Eurocodes –Toward 2010 and National Implementation

Introduction

In 1975 the European Commission decided on the adoption of a programme in the field of construction based on the objective of eliminating technical obstacles to trade which included the harmonization of technical specifications.
For 15 years the Commission, through a steering group made up of representatives from Member States, set about establishing a set of harmonized technical rules for the structural design of construction works which culminated in the publication of the first generation of European design codes in the late 1980's.
In 1989 the Commission and the Member States decided, on the basis of an agreement with the European Standards body (CEN), to transfer the development and publication of the codes to CEN so that they would , through future development, have the status of European standards (EN's).

Therefore EN Eurocodes, in providing common design methods, expressed as a set of European standards are intended to be used as the recommended means to;

1. prove compliance of building and civil engineering works with Essential Requirement No.1 (Mechanical resistance and stability) and part of Essential Requirement No.2 (Safety in case of fire) as defined in Annex 1 of the *Construction Products Directive* (CPD) [1],
2. express in technical terms, these Essential Requirements, applicable to the works or part thereof,
3. determine the performance of structural components and kits with regard to mechanical resistance and stability and resistance to fire (in so far as is applicable with regard to CE marking).

The intended benefits of the Eurocodes programme also include to;

- provide common design criteria and methods to fulfil the specified requirements of the Essential Requirements (referred to above),
- facilitate the marketing and use of structural materials and constituent products , the properties of which will enter into design calculations,
- provide a common understanding regarding the design of structures between all associated parties,
- be a common basis for research and development in the construction sector,
- allow for common design aids and software,
- increase the competitiveness of European civil engineering firms, contractors, designers and product manufacturers.

Eurocodes - Parts, Packages and National Provisions

There are 10 Eurocodes, comprising of 58 individual parts, covering 10 design areas. The first two areas (basis of design and actions *or loading*) are common to all designs, the next six are material specific and the two remaining codes cover geotechnical and seismic aspects.

- EN1990 Eurocode 0: Basis of structural design
- EN1991 Eurocode 1: Actions on structures
- EN1992 Eurocode 2: Design of concrete structures
- EN1993 Eurocode 3: Design of steel structures
- EN1994 Eurocode 4: Design of composite steel and concrete structures
- EN1995 Eurocode 5: Design of timber structures
- EN1996 Eurocode 6: Design of masonry structures
- EN1997 Eurocode 7: Geotechnical design
- EN1998 Eurocode 8: Design of structures for earthquake resistance
- EN1999 Eurocode 9: Design of aluminium structures

All of the EN Eurocodes relating to materials have a Part 1-1 which covers the *design of buildings and other civil engineering structures* and a Part 1-2 for *fire design*. The codes for concrete, steel, composite steel and concrete, timber structures and earthquake resistance have a Part 2 covering *design of bridges*. Bridge parts should be used in combination with the appropriate general Parts (Parts 1).Where a Part 3 and subsequent parts exist, these deal with specific matters pertinent to the material design in question.

The 58 parts of the Eurocodes have been grouped into "packages", each of which specifies the parts needed for a given combination of construction material and structural type. While primarily established to set a common date of withdrawal for related national standards the packages also serve to identify all of the codes required for a particular design including those parts of the relevant common codes (basis of design, actions) as well as those for geotechnical and seismic aspects. Annex C of the European Commission document *Guidance Paper L – Application and Use of Eurocodes-*[2]*,* clearly outlines the relationship between the material based packages and those independent codes.

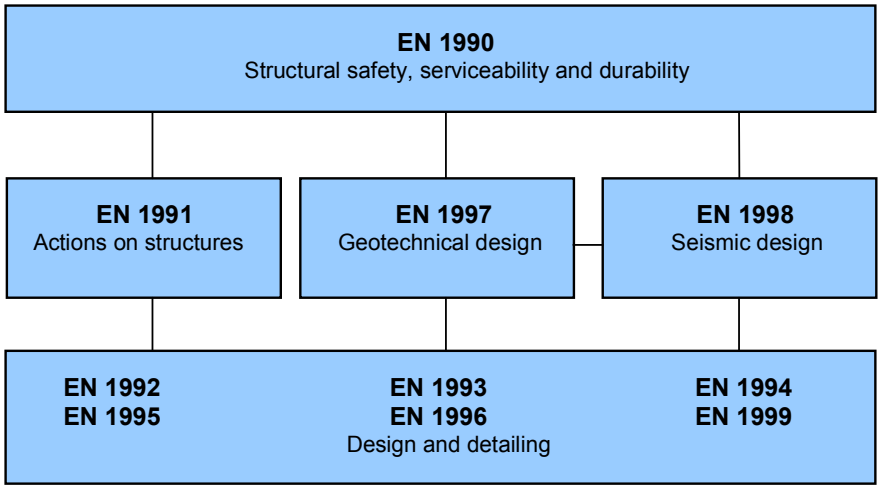

Figure 1 ***Links between the Eurocodes***
The Eurocodes suite is made up by 10 European Standards for structural design. Each Eurocode consists of a number of parts that cover particular technical aspects. The links between the Eurocodes are given in the above figure.

The determination of levels of safety of buildings and civil engineering works, including aspects of durability and economy, has always been considered to be within the competence and authority of individual Member States. Possible differences in geographical or climatic conditions, ways of life as well as different levels of protection that may exist at national, regional and local level can be taken into consideration at national level through specific design parameters which are identified in each Eurocode part as Nationally Determined Parameters (NDP's).Therefore Member States have choices within the codes in respect of levels of safety, including aspects of durability and economy that may pertain within their territory. Additionally where NDP's are called up, the Eurocode part in question will provide a full set, as appropriate, of recommended values, classes, symbols and alternative methods to be used.

Before Eurocodes can be used for design purpose in a particular Member State, the appropriate national authorities are required to undertake a national calibration period (a maximum of 2 years after the publication by CEN) for each Eurocode part after which it must fix its choice for the related NDP's. Once this has been carried out, a national annex (or decision on the adoption of the recommended values for the NDP's) must be published to facilitate the use of Eurocodes in that country.

National Implementation Programme

The National Standards Authority of Ireland (NSAI), as the national body member of CEN and the national publisher of all European (EN) standards, is coordinating the examination of all Eurocode parts and the development of national annexes through its National Eurocodes Advisory Committee. This committee comprises of experts (Liaison Engineers) for each of the 10 Eurocodes together with representatives from the Department of the Environment, Heritage and Local Government, the Irish Concrete Federation, the National Roads Authority (NRA), the Office of Public Works as well as from academic and industry representative bodies.

While a comprehensive technical evaluation of each of the Eurocodes has been and continues to be carried out by the respective Liaison Engineers, particular consideration has been given to a number of the codes and individual parts through the application of externally contracted study programmes. Eurocode 1 parts 1-2 (actions on structures exposed to fire) and 1-4 (wind action) have been subject to such a study and while the EC 1 fire part national annex is now complete and published, the wind part is still under consideration but when available will include a definitive wind map for Ireland. Studies have also recently commenced for EC 2 (concrete) and EC 6 (masonry), being the most traditionally used structural materials in buildings and other civil engineering works. The NRA, as the authority responsible for National road and bridge design in Ireland, is also currently undertaking a review of all the Eurocodes pertaining to bridge design.

As previously stated, Eurocodes can not be used for design purposes until the corresponding national annexes (or decision on the adoption of the recommended values for a given Eurocode part, in which case a national annex will not be produced) are available.However since the Eurocodes parts have become available from CEN, national standard bodies, on recommendation from the Commission, are publishing the codes to promote their existence and to facilitate industry parties in providing the training, skills and all of the necessary software tools required by designers in advance of full national implementation.All Eurocode parts are now available as adopted Irish standards (I.S.EN's) and can be purchased from the NSAI through their on line sales channel at ***www.standards.ie***

With national implementation of Eurocodes by all Member States scheduled to be completed at the latest by March 2010, work on the development of Irish national annexes is progressing well. While 7 national annexes have been published to date it is expected that a large tranche of draft national annexes will be available for a three month period of public consultation during January and February 2008. Once a national annex is published for a given Eurocode part a period of coexistence with the corresponding national design codes comes into consideration. This period of coexistence exists until the end of the coexistence period of the last part in the related Eurocode package (referred to earlier).This ensures that national design codes can still be used until all of the relevant Eurocode parts are available for a particular design type. During this time specifiers and designers are free to use both codes but once the coexistence period is over the only design standards in place will be the Eurocodes. A full summary of the status of publication of Eurocode standards, technical studies and the development of Irish national annexes can be found in the standards section of the NSAI website at ***www.nsai.ie***

It is important to mention that once Eurocode parts become available as European standards they form part of the application of the *Public Procurement Directive*[3] (PPD) and so public bodies are encouraged to call up the use of Eurocodes during the coexistence periods. While the spirit of the PPD does not preclude the procuring body referencing other design codes their equivalence to the Eurocodes must be demonstrated by the contractor. In relation to Irish building regulations, once the full set of national annexes is available, the accompanying Technical Guidance Document (TGD) to Part A (Structure) will be revised to refer to the Eurocodes and their national annexes. Designs carried out using the codes and related national annexes will then indicate, prima facie, compliance with the building regulations.

Future developments

One of the ongoing tasks for CEN TC250 (Eurocodes) is the maintenance of the Eurocode standards, including the need to address corrections and amendments. Future amendments

are expected to include improved formulations and presentation of design rules, improved design rules and supplementary design rules.

There are also a number of initiatives currently being considered for the future development of the codes which include:

1. Further harmonization and development of the Eurocodes through;
   - improved consistency between design specifications and product specifications including those areas related to Essential Requirements 3(hygiene, health and the environment), 4(safety in use), 5(protection against noise) and 6(energy, economy and heat retention),
   - including additional aspects of sustainability,
   - updating rules and specifications according to state of the art research.

2. Establishing guidelines for;
   - the assessment and retrofitting of existing structures,
   - the design of glass structures including proposals for future test standards,
   - the design of Fibre Reinforced Polymer(FRP) structures for both in situ execution, and for manufacturing from prefabricated components.

It is expected that this work will be carried out by CEN TC 250 and the Commission under the auspices of the Joint Research Centre / ELSA unit. To facilitate this and in providing the necessary support data, national standards bodies are expected to upload details of their decisions on the NDP's to the Commissions JRC Eurocodes database.

References

[1] The Construction Products Directive (89/106/EEC)
http://ec.europa.eu/enterprise/construction
[2] Guidance Paper L – Application and use of Eurocodes
http://ec.europa.eu/enterprise/construction (follow the links to Guidance Papers / Position Papers)
[3] The Public Procurement Directive (2004/18/EC)
http://ec.europa.eu/internal_market/publicprocurement
[4] Technical Guidance Document Part A
http://www.environ.ie/en/TGD

Others

European Commission DG Enterprise & Industry Joint Research Centre
http://eurocodes.jrc.ec.europa.eu

Eurocodes Expert – Making Eurocodes Easier
(An Institution of Civil Engineers (ICE) and Institution of Structural Engineers initiative)
http://www.eurocodes.co.uk

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