SLOVENSKI STANDARD
SIST EN ISO 22476-16:2025

01-januar-2025

Geotehnično preiskovanje in preskušanje - Preskušanje na terenu - 16. del: Strižni preskus v vrtini (ISO 22476-16:2024)

Geotechnical investigation and testing - Field testing - Part 16: Borehole shear test (ISO 22476-16:2024)

Geotechnische Erkundung und Untersuchung - Felduntersuchungen - Teil 16: Bohrscherversuch mit Phikometer (ISO 22476-16:2024)

Reconnaissance et essais géotechniques - Essais en place - Partie 16: Essai de cisaillement en forage (ISO 22476-16:2024)

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ICS:

93.020	Zemeljska dela. Izkopavanja. Gradnja temeljev. Dela pod zemljo	Earthworks. Excavations. Foundation construction. Underground works

SIST EN ISO 22476-16:2025 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 22476-16

November 2024

ICS 93.020

English Version

Geotechnical investigation and testing - Field testing - Part 16: Borehole shear test (ISO 22476-16:2024)

Reconnaissance et essais géotechniques - Essais en place - Partie 16: Essai de cisaillement en forage (ISO 22476-16:2024)

Geotechnische Erkundung und Untersuchung - Felduntersuchungen - Teil 16: Bohrscherversuch mit Phikometer (ISO 22476-16:2024)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN ISO 22476-16:2024) has been prepared by Technical Committee ISO/TC 182 "Geotechnics" in collaboration with Technical Committee CEN/TC 341 “Geotechnical Investigation and Testing” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2025, and conflicting national standards shall be withdrawn at the latest by May 2025.

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Endorsement notice

The text of ISO 22476-16:2024 has been approved by CEN as EN ISO 22476-16:2024 without any modification.

International Standard

ISO 22476-16

Geotechnical investigation and testing — Field testing —

Part 16: Borehole shear test

Reconnaissance et essais géotechniques — Essais en place — Partie 16: Essai de cisaillement en forage

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Foreword

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

A list of all parts in the ISO 22476 series can be found on the ISO website.

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Introduction

The determination of the shear strength of soils is of paramount importance in geotechnical investigation and testing of soils. The shear resistance of soils and materials, characterised by the friction angle φ and the cohesion c, represents an important parameter for the geotechnical engineer while studying the stability of construction works and structures in relation with soils and materials. Usually, this resistance is measured in the laboratory using triaxial tests or direct shear tests carried out on field samples and only if sampling, conservation and preparation make it possible to consider the samples as non remolded and sufficiently representative of the soil in place.

Since the 1960's, various experimental devices have been designed and developed to determine the shear strength directly in situ from tests carried out in boreholes, in different soils at different depths.

The study of the bibliography literature shows that the majority of the existing borehole shear tests are based on the use of probes for applying and maintaining a normal pressure on the walls of the borehole and then to carry out a shear phase by a linear displacement of the probe on the soil against the walls of the borehole. The procedure is then repeated through a multistage increase of the normal pressure to obtain more values relating normal pressure and shear resistance.

The test equipment and apparatuses differ from each other by the geometry and size of the probes and by the shape of the friction part of these probes and by the procedure for applying normal pressure stages and shear phases.

One of the first devices of this kind is the Iowa Borehole Shear Tester (BST) developed in the USA.[13] The test is performed by placing a bilateral expandable probe, equipped with two diametrically opposed shear plates in a predrilled borehole, expanding the probe against the wall of the borehole and causing a shear failure in the soil by pulling the probe axially along the borehole. The size of the shear plates is relatively small (32,3 cm^2) and does not allow testing of soils with coarse elements, which can somewhat limit its field of application.

In the early 1970s, H. Mori,[15] in Japan, developed an in situ shearing device called the IST which was used in many projects. The principle of the test is carried out by generating a shearing force while pulling upwards a cylindrical expandable probe provided with teeth driven into the wall of the borehole but it is not reported whether the IST test continues to be performed currently.

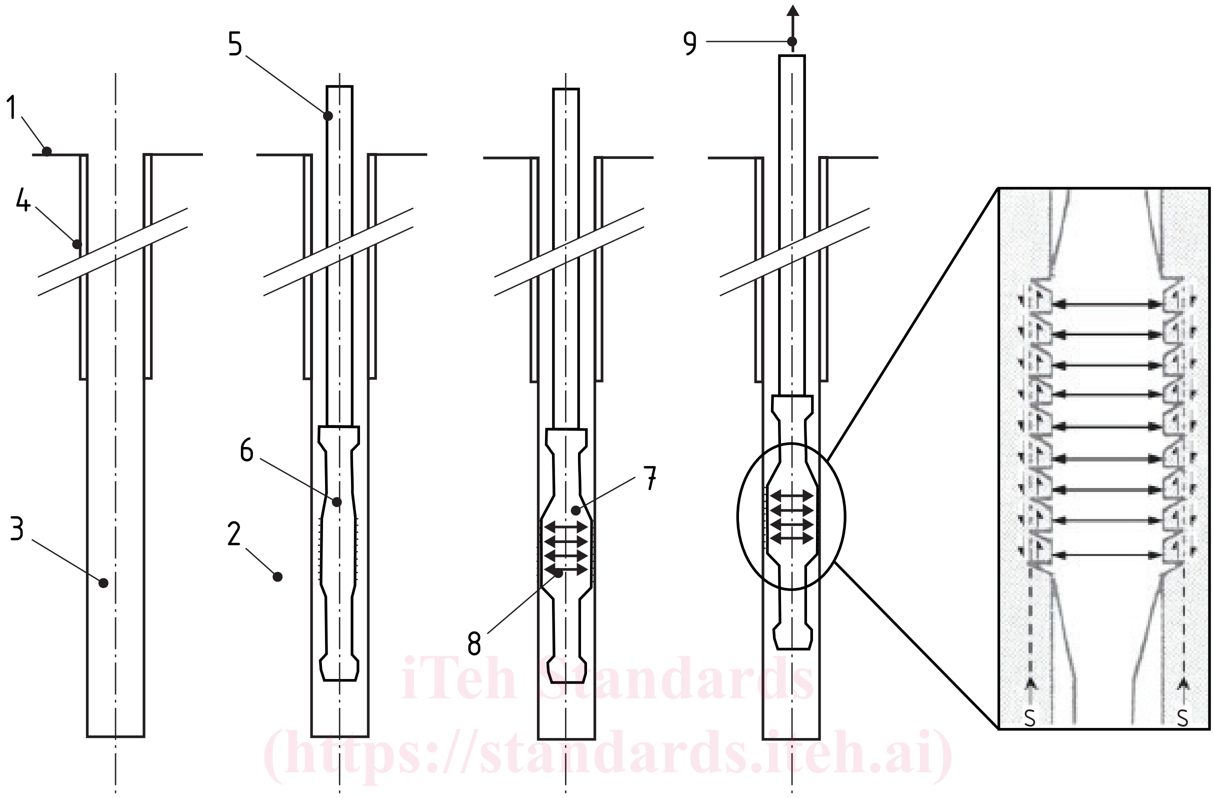
A self-boring in situ friction test (SBIFT), also developed in Japan,[14] allows the evaluation of soil characteristics as the initial horizontal at rest pressure, and deformation modulus and strength characteristics (cohesion and internal friction angle) of the soil. The SBIFT possesses a self-boring drilling functionality that can reduce the disturbance of the tested soil. However, very few data and results are available to currently validate this device and the characteristics of the soil it provides.

The same way as the SBIFT, a self-boring in situ shear pressuremeter (SBISP), was recently developed in China,[12] that allows the evaluation of pressuremetric characteristics as the initial horizontal at rest pressure, deformation yield pressure and modulus and also strength characteristics (cohesion and internal friction angle) of the soil. The SBISP possesses a self-boring drilling functionality that can greatly reduce the disturbance of the tested soil. However, very few data and results are available to currently validate this device and the characteristics of the soil it provides.

This document applies to the borehole shear test using the phicometer procedure, commonly named the phicometer borehole shear test (PBST). This test has been invented and developed by Gérard Philipponnat in the 1980's.[10]

This test has been the subject, between 1986 and 1992, of several applied research programs to design the apparatus and its components and to develop and optimize a common test procedure that can be used in a majority of soils. Various articles have been published as a result of these researches and since then PBST tests continue to be carried out currently, for the determination of the shear strength parameters from the test and to derive values for the undrained shear strength and an estimation of the drained effective shear resistance parameters.[9] The test has been standardized in France since 1997.

The borehole shear test using the phicometer covers a four-phases procedure consisting of drilling a borehole, lowering the probe to the test depth, inflating it into the borehole wall and shearing the soil by applying a series of steps of controlled radial pressure and simultaneously pulling out the probe with a constant displacement rate. The test sequences are shown in Figure 1.



a) Borehole drilling phase: drilling a phicometer borehole with casing (if necessary) and setting up the PBST test pocket in the borehole bottom

b) Probe placing phase: lowering the deflated probe to the test pocket depth

c) Teeth insertion phase: radial expansion of probe and insertion of the annular teeth in the borehole wall

d) Shearing phase: pulling on the probe inflated with a constant radial pressure at each multi-stage step

Key

1 ground surface
2 ground
3 borehole
4 casing (if necessary)
5 string of rods
6 probe (deflated state)
7 probe (inflated state)
8 radial pressure
9 pulling force
S cylindrical shear surface

Figure 1 — General arrangement and phases of the phicometer procedure borehole shear test