The Eurocodes
General overview – Principles, new developments and future challenges

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The Step Pyramid at Sakkara

Imhotep
Marcus Vitruvius Pollio
(c. 80-70 BC – c. 15 BC)
« The Ten books on Architecture »
A new context

World population (billions) : 1950 - 2050
THE HISTORY OF THE EUROCODES

- 25/03/1957 Rome Treaty
- 1957
- 1971
- 10/03/1979 European Monetary System
- 1979
- 12/07/1986 Unique Act New Approach
- 1986
- Construction Products Directive 89/106 CEE
- 1993
- First Eurocodes
- 1996
- ENVs
- 1998
- ENs
- 2007
- Maintenance
- Harmonization
- Promotion
- Further development
- Withdrawal of conflicting national standards March 2010
- New CPR?
The Eurocodes family

EC0 – Basis of structural design

EC1 – Actions

EC2 – Concrete

EC3 – Steel

EC4 – Composite steel-concrete

EC5 – Timber

EC6 – Masonry

EC7 – Geotechnical design

EC8 – Earthquakes

EC9 – Aluminium
LINKS BETWEEN THE EUROCODES

EN 1990

EN 1991

EN 1992
EN 1993
EN 1994
EN 1995
EN 1996
EN 1999

EN 1997
EN 1998

Structural safety, serviceability and durability, combinations of actions
Actions on structures
Design and detailing
Geotechnical and Seismic design
\[ Y = \max_T \left\{ X_1 + \max_{\tau_1} \left( X_2 + \max_{\tau_2} X_3 \right) \right\} \]
\[ Y = \max_T \left\{ \frac{X_1}{\tau_1} + \max_{\tau_2} \left( \frac{X_2}{\tau_2} + \max_{\tau_3} X_3 \right) \right\} \]
The fundamental requirements in EN 1990 for the reliability of construction works include:

**Structural safety:** A structure shall be designed and executed in such a way that it will, during its intended life with appropriate degrees of reliability, and in an economic way sustain all actions likely to occur during execution and use. Safety of people, the structure and contents.

**Serviceability:** A structure shall be designed and executed in such a way that it will, during its intended life with appropriate degrees of reliability and in an economic way remain fit for the use for which it is required. Functioning, comfort and appearance of the structure.
The fundamental requirements in EN 1990 for the reliability of construction works include:

**Robustness:** A structure shall be designed and executed in such a way that it will not be damaged by events such as:
- Explosions
- Impact and
- Consequences of human errors
to an extent disproportionate to the original cause

*Note:* The events to be taken into account are those agreed for an individual project with the client and the relevant authority
The concept of Robustness and the protection of citizens
IMPLEMENTATION OF THE EN EUROCODES

Harmonization

<table>
<thead>
<tr>
<th>EN 199n-p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main text</td>
</tr>
<tr>
<td>Normative Annexes</td>
</tr>
<tr>
<td>Informative Annexes</td>
</tr>
</tbody>
</table>

Choices
Nationally Determined Parameters (NDPs)

Decisions

Transformation into a National Standard (« NS » EN 199n-p)

National Annex (National Standard)

Project specification
The Eurocodes
General overview – Principles, new developments and future challenges

Tripoli (Libya) - Future International Airport – Passengers Terminal (virtual view) – Design with Eurocodes 0, 1, 2 et 8
Liège (Belgium) – TGV Railway Station (Guillemins)
EUROCODES
A tool for building safety and reliability enhancement

EU-Russia cooperation on standardisation for construction

9-10 October 2008
President Hotel, Moscow

Programme

PROMOTION AND EDUCATION

Organised by
Russian Federal Agency on Technical Regulation and Metrology

with the support of
European Commission, CEN and WASCS

中国 - 欧盟建筑标准和节能研讨
EU-China Conference on Standards and Energy Efficiency in Buildings
2008年1月29-30日，北京

Hosted by:
Ministry of Construction, P. R. China
EU Directorate-General for Enterprise and Industry
EU Directorate-General for Transport and Energy

Organised by:
EU-China Trade Project
The family of European standards for construction works
THE FUTURE OF EUROCODES

• New materials and/or techniques
• New concepts and/or requirements
• New societal needs
New Materials and/or Techniques
Structural glass
Footbridge at Rotterdam –
Photo Ulrich Knaack
Berlin – Central Railway Station

Laminated glazing

Insulating glazing

[Diagram of glazing structures and measurements]
Load introduction at the top and bottom of the glass column
Bridge in Spain – Carbon fibres
Fibre reinforced polymers

www.cnr.it/sitocnr/Englishversion
First FRP footbridge – Kolding, Denmark
FRP Bridge – Leida, Spain
Temporary bridge in Pontresina, Switzerland
New Concepts and /or techniques
Basic works requirements

Construction works as a whole and in their separate parts must be fit for their intended use.

Subject to normal maintenance, basic works requirements must be satisfied for an economically reasonable working life.
Basic works requirements

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health and the environment
4. Safety in use
5. Protection against noise
6. Energy economy and heat retention
7. Sustainable use of natural resources
7. Sustainable use of natural resources

The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and ensure the following:

(a) recyclability of the construction works, their materials and parts after demolition;

(b) durability of the construction works;

(c) use of environmentally compatible raw and secondary materials in the construction works.
Development of strategies for sustainability

- **Stockholm 1972**: UN Conference on Human Environment
- **1987**: Bruntland Report
- **1992**: UN Conference on Environment and Development, Rio de Janeiro
- **1997**: Kyoto Protocol
- **2000**: Lisbon Strategy, 2000 Competitiveness
- **Earth Summit, Johannesburg, 2002**: Sustainable development

Evolution of concepts:
- Priority to protection of environment rather than to growth
- Sustainable Development
- Societal and environmental responsibility
- Economic, social and environmental performance

Stakeholders involvement:
- Scientists and NGO
- Governments, States
- Industry
- Consumers
- Convention on Climate Change - UNFCCC, 1994
Goals of the Lead market initiatives

Lead market initiative (LMI)

• to promote favorable market conditions for new innovative products, services and technologies in the EU market
• to achieve improved competitiveness for the European Union
• to provide solutions to economic and societal challenges such as health, energy, environment and transport.
6 Lead market initiatives

- e-Health
- protective textiles
- sustainable construction
- recycling
- bio-based products and
- renewable energies.
CEN-actions supporting the lead Market Initiative

Proposed actions for standardisation (LMI)

• Define a framework, assessment method and benchmarks for assessing the sustainability performance of buildings and of the construction

• Expand the scope of Eurocodes in order to integrate other sustainability aspects in construction design, such as energy and environmental aspects.
## Concept for sustainability assessment

<table>
<thead>
<tr>
<th>Basic work requirements</th>
<th>Essential (basic) requirements</th>
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<td></td>
<td>mechanical resistance and stability</td>
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<td>CEN/TC 250 + CEN/TC's for products</td>
<td>Eurocodes</td>
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<td>CEN/TC 127</td>
<td>Fire safety</td>
</tr>
<tr>
<td>CEN/TC 126</td>
<td>Acoustics</td>
</tr>
<tr>
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<td>Design methods, Products</td>
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<tr>
<td>BT/PC 371</td>
<td>Energy performance</td>
</tr>
<tr>
<td>CEN/TC 350, CEN/TC 351</td>
<td>Sustainability Indicators</td>
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Market growth drivers for sustainable construction

- The factor time will get more and more importance for real estates.
- In view of growing prices for energy, the question is until when the building will be competitive?
- How can by design a building be made adaptable for fully new energy-innovations in the future?
- How can vacancies be prevented, that result from no more meeting the home requirements of an aging or more flexible society?
- How can demolition and substitution of a building be performed?
Market growth drivers for sustainable construction

- The rating of the financial risks of real estates will include a premium or a discount for the sustainability of buildings.

- To this end a certification of the energy-efficiency and of the sustainability of services and products is necessary that brings together the responsibility of Member States and the economic competence and competitiveness of industry.
Market growth drivers for sustainable construction

- New instruments are required for the cooperation of governments and industry, to promote sustainable construction:
  - Sustainability strategy for town planning and for civil engineering works, e.g. to turn a town from an energy consumer to an energy producer.
  - Need for adequate coherent and consistent codes as platform for communication that give indicators and methods for calculation. These codes must support “system solutions” that result from “integral design”.
  - A certification shall extend the business field and make it more demanding and pretentious. Sustainability is a goal to make money with durable success including ecological, economic and socio-cultural goals.
Pollution in the World
New Societal Needs
Assessment of existing structures
Principle 1
Veracity and completeness of information.

Principle 2
Lessons from experience

Principle 3
Improving knowledge

Principle 4
Utility optimisation and intangibles

Principle 5
Ecological values and future of mankind
Principle 1
Veracity and completeness of information.
Principle 2
Lessons from experience
Principle 3
Improving knowledge
Principle 4
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Principle 5
Ecological values and future of mankind
Albrecht Dürer, 1506
Thank you for your attention