

English Version

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

Eurocode 8 - Calcul des structures pour leur résistance
aux séismes - Partie 1-1 : Règles générales et action
sismique

Eurocode 8 - Auslegung von Bauwerken gegen
Erdbeben - Teil 1-1: Grundlagen und
Erdbebeneinwirkung

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

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

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Contents

Page

European foreword	4
0 Introduction	5
1 Scope	8
1.1 Scope of EN 1998-1-1	8
1.2 Assumptions	8
2 Normative references	9
3 Terms, definitions and symbols	9
3.1 Terms and definitions	9
3.2 Symbols and abbreviations	15
3.2.1 Symbols	15
3.2.2 Abbreviations	27
3.3 S.I. Units	29
4 Basis of design	30
4.1 Performance objectives	30
4.2 Consequence classes	31
4.3 Limit states and associated seismic action	31
4.4 Primary and secondary seismic members	32
4.5 Compliance criteria for new structures	33
4.5.1 General	33
4.5.2 Design verification principles	33
5 Site conditions and seismic action	35
5.1 Site conditions	35
5.1.1 General	35
5.1.2 Site categorisation	35
5.2 Seismic action	36
5.2.1 Spectral acceleration maps	36
5.2.2 Basic representation of the seismic action	38
5.2.3 Alternative representations of the seismic action	45
6 Modelling, analysis, and verification	47
6.1 General	47
6.2 Modelling	47
6.2.1 General	47
6.2.2 Additional modelling rules for linear analysis	48
6.2.3 Additional modelling rules for non-linear analysis	48
6.3 Seismic action	49
6.4 Force-based approach	49
6.4.1 Reduced spectrum for the force-based approach	49
6.4.2 Lateral force method	51
6.4.3 Response spectrum method	52
6.4.4 Combination of the effects of the components of the seismic action	53
6.5 Non-linear static analysis	54
6.5.1 General	54
6.5.2 Lateral loads and capacity curve	54
6.5.3 Equivalent SDOF system	55

6.5.4	Target displacement.....	56
6.6	Response-history analysis.....	58
6.7	Verification to limit states	58
6.7.1	General.....	58
6.7.2	Verifications to Significant Damage limit state.....	59
6.7.3	Verifications to additional limit states.....	60
6.8	Structures equipped with anti-seismic devices.....	61
6.8.1	Scope.....	61
6.8.2	Basis of design for structures equipped with anti-seismic devices.....	61
6.8.3	Seismic action.....	65
6.8.4	Modelling	65
6.8.5	Analysis of structures equipped with anti-seismic devices.....	66
6.8.6	Verifications of anti-seismic devices to limit states	69
7	Deformation criteria for displacement-based approach	70
7.1	General.....	70
7.2	Reinforced concrete structures.....	72
7.2.1	General.....	72
7.2.2	Deformation criteria.....	72
7.2.3	Resistance to shear.....	77
7.3	Steel and composite steel-concrete structures.....	78
7.3.1	General.....	78
7.3.2	Beams and columns under flexure with or without axial load	80
7.3.3	Steel bracings	85
7.3.4	Beam-to-column web panel joint.....	88
7.3.5	Links in frames with eccentric bracings.....	90
7.3.6	Buckling restrained bracings	92
7.4	Timber structures.....	93
Annex A (informative)	European seismic hazard maps.....	94
A.1	Use of this annex	94
A.2	Scope and field of application	94
Annex B (normative)	Alternative identification of site categories	97
B.1	Use of this annex	97
B.2	Scope and field of application	97
B.3	Simplified identification of site categories.....	97
B.4	Case of incomplete quantitative information for identification of site categories	98
B.4.1	Missing direct measurements of v_s or values available only down to a limited depth	98
B.4.2	Missing quantitative information on H_{800}	98
Annex C (normative)	Site-specific elastic response spectra.....	100
C.1	Use of this annex	100
C.2	Scope and field of application	100
C.3	Site-specific elastic response spectra based on a local seismic hazard analysis.....	100
C.4	Site-specific elastic response spectra based on evaluation of local seismic wave amplification effects	100
C.5	Limitations on site-specific spectral values	101
Annex D (informative)	Criteria for selection and scaling of input motions.....	102
D.1	Use of this annex	102
D.2	Scope and field of application	102
D.3	Recorded accelerograms.....	102
D.4	Multiple input motions using recorded accelerograms.....	103
D.5	Simulated accelerograms.....	104

D.6	Artificial accelerograms	104
Annex E (normative) Determination of target displacement and limit-state spectral acceleration by using non-linear response-history analyses of an equivalent SDOF model		
E.1	Use of this annex	105
E.2	Scope and field of application	105
E.3	Definition of a multi-linear equivalent SDOF model.....	105
E.4	Determination of the target displacement through non-linear response-history analyses.....	107
E.5	Determination of the limit-state spectral acceleration through non-linear response-history analyses	107
Annex F (informative) Target reliability and simplified reliability-based verification format		
F.1	Use of this annex	108
F.2	Scope and field of application	108
F.3	Target reliability.....	108
F.4	Reliability-based verification.....	109
Annex G (normative) Design of fastenings to concrete in the seismic design situation		
G.1	Use of this annex	111
G.2	Scope and field of application	111
G.3	Basis of design	111
G.3.1	General	111
G.3.2	Seismic performance category for post-installed fasteners	113
G.3.3	Design criteria	114
G.4	Resistance.....	116
G.5	Displacement of fasteners	119
Annex H (informative) Material or product properties in EN 1998-1-1		
F.5	Use of this annex	120
F.6	Scope and field of application	120
Bibliography		122

European foreword

This document (FprEN 1998-1-1:2024) 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 is currently submitted to the Formal Vote.

Together with EN 1998-1-2:202x, this document will partially supersede EN 1998-1:2004. 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 main changes compared to the previous edition are listed below:

- Simplification of the national-level global safety choice through seismic action classes
- New reliability-based definition of partial factors
- Homogenisation of Limit States’ definitions across all parts and with improved consistency with EN 1990 (ULS and SLS)
- Unambiguous definition of site classification introducing the depth of the bedrock formation
- Definition of one standard elastic response spectrum instead of two by introducing two parameters in place of a_g
- New definition of ductility classes
- Deepening of the two possible approaches for analysis: force-based or displacement-based; modelling, analysis and associated verifications
- Improved definition of the behaviour factor (decomposed in three components) for the force-based approach
- Introduction of deformation criteria and strength models for the displacement-based approach
- New coverage for structures equipped with anti-seismic devices and dissipative components

The Eurocodes recognise 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 1998 (all parts)

EN 1998 (all parts) defines the rules for the seismic design of new buildings and other structures, as well as temporary ones, including geotechnical aspects.

EN 1998 (all parts) also defines the rules for the seismic assessment and retrofit of existing buildings and other structures.

EN 1998 (all parts) additionally covers the verification of structures in the seismic design situation during construction, when required.

For the design of structures in seismic regions, the provisions of EN 1998 (all parts) are to be applied in conjunction with the relevant provisions of EN 1990 to EN 1997 and EN 1999.

EN 1998 (all parts) applies to structures of consequence classes CC1, CC2 and CC3, as defined in EN 1990. The provisions in the Eurocodes do not entirely cover design rules needed for structures classified as CC4. For these structures, additional provisions to those given in the Eurocodes can be needed.

Given that seismic hazard is characterised by a significant uncertainty, a null seismic risk is not achievable in practice. Therefore, in Eurocode 8, the seismic action is represented in a conventional form, proportional in amplitude to earthquake ground motions likely to occur at a given location and representative of their frequency content. This representation is not the prediction of a particular seismic movement, and such a movement could give rise to more severe effects than those of the seismic action considered, inflicting damage greater than the one described by the Limit States contemplated in EN 1998 (all parts).

In addition, engineering methods are associated with assumptions that cannot be verified when considering the effects of the seismic action, under which structures are assumed to respond in the non-linear regime. Such uncertainties are taken into account according to the general framework of EN 1990, with a residual risk of underestimation of their effects.

EN 1998 is subdivided in various parts:

- EN 1998-1-1 Eurocode 8 — Design of structures for earthquake resistance — Part 1-1: General rules and seismic action
- EN 1998-1-2 Eurocode 8 — Design of structures for earthquake resistance — Part 1-2: Buildings
- EN 1998-2 Eurocode 8 — Design of structures for earthquake resistance — Part 1-2: Bridges
- EN 1998-3 Eurocode 8 — Design of structures for earthquake resistance — Part 3: Assessment and retrofitting of buildings and bridges
- EN 1998-4 Eurocode 8 — Design of structures for earthquake resistance — Part 4: Silos, tanks, pipelines, towers, masts and chimneys
- EN 1998-5 Eurocode 8 — Design of structures for earthquake resistance — Part 5: Geotechnical aspects, foundations, retaining and underground structures

0.3 Introduction to EN 1998-1-1

This document contains general requirements for the earthquake resistant design of all types of structures covered by EN 1998 (all parts), including definition of the seismic action and the description of the methods of analysis and verification.

The definition of the seismic action allows adaptation to a local specific seismic context through Nationally Determined Parameters defined in the National Annex or through a site-specific assessment.

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 EN 1998-1-1

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

The national standard implementing EN 1998-1-1 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 document is to be used.

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