
Geregistreeerde Belgische norm

NBN EN 1990

1e uitg., juli 2002

Normklasse: B 03

Eurocode - Grondslagen van het constructief ontwerp

Eurocodes structuraux - Eurocodes : Bases de calcul des structures

Eurocode - Basis of structural design

Toelating tot publicatie: 28 juni 2002

Vervangt NBN ENV 1991-1 (2002), NBN B 03-001 (1988).

Deze Europese norm EN 1990 : 2002 heeft de status van een Belgische norm.

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

Er is bij het NBN ook een Nederlandstalige versie beschikbaar, die dezelfde status heeft als de officiële versies.

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.

ICS: 91.010.30

***norme belge
enregistrée***

NBN EN 1990

1e éd., juillet 2002

Indice de classement: B 03

Eurocodes structuraux - Eurocodes : Bases de calcul des structures

Eurocode - Grondslagen van het constructief ontwerp

Eurocode - Basis of structural design

Autorisation de publication: 28 juin 2002

Remplace NBN ENV 1991-1 (2002).

La présente norme européenne EN 1990 : 2002 a le statut d'une norme belge.

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

Une version en néerlandais, ayant le même statut que les versions officielles, est également disponible au NBN.

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 de NBN EN 1990:2002

1. De norm NBN EN 1990:2002 « Eurocode - Grondslagen van het constructief ontwerp » wordt aangevuld door de nationale bijlage NBN EN 1990 ANB:2021 die een normatief karakter in België heeft.

Hij vervangt vanaf 1 januari 2006 (1^{ste} uitgave) de volgende normen:

- NBN B 03-001:1988 «Grondslagen voor de beoordeling van de veiligheid en de bruikbaarheid van draagsystemen»;
- NBN ENV 1991-1:2002 «Eurocode 1 – Grondslag voor ontwerp en belastingen op draagsystemen - Deel 1: Grondslag voor ontwerp samen met Belgisch toepassingsrichtlijn (gehomologeerde versie + NAD)».

Hij vervangt, vanaf 11 januari 2013 (tweede uitgave), de volgende normen:

- NBN EN 1990 ANB:2007 « Eurocode 0 – Grondslagen van het constructief ontwerp - Bijlage A.1: Toepassing op gebouwen – Nationale bijlage » (1^{ste} uitgave, bekrachtigd op 19/05/2008);
- (voor de delen over bruggen) NBN ENV 1991-1:2002 «Eurocode 1 – Grondslag voor ontwerp en belastingen op draagsystemen - Deel 1: Grondslag voor ontwerp samen met Belgisch toepassingsrichtlijn (gehomologeerde versie + NAD)»;
- (gedeeltelijk) NBN ENV 1991-3:2002 «Eurocode 1 – Grondslag voor ontwerp en belasting op draagsystemen - Deel 3: Verkeersbelasting op bruggen samen met Belgisch toepassingsrichtlijn (gehomologeerde versie + NAD) ».

Hij vervangt, vanaf de datum van de publicatie van de bekrachtiging van deze nieuwe uitgave in het Belgisch Staatsblad, de volgende norm:

NBN EN 1990 ANB:2013 « Eurocode 0 – Grondslag voor het constructief ontwerp - Nationale bijlage » (2^{de} uitgave, bekrachtigd op 11/01/2013)

Om volledig te zijn moet deze norm het volgende omvatten:

- het amendement nr. 1, gepubliceerd als NBN EN 1990/A1:2006, waarin de bijlage A2 met betrekking tot bruggen is verwerkt,
- het corrigendum NBN EN 1990:2002/A1:2005/AC:2010.

2. De eerste uitgave van deze norm NBN EN 1990:2002 omvatte, in de reeks van bijzondere bijlagen voor de verschillende toepassingen, enkel de nationale bijlage met betrekking tot bijlage A1 «Toepassing op gebouwen».

De tweede uitgave omvat ook de nationale bijlage met betrekking tot bijlage A2 «Toepassing op bruggen» (die werd gepubliceerd onder de vorm van amendement 1 van de EN 1990 NBN EN 1990/A1:2006).

De andere bijlagen zullen later worden gepubliceerd door het CEN en dan door het NBN:

- toepassing op torens, masten en schoorstenen;
- toepassing op silo's en opslagtanks;
- toepassing op kraanbanen en machines;
- toepassing op palen en damwanden.

3. De Nederlandstalige versie van EN 1990 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 design situation	buitengewone ontwerpsituatie	bijzondere ontwerptoestand, buitengewone ontwerptoestand
action-effect	belastingseffect, snedegrootheid	(aangrijpende) snedekracht
civil engineering	civiele techniek	burgerlijke bouwkunde (B)
construction work	bouwwerk	werk (B)
effects of actions	belastingseffecten	belastingsuitwerkingen (B)
Ψ factor	Ψ -factor	(in het Frans: "coefficient Ψ ")
hazard	bedreiging, dreiging	gevaarlijk ongewoon voorval (N)
leading action	overheersende belasting	dominante belasting (N); hoofdbelasting (B)
partial factor	partiële factor	(in het Frans: "coefficient partiel")
permanent action, value, combination, load	blijvende belasting, waarde, combinatie, belasting	permanente belasting, waarde, combinatie, belasting (N)
persistent design situation	blijvende ontwerpsituatie	permanente ontwerptoestand, blijvende ontwerptoestand
quasi-permanent combination	quasi-blijvende combinatie	quasi-permanente combinatie (N)
quasi-permanent value	quasi-blijvende waarde	quasi-permanente waarde
resistance	weerstand	capaciteit, sterkte (N)
road bridge	wegverkeersbrug	verkeersbrug (N); wegbrug (B)
seismic design situation	seismische ontwerpsituatie	seismische ontwerptoestand
serviceability limit state	bruikbaarheidsgrenstoestand	gebruiksgrenstoestand (B)
transient design situation	tijdelijke ontwerpsituatie	tijdelijke ontwerptoestand
verification	toetsing	verificatie, controle

3bis. De Europese normen (EN) waarnaar de tekst van deze norm met hun Engelse titel verwijst, dragen in België de volgende Nederlandstalige titels:

Vermelde norm met Engelse titel	Nederlandstalige titel (NBN)
EN 1991 Eurocode 1: Actions on structures (serie)	NBN EN 1991 Eurocode 1: Belastingen op constructies (reeks)
EN 1992 Eurocode 2: Design of concrete structures (serie)	NBN EN 1992 Eurocode 2: Ontwerp en berekening van betonconstructies (reeks)
EN 1993 Design of steel structures (serie)	NBN EN 1993 Eurocode 3: Ontwerp en berekening van staalconstructies (reeks)
EN 1994 Design of composite steel and concrete structures (serie)	NBN EN 1994 Eurocode 4: Ontwerp en berekening van staal-betonconstructies (reeks)
EN 1995 Design of timber structures (serie)	NBN EN 1995 Eurocode 5: Ontwerp en berekening van houtconstructies (reeks)
EN 1996 Design of masonry structures (serie)	NBN EN 1996 Eurocode 6: Ontwerp en berekening van constructies van metselwerk (reeks)
EN 1997 Geotechnical design (serie)	NBN EN 1997 Eurocode 7: Geotechnisch ontwerp (reeks)
EN 1998 Design of structures for earthquake resistance (serie)	NBN EN 1998 Eurocode 8: Ontwerp en berekening van aardbevingsbestendige constructies (reeks)
EN 1999 Design of aluminium structures (serie)	NBN EN 1999 Eurocode 9: Ontwerp en berekening van aluminiumconstructies
ISO 2394 General principles on reliability for structures	NBN ISO 2394 Algemene beginselen voor de betrouwbaarheid van draagsystemen
ISO 2631:1997 Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration	-
ISO 3898 Bases for design of structures - Notations - General symbols	NBN ISO 3898 Grondslagen voor het ontwerpen van draagsystemen - Notaties - Algemene symbolen
ISO 6707-1 Building and civil engineering - Vocabulary - Part 1: General terms	NBN ISO 6707-1 Bouwwezen - Woordenlijst - Deel 1: Algemene begrippen
ISO 8402 Quality management and quality assurance – Vocabulary	NBN EN ISO 8402 Kwaliteitszorg en kwaliteitsborging – Termen en definities
ISO 8930 General principles on reliability for structures - List of equivalent terms	NBN ISO 8930 Algemene beginselen voor de betrouwbaarheid van draagsystemen - Lijst van gelijkwaardige termen
EN ISO 9001:2000 Quality management systems – Requirements (ISO 9001:2000)	NBN EN ISO 9001:2000 Kwaliteitsmanagementsystemen – Eisen (ISO 9001:2000)
ISO 10137 Bases for design of structures – Serviceability of buildings against vibrations	NBN ISO 10137 Grondslagen voor het ontwerp van draagsystemen - Bruikbaarheid van gebouwen bij trillingen

Avant-propos national à l'EN 1990:2002

1. La norme européenne NBN EN 1990:2002 « Eurocode 0 - Bases de calcul des structures » est complétée par l'annexe nationale NBN EN 1990 ANB:2021 qui a un caractère normatif en Belgique.

Elle remplace, à partir du 1^{er} janvier 2006 (1^{ère} édition), les normes suivantes :

- NBN B 03-001:1988 « Principes généraux de détermination de la sécurité et de l'aptitude au service des structures » ;
- NBN ENV 1991-1:2002 « Eurocode 1 - Bases du calcul et actions sur les structures - Partie 1 : Bases du calcul y compris le document d'application belge (version homologuée + DAN) » .

Elle remplace, à partir du 11 janvier 2013 (2^{ème} édition), les normes suivantes :

- NBN EN 1990 ANB:2007 « Eurocode 0 - Bases de calcul des structures - Annexe A.1 : Application pour les bâtiments - Annexe nationale » (1^{re} édition, homologuée le 19/05/2008) ;
- (pour les parties ponts) NBN ENV 1991-1:2002 «Eurocode 1 - Bases du calcul et actions sur les structures – Partie 1: Bases du calcul, y compris le document d'application belge (version homologuée + DAN)» ;
- (en partie) NBN ENV 1991-3:2002 «Eurocode 1 - Bases du calcul et actions sur les structures - Partie 3 : Charges sur les ponts dues au trafic, y compris le document d'application belge (version homologuée + DAN) ».

Elle remplace, à partir de la date de publication de l'homologation de cette nouvelle édition dans le Moniteur Belge, la norme suivante :

NBN EN 1990 ANB:2013 « Eurocode 0 – Bases de calcul des structures - Annexe Nationale » (2^{ème} édition, homologuée le 11/01/2013).

Pour être complète, cette norme doit contenir :

- l'amendement n°1, publié comme NBN EN 1990/A1:2006, reprenant l'annexe A2 relative aux ponts,
- le corrigendum NBN EN 1990:2002/A1:2005/AC:2010.

2. La première édition de la présente norme NBN EN 1990:2002 comprenait, dans la série des annexes particulières aux différentes applications, uniquement l'annexe nationale relative à l'annexe A1 «Application aux bâtiments». La seconde édition comprend aussi l'annexe nationale relative à l'annexe A2 «Applications aux ponts» (publiée sous la forme de l'amendement 1 à l'EN 1990 NBN EN 1990/A1:2006).

Les autres annexes seront publiées ultérieurement par le CEN puis par le NBN:

- application pour les tours, mâts et cheminées ;
- application pour les silos et citernes ;
- application pour les ponts roulants et la machinerie ;
- application pour les pieux et palplanches.

3. La version de langue française de l'EN 1990 a été rédigée en France par l'AFNOR. En conséquence, on y rencontre certaines expressions d'usage moins courant en Belgique.

Une liste des synonymes est donnée ci-après :

Termes de l'EN 1990	Synonymes
analyse client	calcul le maître de l'ouvrage assisté de ses bureaux d'architectes, d'ingénierie et de consultance
coefficient ψ	on notera que le texte néerlandais (comme le texte anglais) utilise l'expression <i>ψ-factor</i>
coefficient partiel	on notera que le texte néerlandais (comme le texte anglais) utilise l'expression <i>partielle factor / partial factor</i>
poteau	colonne

4. Note complémentaire du NBN : les corrections éditoriales suivantes restent à apporter à la version française de l'EN 1990 d'avril 2002.

- Page 12 : définition 1.5.2.5 "...au niveau de la structure ou de son exposition, comprenant le feu, l'explosion, les chocs ou la défaillance locale.";
- Page 20 « u =...structurel » et « w =...structurel » par « u =...structural » et « w =...structural »
- Page 27 : 3.3 (1)P au lieu de P(1);
- Page 51 : indice $G_{j,inf}$ au lieu de $G_{,inf}$ dans la dernière phrase de la Note 2 au Tableau A1.2 (A);
- Page 53 : Tableau A1.3 , il manque des virgules en indice à $\psi_{1,1}$, $\psi_{2,1}$ et $Q_{k,1}$ et la lettre A de A_d ne doit pas être en gras;
- Page 79 : équation D.1: lire V_X au lieu de VX et m_x au lieu de mx;
- Page 80 : en-dessous du Tableau D.1, Note 2: l'équation donnant m_y manque :

$$m_y = (1/n) \sum \ln(x_i);$$
- Page 83 : supprimer "à" dans la phrase du D.8.2.2.4 (4).

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1990

April 2002

ICS 91.010.30

Supersedes ENV 1991-1:1994

English version

Eurocode - Basis of structural design

Eurocodes structuraux - Eurocodes: Bases de calcul des structures

Eurocode: Grundlagen der Tragwerksplanung

This European Standard was approved by CEN on 29 November 2001.

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 Management Centre 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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Foreword

This document (EN 1990:2002) 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 October 2002, and conflicting national standards shall be withdrawn at the latest by March 2010.

This document supersedes ENV 1991-1:1994.

CEN/TC 250 is responsible for all Structural Eurocodes.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, 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 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 1980's.

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).

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 1990:2002 (E)

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
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 Documents² referred to in Article 12 of the CPD, although they are of a different nature from harmonised 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.

² According to Art. 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.

³ According to Art. 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. ;
- 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.

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 Eurocode⁴.

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 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 1990

EN 1990 describes the Principles and requirements for safety, serviceability and durability of structures. It is based on the limit state concept used in conjunction with a partial factor method.

For the design of new structures, EN 1990 is intended to be used, for direct application, together with Eurocodes EN 1991 to 1999.

EN 1990 also gives guidelines for the aspects of structural reliability relating to safety, serviceability and durability :

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

EN 1990:2002 (E)

- for design cases not covered by EN 1991 to EN 1999 (other actions, structures not treated, other materials) ;
- to serve as a reference document for other CEN TCs concerning structural matters.

EN 1990 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 constructors ;
- relevant authorities.

EN 1990 may be used, when relevant, as a guidance document for the design of structures outside the scope of the Eurocodes EN 1991 to EN 1999, for :

- assessing other actions and their combinations ;
- modelling material and structural behaviour ;
- assessing numerical values of the reliability format.

Numerical values for partial factors and other reliability parameters are recommended as basic values that provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management applies. When EN 1990 is used as a base document by other CEN/TCs the same values need to be taken.

National annex for EN 1990

This standard 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 1990 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 1990 through :

- A1.1(1)
- A1.2.1(1)
- A1.2.2 (Table A1.1)
- A1.3.1(1) (Tables A1.2(A) to (C))
- A1.3.1(5)
- A1.3.2 (Table A1.3)
- A1.4.2(2)

Section 1 General

1.1 Scope

(1) EN 1990 establishes Principles and requirements for the safety, serviceability and durability of structures, describes the basis for their design and verification and gives guidelines for related aspects of structural reliability.

(2) EN 1990 is intended to be used in conjunction with EN 1991 to EN 1999 for the structural design of buildings and civil engineering works, including geotechnical aspects, structural fire design, situations involving earthquakes, execution and temporary structures.

NOTE For the design of special construction works (*e.g.* nuclear installations, dams, etc.), other provisions than those in EN 1990 to EN 1999 might be necessary.

(3) EN 1990 is applicable for the design of structures where other materials or other actions outside the scope of EN 1991 to EN 1999 are involved.

(4) EN 1990 is applicable for the structural appraisal of existing construction, in developing the design of repairs and alterations or in assessing changes of use.

NOTE Additional or amended provisions might be necessary where appropriate.

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 publication 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 :

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