2020 vision: Future direction of Eurocode 7
Dr Andrew Bond (Geocentrix)
Chairman TC 250/SC 7

Outline of talk
- Quo vadis, Eurocode 7?
- What are we changing in Eurocode 7?
- What are we removing from Eurocode 7?
- What are we adding to Eurocode 7?
- What happens next?
- Summary of key points
Harmonization of technical specifications

In 1975, the Commission of the European Community* (CEC) decided to create an action programme in the field of construction...

“with the objective of promoting free trade between the member states by the elimination of technical obstacles and the harmonization of technical specifications”

*At the time, the European Economic Community (EEC)
**Eurocode 7 timeline 2010-2020**

- **Mar 2010**: European Commission issues Mandate M/466
- **May 2010**: Mandate M/466 invited CEN to ‘initiate the process of further evolution of the Eurocode system, incorporating both new and revised Eurocodes’
- **Jun ‘11**: CEN’s reply, prepared by TC 250, was issued to EC
- **Dec ‘12**: EC Mandate M/515 invited CEN to develop a detailed work programme based on its reply to M/466
- **Q1 2013**: TC250 prepared a work programme comprising 77 discrete tasks, following consultation with Member States (the ‘Response’ – since favourably received by EC)
- **Q1 2014**: TC250/CEN submitted technical proposal and financial quotation to EC
TC250/SC7’s six tasks in Response to M/515

**Phase 1**
1. **Harmonization and ease-of-use**
   Reorganized framework for Eurocode 7, to be used as starting documents for Tasks 2-5 below
2. **General rules**
   Revised Eurocode 7 Part 1

**Phase 2**
3. **Ground investigation**
   Revised Eurocode 7 Part 2 plus new/revised paragraphs input to Task 2
4. **Foundation, slopes, and ground improvement**
   Sections 2-5 and new Annexes in (new) Eurocode 7 Part 3
5. **Retaining structures, anchors, and reinforced ground**
   Sections 6-8 and new Annexes in (new) Eurocode 7 Part 3

**Phase 3**
6. **Rock mechanics and dynamic design**
   New/revised paragraphs into Tasks 2-5

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**WHAT ARE WE CHANGING IN EUROCODE 7?**
Planned changes for EN 1997: 2020

Restructure Eurocode 7 to ...
- Make the code easier to navigate
- Harmonize the contents with other Eurocodes
- Make space for new topics

Improved guidance on...
- Selecting characteristic ground parameters
- Selecting design water pressures
- Applying Eurocode 7 to numerical methods
- Rock mechanics and dynamic design

Improve ease-of-use...
- Improve the clarity of existing clauses
- Remove repetition
- Remove ‘useless’ information

Proposed structure of EN 1997: 2020

EN 1997: 202x
1. General rules
2. Ground investigation
3. Geotechnical constructions

Part 1 – General rules
1. General
2. Basis of geotechnical design
3. Materials
4. Durability
5. Geotechnical analysis
6. Ultimate limit states
7. Serviceability limit states
8. Execution
9. Reporting

Part 2 – Ground investigation
1. General
2. Principles of ground investigation
3. Planning of ground investigations
4. Sampling and groundwater measurements
5. Field tests
6. Laboratory tests
7. Reporting

Part 3 – Geotechnical constructions
1. General
2. Slopes, cuttings, and embankments
3. Spread foundations
4. Pile foundations
5. Retaining structures
6. Anchors
7. Ground improvement
8. Reinforced ground structures
WHAT ARE WE REMOVING FROM EUROCODE 7?

Eurocode 7’s existing Design Approaches

Ground strength is verified using ONE of THREE different Design Approaches (DAs). Each DA uses a different set of partial factors

\[ E_d \leq R_d \]

Design Approach 1:
- A1 “+” M1 “+” R1 (Combination 1)
- A2 “+” M2 “+” R1 (Combination 2)

...except for piles, when:
- A1 “+” M1 “+” R1 (Combination 1)
- A2 “+” (M1 or M2) “+” R4 (Combination 2)

Design Approach 2:
- A1 “+” M1 “+” R1

...except for slopes, when the A1 factors must be applied to effects of actions

Design Approach 3:
- (A1† or A2†) “+” M1 “+” R1 (Combination 1)

...*on structural actions and †on geotechnical actions
### Design Approaches expressed more simply

<table>
<thead>
<tr>
<th>Partial factors applied to</th>
<th>Design Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions</td>
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<tr>
<td>Material strengths</td>
<td>✓</td>
</tr>
<tr>
<td>Effects of actions</td>
<td>✓</td>
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<tr>
<td>Resistance</td>
<td>✓</td>
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</table>

<table>
<thead>
<tr>
<th>Comb. 1</th>
<th>Comb. 2</th>
<th>(2)</th>
<th>(2*)</th>
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</thead>
</table>

### National choice of Design Approach for slopes

[Map showing the national choice of Design Approach for slopes across various countries in Europe.]

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3rd ISSMGE Webinar, Past, present, and future of Eurocode 7, 19 Dec 2011

Mar-14 Decoding Eurocode 7 ©2005-13 Geocentrix Ltd. All rights reserved
National choice of Design Approach for pile foundations

Design Approaches expressed mathematically

Verification of strength \[ E_d \leq R_d \]

Design Approach 1
\[ E \left\{ \gamma f_{\text{rep}} \right\} \leq R \left\{ X_k \right\} \quad \text{and} \quad E \left\{ F_{\text{rep}} \right\} \leq R \left( \frac{X_k}{\gamma_M} \right) \]

Design Approach 2
\[ E \left\{ \gamma f_k \right\} \leq \frac{R \left\{ X_k \right\}}{\gamma_R} \quad \text{or} \quad \gamma f_k E \left\{ F_k \right\} \leq \frac{R \left\{ X_k \right\}}{\gamma_R} \]

Design Approach 3
\[ E \left\{ \gamma f_{\text{rep, str}}, f_{\text{rep, geo}} \right\} \leq R \left( \frac{X_k}{\gamma_M} \right) \]

\( E = \) action-effect; \( R = \) resistance; \( F = \) action; \( X = \) material property
\( \gamma_f, \gamma_M, \gamma_R = \) partial factors
Universal method for verifying strength in EN 1997: 2020

\[ E_d \leq R_d \]

\[ \gamma_E \left\{ F_d, X_d, a_d \right\} \leq \frac{R\left\{ F_d, X_d, a_d \right\}}{\gamma_R} \]

\[ F_d = \sum_i \gamma_{F,i} \psi_{F,i} F_{k,i}, X_d = \frac{X_k}{\gamma_M}, a_d = a_{\text{nom}} \pm \Delta a \]

E = action-effect; R = resistance; F = action; X = material property; a = geometrical data; \( \gamma_P, \gamma_M, \gamma_E, \gamma_R \) = partial factors; \( \Delta_a \) = safety margin \( \psi \) = combination factor

Design combinations to replace Design Approaches

<table>
<thead>
<tr>
<th>Table 3a - Partial factors for persistent design situations</th>
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</thead>
<tbody>
<tr>
<td>Category</td>
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<tr>
<td>-----------</td>
</tr>
<tr>
<td>Load effect</td>
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<tr>
<td>Load action</td>
</tr>
<tr>
<td>Structural design</td>
</tr>
<tr>
<td>Partial factors on load effects including important factors</td>
</tr>
</tbody>
</table>

PROVISIONAL – DO NOT USE!
Design Combinations 2020 – applying partial factors

Verification of strength for slopes:

\[ \gamma_{C,0} = 1.0, \gamma_{C,bw} = 1.0, \gamma_{Q,0} = 1.3 \]
\[ \gamma_{e,0} = \gamma_{c,0} = 1.25, \gamma_{a,0} = 1.4 \]
\[ \left( \gamma_{f,0} = 1.0, \gamma_{b,0} = 1.0 \right) \]

... for pile foundations:

\[ \gamma_{C,0} = 1.35, \gamma_{C,bw} = 1.0, \gamma_{Q,0} = 1.5 \]
\[ \gamma_{b,0} > 1.0, \gamma_{a,0} > 1.0, \gamma_{f,0} > 1.0 \]
\[ \left( \gamma_{f,0} = 1.0, \gamma_{a,0} = 1.0, \gamma_{b,0} = 1.0 \right) \]

... for shallow foundations and retaining structures:

\[ \gamma_{C,0} = 1.0, \gamma_{C,bw} = 1.0, \gamma_{Q,0} = 1.1 \]
\[ \gamma_{C,0} = 1.0, \gamma_{C,bw} = 1.0, \gamma_{Q,0} = 1.1 \]
\[ \gamma_{f,0} = 1.35 \]
\[ \left( \gamma_{a,0} = \gamma_{c,0} = 1.0 \right) \]
\[ \left( \gamma_{b,0} = \gamma_{a,0} = 1.0 \right) \]
\[ \left( \gamma_{f,0} = \gamma_{a,0} = 1.0 \right) \]

+ slope stability check (above)

WHAT ARE WE ADDING TO EUROCODE 7?
Proposed new Part 3 – Geotechnical constructions

Part 3 – Geotechnical constructions
1. General
2. Slopes, cuttings, and embankments
3. Spread foundations
4. Pile foundations
5. Retaining structures
6. Anchors
7. Ground improvement
8. Reinforced ground structures
Annexes – including calculation models for each type of construction

Part 3’s common sub-sections
1. General
2. Limit states
3. Actions and design situations
4. Design methods and design considerations
5. Ultimate limit state design
6. Serviceability limit state design
7. Structural design
8. Execution

Reliability differentiation

Each partial factor is ‘built-up’ from various sub-factors:

\[
\gamma_{F,0} = \text{‘base’ load factor}
\]

\[
\gamma_{M,0} = \text{‘base’ material factor, etc.}
\]

\[
K_i = \text{‘importance’ factor}
\]

\[
\gamma_{Rd} = \text{model factor}
\]

\[
\gamma_C = \gamma_{C,0} \times K_F
\]

\[
\gamma_Q = \gamma_{Q,0} \times K_F
\]

\[
\gamma_{\sigma} = \gamma_{\sigma,0} \times K_M
\]

\[
\gamma_c = \gamma_{c,0} \times K_M
\]

\[
\gamma_{cu} = \gamma_{cu,0} \times K_M
\]

\[
\gamma_{E} = \gamma_{E,0} \times K_E
\]

\[
\gamma_{R} = \gamma_{R,0} \times K_R \times \gamma_{Rd}
\]
Presumed values compared – sand and clay

WHAT HAPPENS NEXT?
SC7’s Evolution Groups (established 2010)

Proposed reorganization of SC7 ‘sub-groups’ starting 2014
Next steps towards EN 1997: 2020

- Mandate Response with Quotation submitted to Commission (5/3/14)
  Quotation may need to be revised in line with FPA 2014...

1. Framework Partnership Agreement (FPA) between CEN and the Commission
   FPA governs flow of money from European Commission to CEN to NSBs
   Existing agreement expired end 2013
   All funding on hold until FPA 2014 is signed
2. ‘Call for Experts’ to undertake mandated work (June 2014?)
3. Selection of Project Teams (September 2014?)
4. Contract negotiation between PTs and NEN (November 2014?)
5. Mandated work by Phase 1 Project Teams begins (December 2014?)

- Systematic Review of relevant Eurocodes
  NSBs to launch public review of all Eurocodes in Phase 1
  Can run in parallel to the above
  To start end of March 2014

Systematic Review of Eurocode 7

Opportunity for public comments on current Eurocode (Parts 1 and 2 of EN 1997)

1. Do any clauses require editorial or technical correction?
2. Which clauses would benefit from improvements in clarity?
3. Where should the scope of the EN be extended?
4. Where could the EN be shortened?
5. Are there any clauses whose application results in uneconomic construction?
6. Are there any clauses whose application necessitates excessive design effort?

In simpler terms:
1. What should we correct?
2. What should we clarify?
3. What should we add?
4. What should we remove?
5. What’s too expensive?
6. What’s too much effort?
How to respond to the Systematic Review

1. Obtain the ‘Template for comments and secretariat observations’
2. Complete the template with your suggestions
3. Submit the template to your NSB
4. NSB will forward to CEN and then onto SC7

In early April 2014, visit www.eurocode7.com
... to find out where this document can be found on the BSI website
Or, follow my blog at blog.eurocode7.com
2020 vision: future direction of Eurocode 7

Eurocode 7 is now almost 20 years old...
Preparatory work of improving the code has been underway since 2010
By the end of 2014, funded work will be underway on the Eurocode evolution...

The 2nd generation of Eurocodes are expected to appear in 2020

From April to September 2014, several Eurocodes will be ‘out for comment’
This is YOUR chance to influence the future direction of Eurocode 7

Don’t miss this once in a lifetime opportunity!

Decoding the Eurocodes

www.geocentrix.co.uk
www.decodingeurocode2.com
www.decodingeurocode7.com

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