SLOVENSKI STANDARD
oSIST prEN 1996-3:2021

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Evrokod 6: Projektiranje zidanih konstrukcij - 3. del: Poenostavljene računske metode za nearmirane zidane konstrukcije

Eurocode 6 - Design of Masonry structures - Part 3: Simplified calculation methods for unreinforced masonry structures

Eurocode 6 - Bemessung und Konstruktion von Mauerwerksbauten - Teil 3: Vereinfachte Berechnungsmethoden für unbewehrte Mauerwerksbauten

Eurocode 6 - Calcul des ouvrages en maçonnerie - Partie 3: Méthodes de calcul simplifiées pour les ouvrages en maçonnerie non armée

Ta slovenski standard je istoveten z: **prEN 1996-3**

ICS:

91.010.30	Tehnični vidiki	Technical aspects
91.080.30	Zidane konstrukcije	Masonry

oSIST prEN 1996-3:2021 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT prEN 1996-3

September 2021

ICS 91.010.30; 91.080.30

Will supersede EN 1996-3:2006

English Version

Eurocode 6 - Design of Masonry structures - Part 3: Simplified calculation methods for unreinforced masonry structures

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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.

This draft European Standard was established by CEN 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 CEN-CENELEC Management Centre has the same status as the official versions.

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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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European foreword

This document (prEN 1996-3:2021) 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 1996-3:2006, including EN 1996-3:2006/AC:2009.

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 a Mandate M/515 given 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>

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 1996 Eurocode 6

EN 1996 Eurocode 6 standards, applies to the design of building and civil engineering works, or parts thereof, in unreinforced, reinforced, prestressed and confined masonry.

EN 1996 deals only with the requirements for resistance, serviceability and durability of structures. Other requirements, for example, concerning thermal or sound insulation, are not considered.

EN 1996 does not cover the special requirements of seismic design. Provisions related to such requirements are given in EN 1998, which complements, and is consistent with EN 1996.

EN 1996 does not cover numerical values of the actions on building and civil engineering works to be taken into account in the design. They are provided in EN 1991.

0.3 Introduction to prEN 1996-3

This document describes simplified calculation methods to facilitate the design of unreinforced masonry walls based on the principles from EN 1996-1-1.

This document is intended to be used, for direct application, together with EN 1990, EN 1991, EN 1996-1-1, EN 1996-1-2 and EN 1996-2.

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 1996-3

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 this document 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 1996-3 through notes to the following:

4.4.4 (1) 6.2 (1) – 2 choices D.1 (1) D.2 (1)

National choice is allowed in prEN 1996-3 on the application of the informative annexes:

Annex A Annex C Annex D, D.3 (1) – 6 choices Annex D, D.4 (1) – 2 choices

Annex B

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 1996-3

(1) The scope of prEN 1996-1-1 applies also to this this document.

(2) This document provides simplified calculation methods to facilitate the design of the following unreinforced masonry walls, subject to certain conditions of application:

— walls subjected to vertical and wind loads;

— walls subjected to concentrated loads;

— shear walls;

— basement walls subjected to lateral earth pressure and vertical loads;

— walls subjected to lateral loads but not subjected to vertical loads.

NOTE For those types of masonry structures or parts of structures not covered by (2), the design can be based on prEN 1996-1-1.

(3) The rules given in this document are consistent with those given in prEN 1996-1-1, but are more conservative in respect of the conditions and limitations of their use.

(4) The rules given in this document assume that concrete floors are designed according to EN 1992-1-1.

(5) This document applies only to those masonry structures, or parts thereof, that are described in prEN 1996-1-1 and EN 1996-2.

(6) The simplified calculation methods given in this document do not cover the design of double-leaf walls.

(7) The simplified calculation methods given in this document do not cover the design for accidental situations.

1.2 Assumptions

(1) The assumptions of prEN 1990 apply to this document.

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, *Eurocode — Basis of structural and geotechnical design*

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

prEN 1996-1-1:2019, *Eurocode 6 — Design of masonry structures — Part 1-1: General rules for reinforced and unreinforced masonry structures*

EN 1996-2, *Eurocode 6 — Design of masonry structures - Part 2: Design considerations, selection of materials and execution of masonry*

EN 1997-1, *Eurocode 7 — Geotechnical design - Part 1: General rules*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in prEN 1990, prEN 1996-1-1 and the following apply.

3.1 Terms relating to wall types

3.1.1
basement wall
retaining masonry wall constructed partly or fully below ground level

3.2 Symbols

For the purposes of this document, the material-independent symbols given in prEN 1990, the material-dependent symbols given in prEN 1996-1-1 and the following material-dependent symbols apply.

Latin upper case letters

K_e earth pressure coefficient;

$N_{Ed,max}$ design value of the maximum vertical load at mid height of the fill;

$N_{Ed,min}$ design value of the minimum vertical load at mid height of the fill.

Latin lower case letters

c_t constant;

h clear storey height;

h_a average height of the building;

h_e vertical distance between the ground level and the face of the bottom support of the wall;

h_m maximum height of a building allowed with the simplified calculation method;

l length of a wall in the horizontal direction;

l_{bx} plan dimension of a building in the x-direction;

l_{by} plan dimension of a building in the y-direction;

l_{cw} spacing of cross walls or other buttressing elements;

$l_{f,ef}$ effective span of a floor;

$l_{f,i}$ span of floor i;

$l_{f,ix}$ span of floor i perpendicular to the considered wall;

$l_{f,iy}$ span of floor i parallel to the considered wall;

$l_{ref,c}$ reference value for the span of the floor;

$l_{ref,t}$ reference value for the span of the floor;

l_{sx} length of a shear wall orientated in the x-direction;

l_{sy} length of a shear wall orientated in the y-direction;

l_w length of the analysed wall loaded by wind;

t_b bearing length of the floor or roof on the wall;

w_{Ek} characteristic wind load per unit area;

w_{Ed} design wind load per unit area;

Greek upper case letters

Φ_s capacity reduction factor;

Greek lower case letters

α_r is the ratio between the characteristic value of the permanent vertical load in a shear wall and the design value of the resistance $A f_d$ of a shear wall;

β_e constant accounting for uniaxial or biaxial load transfer in basement walls;

ρ_e density of the soil;

ρ_{sn} reduction factor for the effective height obtained from a simplified rule.

4 Basis of design

4.1 General rules

4.1.1 Basic requirements

(1) The design of masonry structures shall be in accordance with the general rules given in prEN 1990 and the specific design provisions for masonry structures given in prEN 1996-1-1.

4.2 Principles of limit state design

(1) For masonry structures, the ultimate limit state and serviceability limit state shall be considered for all aspects of the structure including ancillary components in the masonry according to prEN 1996-1-1.

4.3 Basic variables

4.3.1 Actions

(1) The characteristic values of actions shall be obtained from the relevant parts of EN 1991.

4.3.2 Material, and product properties

(1) Properties of materials and construction products and their geometrical data to be used for design should be those specified in the relevant European Standards (EN), European Technical Specifications (TS) or according to a transparent and reproducible assessment that complies with all the requirements of a European Assessment Document (EAD), unless otherwise indicated in this document.

4.4 Verification by the partial factor method

4.4.1 Design values of actions

(1) Partial factors for actions shall be obtained from prEN 1990.

(2) Design values of indirect actions arising from interacting components of other materials shall be determined using the relevant code and applicable partial safety factors.

(3) For serviceability limit states, imposed deformations should be introduced as estimated (mean) values.

4.4.2 Design values of material properties

(1) The design value for a material property is obtained by dividing its characteristic or declared value by the relevant partial factor for materials, γ_M.

4.4.3 Combination of actions

(1) Combination of actions shall be in accordance with the general rules given in prEN 1990.

4.4.4 Ultimate limit states

(1) The relevant values of the partial factor for materials γ_M shall be specified for the ultimate limit state either for persistent or transient design situations, or for accidental design situations.

NOTE The value of γ_M is given in Table 4.1 (NDP) unless the National Annex gives different values for use in a country.

Table 4.1 (NDP) — Partial factors on materials for masonry buildings

Material Masonry made with:		γ_M
A	Units of Category I, designed mortar [a]	2,0
B	Units of Category I, prescribed mortar [b]	2,2
C	Units of Category II, any mortar [a, b, c]	2,5

[a] Requirements for designed mortars are given in EN 998-2 and EN 1996-2.

[b] Requirements for prescribed mortars are given in EN 998-2 and EN 1996-2.

[c] When the coefficient of variation for Category II units is not greater than 25 %.

5 Materials

5.1 General

(1) The materials used in the masonry walls referred to in this document shall be in accordance with prEN 1996-1-1:2019, Clause 5.

(2) Masonry units should be grouped as Group 1, Group 1S, Group 2, Group 3 or Group 4 according to prEN 1996-1-1:2019, 5.1.2.

NOTE Normally the manufacturer will state the grouping of units in the product declaration.

(3) Annex D provides a simplified method for the determination of material properties. These material properties may be used instead of those given in prEN 1996-1-1.

5.2 Characteristic compressive strength of masonry

(1) The characteristic compressive strength of masonry should be determined according to prEN 1996-1-1:2019, 5.7.1.

5.3 Characteristic flexural strength of masonry

(1) The characteristic flexural strength of masonry should be determined according to prEN 1996-1-1:2019, 5.7.4.

6 Design of unreinforced masonry walls using simplified calculation methods

6.1 General

(1) The overall stability of a building, of which the wall forms a part, should be verified.

NOTE A method for verification of the stability is given in Annex A.

(2) A structure should have shear walls placed in two orthogonal directions. At least in one direction two shear walls not in the same plane should be present. When the eccentricity between the resultant of the wind load and the resulting shear force is smaller than 0,05 times the width of the area loaded by the wind, the torsional effect may be neglected.

(3) The slenderness ratio of a wall h_{ef}/t should not be greater than 27.

(4) The detailing rules according to prEN 1996-1-1:2019, 10.1 and 10.5 should be taken into account.

(5) An analysis of bending moments in the walls may be omitted, because the simplified calculation methods take the effects of wind, earth pressure and floor-wall-interaction into account. If other horizontal loads act on a loadbearing wall or conditions regarding the loads are not fulfilled, the analysis shall be performed as specified in prEN 1996-1-1.

(6) In case of concrete floors, an increase in the eccentricity owing to a change in the position of the axis of a loadbearing wall from storey to storey due to a change in wall thickness may be neglected, if the cross-section of the thinner wall falls in plan within that of the thicker one.

(7) The analysis of free-standing walls shall be performed in accordance with prEN 1996-1-1.

6.2 Conditions for application

(1) For use of the simplified method, the following conditions shall be complied with:

— the height of the building above ground level does not exceed h_m; for buildings with a sloping roof the height h_m shall be determined as average height h_a indicated in Figure 6.1;

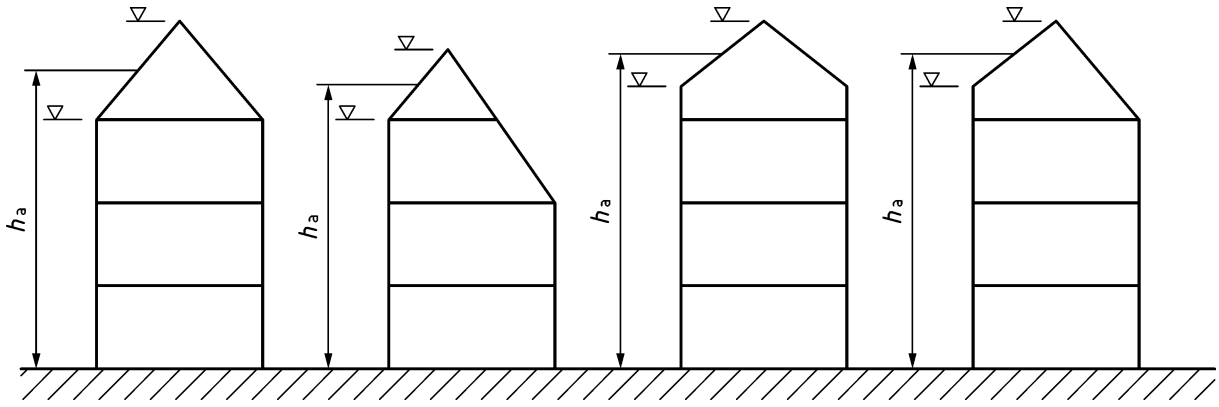

Figure 6.1 — Determination of average height