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Geotechnical investigation and testing — Identification and classification of soil —

Part 2: Principles for a classification

Reconnaissance et essais géotechniques — Identification et classification des sols —

Partie 2: Principes pour une classification

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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

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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.

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 14688-2:2004), which has been technically revised. It also incorporates the Amendment ISO 14688-2:2004/Amd 1:2013.

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

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Introduction

This document 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.

Prior to classification, ISO 14688-1 gives details of the procedures that should be followed in the identification and description of soils.

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Geotechnical investigation and testing — Identification and classification of soil —

Part 2:
Principles for a classification

1 Scope

This document specifies the basic principles for classification of those material characteristics most commonly used for soils for engineering purposes. It is intended to be read in conjunction with ISO 14688-1, which gives rules for the identification and description of soils. The relevant characteristics could vary and therefore, for particular projects or materials, more detailed subdivisions of the descriptive and classification terms could be appropriate. Due to differences in local geological conditions, practices to enhance relevant classification criteria are used.

The classification principles established in this document allow soils to 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.

This document is applicable to natural soil *in situ*, natural soil reworked artificially and synthetic materials. A more detailed classification specific to use in earthworks is given in EN 16907-2.

NOTE 1 Identification and description of rocks are covered by ISO 14689. Identification and description of materials intermediate between soil and rock are carried out using the procedures in ISO 14688-1, this document and ISO 14689, 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 14688-1:2017, *Geotechnical investigation and testing — Identification and classification of soil — Part 1: Identification and description*

ISO 14689, *Geotechnical investigation and testing — Identification, description and classification of rock*

ISO 17892-1, *Geotechnical investigation and testing — Laboratory testing of soil — Part 1: Determination of water content*

ISO 17892-2, *Geotechnical investigation and testing — Laboratory testing of soil — Part 2: Determination of bulk density*

ISO 17892-3, *Geotechnical investigation and testing — Laboratory testing of soil — Part 3: Determination of particle density*

ISO 17892-4, *Geotechnical investigation and testing — Laboratory testing of soil — Part 4: Determination of particle size distribution*

ISO 17892-5, *Geotechnical investigation and testing — Laboratory testing of soil — Part 5: Incremental loading oedometer test*

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ISO 17892-6, *Geotechnical investigation and testing — Laboratory testing of soil — Part 6: Fall cone test*

ISO/TS 17892-7, *Geotechnical investigation and testing — Laboratory testing of soil — Part 7: Unconfined compression test on fine-grained soils*

ISO/TS 17892-8, *Geotechnical investigation and testing — Laboratory testing of soil — Part 8: Unconsolidated undrained triaxial test*

ISO/TS 17892-9, *Geotechnical investigation and testing — Laboratory testing of soil — Part 9: Consolidated triaxial compression test*

ISO/TS 17892-10, *Geotechnical investigation and testing —Laboratory testing of soil — Part 10: Direct shear tests*

ISO/TS 17892-11, *Geotechnical investigation and testing — Laboratory testing of soil — Part 11: Permeability tests*

ISO/TS 17892-12, *Geotechnical investigation and testing — Laboratory testing of soil — Determination of Atterberg limits*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14688-1 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
coefficient of curvature
C_C
ratio $(D_{30})^2/(D_{10} \times D_{60})$, where D_{60}, D_{30} and D_{10} are the particle diameters corresponding to 60 %, 30 % and 10 % finer on the cumulative particle size distribution curve, respectively

3.2
compression index
C_c
defined in accordance with the following relation:

$$C_c = -\frac{\Delta e}{\lg\left[(\sigma' + \Delta\sigma')/\sigma'\right]} = -\frac{\Delta e}{\Delta(\lg\sigma')}$$

Note 1 to entry: Δe is the change in void ratio (negative value when e decreases) for plastic deformation and is the change in void ratio Δe for a relative increase of effective stress from lgσ' to lg $(\sigma' + \Delta\sigma')$.

3.3
consistency index
I_C
numerical difference between the *liquid limit* (3.6) and the natural *water content* (3.16) expressed as a percentage ratio of the *plasticity index* (3.10)

$$I_C = (w_L - w)/I_P$$

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3.4
density index
I_D
index for coarse soils (sands and gravels) dependent upon the *void ratio* (3.15) and the void ratios corresponding to the minimum density (e_{min}) and the maximum density (e_{max}), as measured in the laboratory

$$I_D = (e_{max} - e)/(e_{max} - e_{min})$$

3.5
dry density
ρ_d
mass of oven-dried soil per unit volume of the material

3.6
liquid limit
w_L
water content (3.16) at which a fine soil passes from the liquid to the plastic condition, as determined by the *liquid limit* (3.6) test

3.7
liquidity index
I_L
numerical difference between the natural *water content* (3.16) and the *plastic limit* (3.9) expressed as a percentage ratio of the *plasticity index* (3.10)

$$I_L = (w - w_P)/I_P$$

3.8
particle density
ρ_S
density of the soil particles

3.9
plastic limit
w_P
water content (3.16) at which a fine soil passes from the plastic to the semi-solid condition, as determined by the plastic limit test

3.10
plasticity index
I_P
numerical difference between the *liquid limit* (3.6) and *plastic limit* (3.9) of a fine soil

$$I_P = w_L - w_P$$

3.11
soil classification
assignment of soil into groups on the basis of certain behavioural characteristics, criteria and genesis

3.12
soil groups
soils of similar composition and geotechnical properties

3.13
undrained shear strength
c_u
shear resistance of soil in the undrained condition

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3.14
uniformity coefficient
C_U
ratio D_{60}/D_{10}, where D_{60} and D_{10} are the particle sizes such that 60 % and 10 % of the particles by weight are smaller than those sizes

3.15
void ratio
e
ratio of the volume of voids to the volume of solids of a soil

3.16
water content
w
mass of water which can be removed from the soil, usually by drying, expressed as a percentage of the dry mass

4 Principles of soil classifications

4.1 General

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

Classification uses the results of laboratory tests. The classification of soils shall be based on tests carried out in accordance with ISO 17892-1 to ISO 17892-12.

Classification places soils into groups on the basis of their nature which is the composition only, irrespective of their water content or compactness, taking into account the following characteristics:

— particle size distribution (grading);

— plasticity;

— organic content;

— chemical constituents such as carbonate or sulfate;

— origin of the deposit (see ISO 14688-1:2017, 5.9).

This document describes general principles for a unique soil classification system. In a geotechnical investigation, soils shall be classified with the use of an adopted existing national requirement or one created for a specific project. Such a soil classification system should meet the following principles.

a) It will conform to this document and to ISO 14688-1 regarding terms, definitions and identification of the soil groups.

b) It will comprise a sufficient series of soil groups that will correspond to and cover the geotechnical conditions of the project.

c) It will comprise specific criteria for classifying soils into distinct groups.

Principles for soil classification, which correspond to the principles of identification given in ISO 14688-1, are given in Table 1.

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