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Geotechnical investigation and testing — Identification and classification of rock —

Part 1: Identification and description

Recherches et essais géotechniques — Dénomination et classification des roches —

Partie 1: Dénomination et description

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 14689-1 was prepared by Technical Committee ISO/TC 182, *Geotechnics*, Subcommittee SC 1, *Geotechnical investigation and testing*.

ISO 14689 consists of the following parts, under the general title *Geotechnical investigation and testing — Identification and classification of rock*:

— *Part 1: Identification and description*

— *Part 2: Electronic exchange of data on identification and description of rock.*

Introduction

This part of ISO 14689 covers areas in the international field that were never previously standardized. It is intended that this document presents broad good practice throughout the world and significant differences with national documents are not anticipated. A more detailed description of rock and related to the site and project is likely to be appropriate.

This document is based on international practice (see the Bibliography).

Geotechnical investigation and testing — Identification and classification of rock —

Part 1: Identification and description

1 Scope

This part of ISO 14689 relates to the identification and description of rock material and mass on the basis of mineralogical composition, genetic aspects, structure, grain size, discontinuities and other parameters. It also provides rules for the description of other characteristics as well as for their designation.

This part of ISO 14689 applies to the description of rock for geotechnics and engineering geology in civil engineering. The description is carried out on cores and other samples of natural rock and on rock masses.

Rock mass classification systems using one or more descriptive parameters to suggest likely rock mass behaviour are beyond the scope of this part of ISO 14689 (see Bibliography).

Identification and classification of soil for engineering purposes is covered in ISO 14688-1 and ISO 14688-2.

2 Normative references

The following referenced documents are indispensable for the application 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 710-1, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 1: General rules of representation*

ISO 710-2, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 2: Representation of sedimentary rocks*

ISO 710-3, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 3: Representation of magmatic rocks*

ISO 710-4, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 4: Representation of metamorphic rocks*

ISO 710-5, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 5: Representation of minerals*

ISO 710-6, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 6: Representation of contact rocks and rocks which have undergone metasomatic, pneumatolytic or hydrothermal transformation or transformation by weathering*

ISO 710-7, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 7: Tectonic symbols*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Additional terms and definitions are given in EN 12670.

3.1
rock
a naturally occurring assemblage of minerals, consolidated, cemented, or otherwise bonded together, so as to form material of generally greater strength or stiffness than soils

3.2
rock mass
the rock together with its discontinuities and weathering profile

3.3
rock material
the rock within the framework of the discontinuities

3.4
rock type
a name in relation to a defined petrological composition, predominant grain size and genetic origin, including relevant structure and texture

NOTE Common examples are given in Table A.1.

3.5
matrix
fine grained, glassy or amorphous groundmass of a rock containing larger mineral grains or rock particles

3.6
texture
size, shape and arrangement of the grains for sedimentary rocks and crystals for igneous and metamorphic rocks

3.7
fabric
spatial arrangement of the constituents (grains) in the rock

NOTE In sedimentary rocks, fabric is the orientation (or lack of it) in space of the elements (discrete particles, crystals, cement) comprising the rock. The term is used in igneous and other crystalline rocks for the patterns produced by non-uniform arrangements of grains, crystals and matrix.

3.8
foliation
planar arrangements of components like minerals in any type of rock, especially the planar structure that results from flattening, segregation and other processes undergone by the grains in a metamorphic rock

3.9
discontinuity
surface which breaks the rock material continuity within the rock mass and that is open or may become open under the stress applied by the engineering work

EXAMPLES Bedding plane, joint, fissure, cleavage and fault in rock mass.

3.10
structure
pattern of discontinuities in rock masses, which subdivide the mass into individual rock blocks

4 Identification and description of rock

4.1 Rock identification

The identification of rocks is based on the determination of the following:

a) genetic group:

- sedimentary: clastic, chemical, organic;
- metamorphic;
- igneous: plutonic, volcanic;

b) structure:

- bedded, foliated or massive (without sharp genetic discontinuities);

c) grain size:

- descriptive terms (for various sizes) are given in Table A.1 in correlation to rock types;

d) mineralogical composition:

- quartz, feldspars and related silicate minerals;
- dark coloured minerals (e.g. biotite, amphibole, pyroxene);
- clay minerals;
- carbonate minerals (e.g. calcite and dolomite);
- siliceous amorphous material (e.g. glass);
- carbonaceous material (e.g. coal and graphite);
- salts (e.g. halite [rock salt]), gypsum);
- swelling minerals (e.g. anhydrite and clay minerals)
- sulfide minerals (e.g. pyrite);

e) void content:

- primary voids (e.g. gas bubbles in volcanic rocks);
- secondary voids (e.g. solution voids).

NOTE Lithological identification of rock is necessary to appreciate the geology of an area, to correlate geological profiles seen in boreholes or to distinguish boulders from bedrock. It is also important when rock material is required for construction purposes. Engineering properties can only partially be inferred from the identification of rock type.

The names of the more common rock types are given in Table A.1, which presents an aid to rock identification for engineering purposes.

Rock names are given particular combinations of features in this subclause and correct naming requires recognition of the attributes listed. The rock shall be correctly identified within geological science.

Geological maps related to the project shall be used for the designation of rocks.

4.2 Description of rock material

4.2.1 Colour

Rock material colour may be described using Colour Charts of an approved type. As an alternative, the following simple system should be used, which serves to limit the subjectivity of an estimation. One term is selected as required from each column (see Table 1) and combined as a colour assessment.

Examples of use are: yellow, light yellowish brown, dark reddish brown, dark brown, etc. If necessary, colour differences can be emphasised separately by the use of terms such as spotted, dappled, mottled, streaked; for example, light yellowish brown spotted with dark brown.

A colour chart provides a useful aid, particularly to improve the consistency between descriptions by different persons.

Table 1 — Terms for lightness, chroma and hue which may be used in combination for colour description (examples)

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

4.2.2 Grain size

A descriptive scheme is given in Table A.1. Grain size refers to the average dimension of the predominant mineral or rock fragments comprising the rock material. It is usually sufficient to estimate the size by eye, which may be aided by a hand lens in the assessment of fine-grained or amorphous rocks, but separate descriptions of the grains and the matrix may be appropriate.

4.2.3 Matrix

The particle size and the mineralogical composition of the matrix shall be determined. Mineralogical composition shall be described using the terms given in Table A.1 (siliceous, calcareous, carbonaceous, etc.) but may be amplified, as appropriate, with such standard geological terms as ferruginous, argillaceous (containing clay minerals), quartzose and others.

4.2.4 Weathering and alteration effects

The results of weathering/alteration of rock material are given in Table 2. Any or all of the descriptive terms can be used to describe weathering/alteration

Table 2 — Terms to describe weathering/alteration of rock materials

Term	Description
Fresh	No visible sign of weathering/alteration of the rock material
Discoloured	The colour of the original fresh rock material is changed and is evidence of weathering/alteration. The degree of change from the original colour should be indicated. If the colour change is confined to particular mineral constituents, this should be mentioned.
Disintegrated	The rock material is broken up by physical weathering, so that bonding between grains is lost and the rock is weathered/altered towards the condition of a soil in which the original material fabric is still intact. The rock material is friable but the mineral grains are not decomposed.
Decomposed	The rock material is weathered by the chemical alteration of the mineral grains to the condition of a soil in which the original material fabric is still intact; some or all of the mineral grains are decomposed.

The weathering terms given in Table 2 may be subdivided using qualifying terms, for example “partially discoloured”, “wholly discoloured” and “slightly discoloured”, as this will aid the description of the material being examined. The last three terms may be used in combination, for example, “wholly discoloured and slightly decomposed”.

4.2.5 Carbonate content

The carbonate content is determined by the application of droplets of dilute hydrochloric acid (HCl) (3:1 or 10 %). The following characteristics could be distinguished:

a) **carbonate-free (O)** if the addition of HCl produces no effervescence;

b) **calcareous (+)** if the addition of HCl produces clear, but not sustained, effervescence;

c) **highly calcareous (++)** if the addition of HCl produces strong and sustained effervescence.

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

4.2.6 Stability of rock material

The degradation of rock material when it is exposed to a new water or atmospheric environment should be assessed where the relevant conditions shall be determined (see Table 3).

Table 3 — Stability of rock material

Term	Description
Stable	No changes
Fairly stable	Specimen surface crumbles, slakes
Unstable	Specimen disintegrates

Its behaviour when exposed to water should be described using the terms in Table 4, together with a description of the test undertaken. Some weak rocks do not show disintegration in water straight away, but only after being dried.