SLOVENSKI STANDARD
oSIST prEN 1997-2:2022

01-december-2022

Evrokod 7 - Geotehnično projektiranje - 2. del: Lastnosti tal

Eurocode 7 - Geotechnical design - Part 2: Ground properties

Eurocode 7: Entwurf, Berechnung und Bemessung in der Geotechnik - Teil 2: Erkundung und Untersuchung des Baugrunds

Eurocode 7 - Calcul géotechnique - Partie 2 : Propriétés des terrains

Ta slovenski standard je istoveten z: **prEN 1997-2**

ICS:

91.010.30	Tehnični vidiki	Technical aspects
93.020	Zemeljska dela. Izkopavanja. Gradnja temeljev. Dela pod zemljo	Earthworks. Excavations. Foundation construction. Underground works

oSIST prEN 1997-2:2022 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1997-2

September 2022

ICS 91.010.30; 93.020

Will supersede EN 1997-2:2007

English Version

Eurocode 7 - Geotechnical design - Part 2: Ground properties

Eurocode 7: Entwurf, Berechnung und Bemessung in der Geotechnik - Teil 2: Erkundung und Untersuchung des Baugrunds

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 250.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Ref. No. prEN 1997-2:2022 E

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European foreword

This document (prEN 1997-2:2022) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

This document will supersede EN 1997-2:2007.

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by the Eurocodes.

The Eurocodes recognize the responsibility of each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level through the use of National Annexes.

0 Introduction

0.1 Introduction to the Eurocodes

The Structural Eurocodes comprise the following standards generally consisting of a number of Parts:

— EN 1990, *Eurocode: Basis of structural and geotechnical design*

— EN 1991, *Eurocode 1: Actions on structures*

— EN 1992, *Eurocode 2: Design of concrete structures*

— EN 1993, *Eurocode 3: Design of steel structures*

— EN 1994, *Eurocode 4: Design of composite steel and concrete structures*

— EN 1995, *Eurocode 5: Design of timber structures*

— EN 1996, *Eurocode 6: Design of masonry structures*

— EN 1997, *Eurocode 7: Geotechnical design*

— EN 1998, *Eurocode 8: Design of structures for earthquake resistance*

— EN 1999, *Eurocode 9: Design of aluminium structures*

— New parts are under development, e.g. Eurocode for design of structural glass

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, software developers, and committees drafting standards for related product, testing and execution standards.

NOTE Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

0.2 Introduction to EN 1997 Eurocode 7

EN 1997 consists of a number of parts:

— EN 1997-1, *Geotechnical design – Part 1: General rules*

— EN 1997-2, *Geotechnical design – Part 2: Ground properties*

— EN 1997-3, *Geotechnical design – Part 3: Geotechnical structures*

EN 1997 standards establish additional principles and requirements to those given in EN 1990 for the safety, serviceability, robustness, and durability of geotechnical structures.

EN 1997 standards are intended to be used in conjunction with the other Eurocodes for the design of geotechnical structures, including temporary geotechnical structures.

Design and verification in EN 1997 (all parts) are based on the partial factor method or other reliability-based methods, prescriptive rules, testing, or the observational method.

0.3 Introduction to prEN 1997-2

prEN 1997-2 establishes rules for obtaining information about the ground at a site, as needed for the design and execution of geotechnical structures, including temporary geotechnical structures.

0.4 Verbal forms used in the Eurocodes

The verb “shall" expresses a requirement strictly to be followed and from which no deviation is permitted in order to comply with the Eurocodes.

The verb “should” expresses a highly recommended choice or course of action. Subject to national regulation and/or any relevant contractual provisions, alternative approaches could be used/adopted where technically justified.

The verb “may" expresses a course of action permissible within the limits of the Eurocodes.

The verb “can" expresses possibility and capability; it is used for statements of fact and clarification of concepts.

0.5 National annex for prEN 1997-2

National choice is allowed in this standard where explicitly stated within notes. National choice includes the selection of values for Nationally Determined Parameters (NDPs).

The national standard implementing prEN 1997-2 can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

When no national choice is given, the default choice given in this standard is to be used.

When no national choice is made and no default is given in this standard, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by appropriate parties.

National choice is allowed in prEN 1997-2:2022 through the following clauses:

5.4.3(2) 5.4.3(3)

National choice is allowed in prEN 1997-2 on the application of the following informative annexes:

Annex B Annex C Annex D Annex E

Annex F Annex G

The National Annex can contain, directly or by reference, non-contradictory complementary information for ease of implementation, provided it does not alter any provisions of the Eurocodes.

1 Scope

1.1 Scope of prEN 1997-2

(1) This document provides rules for determining ground properties for the design and verification of geotechnical structures.

(2) This document covers guidance for planning ground investigations, collecting information about ground properties and groundwater conditions, and preparation of the Ground Model.

(3) This document covers guidance for the selection of field investigation and laboratory test methods to obtain derived values of ground properties.

(4) This document covers guidance on the presentation of the results of ground investigation, including derived values of ground properties, in the Ground Investigation Report.

1.2 Assumptions

(1) The provisions in prEN 1997-2:2022 are based on the assumptions given in prEN 1990:2021 and prEN 1997-1:2022.

(2) This document is intended to be used in conjunction with prEN 1997-1:2022, which provides general rules for design and verification of all geotechnical structures.

(3) This document is intended to be used in conjunction with prEN 1997-3:2022, which provides specific rules for design and verification of certain types of geotechnical structures.

(4) This document is intended to be used in conjunction with prEN 1998-1-1 which provides the requirements for the ground properties needed to define the seismic action.

(5) This document is intended to be used in conjunction with prEN 1998-5 which provides rules for the design of geotechnical structures in seismic regions.

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.

NOTE See the Bibliography for a list of other documents cited that are not normative references, including those referenced as recommendations (i.e. in 'should' clauses), permissions ('may' clauses), possibilities ('can' clauses), and in notes.

prEN 1990:2021, *Eurocode - Basis of structural and geotechnical design*

prEN 1997-1:2022, *Eurocode 7: Geotechnical design - Part 1: General rules*

prEN 1998-1-1, *Eurocode 8 - Design of structures for earthquake resistance - Part 1-1: General rules and seismic action*

prEN 1998-5, *Eurocode 8 - Design of structures for earthquake resistance - Part 5: Geotechnical aspects, foundations, retaining and underground structures*

EN ISO 22475-1, *Geotechnical investigation and testing - Sampling methods and groundwater measurements - Part 1: Technical principles for the sampling of soil, rock and groundwater (ISO 22475-1)*

EN ISO 22476-1, *Geotechnical investigation and testing - Field testing - Part 1: Electrical cone and piezocone penetration text (ISO 22476-1)*

3 Terms, definitions, and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 1990:2021 and prEN 1997-1:2022 and the following apply.

3.1.1 Common terms used in prEN 1997-2

3.1.1.1
site
surface area or underground space where construction work or other development is undertaken

3.1.1.2
anthropogenic ground
materials placed by human activity

3.1.1.3
rockhead
boundary between soil and rock

Note 1 to entry: Rockhead can either be a geological boundary between in-situ (usually weathered) and transported materials or an engineering boundary between materials that behave as soil and those that behave as rock.

3.1.2 Terms relating to the Ground Model

3.1.2.1
state property
ground property that can change over time, such as mass density, water content and saturation, density index, or stress state

3.1.2.2
measured value of a ground property
value of a ground property recorded during a test

3.1.3 Terms relating to content of ground investigation

3.1.3.1
ground investigation
use of non-intrusive and intrusive methods to investigate the ground and groundwater conditions beneath or around the site or zone of influence

3.1.3.2
ground investigation location
location (point, line, or area) on the site where the ground is examined and investigated by intrusive or non-intrusive methods

3.1.3.3
low-rise structure
warehouse sheds, factory buildings, or residential buildings up to three storeys high

3.1.3.4
high-rise structure
buildings and structures greater than three storeys high, including chimneys and towers

3.1.3.5
site inspection
observation and recording of features relevant to the surface and sub-surface conditions and any exposures of the ground, existing infrastructure or environment

Note 1 to entry: The inspection normally extends beyond the site boundaries.

3.1.3.6
sample
defined amount of rock, soil, or groundwater recovered from recorded depth

[SOURCE: EN ISO 22475-1:2021]

3.1.3.7
specimen
part of the sample taken for laboratory testing

3.1.3.8
sample quality class
quality class of the sample based on its degree of disturbance according to sampling technique

[SOURCE: EN ISO 22475-1:2021]

3.1.3.9
disturbance factor
disturbance of the rock mass

3.1.3.10
mapping

process of physically going out into the field and recording information from the ground at the surface or from excavations and exposures

3.1.3.11
geological mapping
mapping to record and describe geological information and features observed in the field

Note 1 to entry: Description covers features such as morphology, lithology, hydrogeology, weathering, and any visible geological structure.

3.1.3.12
geotechnical mapping
geological mapping with the addition of ground classification in terms of quality indexes and of geometrical features of discontinuities

Note 1 to entry: Classification covers parameters such as rock quality designation, rock mass rating, joint sets, alteration and weathering numbers, joint wall roughness, and technical ground behaviour.

3.1.4 Terms relating to chemical, physical, and state properties

3.1.4.1
classification
definition of material groups and classes and assigning of materials to groups and classes with similar properties

[SOURCE: EN 16907-2:2018, 3.1.2, modified – deleted “for earthworks”.]

3.1.4.2
very coarse soil
soil with particle sizes larger than 63 mm

[SOURCE: EN ISO 14688-1:2018]

3.1.4.3
coarse soil
soil with particle sizes between 0,063 and 63 mm

[SOURCE: EN ISO 14688-1:2018]

3.1.4.4
fine soil
soil with particle sizes smaller than 0,063 mm

[SOURCE: EN ISO 14688-1:2018]

3.1.4.5
density index
ratio of the difference between the maximum void ratio and the observed void ratio to the difference between maximum and minimum void ratios

3.1.4.6
relative density
synonym for 'density index'

3.1.4.7
consistency (Atterberg) limits
collective name for liquid, plastic, and shrinkage limits of soil

3.1.4.8
liquid limit
water content of soil at which a fine soil passes from the liquid to the plastic condition, as determined by the liquid limit test

[SOURCE: EN ISO 14688-2:2018]

3.1.4.9
plastic limit
water content of soil at which a fine soil passes from the plastic to the semi-solid condition, as determined by the plastic limit test

[SOURCE: EN ISO 14688-2:2018]

3.1.4.10
shrinkage limit
water content of soil below which loss of water does not result in volume reduction

3.1.4.11
activity index
ratio of the plasticity index and the clay fraction that is finer than two microns

3.1.5 Terms relating to strength

3.1.5.1
shear strength envelope
expression that identifies stress combinations that produce material failure

3.1.5.2
shear strength parameters
material parameters appearing in the expression of shear strength envelopes

3.1.5.3
shear strength in effective stresses
shear strength obtained from an envelope defined in terms of effective stress

3.1.5.4
peak shear strength
upper limit of the shear strength observed in a test

3.1.5.5
critical state shear strength
shear strength observed when shearing continues without change in either volume or pore water pressure

3.1.5.6
residual shear strength
lower limit of the shear strength of a fine soil reached after extensive shearing and particle re-orientation or lower limit of the shear strength reached after extensive shearing of discontinuities

3.1.5.7
undrained shear strength
shear strength of water saturated soils obtained from an envelope defined in terms of total stress

3.1.5.8
peak undrained shear strength
upper limit of the undrained shear strength for undisturbed soil

3.1.5.9
remoulded undrained shear strength
undrained shear strength for totally remoulded soil

3.1.5.10
sensitivity
ratio between peak and remoulded undrained shear strengths

3.1.5.11
crack initiation stress
stress level at which pre-existing cracks (rock material) or discontinuities (rock mass) initiate growth

3.1.5.12
crack damage stress
stress level at which unstable growth of cracks (rock material) or discontinuities (rock mass) occurs

3.1.5.13
Geological Strength Index
index used to estimate rock mass strength and rock mass deformation modulus

3.1.5.14
Joint Roughness Coefficient
number characterizing the roughness of discontinuities

3.1.5.15
joint wall compressive strength
compressive strength of a discontinuity adjusted for weathering, size, width, infill and scale

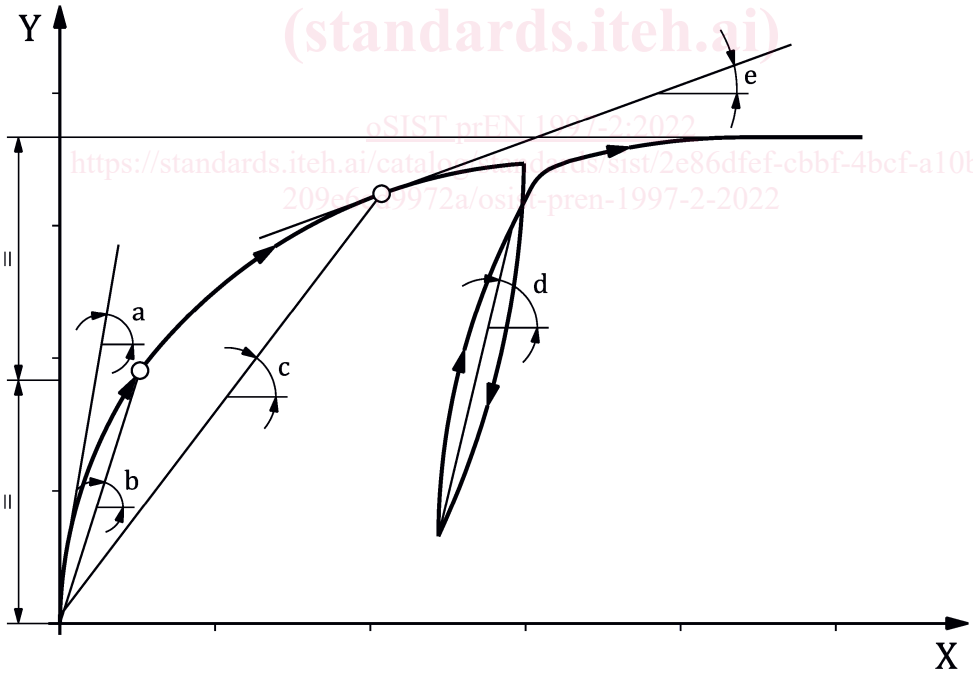
3.1.5.16
rock mass strength
strength resulting from the combination of the structural and material properties of the rock mass

3.1.5.17
flexural strength
strength of the rock material from a flexure test

[SOURCE: ASTM C880-98]

3.1.6 Terms relating to stiffness and consolidation

3.1.6.1
elastic modulus
ratio of stress increase to the corresponding increase in strain in the stress-strain relationship as shown in Figure 3.1



Key

X	strain	c	E_{sec} or G_{sec}
Y	shear stress	d	E_{cyc} or G_{cyc}
a	E_0 or G_0	e	E_{tan} or G_{tan}
b	E_{50} or G_{50}		

Figure 3.1 — Definition of modulus on stress-strain curve

3.1.6.2
bulk modulus
ratio between mean stress increase to a corresponding decrease in volumetric strain

3.1.6.3
shear modulus
ratio of shear stress increase to a corresponding increase in shear strain, as shown in Figure 3.1

3.1.6.4
secant modulus
ratio between stress and the corresponding strain accumulated from an initial reference state, as defined by Figure 3.1

3.1.6.5
tangent modulus
ratio between small increments of stress and strain from a given reference state, as shown in Figure 3.1

3.1.6.6
very small strain elastic modulus
value of the elastic modulus at strains < 10^{-5}

3.1.6.7
very small strain Poisson's ratio
value of Poisson's ratio at strains < 10^{-5}

3.1.6.8
oedometer (one dimensional) modulus
ratio of the variation of a principal stress by the linear strain obtained in the same direction, with the other principal strains equal to zero

Note 1 to entry: Also known as the 'constrained modulus'.

3.1.6.9
swelling
ground volume expansion caused by physicochemical processes or by the ingress of water

3.1.6.10
undrained modulus
elastic modulus for undrained conditions

3.1.7 Terms relating to cyclic, dynamic, and seismic properties

3.1.7.1
compressional wave velocity
velocity of propagation of a compressional (primary) wave in a medium

3.1.7.2
cyclic liquefaction
transition of soil behaviour from solid-like to liquid-like due to cyclic or seismic actions

3.1.7.3
cyclic modulus
slope of the line connecting the two points of reversal in cyclic loading as shown in Figure 3.1