INTERNATIONAL STANDARD

ISO 14689

First edition
2017-12

Geotechnical investigation and testing — Identification, description and classification of rock

Reconnaissance et essais géotechniques — Identification, description et classification des roches

Reference number
ISO 14689:2017(E)

© ISO 2017



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Identification and description of rocks ... **3**
4.1 General ... 3
4.2 Rock identification ... 3
4.3 Geological formation and age ... 4

5 Rock material description ... **4**
5.1 Colour ... 4
5.2 Grain size ... 5
5.3 Unconfined compressive strength ... 5
5.4 Weathering and alteration effects ... 6
5.5 Carbonate content ... 7
5.6 Degradation of rock material ... 7

6 Rock mass description ... **7**
6.1 General ... 7
6.2 Rock types ... 8
6.3 Structure and bedding ... 8
6.4 Discontinuities ... 8
6.4.1 General ... 8
6.4.2 Measurement of discontinuity orientation ... 9
6.4.3 Discontinuity spacing ... 10
6.4.4 Rock block shapes in three dimensions ... 10
6.4.5 Persistence of discontinuities ... 11
6.4.6 Roughness ... 11
6.4.7 Aperture ... 12
6.4.8 Infilling ... 13
6.4.9 Seepage ... 13
6.4.10 Joint sets ... 13
6.5 Weathering of the rock mass ... 13

7 Fracture indices in cores ... **14**

8 Rock mass classification ... **15**

9 Reporting ... **16**

Annex A (informative) **Aid to identification of rocks on the basis of geological features for engineering purposes** ... **17**

Annex B (informative) **Classification of weathering of rocks (material and mass)** ... **18**

Annex C (informative) **Description of discontinuities in three dimensions** ... **20**

Bibliography ... **21**

© ISO 2017 – All rights reserved

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 first edition of ISO 14689 cancels and replaces ISO 14689-1:2003, which has been technically revised.

© ISO 2017 – All rights reserved

Introduction

This document gives details of the procedures to be followed in the identification and description of rocks which are to be used at all stages of ground investigation and geotechnical design. This comprises the description of the rock material and the rock mass characteristics in terms of the bedding and discontinuities.

The level of detail in a description will depend on the characteristics of the rock, the size and quality of the rock 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 rock 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 varies due to the investigation methods employed, as methods of investigation have been developed in response to the ground conditions present.

© ISO 2017 – All rights reserved

Geotechnical investigation and testing — Identification, description and classification of rock

1 Scope

This document specifies the rules for 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 document 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 rock and on exposures of rock masses.

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

NOTE Identification and classification of soil for engineering purposes are covered in ISO 14688-1 and ISO 14688-2. Identification and description of materials intermediate between soil and rock are carried out using the procedures in ISO 14688-1, ISO 14688-2 and this document, as appropriate.

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 14688-1, *Geotechnical investigation and testing — Identification and classification of soil — Part 1: Identification and description*

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

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

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

3.1
discontinuity
break in the *rock material* (3.7) continuity that is open or can open under the stress increase or reduction as a result of the engineering works

3.2
duricrust
cemented zone occurring in weathered *rock* (3.5) or soil formed by the mobilization and deposition of minerals often due to pedogenic or evaporative processes

© ISO 2017 – All rights reserved

3.3
fabric
preferred orientation or spatial arrangement of the constituent grains, crystals and matrix in the *rock* (3.5)

Note 1 to entry: In sedimentary rocks, fabric is the orientation (or lack of it) in space of the constituents of the rock. The term is used in igneous and other crystalline rocks for the patterns produced by non-uniform arrangements of constituents.

3.4
foliation
planar arrangements of constituents such as crystals in any type of *rock* (3.5), especially the parallel *structure* (3.11) that results from flattening, segregation and other processes undergone by the grains in a metamorphic rock

Note 1 to entry: The original planar structure can be disrupted by folding or faulting during tectonic processes.

3.5
rock
naturally occurring assemblage or aggregate of mineral grains, crystals or mineral based particles compacted, cemented or otherwise bound together and which cannot be disaggregated by hand in water

Note 1 to entry: Rocks are generally of greater strength than soils.

3.6
rock mass
rock (3.5) comprising the intact material together with the discontinuities and weathering zones

3.7
rock material
intact *rock* (3.5) between the discontinuities

3.8
rock matrix
groundmass of a *rock material* (3.7) which contains larger crystals, mineral grains or *rock* (3.5) particles

3.9
rock type
natural aggregation of one or more minerals or *rock* (3.5) fragments defined by its petrological composition, predominant grain size, *structure* (3.11), *texture* (3.12) and genetic origin

EXAMPLE Common examples are given in Table A.1.

3.10
solid core
core with at least one full diameter uninterrupted by natural discontinuities, but not necessarily a full circumference, commonly measured along the core axis or other scan line

3.11
structure
pattern of bedding, folds, faults and discontinuities in *rock masses* (3.6), which subdivide the mass into individual domains or *rock* (3.5) blocks

3.12
texture
size, shape and arrangement of the grains or crystals that constitute a *rock* (3.5)

© ISO 2017 – All rights reserved

3.13
volumetric joint count
Jv
number of discontinuities (joints) in 1 m^3 volume of *rock mass* (3.6) where Jv = 1/S1 + 1/S2 + 1/S3

Note 1 to entry: S1, S2, S3 are spacings (in metres) of each of the *discontinuity* (3.1) sets at a location.

4 Identification and description of rocks

4.1 General

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

Identification and description of rocks are sub-divided into the following actions: (i) identification (naming) of the rock (4.2), (ii) description of the rock material (Clause 5) and (iii) description of the characteristics of the rock mass (Clause 6).

Guidance on several aspects of the identification and description of rocks is given in ISRM Suggested Methods[7][8] which can be usefully followed.

4.2 Rock identification

The identification of rock types shall be based on the determination of the following:

a) genetic group:
   - sedimentary: clastic, chemical, organic;
   - metamorphic;
   - igneous: plutonic, volcanic;
   - duricrusts;

b) structure:
   - bedded, foliated or massive (without discontinuities);
   - isotropy or anisotropy of the rock;

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);
   - oxide minerals (e.g. magnetite);
   - siliceous amorphous material (e.g. glass);
   - carbonaceous material (e.g. coal and graphite);

© ISO 2017 – All rights reserved