



SLOVENSKI STANDARD
SIST EN 1991-1-6:2005
01-oktober-2005

Evrokod 1: Vplivi na konstrukcije – 1-6. del: Splošni vplivi – Vplivi med gradnjo

Eurocode 1 - Actions on structures Part 1-6: General actions - Actions during execution

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-6 : Allgemeine Einwirkungen -
Einwirkungen während der Bauausführung

Eurocode 1 - Actions sur les structures - Partie 1-6: Actions générales - Actions en cours
d'exécution

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ICS:

91.010.30 V^@ã}ãããã Technical aspects

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English version

Eurocode 1 - Actions on structures Part 1-6: General actions - Actions during execution

Eurocode 1 - Actions sur les structures - Partie 1-6: Actions
générales - Actions en cours d'exécution

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-6 :
Allgemeine Einwirkungen - Einwirkungen während der
Ausführung

This European Standard was approved by CEN on 13 January 2005.

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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Foreword

This European document (EN 1991-1-6), has been prepared by Technical Committee CEN/TC250 "Structural Eurocodes", the Secretariat of which is held by BSI.

This European Standard shall be given the status of national standard, either by publication of an identical text or by endorsement, at the latest by December 2005, and conflicting national standards shall be withdrawn at the latest by March 2010.

CEN/TC250 is responsible for all Structural Eurocodes.

This document will supersede ENV 1991-2-6:1996.

Annexes A1 and A2 are normative and Annex B is informative. This standard includes a Bibliography.

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 the United Kingdom.

Background of 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 harmonized 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 Commission's 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
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

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 1998	Eurocode 8:	Design of structures for earthquake resistance
EN 1999	Eurocode 9:	Design of aluminium structures

Eurocode standards recognize the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at the 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 recognize 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 harmonized 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 harmonized 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 a 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.

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, etc), 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.

² According to Article 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 hENs and ETAGs/ETAs.

³ According to Article 12 of the CPD the interpretative documents shall :

- give concrete form to the essential requirements by harmonizing 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 harmonized 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.

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

There is a need for consistency between the harmonized 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 shall clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific to EN 1991-1-6

EN 1991-1-6 describes Principles and Application rules for the determination of actions to be considered during execution of buildings and civil engineering works, including the following aspects :

- actions on structural and non-structural members during handling;
- geotechnical actions ;
- actions due to prestressing effects ;
- pre-deformations ;
- temperature, shrinkage, hydration effects ;
- wind actions ;
- snow loads ;
- actions caused by water ;
- actions due to atmospheric icing ;
- construction loads ;
- accidental actions
- seismic actions;

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EN 1991-1-6 is intended for use by:

- clients (e.g. for the formulation of their specific requirements),
- designers and constructors,
- relevant authorities.

EN 1991-1-6 is intended to be used with EN 1990, the other parts of EN 1991 and EN 1992 to EN 1999 for the design of structures.

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

National annex

This part of EN1991 gives alternative procedures, values and recommendations for classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1991-1-6 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.

National choice is allowed in EN 1991-1-6 through clauses:

Clause	Item
1.1(3)	Design rules for auxiliary construction works
2 (4)	Positioning of construction loads classified as free
3.1(1)P	Design situation corresponding to storm conditions
3.1(5) NOTE 1	Return periods for the determination of the characteristic values of variable actions during execution
NOTE 2	Minimum wind speed during execution
3.1(7)	Rules for the combination of snow loads and wind actions with construction loads
3.1(8) NOTE 1	Rules concerning imperfections in the geometry of the structure
3.3(2)	Criteria associated with serviceability limit states during execution
3.3(6)	Serviceability requirements for auxiliary construction works
4.9(6) NOTE 2	Loads and water levels for floating ice
4.10(1)P	Definition of actions due to atmospheric icing
4.11.1(1) Table 4.1	Recommended characteristic values of construction loads Q_{ca} , Q_{cb} and Q_{cc}
4.11.2(1)	Construction loads during the casting of concrete
4.12(1)P	Dynamic effects due to accidental actions
NOTE 2	
4.12(2)	Dynamic effects due to falls of equipment
4.12 (3)	Design values of human impact loads
4.13(2)	Seismic actions
Annex A1	Representative values of the variable actions due to construction loads
A1.1(1)	
Annex A1	Characteristic values of equivalent horizontal forces
A1.3(2)	
Annex A2	Design values of vertical deflections for the incremental launching of bridges.
A2.3(1)	
Annex A2	Reduction of the characteristic value of snow loads
A2.4(2)	
Annex A2	Reduced values of characteristic snow loads for the verification of static equilibrium
A2.4(3)	
Annex A2	Design values of horizontal friction forces
A2.5(2)	
Annex A2	Determination of friction coefficients μ_{min} and μ_{max}
A2.5(3)	

Section 1 General

1.1 Scope

(1) EN 1991-1-6 provides principles and general rules for the determination of actions which should be taken into account during the execution of buildings and civil engineering works.

NOTE 1 This part of EN 1991 may be used as guidance for the determination of actions to be taken into account for different types of construction works, including structural alterations such as refurbishment and/or partial or full demolition. Further rules and guidance is given in Annexes A1, A2 and B.

NOTE 2 Rules concerning the safety of people in and around the construction site are out of the scope of this European standard. Such rules may be defined for the individual project.

(2) The following subjects are dealt with in this part of EN 1991.

Section 1 : General

Section 2 : Classification of actions

Section 3: Design situations and limit states

Section 4 : Representation of actions

Annex A1 : Supplementary rules for buildings (normative)

Annex A2 : Supplementary rules for bridges (normative)

Annex B : Actions on structures during alteration, reconstruction or demolition (informative)

(3) EN 1991-1-6 also gives rules for the determination of actions which may be used for the design of auxiliary construction works as defined in 1.5, needed for the execution of buildings and civil engineering works.

NOTE Design rules for auxiliary construction works may be defined in the National Annex or for the individual project. Guidance may be found in the relevant European standards. For example, design rules for formworks and falseworks are given in EN 12812.

1.2 Normative references

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 publications 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 or in NOTES to normative clauses.

EN 1990	Eurocode : Basis of structural design
EN 1991-1-1	Eurocode 1: Actions on structures Part 1-1: Densities, self-weight, imposed loads for buildings
EN 1991-1-2	Eurocode 1: Actions on structures Part 1-2: Fire actions
EN 1991-1-3	Eurocode 1: Actions on structures Part 1-3: General actions: Snow loads
EN 1991-1-4	Eurocode 1: Actions on structures Part 1-4: General actions: Wind actions
EN 1991-1-5	Eurocode 1: Actions on structures Part 1-5: General actions: Thermal actions
EN 1991-1-7	Eurocode 1: Actions on structures Part 1-7: Accidental actions
EN 1991-2	Eurocode 1: Actions on structures Part 2: Traffic loads on bridges

EN 1991-3	Eurocode 1: Actions on structures Part 3: Actions induced by cranes and machinery
EN 1991-4	Eurocode 1: Actions on structures Part 4: 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	Eurocode 7: Geotechnical design
EN 1998	Eurocode 8: Design of structures for earthquake resistance
EN 1999	Eurocode 9: Design of aluminium structures

1.3 Assumptions

(1)P The general assumptions given in EN 1990:2002, 1.3 apply.

1.4 Distinction between Principles and Application rules

(1)P The rules in EN 1990:2002, 1.4 apply.

1.5 Terms and definitions

1.5.1 General

(1) The terms and definitions given in EN 1990:2002, 1.5 apply.

1.5.2 Additional terms and definitions specific to this standard

1.5.2.1

auxiliary construction works

any works associated with the construction processes that are not required after use when the related execution activities are completed and they can be removed (e.g. falsework, scaffolding, propping systems, cofferdam, bracing, launching nose)

NOTE Completed structures for temporary use (e.g. a bridge for temporarily diverted traffic) are not regarded as auxiliary construction works.

1.5.2.2

construction load

load that can be present due to execution activities, but is not present when the execution activities are completed.

1.5.2.3

general scour depth

is the scour depth due to river flow, independently of the presence of an obstacle (scour depth depends on the flood magnitude)

1.5.2.4

local scour depth

is the scour depth due to water vortices next to an obstacle such as a bridge pier.

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1.6 Symbols

For the purpose of this European standard, the following symbols apply (see also EN 1990).

Latin upper case letters

A_{deb}	area of obstruction (accumulation of debris)
F_{deb}	horizontal forces exerted by accumulation of debris
$F_{cb,k}$	characteristic values of concentrated construction loads Q_{cb}
F_{hn}	nominal horizontal forces
F_{wa}	horizontal forces due to currents on immersed obstacles
Q_c	Construction loads (general symbol)
Q_{ca}	construction loads due to working personnel, staff and visitors, possibly with hand tools or other small site equipment
Q_{cb}	construction loads due to storage of moveable items (e.g. building and construction materials, precast elements, and equipment)
Q_{cc}	construction loads due to non permanent equipment in position for use during execution, either static (e.g. formwork panels, scaffolding, falsework, machinery, containers) or during movement (e.g. travelling forms, launching girders and nose, counterweights)
Q_{cd}	construction loads due to moveable heavy machinery and equipment, usually wheeled or tracked (e.g. cranes, lifts, vehicles, lifttrucks, power installations, jacks, heavy control devices)
Q_{ce}	construction loads from accumulation of waste materials (e.g. surplus construction materials, excavated soil or demolition materials)
Q_{cf}	construction loads from parts of a structure in temporary states (under execution) before the final design actions take effect
Q_w	wind actions
Q_{wa}	actions caused by water

Latin lower case letters

b	width of an immersed object
c_{pe}	external wind pressure coefficients for free-standing walls
h	water depth
k	shape factor for an immersed object
k_{deb}	debris density parameter