An Overview of the Eurocodes Evolution Project

Steve Denton
FREng FICE FIStructE
Head of Civil, Bridge and Ground Engineering, WSP
Visiting Professor, University of Bath
Chairman, CEN/TC 250

2 May 2018
Oslo
500 000
Engineers
500 000 Engineers

€65 Billion
500,000 Engineers
€65 Billion
10-58
500,000 Engineers  €65 Billion  10-58  5000 Pages
<p>| Engineers | €65 Billion | 10-58 | 5000 Pages | 1055 NDPs |</p>
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Agenda

— Background
— Why Design Standards Matter
— Research into Design Standards
— Aims for the evolution of Structural Eurocodes
— Process and timing
— Future Challenges
Agenda

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My background

— Chairman of CEN/TC 250 Structural Eurocodes
— WSP’s Head of Civil, Bridge and Ground Engineering
— Visiting Professor at the University of Bath
— Advisor to Clients and Government
CEN/TC 250 Structural Eurocodes

Management Group
Chairman: S Denton

Chairman's Advisory Panel(s)

CEN/TC 250 Structural Eurocodes
Chairman: S Denton
Vice Chair: M Fardis
Secretary: T Wilkins [BSI]
CEN PM: G Ascontao
NEN M/515 lead: M Lurink

CEN/TC 250 Coordination Group
Chairman: S Denton
Secretary: T Wilkins [BSI]

Horizontal Group Bridges
Convenor: P Croce

Horizontal Group Fire
Convenor: B Zhao

WG 1 Policy and guidelines
Convenor: J Moore [UK]

Other Tier 1 WG's

SC 10 - EN 1990
Chairman: P Formichi
Secretary: V Melaysund [SN]

SC 6 - EN 1996
Chairman: R Van der Pluijm
Secretary: P Rauh [DIN]

SC 1 - EN 1991
Chairman: N Malakats
Secretary: J Brunner [DIN]

SC 7 - EN 1997
Chairman: A Bond
Secretary: M Lurink [NEN]

SC 2 - EN 1992
Chairman: H Ganz
Secretary: A Schleifer [DIN]

SC 8 - EN 1998
Chairman: P Bisch
Secretary: E Coelho [IPQ]

SC 3 - EN 1993
Chairman: U Kuhlmann
Secretary: S Kempa [DIN]

SC 9 - EN 1999
Chairman: F Mazzolani
Secretary: R Siagrov [SN]

SC 4 - EN 1994
Chairman: G Couchman
Secretary: J Duncan [BSI]

SC 11 - EN 'Structural Glass'
Chairman: M Feldmann
Secretary: S Tiedtke [DIN]

SC 5 - EN 1995
Chairman: S Winter
Secretary: A Stenmark [SIS]

WG 2 Existing Structures
Convenor: P Lüchinger [SNV]

WG 4 Fibre reinforced polymer
Convenor: L Ascione [UNI]

WG 5 Membrane Structures
Convenor: M Mollaert [NBN]

WG 6 Robustness
Convenor: R Van der Pluijm [NEN]
“Like life in general our codes seem to get more and more complicated.”
Historical evolution (*)

If a designer-builder has designed -built a home for a man and his work is not good, and if the house he has designed -built falls in and kills the householder, that designer-builder shall be slain

Rule 229, Code of Hammurabi

(*) The graph is indicative
The Structural Eurocodes

- European Product Standards
- European Execution Standards

Non-contradictory complementary information

Client implementation and requirements

Support to the profession

European standards for construction
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— Why Design Standards Matter
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Why do design standards matter?
Why Design Standards Matter

Impact
International trade
Verification of adequacy
Feedback
New societal demands
Research to application
Agenda

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— Why Design Standards Matter
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Research questions:

RQ: How can better design standards for the construction industry be developed?

RSQ1: Which role do design standards currently fulfil in the construction industry and are expected to fulfil in the future, particularly to meet needs, interests and capabilities of users?

RSQ2: What are the issues in the development and use of design standards, what is their impact and how can they be managed?

RSQ3: What is a good design standard and what are its attributes and/or components?

RSQ4: What practical steps can standards writers take to develop better design standards?
Number of research papers that address this question for the construction sector
Research into Design Standards

Number of research papers that address this question for the construction sector

1. ICE Debate, Moffatt and Dowling, 1981
2. IStructE Debate, Sunley and Taylor, 1982
3. Dibley 1990
4. SEI special issue "Codes of Practice in Structural Engineering", 2012
Research into Design Standards

From:
Angelino M (2017). Developing better design standards for the construction industry. Doctorate dissertation for the University of Bristol, UK (to be submitted)
# Research into Design Standards

## Challenges at different stages of standardisation

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<thead>
<tr>
<th>Stage</th>
<th>Hard (content)</th>
<th>Soft (human issues)</th>
<th>Macro-environmental (external factors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
<td>• Balance between advice and requirements&lt;br&gt;• Boundaries between design standards and other documents&lt;br&gt;• Balance between performance-based and method-based requirements&lt;br&gt;• Organisation of content</td>
<td>• Competing needs of stakeholders&lt;br&gt;• Subjectivity in the development process&lt;br&gt;• Unclear purpose of design standards&lt;br&gt;• Users’ engagement</td>
<td>• Changes in the construction industry&lt;br&gt;• Political aspects&lt;br&gt;• Legal aspects&lt;br&gt;• Social and cultural aspects&lt;br&gt;• Economic aspects&lt;br&gt;• Sustainability aspects&lt;br&gt;• Resources available</td>
</tr>
<tr>
<td>Use</td>
<td>• Increase in technical standards&lt;br&gt;• Cross-references among documents&lt;br&gt;• Navigation between technical provisions&lt;br&gt;• Length of design standards&lt;br&gt;• Degree of complexity of standards</td>
<td>• Users’ needs and primary audience&lt;br&gt;• Users’ skills and learning component</td>
<td>• Contractual aspects&lt;br&gt;• Legal aspects</td>
</tr>
<tr>
<td>Maintenance</td>
<td>-</td>
<td>-</td>
<td>• Resources available&lt;br&gt;• Document management system</td>
</tr>
<tr>
<td>Derogation</td>
<td>-</td>
<td>• Subjectivity in the derogation process</td>
<td>• Resources available</td>
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Research into Design Standards

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Challenges

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Aims of the Evolution of the Eurocode
Aims of the Evolution of the Eurocode

✓ **Enhanced Ease of Use**
Aims of the Evolution of the Eurocode

✓ Enhanced Ease of Use
✓ Exemplary levels of international consensus
Aims of the Evolution of the Eurocode

✓ Enhanced Ease of Use

✓ Exemplary levels of international consensus
CEN/TC 250’s vision on the second generation of the Structural Eurocodes

Whilst respecting the achievements of the past, our vision for the second generation of Structural Eurocodes is to create a more user-orientated suite of design standards that are recognised as the most trusted and preferred in the world.
CEN/TC 250 Position Paper on Ease of Use

Aims of the Evolution of the Eurocode

Five pillars to enhance ease of use of the Eurocodes
CEN/TC 250 Position Paper on Ease of Use

Aims of the Evolution of the Eurocode

Five pillars to enhance ease of use of the Eurocodes

1. Statements of intent to meet users’ needs
2. Principles and related priorities
3. Examples
4. Strategic performance measures
5. Management, governance and support
Recommendation 1: Statements of intent to meet users’ needs

**PRIMARY TARGET AUDIENCE**

Practitioners – Competent engineers

**DEFINITION**

Competent civil, structural and geotechnical engineers, typically qualified professionals able to work independently in relevant fields.

Aims of the Evolution of the Eurocode
## Recommendation 1: Statements of intent to meet users’ needs

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<th>CEN/TC 250 STATEMENTS OF INTENT</th>
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<td>We will aim to produce Standards that are suitable and clear for all common design cases without demanding disproportionate levels of effort to apply them</td>
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<td>Practioners – Graduates</td>
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<td>Expert specialists</td>
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<td>Product Manufacturers</td>
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<td>Software developers</td>
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<td>Educators</td>
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<td>9   Limiting the inclusion of alternative application rules</td>
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CEN/TC 250 Position Paper on Ease of Use

Aims of the Evolution of the Eurocode

Five pillars to enhance ease of use of the Eurocodes

1. Statements of intent to meet users' needs
2. Principles and related priorities
3. Examples
4. Strategic performance measures
5. Management, governance and support
Enhancing Ease of Use

— Appointment of Technical Reviewer
— Detailed review of deliverables
— Development of TC 250 document N1250 ‘Policy Guidelines and Procedures’
— Provision of examples and advice
Enhancing Ease of Use
— Guidance materials, examples and briefings developed
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Evolution process and timing

European Commission Mandate M/515

MANDATE FOR AMENDING EXISTING EUROCODES AND EXTENDING THE SCOPE OF STRUCTURAL EUROCODES

Brussels, 12 December 2012
M/515 EN
Evolution process and timing

CEN/TC 250 Technical response

- 138 pages
- Over 1000 experts from across Europe involved
- Structure of tasks and sub-tasks
- Phased programme
Evolution process and timing

CEN/TC 250 Work Programme Structure

SC / WG etc

Task 1
Task 2
Task n

Sub-task
Sub-task
Sub-task

Task 2

Sub-task
Sub-task
Sub-task

Task n

Sub-task
Sub-task
Sub-task
### Detailed task plans

**Evolution process and timing**

<table>
<thead>
<tr>
<th>Sub-task</th>
<th>Sub-task name</th>
<th>Brief description, background and reasons for the work (including any additional comments / notes)</th>
<th>Interdependencies</th>
<th>Key benefits</th>
<th>Output</th>
<th>Priority item for EC contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Evolution of number of National Flankers (ENR)</td>
<td>Review the evolution of all European flankers and assess their impact on the project.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Detailed design</td>
<td>Enhance the design of the project, focusing on the integration of European flankers.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Transfer of tasks from ENR to ENR Phase</td>
<td>Transfer tasks from the ENR phase to the ENR Phase, ensuring smooth transition.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Evolution of management of structural analysis of connection works (Artefact A)</td>
<td>Assess the evolution of the management of structural analysis, focusing on the integration of European flankers.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Revisions</td>
<td>Review and update project documents to ensure alignment with European flankers and best practices.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Sustainability</td>
<td>Ensure that the project meets sustainability goals, integrating European flankers into the design process.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Evolution process and timing

- 76 tasks
- Four overlapping phases of drafting work
Evolution process and timing

Key changes

- EN 1990
- EN 1991
- EN 1992
- EN 1993
- EN 1994
- EN 1995
- EN 1996
- EN 1997
- EN 1998
- EN 1999

Robustness

Assessment

Climate change

Ease of use

Glass

FRP

Membrane
Evolution process and timing

Responding to systematic review comments

Mandate M515 Work Programme

Eurocode Systematic Review Comments

Evolution of Eurocodes
Evolution process and timing

→ Follow CEN Internal Regulations
→ Specific information available in CEN/TC 250 document N1250 [CEN, Eurocodes]
→ Further details available in Phase 1 call for experts specification (Vol 3) [NEN, Eurocodes 2020]
Evolution process and timing

- Follow CEN Internal Regulations
- Specific information available in CEN/TC 250 document N1250 [CEN, Eurocodes]
- Further details available in Phase 1 call for experts specification (Vol 3) [NEN, Eurocodes 2020]

Drafting approach and further details

Call for tender - Evolution of Structural Eurocodes

Call for Tender for experts for the development of the second generation of Structural Eurocodes.
- Updated 20th of May 2015 -

The Eurocodes (EN 1990 – EN 1999) enable the design of building and civil engineering works, and comprises of 10 European Standards in 59 parts. The first generation of EN Eurocodes were the most comprehensive and technically advanced suite of standards for structural and geotechnical design in the world. Their development was a tremendous achievement and represented the culmination of over 50 years collaborative effort. Their impact has been considerable. It has been estimated that they affecting the work of around 500,000 professional.

Volume 1: Instructions to Tenderers – This volume provides full instructions on how the Tender Process shall be organized and how and when Tenderers should submit their responses to the questions contained within and to the award criteria;
Volume 2: Contract terms and Conditions - This Volume contains the documentation for Contracts and general terms and conditions;
Volume 3: The Specification – This volume contains the scope/brief, outlining the requirements;
Volume 1 Annex 2: Template for quality submission – This word document provides the template for the quality submission;
Volume 1 Annex 3: Template for financial submission – This excel document provides the template for the financial submission.
Timeline

Eurocodes started
ENVs started
Publication of ENVs
Conversion of ENV to EN
Publication 1st generation of the Eurocodes
2007
Eurocodes started 1975
ENVs started 1990
Publication of ENVs 1992
Conversion of ENV to EN 1998
Publication 1st generation of the Eurocodes 2007
Response to Programming Mandate 2010
Response to Specific Mandate 2011
Programming Mandate 2011
Specific Mandate 2012
Response to Specific Mandate 2013
Timeline

- Eurocodes started 1975
- ENVs started 1990
- ENVs conversion to EN 1998
- Publication 1st generation of Eurocodes 2007
- Programming Mandate 2010
- Response to Programming Mandate 2011
- Specific Mandate 2012
- Response to Specific Mandate 2013
- Start PT Phase 1 2015
- Start PT Phase 2 2017
- Start PT Phases 3 & 4 2018
- End PT Phases 3 & 4 2021
- End PT Phase 1 2020
- End PT Phase 2 2019
- Target: First CEN Enquiry on draft standards 2021

Timeline

Start PT Phase 1 2015
Start PT Phase 2 2017
Start PT Phases 3 & 4 2018
End PT Phases 3 & 4 2021
End PT Phase 1 2020
End PT Phase 2 2019
Target: First CEN Enquiry on draft standards 2021
Timeline

- Eurocodes started: 1975
- ENVs started: 1990
- Publication of ENVs to EN: 1992
- Conversion of ENV to EN: 1998
- Publication 1st generation of Eurocodes: 2007

Response to Programming Mandate: 2010
Specific Mandate: 2011
Response to Specific Mandate: 2012

- Start PT Phase 1: 2015
- Start PT Phase 2: 2017
- End PT Phases 1: 2018
- End PT Phases 3 & 4: 2019
- End PT Phase 1: 2020
- End PT Phase 2: 2021
- Target: Last standards made available to NSBs: 2023

Preliminary plan

Date of withdrawal of 1st generation of Eurocodes: 202x
Objectives for CEN/TC 250 publication plan for second generation of Eurocodes (1 of 2)

1. Ensure that we have a fully compatible suite of standards at all times for use by industry.

2. Schedule enquiries and formal votes so that they do not place an excessive burden on CEN members and their mirror committees, and on SCs and WGs.
Objectives for CEN/TC 250 publication plan for second generation of Eurocodes (2 of 2)

3. Make new Eurocode parts available as early as possible, whilst respecting interdependencies with other Eurocode parts.

4. Ensure that sufficient time is available for development of National Annexes.

5. Ensure that sufficient time is available for removal of national conflicting standards by NSBs and update of supporting industry guidance material.
EN 1991-1-5

- **SC1.T5**: (recommendations produced in Phase 1)
- **HGB.T1**: (recommendations produced in Phase 1)
- **SC1.T4**: (draft standard developed in Phase 2)
- **SC1.T6**: (clauses produced in Phase 3)

**Work on draft standards by SCs/WGs**

**Finalisation**

- **Date of Ratification (DoR)**: 1 month after vote
- **Date of Annoucement (DoA)**: Final draft standard produced
- **Date of Publication (DoP)**: EN made available by CEN to NSBs (DAV)
- **Date of Withdrawal (DoW)**: Work at national level (development of NAs and time to update supporting industry guidance material)

**Translation & editing**

**Consideration of comments by SCs/WGs**

**Finalisation**
- Start PT work
- Drafting by PTs (1st, 2nd and final draft of the deliverables)
- Informal enquiry 3 months
- Review of deliverables by PTs 3 months
- End of PT + sign-off of PT work
Phase 1 drafts: Informal enquiry

Approximate No. of comments from informal enquiry

Over 9,200 comments received

Eurocode part
Work on draft standards by SCs/WGs “Y” months

Translation & editing: 3.25 months
CEN Enquiry: 3 months
Consideration of comments on draft standards by SCs/WGs “Z” months

Final draft standard produced

Translation previous to FV optional, if necessary, 1.5 months to be added
Option to skip FV
Date of Ratification (DoR) – 1 month after vote
EN made available by CEN to NSBs (DAV)
Translation previous to FV: optional. If necessary, 1.5 months to be added
Translation previous to FV optional. If necessary, 1.5 months to be added

1 month after vote

Input / contributions from other PTs

Time (Months)
EN made available by CEN to NSBs (DAV)

Date of Announcement (DoA)

Date of Publication (DoP)

Date of Withdrawal (DoW)

Development of NAs
max. 12 months (see BT C46/2009)

Time to update supporting industry guidance material

Removal of national conflicting standards
max. 36 months, otherwise go to BT

Time (Months)
Publication plan

- Detailed plan with interdependences
- Identification of slots for undertaking CEN enquiries and Formal Vote
- Management of NSBs workload
Agenda

— Background
— Why Design Standards Matter
— Research into Design Standards
— Aims for the evolution of Structural Eurocodes
— Process and timing
— Future Challenges
Aims of the Evolution of the Eurocode

✓ Enhanced Ease of Use
✓ Exemplary levels of international consensus
Aims of the Evolution of the Eurocode

✓ Enhanced Ease of Use

✓ Exemplary levels of international consensus
The chairman shall do everything possible to obtain a unanimous decision of the Technical Committee. If unanimity on a subject is not obtainable, the chairman shall try to seek consensus rather than rely simply on a majority decision.

CEN Internal Regulations - Responsibility of the Chairman of a CEN TC
Introduction

CEN/TC 250 has established two overarching objectives for the evolution of the Structural Eurocodes: firstly, to enhance ease of use, and secondly, to achieve exemplary levels of international consensus, evidenced through positive votes from CEN members.

Achieving consensus is an essential step in our work and clearly a key challenge in the delivery of the CEN/TC 250 work programme, given its scale, complexity and international impact.

The purpose of the Chairman’s Briefing Note is to set out a framework, which encourages behaviour conducive to fulfilling CEN/TC 250’s objective. It is based on discussions at meetings of CEN/TC 250 and was requested by the CEN/TC 250 Coordination Group. It will be discussed further at the CEN/TC 250 meeting to be held in Berlin in November 2017.

Background

In defining the responsibilities of the Chairman of a Technical Committee, the CEN Internal Regulations state the Chairman should do everything possible to obtain a unanimous decision of the Technical Committee. If unanimity on a subject is not obtainable, the Chairman should try to seek consensus rather than rely simply on a majority decision.

Consensus in this context means that there is general agreement on an outcome that everyone can support or control to, even if it is not the preference of each party. Crucially, therefore, it must be recognised that consensus is the outcome of a process of engagement and dialogue during which (i) the understanding of needs and perspectives of all parties concerned builds collectively over time and (ii) any certifying arguments are reconsidered.

Enabling consensus building

The CEN Internal Regulations establish roles, responsibilities and processes that promote consensus building between CEN members and stakeholders.

In addition, CEN/TC 250 has taken significant steps to support consensus building, aligned with the TC’s commitment to openness and transparency throughout the execution of Mandate M5/5 and the development of the second generation of EN Eurocodes. These steps have included:

- widespread consultation on the development of the CEN/TC 250 work programme, that was unanimously endorsed by the TC;
- development of unanimously agreed position papers on enhancing ease of use and the reduction of NDCs;
- establishing ad hoc groups to examine issues of concern to CEN/TC 250 members, particularly when of a horizontal nature;
- open calls for experts to serve on Project Teams, providing transparency of obligations and terms of appointment;
- requirement for Project Teams to develop background documents;
- providing opportunities for CEN members to comment on draft interim deliverables at multiple milestones during their development by Project Teams;
- development and on-going review of N1250, providing consistent guidance to all those engaged in Eurocode evolution.

Decision taken based on options

Issue / disagreement identified

Different perspectives fully understood (including underlying concerns)

Points of agreement noted and then disagreement isolated

Options set out (and refined)
Thank you