INTERNATIONAL STANDARD

ISO 14688-1

Second edition
2017-12

Geotechnical investigation and testing — Identification and classification of soil —

Part 1: Identification and description

Reconnaissance et essais géotechniques — Identification et classification des sols —

Partie 1: Identification et description

Reference number
ISO 14688-1:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 182, *Geotechnics*.

This second edition cancels and replaces the first edition (ISO 14688-1:2002), which has been technically revised. It also incorporates the Amendment ISO 14688-1:2002/Amd 1:2013.

A list of all parts in the ISO 14688 series can be found on the ISO website.

Introduction

This document gives details of the procedures to be followed in the identification and description of soils. Clauses 4 and 5 provide the rules for soil identification which are used at all stages of ground investigation and geotechnical design. Clauses 6 and 7 give details of the procedures to be followed by those actually describing soils in the field or laboratory. This comprises the description of the soil material in all aspects and the description of the soil mass characteristics in terms of the bedding and discontinuities.

The level of detail in a description will depend on the characteristics of the soil, the size and quality of the soil exposure or sample, and the needs of the particular project. The person carrying out the field identification and description should be suitably qualified, skilled and experienced to make a correct and appropriate description and experienced in the geological materials involved in the investigation.

Practice in soil identification and description varies from country to country, in part reflecting significant differences in geological conditions. In addition, the quality of samples available for description vary due to the investigation methods employed, as methods of investigation have been developed in response to the ground conditions present.

Following identification and description, ISO 14688-2 gives the means by which soils can be classified into groups of similar composition and geotechnical properties based on the results of field and laboratory tests with respect to their suitability for geotechnical engineering purposes. Test results provide a means of checking the accuracy of the field or laboratory descriptions.

Geotechnical investigation and testing — Identification and classification of soil —

Part 1: Identification and description

1 Scope

This document specifies the rules for the identification and description of soils and is intended to be read in conjunction with ISO 14688-2, which outlines the basis of classification of those material characteristics most commonly used for soils for engineering purposes. The relevant characteristics could vary and therefore, for particular projects or materials, more detailed subdivisions of the descriptive and classification terms could be appropriate.

This document specifies procedures for the identification and description of soils based on a flexible system for use by experienced persons, covering both material and mass characteristics by visual and manual techniques. Details are given of the individual characteristics for identifying soils and the descriptive terms in regular use, including those related to the results of hand tests carried out in the field as part of the descriptive process.

This document is applicable to the description of soils for engineering purposes which can be those laid by natural processes, those laid by man or comprise synthetic materials.

NOTE 1 The identification and description of rocks are covered by ISO 14689-1. Identification and description of materials intermediate between soil and rocks are carried out using the procedures in this document, ISO 14688-2 and ISO 14689-1 as appropriate.

NOTE 2 The identification and classification of soil for pedological purposes, as well as in the framework of measurements for soil protection and for remediation of contaminated areas, is covered by ISO 25177.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14688-2, *Geotechnical investigation and testing — Identification and classification of soil — Part 2: Principles for a classification*

ISO 14689-1, *Geotechnical investigation and testing — Identification and classification of rock — Part 1: Identification and description*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14688-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at www.iso.org/obp

— IEC Electropedia: available at www.electropedia.org

3.1
anthropogenic soil
soil (3.17) placed by human activity which can be divided into those composed of reworked natural soils and those composed of synthetic materials

3.2
carbonate soil
soil (3.17) with a significant proportion of calcium carbonate

3.3
description of soil
description of the type of material, the characteristics of the mineral (inorganic) and/or organic constituents and any fabric, bedding or discontinuities

3.4
discontinuities
bedding planes, joints, fissures, faults and shear planes

3.5
fill
anthropogenic soil or rock materials placed with engineering control

3.6
geological structure
variation in composition including bedding and *discontinuities* (3.4)

3.7
grading
measure of the particle sizes of a *soil* (3.17) and their distribution

Note 1 to entry: See 3.13.

3.8
identification of soil
naming of a *soil* (3.17) on the basis of its mineral composition, *grading* (3.7) and/or *plasticity* (3.16) and/or organic content

Note 1 to entry: The identification may include geological information, such as depositional environment, geological age and geological formation.

3.9
loess
windblown (aeolian) sediment

3.10
made ground
reconstituted ground
anthropogenic soil (3.1) or rock materials placed without engineering control

3.11
mineral soil
soil (3.17) composed largely or entirely of mineral (inorganic) constituents

3.12
organic soil
soil (3.17) containing a high proportion of plant and/or animal organic materials and the conversion products of those materials

Note 1 to entry: Organic soil has a very low density and usually a very high water content.

3.13
particle size distribution
measure of the particle sizes of a *soil* (3.17) and their distribution

Note 1 to entry: See 3.7.

3.14
particle size fraction
size fraction
portion of a *soil* (3.17) defined by a range of particle sizes

3.15
plastic behaviour
propensity of fine *soil* (3.17) to undergo permanent deformation when kneaded by hand

Note 1 to entry: This behaviour, often referred to as the plasticity, depends on water content, mineral composition and particle size fractions.

Note 2 to entry: Plasticity can be measured by the Atterberg limits in the laboratory (see ISO 14688-2).

3.16
plasticity
propensity to undergo permanent deformation when kneaded by hand

3.17
soil
aggregate of minerals and/or organic materials which can be disaggregated by hand in water

Note 1 to entry: The term is also applied to anthropogenic soil consisting of materials exhibiting similar behaviour but reworked or artificially made, e.g. embankment fill, crushed rock, mine tailings.

Note 2 to entry: Soils may result from the weathering of rocks and have rock structures and/or textures, but are of lower strength than rocks.

3.18
sulfide soil
soil (3.17) with a high iron sulfide content

3.19
till
original form of a glacigenic multi-graded material derived from ice sheets and glaciers

3.20
volcanic soil
unconsolidated pyroclastic sediment produced and formed by explosive volcanic eruption

4 General

Soils shall be identified and described in accordance with this document. The classification of soils and the description of rocks shall be carried out in accordance with ISO 14688-2 and ISO 14689-1, respectively.

Soils are categorized as natural soils or anthropogenic soils. Natural soils are either mineral soils (including carbonate soils, volcanic soils, loess and till) or organic soils.

The characteristics of soils are identified in accordance with the rules given in Annex A which are based on the particle size grading of very coarse and coarse particles, the plasticity of fine particles, the content of organic matter (for organic soils) and the content of carbonate (for carbonate soils) all of which play a major role in determining the engineering properties of the soil and form the basis of the soil's identification. The soils shall be identified in the field following the guidance given in Clause 5.

This comprises decisions as to the primary soil fraction, the secondary and tertiary fractions, the carbonate and organic contents (if present) and the origin of the deposit where possible.

NOTE Other chemical constituents such as salt, sulfate, gypsum can be described where present.

The description and identification of the soil can be reviewed subsequently, and adjusted if necessary, by the results of grading, plasticity and/or laboratory tests to measure carbonate or organic contents.

Following identification, the description of the soil shall be made using the methods given in Clause 6 and Clause 7 to include relevant features.

The identification and description of soils shall conform to the flow chart in Figure 1.

The identification procedure for the mineral soils follows these steps:

a) categorization of soils into subcategories: very coarse soil, coarse soil and fine soil;

b) identification of primary, secondary and tertiary fractions;

c) naming of the soil according to the procedures outlined in this document;

d) identification of the origin of the deposit in terms of the depositional environment and geological age.

Mineral soils can contain some organic matter, but this organic content does not dominate the engineering properties of the soil. Such soils are categorized as mineral soils with organic secondary constituents.

5 Identification of soil

5.1 Mineral soil

5.1.1 General

Identification of very coarse and coarse mineral soils shall be made on the basis of the particle size fractions. The identification of fine soil shall be made on the basis of the plasticity of the soil, despite particle sizes also being defined for these soils. Table 1 shows the terms to be used for each size fraction, together with the corresponding range of particle sizes.

Table 1 — Particle size fractions

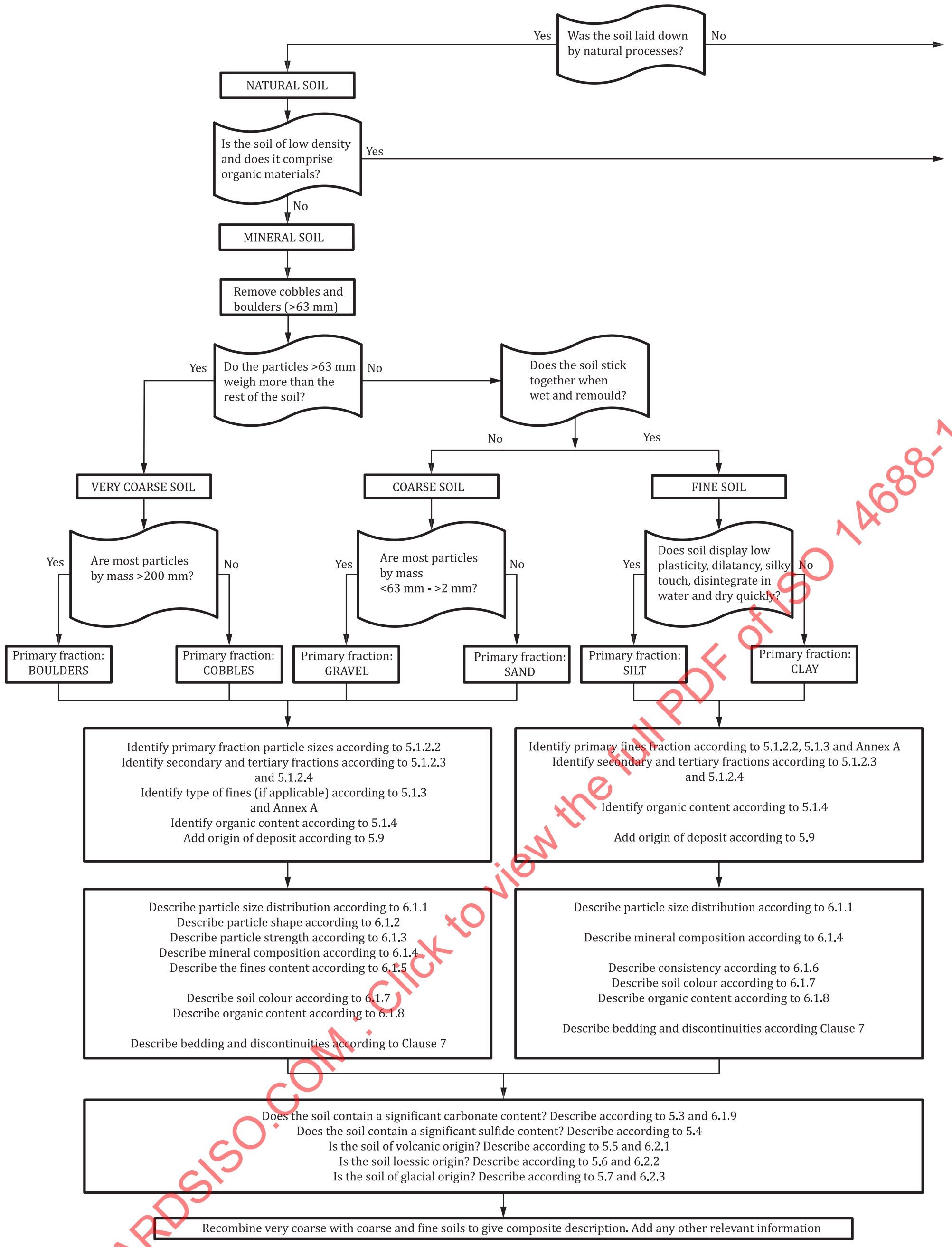
Soil group	Particle size fractions (symbol)	Range of particle sizes mm
Very coarse soil	Large boulder (lBo)	>630
	Boulder (Bo)	>200 to ≤630
	Cobble (Co)	>63 to ≤200
Coarse soil	Gravel (Gr)	>2,0 to ≤63
	Coarse gravel (cGr)	>20 to ≤63
	Medium gravel (mGr)	>6,3 to ≤20
	Fine gravel (fGr)	>2,0 to ≤6,3
	Sand (Sa)	>0,063 to ≤2,0
	Coarse sand (cSa)	>0,63 to ≤2,0
	Medium sand (mSa)	>0,20 to ≤0,63
	Fine sand (fSa)	>0,063 to ≤0,20

Table 1 *(continued)*

Soil group	Particle size fractions (symbol)	Range of particle sizes mm
Fine soil	Silt (Si)	>0,002 to ≤0,063
	Coarse silt (cSi)	>0,02 to ≤0,063
	Medium silt (mSi)	>0,006 3 to ≤0,02
	Fine silt (fSi)	>0,002 to ≤0,006 3
	Clay (Cl)	≤0,002

NOTE 1 The use of one significant figure (2 mm and 6 mm) rather than two significant figures (2,0 mm and 6,3 mm) for the boundaries is also widespread. The difference is of little significance in soil identification.

NOTE 2 Particle size ranges for silt and clay are given only as a reference for the particle size of "clay particles" and "silt particles" and not for "clay" and "silt" as fine fractions.


Was the soil laid down by natural processes?
Yes
No
NATURAL SOIL
Is the soil of low density and does it comprise organic materials?
Yes
No
MINERAL SOIL
Remove cobbles and boulders (>63 mm)
Do the particles >63 mm weigh more than the rest of the soil?
Yes
No
Does the soil stick together when wet and remould?
No
Yes
VERY COARSE SOIL
COARSE SOIL
FINE SOIL
Are most particles by mass >200 mm?
Are most particles by mass <63 mm - >2 mm?
Does soil display low plasticity, dilatancy, silky touch, disintegrate in water and dry quickly?
Primary fraction: BOULDERS
Primary fraction: COBBLES
Primary fraction: GRAVEL
Primary fraction: SAND
Primary fraction: SILT
Primary fraction: CLAY
Identify primary fraction particle sizes according to 5.1.2.2
Identify secondary and tertiary fractions according to 5.1.2.3 and 5.1.2.4
Identify type of fines (if applicable) according to 5.1.3 and Annex A
Identify organic content according to 5.1.4
Add origin of deposit according to 5.9
Identify primary fines fraction according to 5.1.2.2, 5.1.3 and Annex A
Identify secondary and tertiary fractions according to 5.1.2.3 and 5.1.2.4
Identify organic content according to 5.1.4
Add origin of deposit according to 5.9
Describe particle size distribution according to 6.1.1
Describe particle shape according to 6.1.2
Describe particle strength according to 6.1.3
Describe mineral composition according to 6.1.4
Describe the fines content according to 6.1.5
Describe soil colour according to 6.1.7
Describe organic content according to 6.1.8
Describe bedding and discontinuities according to Clause 7
Describe particle size distribution according to 6.1.1
Describe mineral composition according to 6.1.4
Describe consistency according to 6.1.6
Describe soil colour according to 6.1.7
Describe organic content according to 6.1.8
Describe bedding and discontinuities according Clause 7
Does the soil contain a significant carbonate content? Describe according to 5.3 and 6.1.9
Does the soil contain a significant sulfide content? Describe according to 5.4
Is the soil of volcanic origin? Describe according to 5.5 and 6.2.1
Is the soil loessic origin? Describe according to 5.6 and 6.2.2
Is the soil of glacial origin? Describe according to 5.7 and 6.2.3
Recombine very coarse with coarse and fine soils to give composite description. Add any other relevant information

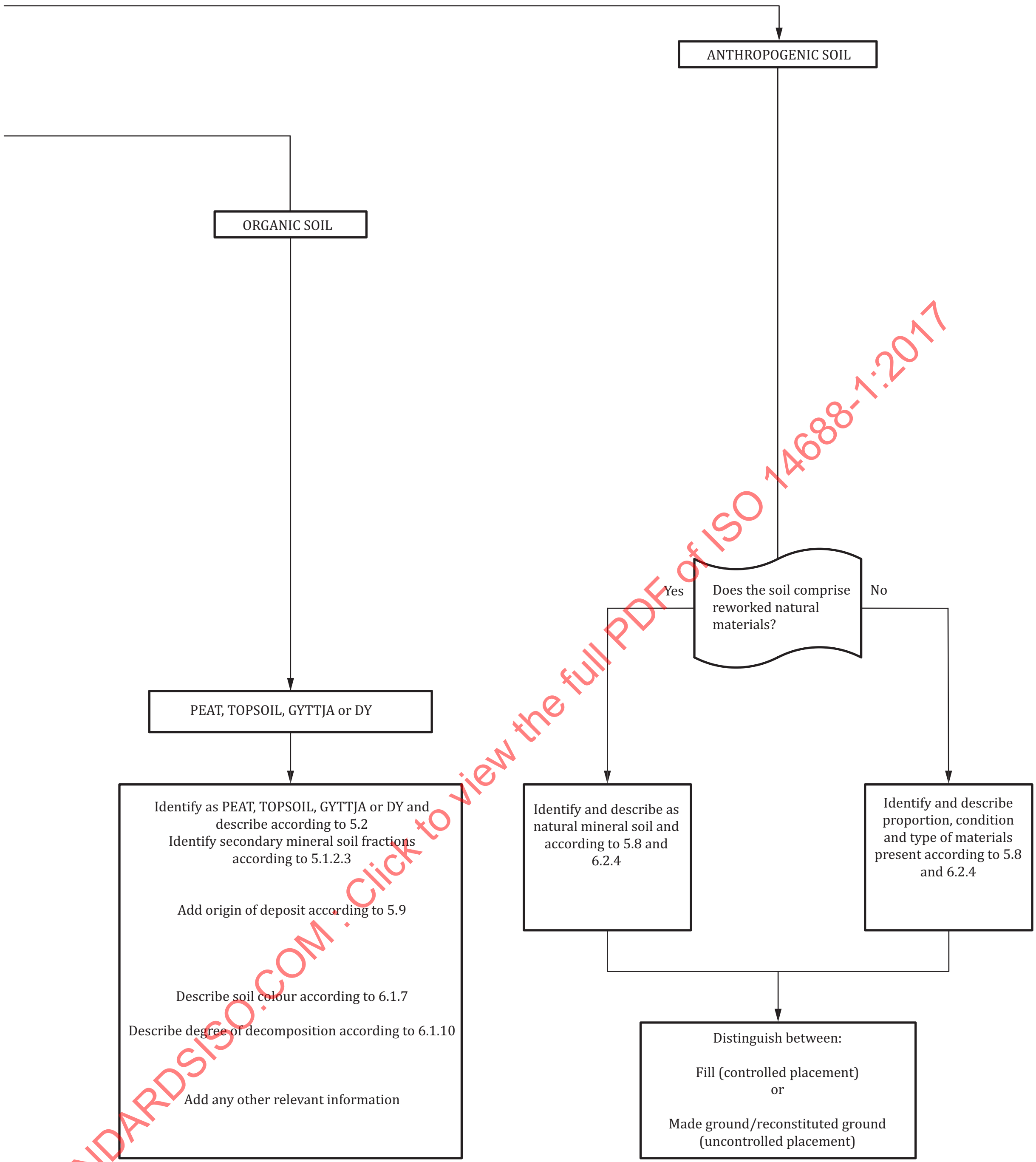


Figure 1 — Flowchart for the identification and description of soils

5.1.2 Composite soils

5.1.2.1 General

Basic soils comprise a single size fraction as given in Table 1. Most soils are mixtures of particles of different sizes (see Table 1) and consist of primary, one or more secondary and tertiary size fractions. The soil identification shall be designated by a noun giving the primary fraction (usually given in upper case) and by one or more adjectives (given in lower case) describing proportions of the secondary and tertiary fractions (e.g. sandy GRAVEL, CLAY gravelly).

The word order used for the fractions should be established in each country to make it clear which are the primary, secondary and tertiary fractions.

5.1.2.2 Primary fraction

The primary fraction in terms of mass (very coarse and/or coarse soils) or plastic behaviour (fine soils) determines the engineering properties of the soil. The identification of soils on this basis shall follow the procedures given in Annex A.

NOTE The fines fraction (silt and/or clay) is regarded as determining the characteristics of a composite soil if the soil sticks together when wet and remoulds as given in Figure 1.

In very coarse and coarse soils, the primary fraction shall be identified as the relevant very coarse or coarse size fraction predominating in terms of mass, as given in 5.1.2. The identification of soils on this basis shall follow the procedures given in A.2. The very coarse fraction should be removed from the sample before identifying the fine and coarse fractions.

If, in coarse soils, two soil fractions are present in approximately equal proportions, an oblique shall be placed between the relevant terms, e.g. GRAVEL/SAND.

Composite coarse soils can include a secondary fines fraction (silt and/or clay) which will affect but not determine the engineering properties of the soil.

In fine soils, the primary fraction shall be identified on the basis of its plasticity as given in 5.1.3 and following the procedures given in A.3. The results of these individual field tests should be reported together with the soil description.

In fine and composite fine soils, the soil shall be identified as either “CLAY” or “SILT”, depending on the plasticity of the fines and not on the grading. The intermediate terms of “silty CLAY” or “clayey SILT” should be used for material that is borderline in behaviour between CLAY and SILT. The identification of these soil types shall be based on the guidance given in A.3.9.

5.1.2.3 Secondary fractions

Secondary fractions modify the engineering properties of the primary soil fraction.

The proportions of the secondary coarse fraction are assessed by mass of different size fractions and the term “slightly” or “very” can precede the qualifying term. If the secondary fraction is fine, it shall be identified as “clayey” or “silty” on the basis of its plasticity according to 5.1.3.

The secondary fractions as adjectives shall be placed with the term describing the primary fraction in the order of increasing proportion when there are two coarse soil secondary features, or coarse and then fine if one of each, as shown in the following examples:

— sandy GRAVEL;

— coarse sandy fine GRAVEL;

— medium sandy SILT;

— fine gravelly silty coarse SAND;

— very silty fine SAND;

— fine gravelly, coarse sandy SILT;

— slightly medium sandy CLAY.

NOTE The sequence of terms to describe the components is optional (e.g. "gravelly SAND" or "SAND, gravelly").

The presence of interbedded soils at any scale shall be recorded (see 7.3).

5.1.2.4 Tertiary fractions

Tertiary constituents in a soil shall be described when they are important in assisting in the identification of the origin of the soil and thus indirectly its possible characteristics. However, they do not affect the engineering behaviour of the soil. Examples of important tertiary constituents include shell fragments, glauconite grains, iron sulfides, plant remains and rootlets, and calcareous or other concretions.

5.1.3 Plasticity

Plasticity of the fines of fine soils, or of coarse soils with a fine secondary fraction, shall be assessed in the field with the use of a series of visual/manual tests given in A.3.1 to A.3.9.

5.1.4 Organic content in mineral soils

The organic content of soils has a significant effect on their geotechnical properties. Even small quantities of dispersed organic matter in mineral soil can affect the properties and produce a distinctive odour and colours. The intensity of odour and colour indicates the proportion of organic matter and shall be described as given in 6.1.8. The colour change may be described and correlated with the organic content.

5.2 Organic soils

The identification of soils rich in organic matter is summarized in Table 2. Peats accumulate *in situ* in a mire, are generally of low density and have a distinctive odour. The description of the degree of decomposition of peat shall be made as given in 6.1.10. Humus accumulates *in situ* as the topsoil or surface layer. Gyttja and dy are sediments deposited through water.

In the case of organic soils with secondary mineral constituents, these shall be described as given in 5.1.2.3, e.g. fine sandy PEAT, identifying whether the mineral constituent is disseminated throughout or occurring as discrete inclusions.

Table 2 — Identification of organic soils

Term	Type	Description
PEAT	Fibrous	Fibrous structure, easily recognizable plant structure, retains some strength
	Pseudo-fibrous	Mixture of fibres and amorphous paste
	Amorphous	No visible plant structure, mushy consistency
TOPSOIL OR HUMUS		Plant remains, living organisms and their excretions together with inorganic constituents
GYTTJA		Sediment formed in nutrient-rich water and mainly consisting of more or less decomposed remains of plants and animals (detritus)
DY		Sediment formed in nutrient-poor water and mainly consisting of precipitated colloidal humic substances (dy matter)

NOTE Gyttja can be an organic soil or as a secondary constituent in, for example, a "very organic clay".

5.3 Carbonate soils

Soils with a significant proportion of calcium carbonate occur extensively in and around coastal areas, both onshore and offshore. Many carbonate soils are pale in colour and range from very loose or very soft, fine grained materials to coarse fragments of shell and coral with varying degrees of cementation. They are usually marine deposits but may be freshwater or aeolian deposits. The soils shall be described as given in 5.1 with additional information of their carbonate content (see 6.1.9).

5.4 Sulfide soils

Sulfide soils have a black or greyish black colour. The organic content varies, but is usually low. Sulfide soils have been formed in a stagnant (reducing) environment. Sulfide soils have a distinct odour and readily oxidize.

5.5 Volcanic soils

Volcanic soils consist of particles of volcanic and other origin (for example, from the host rock). Volcanic particles are glassy or vesicular and so the density of volcanic soils can be relatively low. The soil possesses a characteristic colour depending on the property of their host magma or rock.

Volcanic soil shall be described as given in 5.1 taking into account the diagnostic features and particle sizes of volcanic particles.

5.6 Loess

Loess is typically homogenous, structureless, and composed of 50 % to 90 % silt particles with secondary sand and/or clay. After drying, these deposits are highly susceptible to wind erosion, which causes winnowing of the silt, transportation and redeposition. The small range of grain sizes and mode of deposition tend to give rise to an open, potentially collapsible structure when wetted or loaded, and these soils are of low density. Loessic soils shall be described as given in 5.1.

5.7 Glacial soils

Soils associated with glaciation are deposited in a range of environments, including glacial, fluvio-glacial and lacustrine, and can be coarse or fine grained. A commonly occurring example is till, sometimes referred to as a diamicton, comprising a wide range of grain sizes. The mode of deposition tends to give rise to a well-packed structure, and these soils are generally of high density. Due to the composition and origin, tills are often stiffer than post-glacially deposited soils. Till soils shall be described as given in 5.1.

5.8 Anthropogenic soil

The identification of an anthropogenic soil might rely on information about its origin, the soil fabric and/or the presence of artefacts as primary, secondary or tertiary constituents; these should be clearly identified in the description.

Anthropogenic soils shall be described as given in 5.1 with special attention given to the description of fabric and artefacts. Examples of anthropogenic constituents can include plastic, paper, metal, glass, brick, tile or slag. In anthropogenic soils, a distinction should be made, if possible, between material placed with engineering control (fill) or without engineering control (made ground or reconstituted ground). Engineering control in this context is placement in regular thin layers followed by some degree of compaction.

5.9 Origin of deposit

5.9.1 General

The lithostratigraphical or stratigraphical name of the geological unit, if possible, should be given as required by the project.

The geological unit is usually recorded after the identification of the soil, in parenthesis, with capitals. This also indicates some properties and mineral composition before test results become available.

5.9.2 Depositional environment

The depositional environment should be given as accurately as possible. Knowledge of the depositional environment often provides useful information about the soil strata and in the interpolation between the boreholes. The grain size, the grading, colour, sedimentary structures, content of fossils and diagnostic minerals are all important observations in determining the depositional environment. Knowledge of the general geology and stratigraphy gives a useful overview of the relevant depositional environment. The fossils or microfossils present can give important information about the depositional environment

5.9.3 Geological unit

In order to place a soil type stratigraphically and to understand the general geology, the geological unit as identified by mapping should be given, if possible. Knowledge of the geological unit can provide important information about the geotechnical properties, e.g. stiffness and density. This is particularly useful in areas which have repeatedly been glaciated or tectonised. If there is a specific requirement for a more refined unit name, as required by the project, then experts might be appointed to carry out this determination, for instance, by microfloral or microfaunal analysis or thermoluminescence.

6 Description of soil

6.1 Description of soil properties

6.1.1 Particle size distribution

To assess the grading, the soil sample should be spread out such as on a flat surface or on the palm of the hand. The particle sizes and their proportions shall be described, noting in particular any gaps between the fractions present. The particle sizes of the sample should be compared with those of a grading standard comprising sections containing material of different particle size ranges according to Table 1.

As the individual particles of silt and clay are not visible to the naked eye, the methods given in Annex A should be used in determining the characteristics of such soil.

NOTE The minimum size of soil sample required for accurate identification increases with maximum particle size and is difficult to achieve in practice when there are very coarse fractions present.

6.1.2 Particle shape

In the case of gravel, cobbles and boulders, the particle shape should be described by reference to the angularity of the particles (which indicates the degree of rounding at edges and corners), their general form and their surface characteristics. Terms to be used for these aspects are given in Table 3. It is usual practice to estimate the modal angularity or roundness using a standard set of charts.

Table 3 — Terms for the designation of particle shape

Parameter	Particle shape
Angularity/roundness	Very angular Angular Subangular Subrounded Rounded Well rounded
Form	Cubic Flat Elongate
Surface texture	Rough Smooth

6.1.3 Particle strength

Where possible, the strength of very coarse particles should be described in accordance with ISO 14689-1.

6.1.4 Mineral composition

The mineral composition of the individual particles of a soil should be identified according to geological science. Where relevant, the names of the minerals present, together with any coatings, should be included in the description of the soil. When making a field examination of the coarse fraction, a hand lens is often necessary.

NOTE Gravel size particles are usually rock fragments, e.g. sandstone, limestone, flint, granite. Sand and finer particles are generally individual mineral particles; quartz, mica, feldspar and clay minerals. Gravel and sand particles might be coated with mineral matter, including calcite, or iron oxide. Crystals such as calcite, gypsum, pyrite, and glauconite might be present.

6.1.5 Fines content

If relevant for identifying composite soils, the fines fraction of a small sample quantity should be washed out and the coarse residue described as given in 6.1.1 to 6.1.4. The sand fraction will tend to wash out with the fines but should be clearly identified within the description.

The duration and thoroughness of the washout process and examination of the product should be such as to enable appropriate assessment of the type and the proportion of fines. The characteristics of the fine soil fractions should be described in terms of their dilatancy (see A.3.2), toughness (see A.3.3), plasticity (see A.3.4), dry strength (see A.3.5), feel (see A.3.6), behaviour in air and water (see A.3.7) and cohesion (see A.3.8). These are assessed in determining the primary fine soil fraction.

6.1.6 Consistency

The consistency of a fine soil should be described in the field, where sample quality permits, on the basis of the manual tests given in Table 4.

Table 4 — Terms for the description of consistency

Term	Consistency description definition
Very soft	Finger can be easily pushed in up to 25 mm. Soil exudes between the fingers when squeezed in the hand.
Soft	Finger can be pushed in up to 10 mm. Soil can be moulded by light finger pressure.
Firm	Thumb makes an impression easily. Soil cannot be moulded by fingers, but rolls in the hand to 3 mm thick threads without breaking or crumbling.
Stiff	Soil can be indented slightly by thumb. Soil crumbles and breaks when rolling to 3 mm thick threads but is still sufficiently moist to be moulded to a lump again.
Very stiff	Soil can be indented by thumb nail. Soil cannot be moulded but crumbles under pressure. Many desiccated soils fall in this class.

These subdivisions may be approximate, particularly in materials of low plasticity.

The reported consistency of the soils shall be that of the *in situ* condition. The consistency can be affected by the sampling processes, and if the *in situ* condition cannot be reliably assessed this descriptor can be omitted. The results of any strength tests may be included on the field log as additional information.

6.1.7 Soil colours

The colour of a soil should be described using the terms given in Table 5; colours additional to these would not often be appropriate. Although dependent upon local conditions, the colour can often characterize the composition of the material content and its distribution. Colour can facilitate the distinction between mineral and organic soils.

Table 5 — Terms for colour description

Lightness Tertiary descriptor	Chroma Secondary descriptor	Hue Primary descriptor
Light - Dark	Reddish Pinkish Orangish Yellowish Brownish Greenish Bluish Greyish	Red Pink Orange Yellow Cream Brown Green Blue White Grey Black

NOTE 1 Certain quaternary organic soils are light-coloured, such as calcareous gyttja and diatomite and so the colour does not necessarily help in distinguishing soil types.

It is important to identify the colour of a freshly cut surface in full daylight because some soils change their colour very quickly in air. Colour changes such as those due to oxidation or desiccation shall be recorded.

NOTE 2 An example of a soil changing colour is fine soil containing iron oxide compounds which, in the fresh-water saturated condition, is often green or grey but which rapidly oxidizes to red or brown on exposure to air.

A colour chart provides a useful aid, particularly to improve the consistency between descriptions by different persons and under different lighting conditions. The best lighting conditions are outside or near a window in bright cloudy weather. Care should be taken if logging indoors under fluorescent lights which most often give a green hue to the light. Logging areas should be lit by "blue" or "daylight" lighting such as CIE D65 (which represents noon daylight, 6500 K) or CIE C (which represents average northern daylight, 6774 K).

If the colour chart has colour codes, such as for hue, value and chroma, then these codes should be included in the description.

6.1.8 Organic content

Organic content of soils can have a significant effect on their geotechnical properties. The colour should be described as it can indicate the organic content as given in Table 6.

Table 6 — Terms for the description of organic content

Term	Examples of typical colour
Slightly organic	Grey
Organic	Dark grey
Very organic	Black

The odour of a soil gives an indication of whether it is of inorganic or organic nature. Fresh, moist organic soils generally have a mouldy odour which can be intensified by heating. Putrefying, rotten organic components in soil can be recognized by their odour typical of hydrogen sulfide, which can be intensified by pouring dilute hydrochloric acid on the sample. Dry inorganic clays have an earthy odour after being moistened.

6.1.9 Carbonate content

The carbonate content should be determined, where relevant, by the application of droplets of dilute hydrochloric acid (HCl) (10 %, see NOTE 1). The characteristics given in Table 7 can be distinguished.

Table 7 — Terms for the designation of carbonate content

Carbonate content	**Test result** using 10 % hydrochloric acid
Non-calcareous	The addition of HCl produces no effervescence.
Slightly calcareous	The addition of HCl produces weak or sporadic effervescence.
Calcareous	The addition of HCl produces clear but not sustained effervescence.
Highly calcareous	The addition of HCl produces strong and sustained effervescence.

It should be noted that, in wet or moist clayey soils, the effervescence usually occurs with some delay.

NOTE 1 10 % hydrochloric acid comprises 3,6 molar acid.

NOTE 2 A high dry strength is often the result of carbonate acting as a cementing agent.

6.1.10 Degree of decomposition of peat

The degree of decomposition of peat should be established by squeezing a wet sample in the hand (see Table 8). If squeezing is not effective because the peat is too dry, the peat should be assessed on the basis of its appearance, substantial fractions of preserved plant remains being recognizable in un-decomposed to moderately decomposed peat and no plant remains in highly or completely decomposed peat.

Table 8 — Degree of decomposition of wet peat by squeezing

Term	Decomposition	Remains	Squeeze
Fibrous	Little or none	Clearly recognizable	Only water No solids
Pseudo-fibrous	Moderate	Mixture of fibres and amorphous paste	Turbid water <50 % solids
Amorphous	Full	Not recognizable	Paste >50 % solids

6.2 Description of different soil types

6.2.1 Volcanic soils

Volcanic soils shall be described as given in 5.1 and Annex A, taking account of the diagnostic features of particle size (see Table 9), structure and colour.

Table 9 — Particle size fractions of volcanic soils

<table>
<tr><th>Volcanic particle size fractions</th><th>Particle size
mm</th><th>Description</th></tr>
<tr><td>Bombs</td><td rowspan="2">>63</td><td>Pyroclastic fragments which have a shape (generally rounded) or texture (e.g. “bread-crust” surface) which indicates that they were in a wholly or partly molten state during their formation and subsequent transport.</td></tr>
<tr><td>Blocks</td><td>Pyroclastic fragments which have an angular or sub-angular shape indicating that they were solid during transport.</td></tr>
<tr><td>Lapilli</td><td>>2,0 and ≤63</td><td>Spheroid or teardrop shaped pyroclastic grains of molten or semi-molten lava ejected from a volcanic eruption that fall to earth while still at least partially molten.</td></tr>
<tr><td>Ash</td><td>≤2,0</td><td>It consists of fragments of pulverized rock, minerals and volcanic glass, created during volcanic eruptions.</td></tr>
</table>

Soil located in the distribution area of volcanic eruptions can be identified as volcanic by the existence of pumice and scoria. Another method is to measure the volume of volcanic glass obtained by washing out the soils. If a more accurate identification is requested, the physical and chemical properties of the mineral constituents of the soil may be analysed.

6.2.2 Loess

Loess shall be described in accordance with 5.1; such materials are often non-stratified, light yellow or brown, sometimes calcareous slightly sandy silt. The particles are mostly silt size (2 µ to 63 µ) with lesser and variable amounts of sand and clay. Loess grains can be angular or rounded, and are generally composed predominantly of quartz but also contain feldspar, mica and other minerals. The particles may be sourced locally or from a distance.

6.2.3 Glacial soils

Glacial soils shall be described as given in 5.1. Tills are often well graded soils composed of particles of a wide variety of grain sizes, from clay to large boulders. Depending on the proportions, a till may be described as a very coarse, coarse or fine soil.

6.2.4 Anthropogenic soil

Anthropogenic soils comprising natural materials excavated and re-deposited and those processed and re-deposited should be described as given in 5.1. Soils comprising manufactured materials will require a variety of different approaches suitable to describe the sizes, proportion, condition and type of materials present, which are usually heterogeneous. Where the materials present cannot be described using the procedures outlined in this clause, the materials present and their characteristics should be listed.

Such a list should include any appropriate information on the following aspects (this list is not exhaustive):

— origin of the material;

— presence of large objects, such as concrete, masonry, etc.;

— presence of voids or collapsible hollow objects;

— chemical waste and dangerous or hazardous substances;

— organic matter, with a note on the degree of decomposition;

— odorous smell;

— striking colour tints;

— any dates readable on buried papers etc.;

— signs of underground heat or combustion e.g. steam emerging from borehole;

— structure, variability and method of placement.

7 Description of bedding and discontinuities

7.1 Bedding

Structural features related to soil deposits, in particular, the spatial arrangement of potential weakness zones, shall be described. The successful logging of these structural features depends on the quality and size of the available borehole samples or the excavated face.

Any bedding features within the soil shall be described. Bedding planes are commonly planar, parallel to each other. More complex bedding fabrics such as cross-bedding or graded bedding can occur. Such features might not be mechanical breaks and shall be described by the thickness of units between the bedding planes using measurements and the terms in Table 10. If the bedding planes are mechanical breaks, they should be described in accordance with 7.2.

Table 10 — Bedding thickness terms

Term	Thickness of bedding unit mm
Thinly laminated	<6
Thickly laminated	6 to 20
Very thinly bedded[a]	20 to 60
Thinly bedded[a]	60 to 200
Medium bedded[a]	200 to 600
Thickly bedded[a]	600 to 2 000
Very thickly bedded[a]	>2 000

[a] Use bedded or other fabric name as appropriate.

7.2 Discontinuities

The term discontinuity is used to describe surfaces that separate soils of different types or form planes of weakness within the soil. Most discontinuities in soil fall into one of two broad groups.

a) “Depositional” discontinuities, which result from the way in which the soil was deposited or formed, such as bedding planes where such features are mechanical breaks and shall be described by the spacing between the discontinuities.

b) “Mechanical” discontinuities, which include mechanical breaks in the soil as a consequence of shrinkage, ice unloading or tectonic stress. Fissures, joints, faults and shears (or shear planes) are examples of such discontinuities and are most common in stiff or very stiff soils. Fissures and shears might also be a consequence of landsliding in a soil.

Discontinuities can significantly affect the engineering behaviour of the soil and their frequency of occurrence shall be expressed by noting their spacing using measurements and the terms in Table 11; quantification of the range of actual spacings may also be given. Discontinuities should be described using the methods and terms given in ISO 14689-1.

Table 11 — Discontinuity spacing terms

Term	Spacing of discontinuities mm
Extremely closely spaced	<20
Very closely spaced	20 to 60
Closely spaced	60 to 200
Medium spaced	200 to 600
Widely spaced	600 to 2 000
Very widely spaced	>2 000

7.3 Interbedding and mixed soils

Interbedding is a sequence of different soil layers of variable thickness and extent that are summarized for practical reasons (thin laminae, rapid change). The properties of single layers should be described; also, very thin layers shall be considered. The bedding may be mixed by processes (roots, burrows, cryoturbation), so that mixed soils develop, for example, solifluction soils.

8 Reporting

The reporting shall clearly state that the identification and descriptions have been made in accordance with this document.

The description of any soil shall contain at least the following information:

— name(s) of persons describing the soil;

— date and location of description;

— details of origin of collection and handling of samples (see ISO 22475-1);

— identification and description of each layer of soil;

— key of symbols and terms used.

If investigation results are recorded electronically, data should be transferred using open data transfer systems.

The symbols of the ISO 710 series may be used to represent soils on borehole legends or on engineering geological maps or cross-sections.

Following the previous items, any appropriate descriptions shall be added according to this document.