

# *Geregistreeerde Belgische norm*

**NBN EN 1996-3**

1e uitg., maart 2006

**Normklasse: B 24**

## **Eurocode 6 - Ontwerp en berekening van constructies van metselwerk - Deel 3 : Vereenvoudigde berekeningsmethoden voor niet-gewapende constructies van metselwerk (+ AC:2009)**

Eurocode 6 - Calcul des ouvrages en maçonnerie - Partie 3 : Méthodes de calcul simplifiées pour les ouvrages en maçonnerie non armée (+ AC:2009)

Eurocode 6 - Design of masonry structures - Part 3 : Simplified calculation methods for unreinforced masonry structures (+ AC:2009)

### **Toelating tot publicatie: 28 februari 2006**

Vervangt NBN ENV 1996-3 (1999).

Deze Europese norm EN 1996-3:2006 heeft de status van een Belgische norm.

Deze Europese norm bestaat in drie officiële versies (Duits, Engels, Frans).

Deze norm mag in België slechts samen met zijn Nationale Bijlage (ANB) worden toegepast. Deze laatste legt hoofdzakelijk de waarden van de parameters vast die op nationaal vlak worden bepaald.



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***norme belge  
enregistrée***

**NBN EN 1996-3**

1e éd., mars 2006

**Indice de classement: B 24**

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**Eurocode 6 - Calcul des ouvrages en maçonnerie - Partie 3 : Méthodes de calcul simplifiées pour les ouvrages en maçonnerie non armée (+ AC:2009)**

Eurocode 6 - Ontwerp en berekening van constructies van metselwerk - Deel 3 : Vereenvoudigde berekeningsmethoden voor niet-gewapende constructies van metselwerk (+ AC:2009)

Eurocode 6 - Design of masonry structures - Part 3 : Simplified calculation methods for unreinforced masonry structures (+ AC:2009)

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**Autorisation de publication: 28 février 2006**

Remplace NBN ENV 1996-3 (1999).

La présente norme européenne EN 1996-3:2006 a le statut d'une norme belge.

La présente norme européenne existe en trois versions officielles (allemand, anglais, français).

Cette norme ne peut être utilisée en Belgique qu'en combinaison avec son annexe nationale (ANB) qui fixe principalement la valeur des paramètres à déterminer au niveau national.



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# NATIONAAL VOORWOORD VAN NBN EN 1996-3:2006

1. De norm NBN EN 1996-3:2006 « Eurocode 6 - Ontwerp en berekening van constructies van metselwerk - Deel 3 : Vereenvoudigde berekeningsmethoden voor niet-gewapende constructies van metselwerk » (+AC:2009) omvat de nationale bijlage NBN EN 1996-3 ANB:2012 met een normatief karakter in België. Hij vervangt vanaf de datum van publicatie in het Belgische Staatsblad van de bekrachtiging van de norm NBN EN 1996-3 ANB:2012 de volgende norm:

- NBN ENV 1996-3:1999 «Eurocode 6: Ontwerp van metselwerk - Deel 3 : Vereenvoudigde rekenwijzen en eenvoudige regels voor metselwerk»

Het corrigendum EN 1996-3:2006/AC:2009, zoals door CEN gepubliceerd, is na deze norm toegevoegd.

2. De Nederlandstalige versie van EN 1996-3<sup>1</sup> is tot stand gekomen op basis van een voorkeurterminologie die in samenwerking tussen het NBN en het NEN is opgesteld. Daarbij werd voor elk begrip een unieke woordkeuze gemaakt. Dit heeft als gevolg dat in de norm uitdrukkingen voorkomen die in één van de twee landen minder gebruikelijk zijn. Hierna volgt een lijst met synoniemen:

Oorspronkelijke term (Engels)	Verplichte term (Nederlands)	Synoniem (B); (N)
accidental situation	buitengewone situatie	bijzondere situatie (N) accidentele toestand (B)
aggregate	toeslagmateriaal	granulaat (B)
applied moment	optredend moment	aangrijpend moment (N,B)
civil engineering work	civieltechnisch werk (kunstwerk)	werk van burgerlijke bouwkunde (B)
damp proof course	waterdichte laag	waterdichtheidslaag (B)
diameter	diameter	middellijn (N,B)
jointing	doorstrijken	meegaand voegen (B)
manufactured stone	geprefabriceerde bouwblokken en -stenen van speciaalbeton	kunstbeton (B)
natural stone	natuursteen	breuksteen (B)
note	opmerking	noot (B)
pointing	voegen (als werkwoord)	achter de hand voegen, navoegen (B)
principle	beginsel	principe (B)
relevant	van toepassing	voorkomend (N,B)
second moment of area	kwadratisch oppervlaktemoment	traagheidsmoment (N,B)
serviceability limit state	bruikbaarheidsgrenstoestand	gebruiksgrenstoestand (B)
verification	toetsing	verificatie, controle (N,B)
Thin layer mortar	lijmmortel	Het begrip 'lijmmortel' wordt in deze nationale bijlage gebruikt voor mortels met verbeterde aanhechtingseigenschappen aan het metselwerkelement. Hierdoor worden de waarden voor $f_{xk1}$ en $f_{xk2}$ van bijlage D.2 van deze nationale bijlage minstens voldaan. De dikte van de mortellaag moet voldoen aan de voorschriften van de mortelfabrikant.

<sup>1</sup> In voorbereiding

**NBN EN 1996-3 ANB (2012)**

**2bis.** De Europese normen (EN) waarnaar de tekst van deze norm met hun Engelse titel verwijst, dragen in België de volgende Nederlandstalige titels:

<b>vermelde norm (CEN)</b>	<b>Belgische norm (NBN)</b>	<b>Nederlandstalige titel bij het NBN</b>
EN 206-1	NBN EN 206-1	Beton – Deel 1: Specificatie, eigenschappen, vervaardiging en conformiteit
EN 771-1	NBN EN 771-1	Voorschriften voor metselstenen – Deel 1: Metselbaksteen
EN 771-2	NBN EN 771-2	Voorschriften voor metselstenen – Deel 2: Metselstenen van kalkzandsteen
EN 771-3	NBN EN 771-3	Voorschriften voor metselstenen – Deel 3: Betonmetselstenen (gewone en lichte granulaten)
EN 771-4	NBN EN 771-4	Voorschriften voor metselstenen – Deel 4: Geautoclaveerde cellenbetonmetselstenen
EN 771-5	NBN EN 771-5	Voorschriften voor metselstenen – Deel 5: Metselstenen van kunststeen
EN 771-6	NBN EN 771-6	Voorschriften voor metselstenen – Deel 6: Metselstenen van natuursteen
EN 772-1	NBN EN 772-1	Metselsteenproeven - Deel 1: Bepalen van de druksterkte
EN 845-1	NBN EN 845-1	Voorschriften voor metselwerktoebehoren - Deel 1: Spouwankers, muurankers, raveel-/gordingschoenen en ondersteuningsproducten
EN 845-2	NBN EN 845-2	Voorschriften voor metselwerktoebehoren – Deel 2: Lateien
EN 845-3	NBN EN 845-3	Voorschriften voor metselwerktoebehoren – Deel 3: Lintvoegwapening van staal
EN 846-2	NBN EN 846-2	Proeven voor metselwerktoebehoren - Deel 2 : Hechtsterkte van vooraf vervaardigde voegwapeningen
EN 998-1	NBN EN 998-1	Specificaties voor mortels voor metselwerk - Deel 1: Pleistermortel voor binnen- en buitentoepassingen
EN 998-2	NBN EN 998-2	Specificaties voor mortels voor metselwerk – Deel 2: Metselmortel
EN 1015-11	NBN EN 1015-11	Proeven voor metselmortel - Deel 11: Bepalen van de buigsterkte en druksterkte van verharde mortel
EN 1052-1	NBN EN 1052-1	Beproevingmethoden voor metselwerk – Deel 1: Bepaling van de druksterkte
EN 1052-2	NBN EN 1052-2	Beproevingmethoden voor metselwerk – Deel 2: Bepalen van de buigsterkte
EN 1052-3	NBN EN 1052-3	Beproevingmethoden voor metselwerk – Deel 3: Aanvangsschuifsterkte
EN 1052-4	NBN EN 1052-4	Beproevingmethoden voor metselwerk – Deel 4: Schuifsterkte met inbegrip van de waterkerende laag
EN 1052-5	NBN EN 1052-5	Beproevingmethoden voor metselwerk – Deel 5: Bepaling van de hechtsterkte met de hefboomproef
EN 1990	NBN EN 1990	Eurocode – Grondslagen van het constructief ontwerp
EN 1991:series	NBN EN 1991:reeks	Eurocode 1 – Belastingen op constructies
EN 1992:series	NBN EN 1992:reeks	Eurocode 2 – Ontwerp en berekening van betonconstructies
EN 1993:series	NBN EN 1993:reeks	Eurocode 3 – Ontwerp en berekening van staalconstructies
EN 1994:series	NBN EN 1994:reeks	Eurocode 4 – Ontwerp en berekening van staal-betonconstructies
EN 1995:series	NBN EN 1995:reeks	Eurocode 5 – Ontwerp en berekening van houtconstructies
EN 1996: series	NBN EN 1996: reeks	Eurocode 6 – Ontwerp en berekening van constructies van metselwerk
EN 1997:series	NBN EN 1997:reeks	Eurocode 7 – Geotechnisch ontwerp
EN 1998: series	NBN EN 1998: reeks	Eurocode 8 – Ontwerp en berekening voor aardbevingsbestendige constructies

EN 1999:series	NBN EN 1999:reeks	Eurocode 9 – Ontwerp en berekening van aluminiumconstructies
EN 10080*	NBN EN 10080	Staal voor het wapenen van beton - Lasbaar betonstaal - Algemeen
prEN 10138	-	-
EN ISO 1461	NBN EN-ISO 1461	Door thermisch verzinken aangebrachte deklagen op ijzeren en stalen voorwerpen – Specificaties

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Nationale voetnoot: De referenties van deze geharmoniseerde Europese norm zijn gepubliceerd in OJEU C 319 (d.d. 2005-12-14). In OJEU C 134 (d.d. 2006-06-08) is de volgende mededeling gedaan: "Conform Artikel 5.1 van de Richtlijn 89/106/EEG van de Raad, heeft de Europese Commissie een procedure geïnitieerd teneinde de referenties naar deze norm uit de publicatie af te voeren."

# AVANT-PROPOS NATIONAL À LA NBN EN 1996-3:2006

1. La norme NBN EN 1996-3:2006 « Eurocode 6 - Calcul des ouvrages en maçonnerie - Partie 3 : Méthodes de calcul simplifiées pour les ouvrages en maçonnerie non armée » (+AC:2009) comprend l'annexe nationale NBN EN 1996-3 ANB:2012 qui a un caractère normatif en Belgique. Elle remplace à partir de la date de publication de l'homologation de la norme au Moniteur Belge la norme suivante :
  - NBN ENV 1996-3:1999 «Eurocode 6: Calcul des structures en maçonnerie - Partie 3 : Méthodes de calcul simplifiées»
2. Le corrigendum EN 1996-3:2006/AC:2009, tel que publié par le CEN, est joint à cette norme.
3. La version de langue française de l'EN 1996-3 a été rédigée en France par l'AFNOR. En conséquence, on y rencontre certaines expressions d'usage moins courant en Belgique.

Une liste de termes équivalents est donnée ci-après :

Termes de l'EN 1996-3	Termes équivalents en Belgique
Client	le maître de l'ouvrage assisté de ses bureaux d'architectes, d'ingénierie et de consultance
Mortier de joint mince	Mortier - colle : La terminologie 'mortier-colle' utilisée dans cette annexe nationale est utilisée pour les mortiers qui présentent des caractéristiques améliorées en matière d'adhérence à l'élément de maçonnerie considéré telles que les valeurs de $f_{xk1}$ et $f_{xk2}$ de l'Annexe D.2 de cette annexe nationale sont au minimum vérifiées. L'épaisseur de mortier à mettre en œuvre est conforme aux prescriptions du fabricant de mortier.
Poteau	Colonne

4. Note complémentaire du NBN : les corrections éditoriales suivantes sont à apporter à la version française de la NBN EN 1996-3:2006 :

Origine	Paragraphe	Texte à corriger	Nouveau texte
EN 1996-3	4.2.1.2 formule 4.1a	$N_{Ed} \leq ktb f_d$	$N_{Ed} \leq k_G t b f_d$
	4.2.2.4 (iii)	$?_3 = 1,5 \frac{l}{h} \leq 0,75$	$\rho_3 = 1,5 \frac{l}{h} \leq 0,75$
	4.2.2.4 (iv)	$?_4 = \frac{l}{2h} \leq 0,75$	$\rho_4 = \frac{l}{2h} \leq 0,75$

English Version

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

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

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

This European Standard was approved by CEN on 24 November 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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## **Foreword**

This European Standard EN 1996-3 has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI.

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 July 2006, and conflicting national standards shall be withdrawn at the latest by March 2010.

CEN/TC 250 is responsible for all Structural Eurocodes.

This document supersedes ENV 1996-3:1999

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and 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 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 agreement<sup>1</sup> between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to the 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:

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<sup>1</sup> 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 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*.

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 Documents<sup>2</sup> referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards<sup>3</sup>. Therefore, technical aspects arising from the

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<sup>2</sup> 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 harmonised ENs and ETAGs/ETAs.

<sup>3</sup> According to Article 12 of the CPD the interpretative documents shall:

- a) 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;
- b) 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.;

**EN 1996-3:2006 (E)**

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.

**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 (informative).

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

and 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 works<sup>4</sup>. 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.

This European Standard is part of EN 1996 which comprises the following parts:

Part 1-1: General *rules for reinforced and unreinforced masonry*.

c) 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.

<sup>4</sup> 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.

Part 1-2: General rules - *Structural fire design*.

Part 2: *Design considerations, selection of materials and execution of masonry*.

Part 3: *Simplified calculation methods for unreinforced masonry structures*.

EN 1996-1-1 describes the principles and requirements for safety, serviceability and durability of masonry structures. It is based on the limit state concept used in conjunction with a partial factor method. This EN 1996-3 describes simplified calculation methods to facilitate the design of unreinforced masonry walls based on the principles from EN 1996-1-1.

For the design of new structures, EN 1996 is intended to be used, for direct application, together with ENs 1990, 1991, 1992, 1993, 1994, 1995, 1997, 1998 and 1999.

EN 1996-3 is intended for use by:

- committees drafting standards for structural design and related product, testing and execution standards;
- clients (e.g. for the formulation of their specific requirements on reliability levels and durability);
- designers and contractors;
- relevant authorities.

### **National Annex for EN 1996-3**

This standard gives some symbols for which a National value needs to be given, with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1996-3 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 1996-3 through clauses:

- 2.3 (2)P Verification by the partial factor method
- 4.1 (P) Verification of the overall stability of a building
- 4.2.1.1 (1)P General conditions
- 4.2.2.3 (1) Capacity reduction factor
- D.1 (1) Characteristic compressive strength
- D.2 (1) Characteristic flexural strength
- D.3 (1) Characteristic initial shear strength.

## EN 1996-3:2006 (E)

### 1 General

#### 1.1 Scope Part 3 of Eurocode 6

(1)P The scope of Eurocode 6 for Masonry Structures as given in 1.1.1 of EN 1996-1-1:2005 applies also to this EN 1996-3.

NOTE: Eurocode 6 deals only with the requirements for resistance, serviceability and durability of structures. Other requirements are not considered. Eurocode 6 does not cover the special requirements of seismic design.

(2)P EN 1996-3 provides simplified calculation methods to facilitate the design of the following unreinforced masonry walls, subject to certain conditions of application:

- walls subjected to vertical loading and wind loading;
- 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.

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

(4) For those types of masonry structure or parts of structures not covered by (1), the design shall be based on EN 1996-1-1.

(5) This EN 1996-3 applies only to those masonry structures, or parts thereof, that are described in EN 1996-1-1 and EN 1996-2.

(6) The simplified calculation methods given in this EN 1996-3 do not cover the design for accidental situations.

#### 1.2 Normative references

(1)P The references in 1.2 of EN 1996-1-1:2005 apply to this EN 1996-3.

#### 1.3 Assumptions

(1)P The assumptions given in 1.3 of EN 1990:2002 apply to this EN 1996-3.

#### 1.4 Distinction between Principles and Application Rules

(1)P The rules of 1.4 of EN 1990:2002 apply to this EN 1996-3.