EUROPEAN COMMISSION
ENTERPRISE DIRECTORATE-GENERAL

Single Market : regulatory environment, standardisation and New Approach
Construction

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Eurocodes, a building code for Europe

Implementation and use of Eurocodes in the various Member States in the European Union

1. THE EUROCODES

The Eurocodes will form a set of 56 European standards providing calculation methods to determine the efforts applied to each elements which play a structural role in structures submitted to given actions and to check if the mechanical strength of each element is sufficient to resist to this effort. These calculation methods will be used:

- to design buildings and civil engineering works regardless the type of works or materials used (concrete structures, steel, composite steel/concrete, masonry, timber, aluminium). It also contains specific calculation rules for geotechnical works and rules on earthquake resistance.
- to check the stability and mechanical resistance of structures, including structures submitted to fire,
- to define the dimensions of structural elements,
- to specify the required performance and durability of the product to be incorporated into the structure

2. A LONG ROUTE

Work on elaborating these methods began in the middle of 1970s, on the basis of an initiative taken by experts and industrialists. This initiative has been supported, then undertaken by the European Commission in agreement with the Member States.

In 1984 the European Commission published a series of documents containing an initial version of the calculation methods. This first series of documents was referring to National Codes for many parts of calculation. It corresponded to a first level of harmonisation only.

In 1989, CEN has been contacted, then contracted, to develop these methods and publish them in the form of European standards. A series of 62 "experimental standards" was published between 1992 and 1998. These “experimental standards (ENVs) contained “boxed values”, a series or parameters and safety coefficients let to be fixed by national authorities or designers. They have been supplemented by National Application Documents providing the specific conditions to be applied in each Member States.

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Therefore, an important part of the calculation has been left again under the responsibility of National Authorities, limiting the level of harmonisation introduced by these ENVs. These experimental standards have been used to design some structures as experimental application in some Member States (e.g. United Kingdom, France, Sweden and Belgium). They have been implemented and made compulsory to design bridges in Germany.

The latest stage in drafting the final standards began in 1998, again on the basis of a mandate from the Commission to CEN and is still in progress. This step will allow to delete the "boxed values", therefore to reduce the references to national choices and to reach a higher level of harmonisation. This step is now nearing completion, as six standards of the final series have already been adopted and around 39 are already technically achieved. It is anticipated that the 56 standards should be completed by the end of 2005.

3. THE AIMS OF THE EUROPEAN COMMISSION

The Eurocode will be used:

- For construction works, to design the constitutive elements of structures (buildings and civil engineering works) or to check their mechanical resistance and stability, including safety in case of fire and resistance to seismic actions,

- For structural products, to determine the performance linked to mechanical strength, which will be declared in CE marking according to the Construction Product Directive.

Promoting the elaboration and the implementation of these standards, the European Commission purposes are the following:

- To facilitate the free circulation of services (engineering, design of construction works) in the internal market, providing a common system of reference to prepare the call for tenders and the contracts for the design of works and their execution

- To contribute to the free circulation of structural products, without technical barriers to trade, thanks to the CE marking of the products,

- To facilitate the development of common research efforts undertaken by various actors in the Union and the dissemination of its results, in particular through professional training. This will result in safer building and civil engineering works in Europe.

- To increase the competitiveness of engineering offices and the European enterprises.

4. EUROCODES, A CODE FOR THE DESIGNING OF THE STRUCTURES.

The application of the Eurocodes in the various Member States will remain voluntary. However, as with all other European standards, they should be taken into consideration in public contracts, pursuant to Directive 92/50/CEE (Article 14), Directive 93/37/CEE (Article 10) and Directive 93/38/CEE (Article 18).

But:

- The European Commission clearly wishes that the EN Eurocodes become the recommended European means for the structural design of works in Europe,

- Member States must accept the solutions designed according to EN Eurocodes as complying with ER 1 and aspects of ER 2 in tenders enquiry and public contracts for construction works,

- Member States may also recognize other means (other codes) as being acceptable

It should be noted that the Eurocodes are composed of formulas, which make up the calculation methods as such and, in a number of cases, certain "parameters" which have been identified by symbols indicating that they are left to the discretion of the national authorities. These symbols are called the "Nationally Determined Parameters" (NDP). In choosing appropriate values for these parameters, the Member States will be able to take their specific geographical, geological or climatic conditions into account, as well as the level of protection they wish to achieve or even traditions linked to lifestyle. Some of these symbols will be used, in particular, for the weighting of certain loads (e.g. wind actions or snow loads) or to introduce country-specific safety factors. But, this flexibility is restricted to the parameters identified in the formulas. Furthermore, beside each NDP value, the Eurocode texts contains a "recommended value" which has been proposed by the experts at the European level. The use of such recommended values is recommended by the European Commission, in order to lead the system towards complete harmonisation.

Therefore:

- Member States are competent to determine the level of safety of construction works within their territory, for given intended uses

- In accepting the recommended values given by EN Eurocode for NDPs, or choosing another values for NDPs in National Annexes, they determine the level of safety for given intended uses

- NDPs should provide all the necessary means to regulate works in national regulation, in an harmonized frame.

5. CE MARKING ON STRUCTURAL CONSTRUCTION PRODUCTS

In addition, it will be possible to use the calculation methods (not by test) provided for by the Eurocodes to determine the mechanical resistance of structural products (products contributing to the resistance of structural works, e.g. precast concrete products, structural timber products, structural steel components). These performance values should be declared in the CE marking for these products, pursuant to Directive 89/106/EEC (Construction Products). The standards relating to these structural products, which should refer to the Eurocodes as a supporting standard, are in the process of completion and publication by CEN.

According to Council Directive 89/106/EEC (Construction Products Directive), when the technical specifications will refer to Eurocodes to determine the structural performance

of the products (mechanical strength), Member States will be obliged to authorise the free circulation, placement on their market an free use of these products in their territory even if they have maintained other codes than Eurocodes in force for the design of buildings. They will have to provide the necessary interface with their own codes, if any, to allow the free use of CE marked products in buildings.

6. RECOMMENDATION TO THE MEMBER STATES

Given that some Member States intend to maintain their national calculation codes (Italy and Spain for example), and that many others do not intend to develop rules or will only develop some of them, a legal recommendation of the Commission to the Member States is in preparation.

This recommendation is close to be finalised, and could be published at the beginning of November.

In this recommendation:

- Member States are encouraged to adopt the Eurocodes as single method of design of the construction works in their country,

- Member States are requested to provide their specific choice of Nationally Determined Parameters, if any, to allow designers to made calculations, or to choose recommended values,

- The principle of a comparison of Nationally Determined Parameters is introduced in the recommendation, which will be undertaken in some years. When it will not be justified to maintain specific choices, Member States will be requested to choose the recommended values given by the Eurocodes, or to adopt a common value, in order to harmonise the application of the calculation every where in Europe.

7. FUTURE

Having implemented the Eurocodes, as first generation of standards, the following action will be developed:

- Member States and professional representative bodies will promote the teaching of the Eurocodes in engineering schools and as part of continuous professional development courses for engineers and technicians

- Many designers or industries will develop and distribute softwares based on Eurocodes, which will be used to design buildings and perform calculations

- Member States and Industries are encouraged to undertake researches to facilitate the integration into the Eurocodes of the latest developments in scientific and technological knowledge.

- As the other European standards, Eurocodes will be revised every five years. These revisions will be the occasion to improve their content, taken into account the experience, and to incorporate the results issued from the research. In

addition, during the next years, the technical committee in charge of the elaboration of the Eurocdes, CEN/TC 250, will follow their implementation and use, and will amend or correct them if necessary.

8. CONCLUSION

The benefits which can be expected from the effective implementation of the Eurocodes by the Member States are the following:

- Harmonisation of the market for structural products by making general use of the Eurocodes as the method of determining the structural performance of products, when these are to be determined on the basis of calculations and not of tests.

- A contribution towards harmonising the market in construction engineering and architectural services, in the design of construction works (buildings and civil engineering). The idea is, for example, that a consultancy in one country should be able to link up with a construction company in another country in proposing the construction of civil engineering works in a third country without there being any difficulties in understanding or designing the structure, thanks to the use of a harmonised European design framework, whilst respecting the specific requirements in each Member State arising from geographical and climatic differences and the existing justified level of protection at national, regional or local level.

- Harmonisation of the conditions for designing and verifying structural works through greater transparency regarding the choice of safety factors and prescribed requirements for different construction works in different Member States.

- European citizens are guaranteed a high level of safety in structural works, particularly as regards essential requirement No 1 (mechanical resistance and stability), including aspects relating to essential requirement No 4 (safety in use) and certain aspects of essential requirement No 2 (safety in case of fire).

- The creation of a European framework to promote joint researches in these fields in order to integrate new knowledge or to consolidate and to clarify certain calculation models. This should result in technical progress being made more quickly and thus a higher level of safety in construction work.

The Eurocodes are important for both the civil engineering design sector (construction engineering) and the building and public works industry. Their effective implementation is essential in order to harmonise the construction products market and will make a significant contribution towards harmonising the market in construction engineering and architectural services.

ANNEX

Total of EN Eurocode Parts foreseen: 56 European standards (+ Annexe 2 of EN 1990)

The following table gives the current situation (end of October) of the drafts of EN Eurocode Parts.

Definitive text made available or ratified by CEN/MC: 6	
EN 1990	Basis of Design
EN 1991-1-1	Actions on structures - General actions - Densities, self-weight and imposed loads
EN 1991-1-2	Actions on structures – General actions - Actions on structures exposed to fire
EN 1991-1-3	Actions on structures – General actions - Snow loads
EN 1991-2	Actions on structures – Traffic loads on bridges
EN 1991-1-5	Actions on structures - General actions – Thermal action
Drafts which should be sent for formal vote in the following weeks: 2	
EN 1992-1-1	Design of concrete structures - General - Common rules for building and civil engineering structures
EN 1993-1-1	Design of steel structures - General - Common rules
Draft technically achieved and having been submitted to examination period by Member States and CEN: 32	
EN 1990 – pr Annexe 2	Basis of Design – Annex 2: bridges
EN 1991-1-4	Actions on structures - General actions - Wind actions
EN 1991-1-6	Actions on structures - General actions – Actions during execution
EN 1991-1-7	Actions on structures - General actions – Accidental actions
EN 1991-3	Actions on structures - Actions induced by cranes and machinery
EN 1991-4	Actions on structures – Actions in silo and tanks
EN 1992-1-2	Design of concrete structures - General - Structural fire design
EN 1992-2	Design of concrete structures - Bridges
EN 1993-1-2	Design of steel structures - General - Structural fire design
EN 1993-1-3	Design of steel structures – General – Cold formed thin gauge members and sheeting
EN 1993-1-5	Design of steel structures - General – Strength and stability of planar plated structures without transverse loading
EN 1993-1-8	Design of steel structures - General - Design of joints
EN 1993-1-9	Design of steel structures - General - Fatigue strength
EN 1993-1-10	Design of steel structures - General - Fracture toughness assessment
EN 1993-1-11	Design of steel structures - General – Use of high strength cables
EN 1993-2	Design of steel structures - Bridges
EN 1993-3-1	Design of steel structures – Towers, masts and chimneys – Towers and masts
EN 1993-3-2	Design of steel structures – Towers, masts and chimneys – Chimneys
EN 1994-1-1	Design of composite steel and concrete structures - General – Common rules and rules for buildings
EN 1994-1-2	Design of composite steel and concrete structures - General – Structural fire design
EN 1994-2	Design of composite steel and concrete structures - Bridges
EN 1995-1-1	Design of timber structures - General - Common rules and rules for buildings
EN 1995-1-2	Design of timber structures - General - Structural fire design
EN 1995-2	Design of timber structures - Bridges
EN 1996-1-1	Design of masonry structures – General – Rules for reinforced and unreinforced masonry
EN 1996-2	Design of masonry structures – Selection and execution of masonry
EN 1996-3	Design of masonry structures – Simplified calculation methods and simple rules for masonry structures

EN 1997-1	Geotechnical design - General rules
EN 1998-1	Design provisions for earthquake resistance of structures – General rules, seismic actions and rules for buildings
EN 1998-2	Design provisions for earthquake resistance of structure - Bridges
EN 1998-3	Design provisions for earthquake resistance of structure –Strengthening and repair of buildings
EN 1998-5	Design provisions for earthquake resistance of structures – Foundations, retaining structures and geotechnical aspects
EN 1998-6	Design provisions for earthquake resistance of structures – Towers, masts and chimneys
First drafts established by groups of experts: 7	
EN 1993-1-4	Design of steel structures – General – Structures in stainless steels
EN 1993-5	Design of steel structures – Piling
EN 1996-1-2	Design of masonry structures – General – Structural fire design
EN 1997-2	Geotechnical design – Ground investigation and testing
EN 1998-4	Design provisions for earthquake resistance of structures – Silos, tanks and pipelines
EN 1999-1-1	Design of aluminium alloy structures – General – Common rules
EN 1999-1-2	Design of aluminium alloy structures – General – Structural design
First Project in preparation: 10	
EN 1992-3	Design of concrete structures – Liquid retaining and containment structures
EN 1993-1-6	Design of steel structures – General – Strength and stability of shell structures
EN 1993-1-7	Design of steel structures – General – Strength of planar plated structures loaded transversely
EN 1993-4-1	Design of steel structures – Silos, tanks and pipelines - Silos
EN 1993-4-2	Design of steel structures – Silos, tanks and pipelines – Tanks
EN 1993-4-3	Design of steel structures – Silos, tanks and pipelines - Pipelines
EN 1993-6	Design of steel structures – Crane supporting structures
EN 1999-1-3	Design of aluminium alloy structures – Additional rules for structures susceptible to fatigue
EN 1999-1-4	Design of aluminium alloy structures – Supplementary rules for trapezoidal sheeting
EN 1999-1-5	Design of aluminium alloy structures – Supplementary rules for shell structures

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