SLOVENSKI STANDARD
SIST EN ISO 22477-4:2018

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Geotehnično preiskovanje in preskušanje - Preskušanje geotehničnih konstrukcij - 4. del: Preskušanje pilotov: dinamični obremenilni preskus (ISO 22477-4:2018)

Geotechnical investigation and testing - Testing of geotechnical structures - Part 4: Testing of piles dynamic load testing (ISO 22477-4:2018)

Geotechnische Erkundung und Untersuchung - Prüfung von geotechnischen Bauwerken und Bauwerksteilen - Teil 4: Pfahlprüfungen: Dynamische Pfahlprobebelastung (ISO 22477-4:2018)

Reconnaissance et essais géotechniques - Essais de structures géotechniques - Partie 4: Essais de pieux: essai de chargement dynamique (ISO 22477-4:2018)

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Geotechnical investigation and testing - Testing of geotechnical structures - Part 4: Testing of piles: dynamic load testing (ISO 22477-4:2018)

Reconnaissance et essais géotechniques - Essais de structures géotechniques - Partie 4: Essais de pieux: essai de chargement dynamique (ISO 22477-4:2018)

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European foreword

This document (EN ISO 22477-4:2018) 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of an identical text or by endorsement, at the latest by October 2018, and conflicting national standards shall be withdrawn at the latest by October 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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The text of ISO 22477-4:2018 has been approved by CEN as EN ISO 22477-4:2018 without any modification.

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Geotechnical investigation and testing — Testing of geotechnical structures —

Part 4: Testing of piles: dynamic load testing

Reconnaissance et essais géotechniques — Essais de structures géotechniques —
Partie 4: Essais de pieux: essai de chargement dynamique

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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).

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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 the European Committee for Standardization (CEN) Technical Committee CEN/TC 341, *Geotechnical investigation and testing*, in collaboration with ISO Technical Committee TC 182, *Geotechnics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 22477 series can be found on the ISO website.

Introduction

This document establishes the specifications for the execution of dynamic load tests in which a single pile is subject to an axial load in compression to measure strain, acceleration and displacement under dynamic loading and to allow an assessment of its compressive resistance. This document outlines how a dynamic load test is defined and specifies the equipment and testing procedures required. Informative non-prescriptive guidance is included on the analysis of dynamic load test results required to determine mobilized or ultimate measured compressive resistance of a pile.

Geotechnical investigation and testing — Testing of geotechnical structures —

Part 4: Testing of piles: dynamic load testing

1 Scope

This document establishes the specifications for the execution of dynamic load tests in which a single pile is subject to an axial dynamic load in compression.

This document outlines the methods of testing required to allow assessment of pile resistance to be determined from the following methods and procedures described in EN1997-1:2004+A1:2013:

a) dynamic impact testing – determination of pile compressive resistance by evaluation of measurements of strain and acceleration and or displacement at the pile head with respect to time;

b) pile driving formulae – evaluation of pile compressive resistance from blow counts and hammer energy during pile driving;

c) wave equation analysis – evaluation of pile compressive resistance from blow counts by modelling of the pile, soil and driving equipment;

d) multi-blow dynamic testing – evaluation of pile compressive resistance from a series of blows designed to generate different levels of pile head displacement and velocity.

This document is applicable to piles loaded axially in compression.

This document is applicable to all pile types mentioned in EN 1536, EN 12699 and EN 14199.

The tests considered in this document are limited to dynamic load tests on piles only.

NOTE 1 ISO 22477-4 can be used in conjunction with EN1997-1:2004+A1:2013. Numerical values of partial factors for limit states from pile load tests to be taken into account in design are provided in EN 1997-1. For design to EN 1997-1 the results from dynamic load tests will be considered equivalent to the measured compressive resistance $R_{c,m}$ after being subject to appropriate analysis.

NOTE 2 Guidance on analysis procedures for dynamic load testing results is given in Annexes A, B, D, E and F.

This document provides specifications for:

i) investigation tests, whereby a sacrificial pile is loaded up to ultimate limit state;

ii) control tests, whereby the pile is loaded up to a specified load in excess of the serviceability limit state.

NOTE 3 Generally, an investigation test focuses on general knowledge of a pile type; a control test focuses on one specific application of a pile.

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.

EN1997-1:2004+A1:2013, *Eurocode 7: Geotechnical design — Part 1: General rules*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions in EN1997-1:2004+A1:2013 and the following 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

3.1.1
trial pile
pile installed before the commencement of the main piling works or a specific part of the works for the purpose of investigating the suitability of the chosen type of pile and for confirming its design, dimensions and compressive resistance

Note 1 to entry: The trial pile might be sacrificed to achieve ultimate limit state.

3.1.2
working pile
pile that will form part of the foundation of the structure

3.1.3
test pile
pile to which loads are applied to determine the compressive resistance - deformation characteristics of the pile and the surrounding ground

Note 1 to entry: A test pile can be a trial pile or a working pile.

3.1.4
pile load
axial compressive load (or force) applied to the head of the pile during the test

3.1.5
dynamic load
axial compressive impact load (or force) applied to the head of a pile by a driving hammer or drop mass

3.1.6
maximum pile load
highest axial compressive force applied to the pile during the test

Note 1 to entry: This is generally defined prior to the test.

3.1.7
dynamic load test
test where a pile is subjected to chosen axial dynamic load at the pile head to allow the determination of its compressive resistance

3.1.8
dynamic impact test
pile test with measurement of strain, acceleration and displacement versus time during the impact event

Note 1 to entry: The impact event is normally a hammer blow.

Note 2 to entry: This test is used to assess the compressive resistance of individual piles.

3.1.9
driving formula
formula that relates impact hammer energy and number of blows for a unit distance or permanent set for a single blow to pile compressive resistance

3.1.10
wave equation analysis
analysis of a dynamically loaded pile by a mathematical model that can represent the dynamic behaviour of the pile by the progression of stress waves in the pile and the resulting response of the soil

3.1.11
signal matching
operation to evaluate the shaft and base resistance of piles by modelling of the pile and soil with variation of parameters to match measured signals from pile head strain or displacement and acceleration measurements

3.1.12
impedance
the dynamic stiffness of a pile determined from the cross-sectional area, material stiffness and density.

Note 1 to entry: For a non-uniform pile the impedance can be different over the length of the pile.

3.1.13
mobilized compressive resistance
the resistance that is mobilized with the available energy of the impact device

3.1.14
ultimate measured compressive resistance
corresponding state in which the pile foundation displaces significantly with negligible increase of resistance

Note 1 to entry: Where it is difficult to define an ultimate limit state from a load settlement plot showing a continuous slight increase, a settlement of the pile top equal to 10 % of the pile base diameter should be adopted as the “failure” criterion.

Note 2 to entry: The ultimate compressive resistance is not measured directly during a dynamic load test. The measured or mobilized compressive resistance obtained from dynamic load testing shall be analysed to remove the effects of dynamic soil dependent behaviour before it can be considered equivalent to the ultimate measured compressive resistance as outlined in the appropriate Annex.

3.1.15
design compressive static resistance
ultimate compressive resistance of a pile

Note 1 to entry: This shall be determined prior to load testing to allow specification of the appropriate magnitude of dynamic load test.

3.1.16
equivalent diameter
diameter of the circle of which the area equals the area of the relevant pile section

Note 1 to entry: The equivalent diameter for a circular pile is the outer diameter of the pile, for a square pile the diameter which gives the same area as the square pile (as long as the longest side is smaller than 1,5 times the shortest side) is the equivalent diameter.