SLOVENSKI STANDARD
oSIST prEN 1991-1-7:2023

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Nadomešča:
SIST EN 1991-1-7:2006

Evrokod 1: Vplivi na konstrukcije -1-7. del: Nezgodni vplivi

Eurocode 1 - Actions on structures - Part 1-7: Accidental actions

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-7: Außergewöhnliche Einwirkungen

Eurocode 1 - Actions sur les structures - Partie 1-7: Actions accidentelles

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ICS:

91.010.30	Tehnični vidiki	Technical aspects

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1991-1-7

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ICS 91.010.30

English Version

Eurocode 1 - Actions on structures - Part 1-7: Accidental actions

Eurocode 1 - Actions sur les structures - Partie 1-7: Actions accidentelles

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-7: Außergewöhnliche Einwirkungen

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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Contents

Page

European foreword

This document (prEN 1991-1-7:2023) 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 CEN Enquiry.

This document will supersede EN 1991-1-7:2006.

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.

In comparison with the previous edition, the following technical modifications have been made:

a) Transferring design strategies for robustness and related rules to EN 1990;

b) providing consistency between text and technical information on impact;

c) limiting the scope of Annex A to rules and actions for tying systems and key members; and

d) inserting technical clarifications in Annex C.

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 structure

— 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 1991 (all parts)

(1) EN 1991 (all parts) specifies actions for the structural and geotechnical design of buildings, bridges and other civil engineering works, including temporary structures, in conjunction with EN 1990 and the other Eurocodes.

(2) EN 1991 (all parts) does not cover seismic design. Provisions for structures in seismic regions are given in EN 1998.

(3) EN 1991 (all parts) is also applicable to existing structures for:

— structural assessment,

— strengthening or repair,

— change of use.

NOTE In these cases, additional or amended provisions are necessary.

(4) EN 1991 (all parts) is also applicable for the design of structures where materials or actions outside the scope of the other Eurocodes are involved.

NOTE In this case, additional or amended provisions are necessary.

(5) EN 1991 is subdivided in various parts:

EN 1991-1-1, *Eurocode 1 — Actions on structures — Part 1-1: Specific weight of materials, self-weight of construction works and imposed loads for buildings*

EN 1991-1-2, *Eurocode 1 — Actions on structures — Part 1-2: Actions on structures exposed to fire*

EN 1991-1-3, *Eurocode 1 — Actions on structures — Part 1-3: Snow Loads*

EN 1991-1-4, *Eurocode 1 — Actions on structures — Part 1-4: Wind Actions*

EN 1991-1-5, *Eurocode 1 — Actions on structures — Part 1-5: Thermal Actions*

EN 1991-1-6, *Eurocode 1 — Actions on structures — Part 1-6: Actions during execution*

EN 1991-1-7, *Eurocode 1 — Actions on structures — Part 1-7: Accidental actions*

EN 1991-1-8, *Eurocode 1 — Actions on structures — Part 1-8: Actions from waves and currents on coastal structures*

EN 1991-1-9, *Eurocode 1 — Actions on structures — Part 1-9: Atmospheric icing*

EN 1991-2, *Eurocode 1 — Actions on structures — Part 2: Traffic loads on bridges and other civil engineering works*

EN 1991-3, *Eurocode 1 — Actions on structures — Part 3: Actions induced by cranes and machines*

EN 1991-4, *Eurocode 1 — Actions on structures — Part 4: Silos and tanks*

0.3 Introduction to prEN 1991-1-7

prEN 1991-1-7 describes principles and application rules for the determination of accidental actions on buildings and other civil engineering works. The following actions are included:

— impact forces from vehicles, rail traffic, ships and helicopters;

— actions due to internal explosions of combustible gases and dust as well as of vapour-air-mixture; and

— actions for tying systems and key members.

NOTE Other Eurocodes can cover specific accidental actions.

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 1991-1-7

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 1991-1-7 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.

The National choice is allowed in prEN 1991-1-7 through the following clauses:

4.1(2)	4.2(1)	4.3(1) – 2 choices	4.3(2)
5.1(1) – 2 choices	5.2(2)	5.3(3)	5.4.1(1) – 3 choices
5.4.1(2) – 2 choices	5.4.1(3)	5.4.2(2) – 2 choices	5.4.2(3)
5.4.2(5)	5.5(2)	5.6.1(1)	5.6.2.2(1) – 2 choices
5.6.2.3(1)	5.6.2.4(1)	5.6.2.4(2)	5.6.2.4(3)
5.6.2.4(4)	5.6.2.4(5)	5.6.2.4(6)	5.6.2.5(1)
5.6.3(1)	5.6.3(3)	5.7.1(3)	5.7.1(5)
5.7.2(1)	5.7.2(2) – 2 choices	5.7.2(5)	5.7.2(6)
5.7.2(7) – 2 choices	5.7.3(1)	5.7.3(2)	5.7.3(3)
5.7.3(4)	5.7.3(5) – 2 choices	5.7.3(6) – 2 choices	5.8(2)
6.3.1(1)	A.1(1)	A.3.1(4)	A.3.2(3)
A.3.2(4)	A.3.3(1)	A.4.3(1) – 2 choices	A.5(1)
B.1(1)	C.1(1)	D.1(1)	D.6(3)
E.1(1)			

National choice is allowed in prEN 1991-1-7 on the application of the following informative annexes:

Annex A	Annex B	Annex C	Annex D

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

1 Scope

1.1 Scope of prEN 1991-1-7

(1) prEN 1991-1-7 provides actions and rules for safeguarding buildings and other civil engineering works against identifiable accidental actions.

NOTE 1 Identifiable accidental actions include impact from vehicles and internal explosions.

NOTE 2 Rules on impact from vehicles travelling on a bridge deck are given in prEN 1991-2.

(2) prEN 1991-1-7 also covers actions and rules for tying systems and key members; information on risk assessment; dynamic design for impact; actions for internal explosions; actions from debris.

1.2 Assumptions

(1) The general assumptions of EN 1990 apply to prEN 1991-1-7.

(2) prEN 1991-1-7 is intended to be used in conjunction with EN 1990, EN 1991 (all parts) and the other Eurocode parts for the design of structures.

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.

EN 1990:2023, *Eurocode — Basis of structural and geotechnical design*

EN 1991 (all parts), *Eurocode 1 — Actions on structures*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in EN 1990 and the following terms, definitions and symbols apply.

NOTE Other specific symbols, especially treated in informative annexes, are given within the text.

3.1 Terms and definitions

3.1.1 General terms relevant to accidental actions

3.1.1.1
burning velocity
velocity of flame propagation relative to that of the unburned dust, gas or vapour that is ahead of the flame front

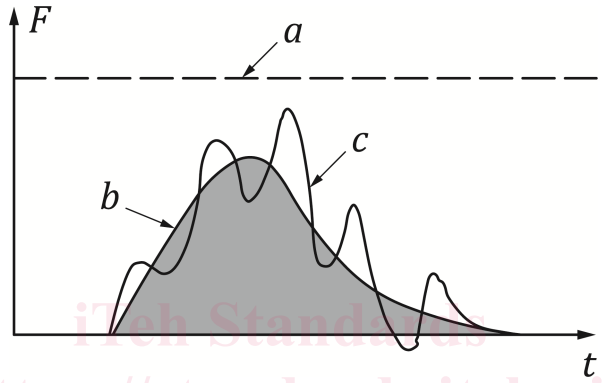
3.1.1.2
consequence class
categorization of the consequences of structural failure in terms of loss of human lives or personal injury and of economic, social, or environmental losses

[SOURCE: EN 1990:2023, 3.1.2.33]

3.1.1.3
deflagration
propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium

3.1.1.4
detonation
propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium

3.1.1.5
dynamic force
force that varies in time and which has the potential to cause significant dynamic effects on the structure; in the case of impact, the dynamic force represents the force with an associated contact area at the point of impact (see Figure 1.1)



Key
a equivalent static force
b dynamic force
c structural response

Figure 1.1 — Dynamic force

3.1.1.6
equivalent static force
alternative representation for a dynamic force including the dynamic response of the structure (see Figure 1.1)

3.1.1.7
flame speed
speed of a flame front relative to a fixed reference point

3.1.1.8
flammable limit
minimum or maximum concentration of a combustible material in a homogeneous mixture with a gaseous oxidizer that will propagate a flame

3.1.1.9
impacting object
object impacting upon a structure (e.g. vehicle, ship, etc.) during an accidental action

3.1.1.10
key member
structural member upon which the stability of the remainder of the structure depends

3.1.1.11
load-bearing wall construction
non-framed masonry cross-wall construction mainly supporting vertical loading, including lightweight panel construction comprising timber or steel vertical studs at close centres with particle board, expanded metal or alternative sheathing

3.1.1.12
localized failure
part of a structure that is assumed to have collapsed, or been severely disabled, by an event

3.1.1.13
risk
measure of the combination (usually the product) of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence

3.1.1.14
robustness
ability of a structure to withstand events like impact, explosions, fire or the consequences of human error, without being damaged to an extent disproportionate to the original cause

3.1.1.15
substructure
part of a building structure that supports the superstructure

Note 1 to entry: In the case of buildings, this usually relates to the foundations and other construction work below ground level. In the case of bridges, this usually relates to foundations, abutments, piers and columns, etc.

3.1.1.16
superstructure
part of a building structure that is supported by the substructure

Note 1 to entry: In the case of buildings this usually relates to the above ground construction. In the case of bridges this usually relates to the bridge deck.

3.1.1.17
venting panel
non-structural part of the enclosure (wall, floor, ceiling) with limited resistance that is intended to relieve the developing pressure from deflagration in order to reduce pressure on structural parts of the building

3.1.1.18
explosion
rapid chemical reaction of dust, gas or vapour in the air, leading to high temperatures and high overpressures, and whose pressures propagate as waves

3.1.2 Specific terms relevant to Annex B

3.1.2.1
consequence
possible result of an (in risk analysis usually unwanted) event

Note 1 to entry: Consequences can be verbally or numerically expressed in terms of loss of life, injury, economic loss, environmental damage, disruption to users and the public, etc. Both immediate consequences and those that arise after a certain time has elapsed are to be included.

3.1.2.2
hazard scenario
critical situation at a particular time consisting of a leading hazard together with one or more accompanying conditions which leads to an unwanted event (e.g. complete collapse of the structure)

3.1.2.4
risk acceptance criteria
acceptable limits for probabilities of certain consequences of an undesired event, expressed in terms of annual frequencies

Note 1 to entry: These criteria are normally determined at national level to reflect the level of risk considered to be acceptable to people and society.

3.1.2.5
risk analysis
systematic approach for describing and/or calculating risk

Note 1 to entry: Risk analysis involves the identification of undesired events, and the causes, likelihoods and consequences of these events.

3.1.2.6
risk evaluation
comparison of the results of a risk analysis with the acceptance criteria for risk and other decision criteria

3.1.2.7
risk management
systematic measures undertaken by an organization in order to attain and maintain a level of safety that complies with defined objectives

3.1.2.8
undesired event
event or condition that can cause loss of life, injury, economic loss, environmental damage, disruption to users and the public, etc.

3.2 Symbols

3.2.1 Latin upper-case letters

C	force term for helicopter impact
F	collision force
F_{dx}	horizontal equivalent static or dynamic design force (frontal force, usually in the direction of the normal travel)
F_{dy}	horizontal equivalent static or dynamic design force (lateral force, usually perpendicular to the direction of the normal travel)
F_{max}	maximum pressure developed in a contained deflagration of an optimum mixture
F_R	frictional impact force
W	sum of the net weight and hoisting load of a loaded forklift truck

3.2.2 Latin lower-case letters

a	height of the application area of a collision force
b	width of the application area of a collision force
b_{Pier}	width of bridge pier
d	distance from the structural member to the centre line of the road or track
h	height of (resulting) collision force
h_0	clearance between the road surface and the underside of the bridge deck, below which an impact on the superstructure needs to be taken into account without any reduction
h_1	clearance between the road surface and the underside of the bridge deck, above which no impact needs to be considered
ℓ	ship length
r_F	reduction factor
s	distance from structural member to the point where the vehicle leaves the trafficked lane
m	mass
x	direction of (normal) travel or track
y	direction perpendicular of (normal) travel or track
v	velocity (i.e. v_0 is an initial moving velocity)

3.2.3 Greek lower-case letters

α	inclination angle
Δh	difference between h_1 and h_0
μ	friction coefficient