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Geotechnical investigation and testing — Laboratory testing of soil —

Part 10: Direct shear tests

Reconnaissance et essais géotechniques — Essais de laboratoire des sols —

Partie 10: Essai de cisaillement direct

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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 341, *Geotechnical Investigation and Testing*, in collaboration with ISO Technical Committee ISO/TC 182, *Geotechnics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO/TS 17892-10:2004, which has been technically revised. It also incorporates the Technical Corrigendum ISO/TS 17892-10:2004/Cor 1:2006.

The main changes compared to the previous edition are as follows:

— general revision of the text and figures and addition of specimen preparation procedures;

— inclusion of two types of ring shear apparatus; Type A wherein failure occurs at the depth in the specimen defined by the split specimen container and Type B wherein the location of the failure surface is not defined by the apparatus;

— addition of Annex A on calibration, maintenance and checks;

— addition of Annex B on additional calculations for effective strength parameters.

A list of all the parts in the ISO 17892 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document provides laboratory test methods for the determination of the effective shear strength of soils by direct shear within the international field of geotechnical engineering.

The tests have not previously been standardized internationally. It is intended that this document presents broad good practice and significant differences with national documents are not anticipated. It is based on international practice (see Reference [1]).

This document specifies two methods for the determination of the effective shear strength of soils under consolidated drained conditions using either a shearbox or a ring shear device.

The shearbox test is generally used for the determination of peak effective shear strength parameters of soils. The ring shear test is generally used for the determination of residual effective shear strength parameters of fine grained soils. Residual effective shear strength parameters can also be obtained from shearbox tests and peak effective shear strength parameters can also be obtained from ring shear tests.

The test method consists of placing the test specimen in the direct shear device, applying a pre-determined vertical stress, providing for draining (and wetting if required) of the test specimen, consolidating the specimen under vertical stress and then shearing the specimen. This shearing is imposed by displacing one part horizontally, relatively with respect to the other part of the specimen at a constant rate of shear-deformation. The shearing force and the horizontal and vertical displacements are measured as the specimen is sheared. Shearing is applied slowly enough to allow excess pore pressures to dissipate by drainage so that effective stresses are equal to total stresses.

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Geotechnical investigation and testing — Laboratory testing of soil —

Part 10: Direct shear tests

1 Scope

This document specifies two laboratory test methods for the determination of the effective shear strength of soils under consolidated drained conditions using either a shearbox or a ring shear device.

This document is applicable to the laboratory determination of effective shear strength parameters for soils in direct shear within the scope of geotechnical investigations.

The tests included in this document are for undisturbed, remoulded, re-compacted or reconstituted soils. The procedure describes the requirements of a determination of the shear resistance of a specimen under a single vertical (normal) stress. Generally three or more similar specimens from one soil are prepared for shearing under three or more different vertical pressures to allow the shear strength parameters to be determined in accordance with Annex B.

Special procedures for preparation and testing the specimen, such as staged loading and pre-shearing or for interface tests between soils and other materials, are not covered in the procedure of this document.

NOTE This document fulfils the requirements of the determination of the drained shear strength of soils in direct shear for geotechnical investigation and testing in accordance with EN 1997-1 and EN 1997-2.

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

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

ISO 386, *Liquid-in-glass laboratory thermometers — Principles of design, construction and use*

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:

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

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

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3.1
direct shear test
test whereby a specimen of soil is laterally restrained and sheared along a mechanically induced horizontal plane while subjected to a vertical stress applied normal to that plane

3.2
shearbox test
direct shear test (3.1) whereby a specimen is placed in a rigid square or circular container (shear box) and shearing is applied by linear displacement of one half of the shear box relative to the other

Note 1 to entry: See Figure 1.

3.3
ring shear test
direct shear test (3.1) whereby an annular specimen is subjected to shear induced by rotation of one half of the specimen relative to the other while subjected to vertical stress applied normal to the *failure* (3.4) plane

Note 1 to entry: See Figures 2 and 3.

3.4
failure
stress or strain condition at which either peak horizontal shear stress is achieved or a specified deformation criterion is achieved, if a peak horizontal shear stress is not observed

3.5
pore pressure
pressure of water in the voids within the soil specimen

3.6
primary consolidation
process whereby the void ratio of a specimen decreases as a result of an increase in the effective stress due to a decrease in the excess *pore pressure* (3.5) under a constant total applied load

Note 1 to entry: Time-dependent volume change during primary consolidation is primarily controlled by drainage conditions.

4 Symbols

D_a	outer diameter of specimen container rings
D_i	inner diameter of specimen container rings
D_m	mean diameter of specimen container rings
R_i	inner radius of the container rings
R_a	outer radius of the container rings
H	height of annulus in the specimen container rings or shear box
t_c	time value from vertical displacement versus root time plot
t_f	calculated minimum time to failure during shear stage
v_{max}	maximum allowable rate of shear displacement
s_{rs}	horizontal shear deformation during ring shear
s_f	estimated horizontal shear deformation at failure
r	mean radius of the specimen in the ring shear test
θ	angular displacement during the ring shear test
θ_{max}	maximum rate of angular displacement in the ring shear test
ρ	initial bulk density of specimen

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