



SLOVENSKI STANDARD
SIST EN 1997-1:2005
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Eurocode 7: Geotechnical design - Part 1: General rules

Eurocode 7: Entwurf, Berechnung und Bemessung in der Geotechnik - Teil 1:
Allgemeine Regeln

Eurocode 7: Calcul géotechnique - Partie 1: Règles générales

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Ta slovenski standard je istoveten z: EN 1997-1:2004

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ICS:

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English version

Eurocode 7: Geotechnical design - Part 1: General rules

Eurocode 7: Calcul géotechnique - Partie 1: Règles
générales

Eurocode 7: Entwurf, Berechnung und Bemessung in der
Geotechnik - Teil 1: Allgemeine Regeln

This European Standard was approved by CEN on 23 April 2004.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

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Contents

Foreword	5
Section 1 General	9
1.1 Scope.....	9
1.2 Normative references	10
1.3 Assumptions.....	11
1.4 Distinction between Principles and Application Rules.....	11
1.5 Definitions	12
1.6 Symbols	13
Section 2 Basis of geotechnical design	19
2.1 Design requirements	19
2.2 Design situations.....	21
2.3 Durability.....	22
2.4 Geotechnical design by calculation.....	23
2.5 Design by prescriptive measures	35
2.6 Load tests and tests on experimental models.....	36
2.7 Observational method	36
2.8 Geotechnical Design Report.....	36
Section 3 Geotechnical data	38
3.1 General	38
3.2 Geotechnical investigations.....	38
3.3 Evaluation of geotechnical parameters	39
3.4 Ground Investigation Report.....	47
Section 4 Supervision of construction, monitoring and maintenance	49
4.1 General	49
4.2 Supervision	49
4.3 Checking ground conditions.....	51
4.4 Checking construction	52
4.5 Monitoring	53
4.6 Maintenance.....	54
Section 5 Fill, dewatering, ground improvement and reinforcement	55
5.1 General	55
5.2 Fundamental requirements.....	55
5.3 Fill construction	55
5.4 Dewatering.....	59
5.5 Ground improvement and reinforcement.....	60
Section 6 Spread foundations	61
6.1 General	61
6.2 Limit states.....	61
6.3 Actions and design situations	61
6.4 Design and construction considerations.....	61
6.5 Ultimate limit state design.....	62
6.6 Serviceability limit state design	65
6.7 Foundations on rock; additional design considerations.....	67
6.8 Structural design of spread foundations.....	68
6.9 Preparation of the subsoil	68
Section 7 Pile foundations	70
7.1 General	70
7.2 Limit states.....	70
7.3 Actions and design situations	70

7.4	Design methods and design considerations	72
7.5	Pile load tests	74
7.6	Axially loaded piles	76
7.7	Transversely loaded piles	86
7.8	Structural design of piles.....	88
7.9	Supervision of construction	88
Section 8 Anchorages		91
8.1	General	91
8.2	Limit states	92
8.3	Design situations and actions.....	92
8.4	Design and construction considerations	93
8.5	Ultimate limit state design	94
8.6	Serviceability limit state design.....	95
8.7	Suitability tests.....	95
8.8	Acceptance tests	96
8.9	Supervision and monitoring.....	96
Section 9 Retaining structures		97
9.1	General	97
9.2	Limit states	97
9.3	Actions, geometrical data and design situations	98
9.4	Design and construction considerations	101
9.5	Determination of earth pressures	102
9.6	Water pressures	105
9.7	Ultimate limit state design	105
9.8	Serviceability limit state design.....	109
Section 10 Hydraulic failure		111
10.1	General.....	111
10.2	Failure by uplift	112
10.3	Failure by heave	114
10.4	Internal erosion.....	114
10.5	Failure by piping	115
Section 11 Overall stability		117
11.1	General.....	117
11.2	Limit states	117
11.3	Actions and design situations.....	117
11.4	Design and construction considerations	118
11.5	Ultimate limit state design	119
11.6	Serviceability limit state design.....	121
11.7	Monitoring.....	121
Section 12 Embankments.....		123
12.1	General.....	123
12.2	Limit states	123
12.3	Actions and design situations.....	123
12.4	Design and construction considerations	124
12.5	Ultimate limit state design	125
12.6	Serviceability limit state design.....	126
12.7	Supervision and monitoring.....	126
Annex A (normative) Partial and correlation factors for ultimate limit states and recommended values		128
Annex B (informative) Background information on partial factors for Design Approaches 1, 2 and 3.....		138
Annex C (informative) Sample procedures to determine limit values of earth pressures on vertical walls		141
Annex D (informative) A sample analytical method for bearing resistance calculation.....		156

Annex E (informative) A sample semi-empirical method for bearing resistance estimation.....	160
Annex F (informative) Sample methods for settlement evaluation.....	161
Annex G (informative) A sample method for deriving presumed bearing resistance for spread foundations on rock.....	163
Annex H (informative) Limiting values of structural deformation and foundation movement	165
Annex J (informative) Checklist for construction supervision and performance monitoring	167

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Foreword

This document (EN 1997-1) has been prepared by Technical Committee CEN/TC250 "Structural Eurocodes", the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes.

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 2005** and conflicting national standards shall be withdrawn by **March 2010**.

This document supersedes ENV 1997-1:1994.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Background to the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980s.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement¹ between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links *de facto* the Eurocodes with the provisions of all the Council's Directives and/or Commissions Decisions dealing with European standards (e.g. the Council Directive 89/106/EEC on construction products - CPD - and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990	Eurocode :	Basis of Structural Design
EN 1991	Eurocode 1:	Actions on structures
EN 1992	Eurocode 2:	Design of concrete structures
EN 1993	Eurocode 3:	Design of steel structures

¹ Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

EN 1997-1:2004 (E)

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

Eurocode standards recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognise that Eurocodes serve as reference documents for the following purposes:

- as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 – Mechanical resistance and stability – and Essential Requirement N°2 – Safety in case of fire;
- as a basis for specifying contracts for construction works and related engineering services;
- as a framework for drawing up harmonised technical specifications for construction products (ENs and ETAs)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents² referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards³. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical Committees and/or EOTA Working Groups working on product standards with a view to achieving full compatibility of these technical specifications with the Eurocodes.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

² According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonised ENs and ETAGs/ETAs.

³ According to Art. 12 of the CPD the interpretative documents shall :

- give concrete form to the essential requirements by harmonising the terminology and the technical bases and indicating classes or levels for each requirement where necessary ;
- indicate methods of correlating these classes or levels of requirement with the technical specifications, e.g. methods of calculation and of proof, technical rules for project design, etc. ;
- serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals.

The Eurocodes, *de facto*, play a similar role in the field of the ER 1 and a part of ER 2.

National Standards implementing Eurocodes

The National Standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a National title page and National foreword, and may be followed by a National annex.

The National annex may only contain information on those parameters, which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, i.e. :

- values and/or classes where alternatives are given in the Eurocode,
- values to be used where a symbol only is given in the Eurocode,
- country specific data (geographical, climatic), e.g. snow map,
- the procedure to be used where alternative procedures are given in the Eurocode.

It may also contain:

- decisions on the application of informative annexes,
- references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and harmonised technical specifications (ENs and ETAs) for products

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works⁴. Furthermore, all the information accompanying the CE Marking of the construction products, which refer to Eurocodes should clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific to Eurocode 7

EN 1997-1 gives design guidance and actions for geotechnical design of buildings and civil engineering works.

EN 1997-1 is intended for clients, designers, contractors and public authorities.

EN 1997-1 is intended to be used with EN 1990 and EN 1991 to EN 1999.

In using EN 1997-1 in practice, particular regard should be paid to the underlying assumptions and conditions given in 1.3.

The 12 sections of EN 1997-1 are complemented by 1 normative and 8 informative annexes.

National annex for EN 1997-1

This standard gives alternative procedures and recommended values with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1997-1 should have a National annex containing all Nationally Determined Parameters to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

⁴ see Art.3.3 and Art.12 of the CPD, as well as clauses 4.2, 4.3.1, 4.3.2 and 5.2 of ID 1.

National choice is allowed in EN 1997-1 through the following paragraphs:

- 2.1(8)P, 2.4.6.1(4)P, 2.4.6.2(2)P, 2.4.7.1(2)P, 2.4.7.1(3), 2.4.7.2(2)P, 2.4.7.3.2(3)P, 2.4.7.3.3(2)P, 2.4.7.3.4.1(1)P, 2.4.7.4(3)P, 2.4.7.5(2)P, 2.4.8(2), 2.4.9(1)P, 2.5(1), 7.6.2.2(8)P, 7.6.2.2(14)P, 7.6.2.3(4)P, 7.6.2.3(5)P, 7.6.2.3(8), 7.6.2.4(4)P, 7.6.3.2(2)P, 7.6.3.2(5)P, 7.6.3.3(3)P, 7.6.3.3(4)P, 7.6.3.3(6), 8.5.2(2)P, 8.5.2(3), 8.6(4), 11.5.1(1)P

and the following clauses in annex A:

- A.2
- A.3.1, A.3.2, A.3.3.1, A.3.3.2, A.3.3.3, A.3.3.4, A.3.3.5, A.3.3.6,
- A.4
- A.5

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Section 1 General

1.1 Scope

1.1.1 Scope of EN 1997

(1) EN 1997 is intended to be used in conjunction with EN 1990:2002, which establishes the principles and requirements for safety and serviceability, describes the basis of design and verification and gives guidelines for related aspects of structural reliability.

(2) EN 1997 is intended to be applied to the geotechnical aspects of the design of buildings and civil engineering works. It is subdivided into various separate parts (see 1.1.2 and 1.1.3).

(3) EN 1997 is concerned with the requirements for strength, stability, serviceability and durability of structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

(4) Numerical values of actions on buildings and civil engineering works to be taken into account in design are provided in EN 1991 for the various types of construction. Actions imposed by the ground, such as earth pressures, shall be calculated according to the rules of EN 1997.

(5) Separate European Standards are intended to be used to treat matters of execution and workmanship. They are denoted in the relevant sections.

(6) In EN 1997 execution is covered to the extent that is necessary to comply with the assumptions of the design rules.

(7) EN 1997 does not cover the special requirements of seismic design. EN 1998 provides additional rules for geotechnical seismic design, which complete or adapt the rules of this Standard.

1.1.2 Scope of EN 1997-1

(1) EN 1997-1 is intended to be used as a general basis for the geotechnical aspects of the design of buildings and civil engineering works.

(2) The following subjects are dealt with in EN 1997-1:

Section 1: General

Section 2: Basis of geotechnical design

Section 3: Geotechnical data

Section 4: Supervision of construction, monitoring and maintenance

Section 5: Fill, dewatering, ground improvement and reinforcement

Section 6: Spread foundations

Section 7: Pile foundations

Section 8: Anchorages

Section 9: Retaining structures

EN 1997-1:2004 (E)

Section 10: Hydraulic failure

Section 11: Overall stability

Section 12: Embankments

(3) EN 1997-1 is accompanied by Annexes A to J, which provide:

- in A: recommended partial safety factor values; different values of the partial factors may be set by the National annex;
- in B to J: supplementary informative guidance such as internationally applied calculation methods.

1.1.3 Further Parts of EN 1997

(1) EN 1997-1 is supplemented by EN 1997-2 that provides requirements for the performance and evaluation of field and laboratory testing.

1.2 Normative references

(1) This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE The Eurocodes were published as European Prestandards. The following European Standards which are published or in preparation are cited in normative clauses

EN 1990:2002	https://standards.iteh.ai/SIST-EN-1997-1-2005 Eurocode: Basis of structural design
EN 1991	Eurocode 1 Actions on structures
EN 1991-4	Eurocode 1 Actions on structures - Part 4 Actions in silos and tanks
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 1997-2	Eurocode 7 Geotechnical design - Part 2: Ground investigation and testing
EN 1998	Eurocode 8 Design of structures for earth quake resistance
EN 1999	Eurocode 9 Design of aluminium and aluminium alloy structures
EN 1536:1999	Execution of special geotechnical work: Bored piles
EN 1537:1999	Execution of special geotechnical work; Ground anchors
EN 12063:1999	Execution of special geotechnical work; Sheet-pile walls

EN 12699:2000	Execution of special geotechnical work; Displacement piles
EN 14199	Execution of special geotechnical works – Micropiles
EN-ISO 13793: 2001	Thermal performance of buildings –Thermal design of foundations to avoid frost heave

1.3 Assumptions

(1) Reference is made to 1.3 of EN 1990:2002.

(2) The provisions of this standard are based on the assumptions given below:

- data required for design are collected, recorded and interpreted by appropriately qualified personnel;
- structures are designed by appropriately qualified and experienced personnel;
- adequate continuity and communication exist between the personnel involved in data-collection, design and construction;
- adequate supervision and quality control are provided in factories, in plants, and on site;
- execution is carried out according to the relevant standards and specifications by personnel having the appropriate skill and experience;
- construction materials and products are used as specified in this standard or in the relevant material or product specifications;
- the structure will be adequately maintained to ensure its safety and serviceability for the designed service life;
- the structure will be used for the purpose defined for the design.

(3) These assumptions need to be considered both by the designer and the client. To prevent uncertainty, compliance with them should be documented, e.g. in the geotechnical design report.

1.4 Distinction between Principles and Application Rules

(1) Depending on the character of the individual clauses, distinction is made in EN 1997-1 between Principles and Application Rules.

(2) The Principles comprise:

- general statements and definitions for which there is no alternative;
- requirements and analytical models for which no alternative is permitted unless specifically stated.

(3) The Principles are preceded by the letter P.

(4) The Application Rules are examples of generally recognised rules, which follow the Principles and satisfy their requirements.

(5) It is permissible to use alternatives to the Application Rules given in this standard, provided it is shown that the alternative rules accord with the relevant Principles and are at least

equivalent with regard to the structural safety, serviceability and durability, which would be expected when using the Eurocodes.

NOTE If an alternative design rule is submitted for an application rule, the resulting design cannot be claimed to be wholly in accordance with EN 1997-1, although the design will remain in accordance with the Principles of EN 1997-1. When EN 1997-1 is used in respect of a property listed in an Annex Z of a product standard or an ETAG, the use of an alternative design rule may not be acceptable for CE marking.

(6) In EN 1997-1, the Application rules are identified by a number in brackets e.g. as in this clause.

1.5 Definitions

1.5.1 Definitions common to all Eurocodes

(1) The definitions common to all Eurocodes are given in EN 1990:2002, 1.5.

1.5.2 Definitions specific for EN 1997-1

1.5.2.1

geotechnical action

action transmitted to the structure by the ground, fill, standing water or ground-water

NOTE Definition taken from EN 1990:2002

1.5.2.2

comparable experience

documented or other clearly established information related to the ground being considered in design, involving the same types of soil and rock and for which similar geotechnical behaviour is expected, and involving similar structures. Information gained locally is considered to be particularly relevant

1.5.2.3

ground

soil, rock and fill in place prior to the execution of the construction works;

1.5.2.4

structure

organised combination of connected parts, including fill placed during execution of the construction works, designed to carry loads and provide adequate rigidity

NOTE Definition derived from EN 1990:2002

1.5.2.5

derived value

value of a geotechnical parameter obtained by theory, correlation or empiricism from test results

1.5.2.6

stiffness

material resistance against deformation

1.5.2.7

resistance

capacity of a component, or cross-section of a component of a structure to withstand actions without mechanical failure e.g. resistance of the ground, bending resistance, buckling resistance, tensile resistance

NOTE Definition derived from EN 1990:2002

1.6 Symbols

(1) For the purpose of EN 1997-1 the following symbols apply.

Latin letters

A'	effective base area
A_b	base area under pile
A_c	total base area under compression
$A_{s,i}$	pile shaft surface area in layer i
a_d	design value of geometrical data
a_{nom}	nominal value of geometrical data
Δa	change made to nominal geometrical data for particular design purposes
b	width of a foundation.
b'	effective width of a foundation
C_d	limiting design value of the effect of an action
c	cohesion intercept
c'	cohesion intercept in terms of effective stress
c_u	undrained shear strength
$c_{u,d}$	design value of undrained shear strength
d	embedment depth;
E_d	design value of the effect of actions
$E_{stb;d}$	design value of the effect of stabilising actions
$E_{dst;d}$	design value of the effect of destabilising actions
$F_{c;d}$	design axial compression load on a pile or a group of piles
F_d	design value of an action
F_k	characteristic value of an action
F_{rep}	representative value of an action
$F_{t;d}$	design axial tensile load on a tensile pile or a group of tensile piles