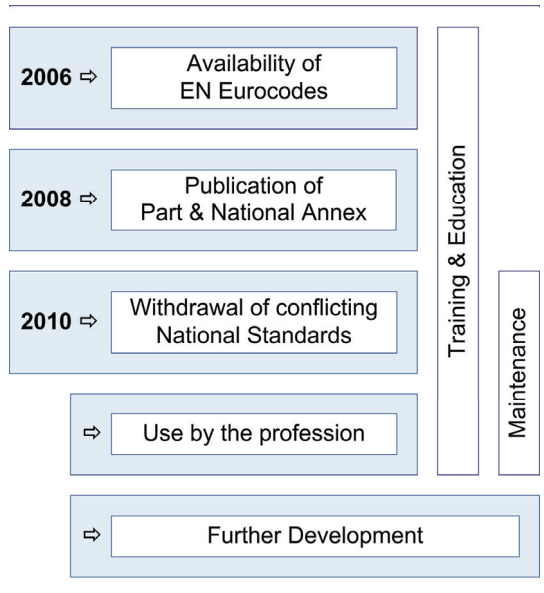




# B1

## THE EUROCODES: IMPLEMENTATION AND USE



This booklet was produced by the JRC in the framework of  
the Administrative Arrangement  
between  
the Enterprise and Industry Directorate General (DG ENTR)  
and  
the Joint Research Centre (JRC)  
regarding support to the implementation, harmonization and further development  
of the Eurocodes

Information contained in this booklet does not necessarily  
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JRC 42745

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for more information:

Guidance Paper L – Application and use of Eurocodes, European Commission, Enterprise  
Directorate-General

Eurocodes – Building the future	<a href="http://eurocodes.jrc.ec.europa.eu">http://eurocodes.jrc.ec.europa.eu</a>
DG ENTR, Construction Sector	<a href="http://ec.europa.eu/enterprise/construction/index_en.htm">http://ec.europa.eu/enterprise/construction/index_en.htm</a>
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# 1. THE EUROCODES

## 1.1. Why the Eurocodes were developed?

The objective of the European Commission is for “*the Eurocodes to establish a set of common technical rules for the design of buildings and civil engineering works which will ultimately replace the differing rules in the various Member States*”.

## 1.2. What are the Eurocodes?

The Eurocodes are a set of European Standards (EN) for the design of buildings and other civil engineering works and construction products, produced by the Comité Européen de Normalisation (CEN). They embody National experience and research output together with the expertise of CEN Technical Committee 250 (CEN/TC250) and of International Technical and Scientific Organisations and represent a world-class standard for structural design.

Publication of the Eurocodes was completed in 2007. Following CEN rules, the Eurocodes can be used in parallel with National Standards until 2010, when all conflicting National Standards will be withdrawn.

The Eurocodes cover in a comprehensive manner all principal construction materials (concrete, steel, timber, masonry and aluminium), all major fields of structural engineering (basis of structural design, loading, fire, geotechnics, earthquake, etc.) and a wide range of types of structures and products (buildings, bridges, towers and masts, silos, etc).

The verification procedure in the Eurocodes is based on the limit state concept used in conjunction with partial safety factors. The Eurocodes allow also for design based on probabilistic methods as well as for design assisted by testing, and provide guidance for the use of these methods.

## 1.3. The Eurocodes suite

The Eurocodes suite is made up by 10 European Standards for structural design.

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

*The EN Eurocodes*

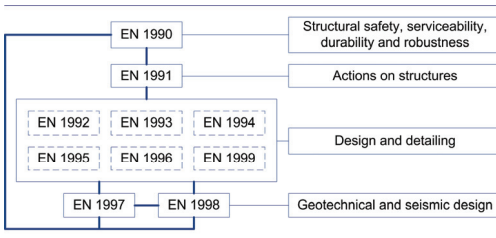
*A European Standard (EN) is published by one of the European Standards Organisations, i.e. CEN, CENELEC and ETSI, and must be adopted as an identical national standard by the National Standards Bodies.*

*CEN is a technical organisation composed of 29 National Members that vote for and implement European Standards, 8 Associate Members and two Counsellors.*

*Each Eurocode consists of a number of parts that cover types of loading or particular technical aspects, e.g. fire, bridge design, etc., as appropriate.*

## 1.4. The role of EN 1990: Eurocode – Basis of structural design

EN 1990: Eurocode – Basis of structural design was the first Eurocode to be published in 2002. It is the first operational material-independent design code and provides the principles and requirements for safety, serviceability, durability and robustness of structures. It also gives the values of factors to establish the relevant combinations of actions.



### Links between the Eurocodes

EN 1990: Eurocode – Basis of structural design provides the material-independent information required for the design of buildings and other civil engineering works for the Eurocodes suite. For the design of buildings and other civil engineering works, every Eurocode Part, from EN 1991: Eurocode 1 – Actions on structures and the design Eurocodes EN 1992 to EN 1999, has to be used together with EN 1990.

## 2. EUROPEAN LEGISLATION FOR CONSTRUCTION WORKS AND PRODUCTS

### 2.1. The Construction Products Directive

The Construction Products Directive (Council Directive 89/106/EEC) is one of over 20 New Approach Directives whose aim is to breakdown artificial barriers to trade throughout the European Union and is intended for products placed on the market.

According to the Construction Products Directive, construction products suitable for construction works need to satisfy the following six essential requirements as appropriate:

- o mechanical resistance and stability
- o safety in case of a fire
- o hygiene, health and the environment
- o safety in use
- o protection against noise
- o energy economy and heat retention

The first and parts of the second and fourth Essential Requirements are applicable to the Eurocodes.

*A Directive is a legally binding document as to the result to be achieved, but leaves it to the National Authorities to decide how these objectives are to be incorporated into their legal system.*

*The New Approach to technical harmonisation moves from detailed technical requirements to essential requirements for products.*

## 2.2. European Standards and European Technical Approvals

The European standardisation and certification system related to construction works and products involves a number of stakeholders, namely the European Commission, Member States, CEN, National Standards Bodies, the European Organisation for Technical Approvals and Industry.

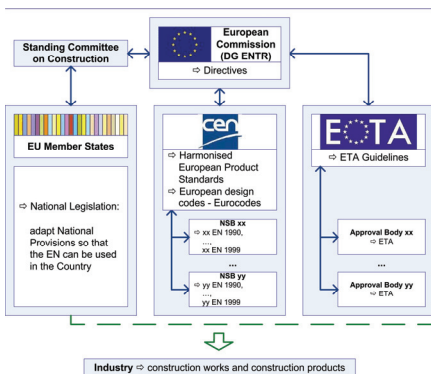
The deliverables of the European standardisation system related to construction include standards for construction products (including execution and test standards), as well as a set of European Technical Approvals and the design Eurocodes.

Member States, Industry and other interested parties may identify the need for a new standard and forward a request to the European Commission.

The European Commission, after consultation with the Standing Committee on Construction, may issue a mandate to CEN for the development of European Standards concerning products that are covered by the Construction Products Directive.

National Standards Bodies must adopt and implement the European Standards produced by CEN. Member States may need to adapt their National Legislation in order to allow the use of the European Standards in their country.

For innovative products that are too early in their life to be covered by a standard, a European Technical Approval (ETA) may be issued according to guidelines given in the Construction Products Directive. ETAs are issued by the members of the European Organisation for Technical Approvals (EOTA), following a mandate of the European Commission, after consultation with the Standing Committee on Construction. EOTA comprises the Approval Bodies designated by EU Member States and European Free Trade Association States who have contracted to the European Economic Area Agreement.



*Construction products may be structural materials and constituent products, as well as prefabricated structural components and kits consisting of structural components.*

*A European Technical Approval (ETA) is a favourable technical assessment of the fitness for use of a product for an intended use.*

*The Standing Committee on Construction is made up of representatives appointed by the Member States and chaired by a representative of the Commission.*

*The European Free Trade Association (EFTA) is an intergovernmental organisation for the promotion of free trade and economic integration to benefit its four Member States: Iceland, Liechtenstein, Norway and Switzerland.*

*The European Economic Area (EEA) unites the EU Member States, Iceland, Liechtenstein and Norway into an internal market, where goods, services, capitals and persons move freely.*

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The Construction Products Directive is based on four elements:

1. A harmonized system of technical specifications which are harmonised European Standards (hENs) and European Technical Approvals (ETAs).
2. The European Organisation for Technical Approvals (EOTA), which coordinates all activities relating to ETAs and ETA Guidelines. There are two possibilities for ETAs to be based on:
  - European Technical Approval Guidelines (ETAGs) relate to a number of separate manufacturers in several countries of the EU
  - Common Understanding of Assessment Procedures (CUAPs) relate to a single manufacturer
3. An agreed system of attestation of conformity for each product family which may involve a third party to assess conformity. The choice of the system of attestation depends upon the consequences of failure of the product and the product characteristics.
4. CE Marking of construction products, based on the provisions of the technical specifications for a product. CE Marking follows the successful approval of a product and symbolises the conformity of the product with the applicable Community requirements imposed on the manufacturer and is mandatory for products covered by a Directive. A product bearing the CE Marking may freely circulate within the European Economic Area.

### 2.3. The Eurocodes and EU Legislation

The Eurocodes serve as reference documents recognised by authorities of the Member States of the EU and the European Free Trade Association for the following purposes:

- as a means of compliance of building and civil engineering works with the Essential Requirements set out in the Construction Products Directive (Council Directive 89/106/EEC), particularly Essential Requirement 1: Mechanical resistance and stability, part of Essential Requirement 2: Safety in case of fire and Essential Requirement 4: Safety in use.
- as a basis for specifying contracts for public construction and related engineering-service contracts. This relates to the Directive on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (Directive 2004/18/EC of the European Parliament and of the Council).
- as a framework for drawing up harmonised European Standards (hENs) and European Technical Approvals (ETAs) for construction products.

The Eurocodes offer a presumption of conformity with the essential requirements of the Construction Products Directive.

*An ETA Guideline (ETAG) is a binding document that aims to establish how Approval Bodies should evaluate the specific characteristics and requirements of a product.*



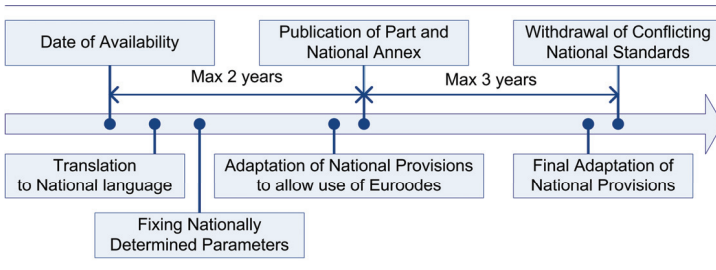
*The European Commission recommends the Member States to adopt the Eurocodes for designing construction works and to refer to them in their provisions on structural construction products (Commission Recommendation of 11 December 2003).*

## 3. IMPLEMENTATION OF THE EUROCODES

### 3.1. Timeline

When an EN Eurocode Part is made available by CEN (Date of Availability), National Authorities and National Standards Bodies should:

- translate the Eurocode Part in authorised national languages
- set the Nationally Determined Parameters to be applied on their territory
- publish the National Standard transposing the EN Eurocode Part and the National Annex
- adapt their National Provisions so that the EN Eurocode Part can be used on their territory
- promote training on the Eurocodes



#### *National implementation of EN Eurocode Part*

The implementation of an EN Eurocode Part has three phases:

**Translation period** (max 1 year). The National Standards Bodies may start the translation of a Eurocode Part in authorised national languages at the latest at the Date of Availability.

**National Calibration period** (max 2 years). The Member States should fix the Nationally Determined Parameters. At the end of this period, the national version of the EN Eurocode Part with the National Annex will be published by the National Standards Bodies. Also, the Member States should adapt the National Provisions so that the Eurocode Part can be used on their territory.

**Coexistence period.** During the coexistence period, which starts at the end of the National Calibration period, the Eurocode Part can be used, just as the presently existing national system can also be used. The coexistence period of a Eurocode Package will last up to a maximum time of three years after the national publication of the last Part of a Package. Member States shall make sure that all the Parts of the related Package can be used without ambiguity on their territory by adapting their National Provisions as necessary.

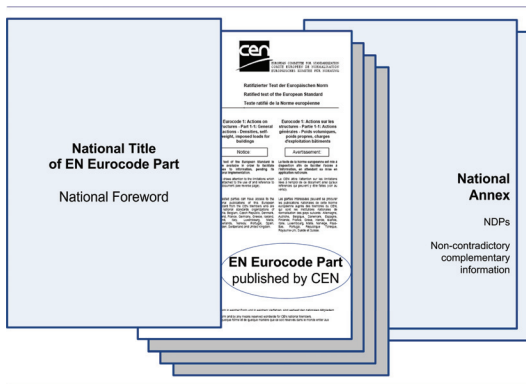
Thus, all conflicting National Standards in a Package should be withdrawn a maximum of 5 years after the Date of Availability of the last available Part in the Package.

*The Nationally Determined Parameters (NDPs) account for possible differences in geographical or climatic conditions, or in ways of life, as well as different levels of protection that may prevail at national, regional or local level.*

*Package is a group of Eurocode Parts that are needed for a particular design (e.g. building, bridge, silo, tank or pipeline).*

### 3.2. National Standards

The National Standard transposing the EN Eurocode Part, when published by a National Standards Body, will be composed of the EN Eurocode text preceded by the National Title page and by the National Foreword and generally followed by the National Annex. The National Standards Bodies should normally publish the National Annex, on behalf of and with the agreement of the competent National Authorities.



#### *National publication of EN Eurocode Part*

The National Annex may contain directly, or by reference to specific provisions, information on the Nationally Determined Parameters to be used for the design of buildings and other civil engineering works to be constructed in the country concerned. It may also contain decisions on the application of informative annexes and reference to non-contradictory complementary information.

A National Annex is not necessary if a Eurocode Part contains no choice open for Nationally Determined Parameters, or if a Eurocode Part is not relevant for the Member State (e.g. EN 1998 for seismic design for some countries).

The National Annex may be attached to the body of the corresponding Eurocode Part. It has also to be kept accessible separately from the body of the Eurocode Part.

*Non-contradictory complementary information aims to assist the user to apply the Eurocode, e.g. by explanation of a clause, perhaps in comparison with existing national rules.*



### 3.3. Nationally Determined Parameters

Eurocodes “recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to safety matters at national level where these continue to vary from State to State”.

National choice is provided by the Eurocodes with sets of recommended values, classes, symbols and alternative methods to be used as Nationally Determined Parameters (NDPs).

The Nationally Determined Parameters account for possible differences in geographical or climatic conditions, or in ways of life, as well as different levels of protection that may prevail at national, regional or local level.

When Member States select their NDPs, they should as appropriate:

- choose from the classes included in the Eurocodes
- use the recommended value, or choose a value within the recommended range of values, where the Eurocodes make a recommendation
- when alternative methods are given, use the recommended method, where the Eurocodes make a recommendation
- take into account the need for coherence of the NDPs laid down for the different EN Eurocodes and the various Parts thereof

When the Eurocodes are used for the design of construction works, or parts thereof, the NDPs of the Member State on whose territory the works are located shall be applied.

### 3.4. Training

In order to achieve an adequate application of the Eurocodes, Member States, National Standards Bodies, Technical and Scientific Organisations and the construction industry must be ready to use them. To this end, extensive continuing training is required.

Three levels of training is recommended depending on the audience, as follows:

- Level 1 deals with the policy of Eurocodes implementation, National Annexes, co-existence with National Codes, the Eurocodes system, etc., aimed at National Authorities, National Standards Bodies and senior personnel in the companies.
- Level 2 comprises introductory courses to each individual Eurocode.
- Level 3 comprehensively describes design examples of a number of typical structures using a particular Eurocode Package.

*The European Commission urges the Member States to use the recommended values of the NDPs provided by the Eurocodes, unless geographical, geological or climatic conditions or specific levels of protection make that necessary (Commission Recommendation of 11 December 2003).*

*The European Commission urges the Member States to “promote instruction in the use of the Eurocodes, especially in engineering schools and as part of continuous professional development courses for engineers and technicians” (Commission Recommendation of 11 December 2003).*

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Guidance to competent authorities and the profession is generally available at national level through:

- education, both by means of continuing training and within universities
- websites
- published information on the implementation procedures
- designer handbooks and manuals
- training and design software

In order to assure consistency between Member States and to facilitate the transfer of knowledge between Eurocodes writers (CEN/TC250) and potential national trainers (building officials, industry, scientific community, technical organisations, etc.), the Commission is supporting the writing and publication of informative material on the Eurocodes (leaflets and booklets) and will organise a number of training/awareness seminars in collaboration with CEN/TC250, Member States and interested industry.

The web site <http://eurocodes.jrc.ec.europa.eu> serves as a platform for the dissemination of training and informative material, along with information on training events both at National and European level.

## **4. MAINTENANCE AND EVOLUTION OF THE EUROCODES**

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CEN is responsible for maintenance of the Eurocodes and has developed an appropriate strategy for revision and updating.

Maintenance activities deal with:

- processing comments from the users
- correction of errors
- technical amendments
- editorial improvements
- resolution of questions of interpretation
- elimination of inconsistencies and misleading statements.

In response to the needs of Industry and the users, a period of stability is foreseen.

The European Commission in the Recommendation of 11 December 2003 advised the Member States to:

- select the NDPs for their territory using the recommended values given in the Eurocodes, unless divergence is essential
- reduce divergence after comparing the NDPs and assessing the impact on any technical differences
- promote instruction on the use of the Eurocodes
- undertake collaborative research relating to the Eurocodes so as to integrate scientific and technical developments, as well as to ensure an ongoing increased level of protection, specifically as regards the resistance to earthquakes and fire.

Further development of the Eurocodes will also follow CEN rules.

## 5. BENEFITS AND OPPORTUNITIES OF USING THE EUROCODES

The intended benefits and opportunities arising from the implementation and use of the Eurocodes are to:

- lead to a more uniform level of constructions safety and performance in the different European regions
- provide common design criteria and methods to fulfil the specified requirements for mechanical resistance, stability and resistance to fire, including aspects of durability and economy
- provide a common understanding between owners, operators and users, designers, contractors and manufacturers
- facilitate the exchange of construction services
- facilitate the marketing and use of structural components and kits
- facilitate the marketing and use of materials and products
- allow the preparation of common design aids and software
- increase the competitiveness of the European civil engineering firms, contractors, designers and product manufacturers in their world-wide activities
- provide a common basis for research and development
- lead to a more uniform level of safety in construction in Europe

The Eurocodes support the Commission's Single Market policy on free movement of people, goods and services related to construction.

Further to economy, the Single Market benefits citizens and business alike.

### **Economic benefits**

- In its first ten years of existence the Single Market created 2.5 million jobs and 877 billion euros of extra prosperity<sup>1</sup>.
- The Single Market has enhanced the ability of EU firms to compete in global markets.
- EU exports to third countries have increased from 6.9% of EU GDP in 1992 to 11.2% in 2001<sup>1</sup>.

### **Benefits for citizens/consumers**

- Less bureaucracy for people wishing to work in another EU country.
- Wider range of products, better quality and lower prices.
- More competition in public procurement means better value and higher quality services for the taxpayer.
- Protection from sub-standard products imported from emerging economies.

### **Benefits for business**

- The absence of border bureaucracy has cut delivery times and reduced costs.
- In most cases companies can do business across the EU by complying with the rules in their home Member State.
- New export markets have been opened up to small and medium-sized enterprises.
- Companies are now able to bid for contracts to supply goods and services to public authorities in other Member States.
- Any business in the EU can benefit from the huge potential market that is the European Union: 27 countries with nearly 500 million potential customers.

*Removing the barriers that still prevent citizens and business from fully enjoying the benefits of the Single Market is a key aim of the European Commission.*

<sup>1</sup> [http://ec.europa.eu/internal\\_market/top\\_layer/benefits\\_en.htm](http://ec.europa.eu/internal_market/top_layer/benefits_en.htm)

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