$ML^{-1}t^{-2}$	(kN/m², kPa)	tensile stress at elongation ε; e.g. σ_{30} is the tensile stress at 30% elongation
σ_{max}	$ML^{-1}t^{-2}$	(kN/m², kPa)	maximum tensile stress
σ_f	$ML^{-1}t^{-2}$	(kN/m², kPa)	tensile stress at failure
E	$ML^{-1}t^{-2}$	(kN/m², kPa)	elastic modulus
E_i	$ML^{-1}t^{-2}$	(kN/m², kPa)	initial tangential modulus (see J_i)
E_ε	$ML^{-1}t^{-2}$	(kN/m², kPa)	tangential modulus at elongation ε (see J_ε)
$E_{sec\ \varepsilon}$	$ML^{-1}t^{-2}$	(kN/m², kPa)	secant modulus between the origin and elongation ε (see $J_{sec\ \varepsilon}$)
ν	-		poisson's ratio
ζ_y	L^2t^2	(N/tex)	tenacity of a yarn (ratio between tensile strength of a yarn and its linear density)
ξ	(varies)		mechanical efficiency (ratio between maximum strength and mass per unit area)
F_f	MLt^{-2}	(N, kN)	load recorded at failure in a tensile test (NB: the tensile test must be specified)
F_{max}	MLt^{-2}	(N, kN)	maximum tensile force of a GT or GM (NB: the tensile test must be specified)
F_G	MLt^{-2}	(N, kN)	breaking force as measured in a Grab test (NB: the Grab test must be specified)
F_P	MLt^{-2}	(N, kN)	breaking force in a static puncture test (NB: the static puncture test must be specified)
F_T	MLt^{-2}	(N, kN)	breaking force in a tear propagation test (NB: the tear propagation test must be specified)
O_{dc}	L	(mm)	perforation resistance in a dynamic tear initiation test (NB: the tear initiation test must be specified)
P_r	Mt^{-2}	(kN/m)	pullout resistance
p_B	$ML^{-1}t^{-2}$	(kN/m², kPa)	bursting pressure (NB: the burst test must be specified)
W_I	ML^2t^{-2}	(Joules)	energy measuring the resistance in an impact test (NB: the impact test must be specified)

3.2.4 Interface properties

$f_{s/GSY}$	-	(-)	friction interaction coefficient between soil and GSY. $f_{s/GSY} \tan \phi' = \tan \phi'_{s/GSY}$. ϕ' is friction angle of soil.
$\mu_{s/GSY}$	-	(-)	coefficient of friction between soil and GSY. $\mu_{s/GSY} = \tan \phi'_{s/GSY}$ and $\mu_{s/GSY} = f_{s/GSY} \tan \phi'$.
$\phi'_{s/GSY}$	-	(°)	effective friction angle between soil and GSY - general term.
$\phi'_{p,\ s/GSY}$	-	(°)	effective peak friction angle between soil and GSY.
$\phi'_{r,\ s/GSY}$	-	(°)	effective large strain friction angle between soil and GSY.

3.3 Properties related to fluids

3.3.1 Physical properties

ρ_w	ML^{-3}	(Mg/m^3)	density of water (mass per unit volume)
γ_w	$ML^{-2}t^{-2}$	(kN/m^3)	unit weight of water (weight per unit volume)
η_w	$ML^{-1}t^{-1}$	(kg/ms)	dynamic viscosity of water

3.3.2 Flow properties

h	L	(m)	hydraulic head or potential
Q	L^3t^{-1}	(m^3/s)	rate of discharge (also called flow rate) - volume of water passing through a given area per unit of time
v	Lt^{-1}	(m/s)	discharge velocity
i	-		hydraulic gradient
j	$ML^{-2}t^{-2}$	(kN/m^3)	seepage force per unit volume (force per unit volume of a porous medium generated by action of fluid upon the solid elements of the porous medium). $j = i \; \gamma_w$

3.4 Properties related to geotechnics

3.4.1 Physical properties

3.4.1.1 Solid particles and their distribution

ρ_s	ML^{-3}	(Mg/m^3)	density of solid particles (ratio between mass and volume of solid particles)
γ_s	$ML^{-2}t^{-2}$	(kN/m^3)	unit weight of solid particles (weight of solid particles per unit volume). $\gamma_s = \rho_s \, g$
d	L	$(\mu m, mm)$	particle diameter
d_n	L	$(\mu m, mm)$	n percent diameter (diameter corresponding to n% by weight of finer particles)
C_u	-		uniformity coefficient. $C_u = d_{60}/d_{10}$

3.4.1.2 Density of soils

ρ	ML^{-3}	(Mg/m^3)	density of soil (ratio between total mass and total volume of soil)
γ	$ML^{-2}t^{-2}$	(kN/m^3)	unit weight of soil (ratio between total weight and total volume of soil). $\gamma = \rho \, g$
ρ_d	ML^{-3}	(Mg/m^3)	density of dry soil (ratio between mass of solid particles and total volume of soil)
γ_d	$ML^{-2}t^{-2}$	(kN/m^3)	unit weight of dry soil (ratio between weight of solid particles and volume of soil). $\gamma_d = \rho_d \, g$
ρ_{sat}	ML^{-3}	(Mg/m^3)	density of saturated soil (ratio between total mass and total volume of completely saturated soil)

γ_{sat}	$ML^{-2}t^{-2}$	(kN/m^3)	unit weight of saturated soil (ratio between total weight and total volume of completely saturated soil). $\gamma_{sat} = \rho_{sat}\, g$
ρ'	ML^{-3}	(Mg/m^3)	density of submerged soil (difference between density of soil and density of water). $\rho' = \rho - \rho_w$
γ'	$ML^{-2}t^{-2}$	(kN/m^3)	unit weight of submerged soil (difference between unit weight of soil and unit weight of water). $\gamma' = \gamma - \gamma_w = \rho'\, g$

3.4.1.3 Voids and water in soils

e	-	(-)	void ratio (ratio between volume of voids and volume of solid particles)
n	-	(%)	porosity (ratio between volume of voids and total volume of soil)
w	-	(%)	water content (ratio between weight of pore water and weight of solid particles)
S_r	-	(%)	degree of saturation (ratio between volume of pore water and volume of voids)

3.4.1.4 Consistency of soils

w_L	-	(%)	liquid limit (water content of a remoulded soil at transition between liquid and plastic states, determined by a standard laboratory test)
w_P	-	(%)	plastic limit (water content of a remoulded soil at transition between plastic and semi-solid states, determined by a standard laboratory test)
w_S	-	(%)	shrinkage limit (maximum water content at which a reduction of water content will not cause a decrease in volume of the soil mass)
I_P	-	(%)	plasticity index (difference between liquid and plasticity limits)
I_L	-	(%)	liquidity limit, defined as $(w - w_P)/I_P$
I_C	-	(%)	Consistency index, defined as $(w_L - w)/I_P$
e_{max}	-	(-)	void ratio in loosest state (maximum void ratio obtainable by a standard laboratory procedure)
e_{min}	-	(-)	void ratio in densest state (minimum void ratio obtainable by a standard laboratory procedure)
I_D	-	(-)	density index (also called 'relative density', R_D). $I_D = (e_{max} - e)/(e_{max} - e_{min})$

3.4.2 Stresses in soils

σ	$ML^{-1}t^{-2}$	(kN/m², kPa)	normal stress
σ'	$ML^{-1}t^{-2}$	(kN/m², kPa)	normal effective stress. $\sigma' = \sigma - u$
σ'_v	$ML^{-1}t^{-2}$	(kN/m², kPa)	normal effective stress acting in a vertical direction
σ'_h	$ML^{-1}t^{-2}$	(kN/m², kPa)	normal effective stress acting in a horizontal direction
U	$ML^{-1}t^{-2}$	(kN/m², kPa)	pore water pressure
τ	$ML^{-1}t^{-2}$	(kN/m², kPa)	shear stress
ε	-	(%)	Strain

3.4.3 Hydraulic properties

k	Lt^{-1}	(m/s)	Coefficient of permeability (or hydraulic conductivity)
I	-	(-)	hydraulic gradient

3.4.4 Mechanical properties

3.4.4.1 Soil behaviour under compressive strains

C_c	-	(-)	compression index (slope of virgin compression curve in a semi-logarithmic plot)
C_r	-	(-)	recompression index (slope of recompression curve in a semi-logarithmic plot).
C_α	-	(-)	secondary compression index (slope of secondary compression curve in a semi-logarithmic plot).
c_h	L^2t^{-1}	(m²/s)	vertical coefficient of consolidation (due to pore water movement in horizontal direction)
c_v	L^2t^{-1}	(m²/s)	vertical coefficient of consolidation (due to pore water movement in vertical direction)
m_v	$M^{-1}Lt^2$	(m²/MN)	coefficient of volume change (in vertical direction)
σ'_p	$ML^{-1}t^{-2}$	(kN/m², kPa)	pre-consolidation pressure (the greatest effective overburden pressure the soil mass has carried in the past)
E	$ML^{-1}t^{-2}$	(MN/m², MPa)	deformation modulus (ratio between a given normal stress change and the strain change in the same direction, all other stresses being constant)
K'	$ML^{-1}t^{-2}$	(MN/m², MPa)	Elastic bulk modulus. $K' = E/(3 - 6\nu)$
k_s	$ML^{-2}t^{-2}$	(kN/m³)	modulus of subgrade reaction (ratio between change of vertical stress on a rigid plate placed on the soil, and the corresponding change of vertical settlement of the plate)
T_v	-	(-)	time factor, $T_v = t\,c_v/d^2$, where t is time and d is the length of the drainage path
ν	-	(-)	poisson's ratio (ratio between strain changes perpendicular to and in the direction of a given uniaxial stress change)

3.4.4.2 Soil behaviour under shear strains

τ	$ML^{-1}t^{-2}$	(kN/m², kPa)	shear strength. $\tau = c + \tan \phi$
τ_u	$ML^{-1}t^{-2}$	(kN/m², kPa)	shear strength measured under undrained (total stress)

conditions. $\tau_u = c_u + \tan \phi_u$

τ_d	$ML^{-1}t^{-2}$	(kN/m², kPa)	shear strength measured under drained conditions. $\tau_d = c_d + \tan \phi_d$
τ'	$ML^{-1}t^{-2}$	(kN/m², kPa)	shear strength measured under effective stress conditions. $\tau' = c' + \tan \phi'$
τ'_{cv}	$ML^{-1}t^{-2}$	(kN/m², kPa)	residual shear strength measured under effective stress conditions. $\tau'_{cv} = c'_{cv} + \tan \phi'_{cv}$
c	$ML^{-1}t^{-2}$	(kN/m², kPa)	cohesion
c_u	$ML^{-1}t^{-2}$	(kN/m², kPa)	cohesion measured under undrained conditions
c_d	$ML^{-1}t^{-2}$	(kN/m², kPa)	cohesion measured under drained conditions
c'	$ML^{-1}t^{-2}$	(kN/m², kPa)	cohesion measured under effective stress conditions
c'_r	$ML^{-1}t^{-2}$	(kN/m², kPa)	residual cohesion measured under effective stress conditions
G'	$ML^{-1}T^{-2}$	(MN/m², MPa)	elastic shear modulus. $G' = E/(2+2\nu)$.
ϕ	-	(°)	soil friction angle
ϕ_u	-	(°)	soil friction angle measured under undrained conditions
ϕ_d	-	(°)	soil friction angle measured under drained conditions
ϕ'	-	(°)	soil friction angle measured under effective stress conditions
ϕ'_{cv}	-	(°)	Critical state soil friction angle measured under effective stress conditions (shearing at constant volume)
ϕ'_r	-	(°)	residual soil friction angle measured under effective stress conditions
ψ	-	(°)	soil dilation angle
ψ'	-	(°)	soil dilation angle under effective stress conditions
μ	-	(-)	coefficient of friction of soil. $\mu = \tan \phi'$.

3.5 Properties related to geotechnical structures

3.5.1 Structure dimensions

b, B	L	(m)	breadth of foundation, slope or embankment
D	L	(m)	depth of foundation, depth below toe of slope
h, H	L	(m)	vertical height of wall, slope or embankment
l, L	L	(m)	length of foundation or embankment
s	L	(m)	settlement
U	-	(%)	degree of consolidation
β	-	(°)	angle of slope to horizontal

3.5.2 External applied loads

F_h	MLt^{-2} or Mt^{-2}	(kN or kN/m)	external applied concentrated horizontal force
F_v	MLt^{-2} or Mt^{-2}	(kN or kN/m)	external applied concentrated vertical force
w_s	$ML^{-1}t^{-2}$	(kN/m², kPa)	external applied surcharge load

3.5.3 Earth pressures
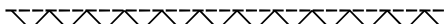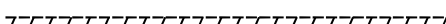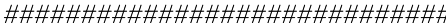
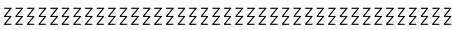|			
K	-	(-)	ratio of horizontal to vertical stress
K_a	-	(-)	active earth pressure coefficient
K_o	-	(-)	at-rest earth pressure coefficient
K_p	-	(-)	passive earth pressure coefficient
α	$ML^{-1}t^{-2}$	(kN/m^2, kPa)	wall adhesion (adhesion between wall and adjacent soil)
δ	-	(°)	angle of wall friction (angle of friction between wall and adjacent soil)
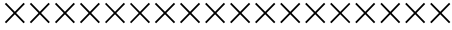
3.6 Factors of safety, partial factors and reduction factors

FS	-	(-)	global factor of safety (normally derived from limit equilibrium methods)
f_{cr}	-	(-)	reduction factor associated with the loss in load carrying capability due to creep effects of a reinforcement over time
f_f	-	(-)	partial factor associated with dead loads in a structure
f_q	-	(-)	partial factor associated with live loads in a structure
f_m	-	(-)	partial factor associated with the strength of the materials used in the structure
f_{mr}	-	(-)	reduction factor associated with the loss in load carrying capability due to installation and durability effects of a reinforcement over time
f_n	-	(-)	partial factor associated with the economic ramifications of structural failure
f_p	-	(-)	partial factor associated with the pull-out resistance of geosynthetic reinforcements
f_s	-	(-)	partial factor associated with the sliding resistance of geosynthetic reinforcements

4. Graphical Symbols

4.1 Products

GTX	— — — — — — — — — — — —	Geotextile (generic)
GMB	————————————	Geomembrane (generic)
GBA	////////////////////	Geobar (generic)
GBL	∿∿∿∿∿∿∿∿∿	Geoblanket (generic)
GCD	⋙⋙⋙⋙⋙⋙⋙	Geocomposite drain (generic) – with geotextile on both sides
GCE	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Geocell (generic)
GCL	⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋⟋	Geocomposite clay liner (generic)
GEC	#############################	Surficial geosynthetic erosion control (generic)

GEK	ʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒʒ	Electrokinetic geosynthetic (generic)
GGR	●——●——●——●——●——●	Geogrid (generic)
GMA	∿∿∿∿∿∿∿∿∿∿	Geomat (generic)
GMT	▬▬▬▬▬▬▬▬▬▬	Geomattress (generic)
GNT	××××××××××××××××××	Geonet (generic)
GSP	⊓⊔⊓⊔⊓⊔⊓⊔⊓⊔⊓⊔	Geospacer (generic)
GST	•—•—•—•—•—•—•—•—•	Geostrip (generic)

4.2 Functions

The following function symbols may be used where it is considered that a description of the role of the geosynthetic material may provide further clarity to the drawing or diagram.

B   Barrier (fluid)
C   Containment (soil & sediments)
D   Drainage (fluid)
E   Surficial erosion control
F   Filtration
P   Protection
R   Reinforcement
S   Separation

e.g. separation geotextile

Ⓢ

e.g. reinforcement geotextile

Ⓡ

4.3 Multiple products on same diagram

GT,1   GT,2