Hva innebærer ny Eurokode 7? Status på arbeidet med ny Eurokode 7

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Rock Engineering Platform

Development of Eurocode 7

1975 – Start Eurocodes by European Commission

1992 – First Eurocodes published – ENV

2002 – 2007 – Introduction present Eurocodes

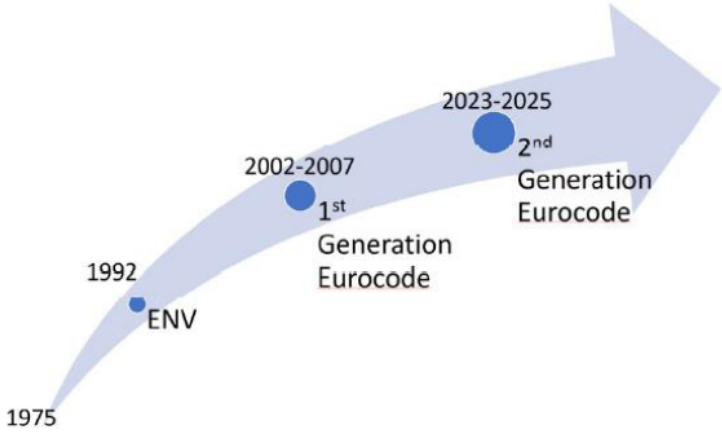
2011 – 2016 – Evolution Groups: topics for revision EC7

2015 – 2025 – Drafting of 2nd Generation Eurocode 7

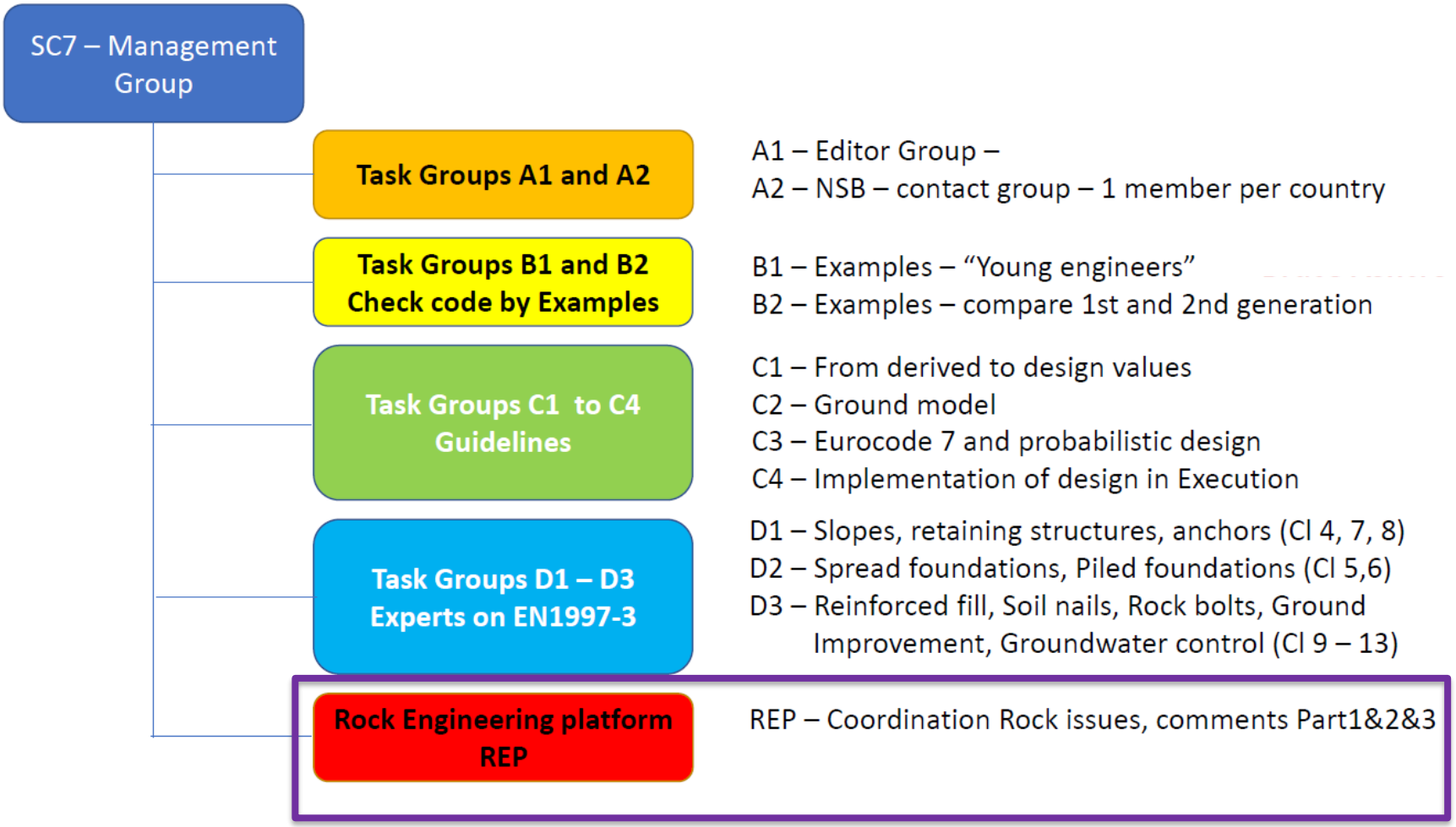
2035 – 2040 – Next Generation of EC7??

Large Geotechnical Community:

- 200 in Taskgroups
- hundreds in National Mirror Committees



Organisation of Sub committees



Organisation of SN/K 066

- SN/K 066 er den norske speilkomiteen som har fulgt arbeidet med Eurokode 7 siden 2011. Astri Eggen er komiteleder.
- Nå jobber flere grupper med nasjonalt tillegg for de ulike deler av standarden, bl.a en for det som dekker bergarbeider.
- Astri Eggen (Veidekke), sekretær Morten Lund (Standard Norge), Arne Schram Simonsen (Multiconsult), Frode Oset og Samson Degago (Statens Vegvesen), Geir Svanø (Bane Nor), Bruce Ashcroft (Multiconsult), Vidar Gjelsvik (NGI), Helen Andersson (Huth & Wien).

IMPROVEMENTS IN 2ND GENERATION OF EN 1997

- Organizational changes to Eurocode 7
- Clearer layout aids ease-of-navigation
- Greater consistency with EN 1990 aids ease-of-use
- No more Design Approaches!
- Simpler (but not simple) choice of partial factors
- Catering for different groundwater conditions
- Better specification of groundwater pressures
- Clear distinction between consequence of failure and complexity of the ground
- Geotechnical Categories now drive meaningful decisions

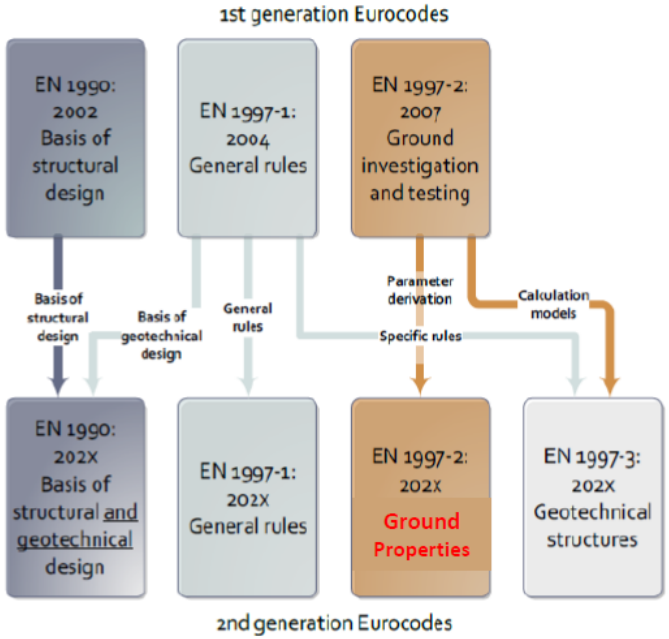
Main changes in 2nd generation Eurocode 7

Old Eurocode (3 parts):

1. EN1990 – Basis of structural design
2. EC7 Part 1 – Geotechnical rules
3. EC7 Part 2 – Testing and derivation of parameters

New Eurocode (4 parts!):

1. EN1990 – Basis of design – also geotechnical!
2. EC7 Part 1 – General rules for all structures, safety, characteristic values
3. EC7 Part 2 – Ground Properties and how to derive them from tests
4. EC7 Part 3 – Rules for specific geotechnical structures, many calculation models in Annexes



Planned changes in Eurocode 7 – Geotechnical design

To make it:

- more consistent with other Eurocodes,
- easier to understand and navigate,
- more comprehensive in its technical coverage,
- easier to make space for new topics.

To improve:

- guidance on selecting characteristic ground parameters and design water pressures,
- guidance on applying Eurocode 7 to numerical methods,
- guidance on rock engineering and dynamic design.
- ease-of-use by improving clarity, removing repetitions and unnecessary information.

– The revised version of Eurocode 7 will treat soil and rock on an equal basis –

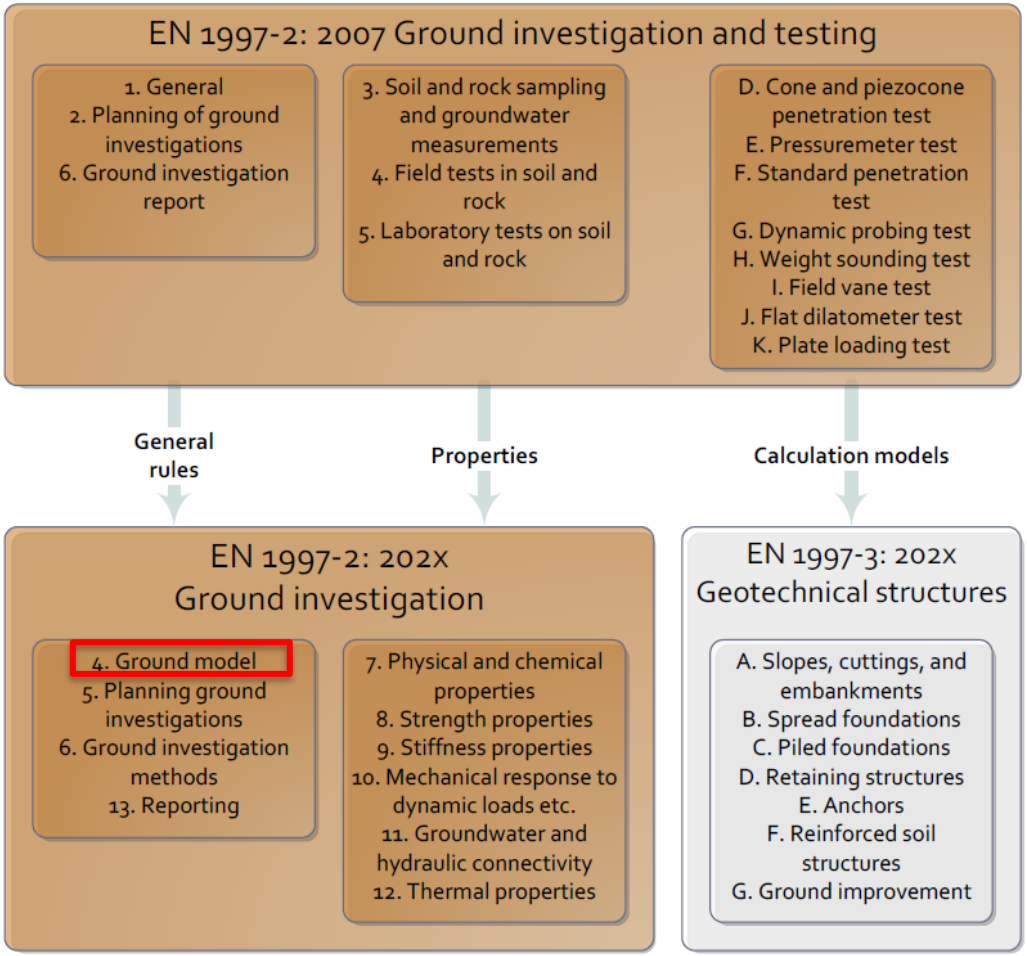
Planning of Eurocode 7

Formal Vote drafts of EN1997

- Formal Vote – EN1997-1 and EN1997-2 – April/May 2024
- Formal Vote – EN1997-3 – October/November 2024
- Date of Availability (DAV) EN1997-parts (final text published by CEN) → asap after Formal Vote, latest March 2026

- **National Annexes**
- Date of Publication (DoP): Latest date **Eurocode implemented nationally** (incl National Annex) September 2027
- Date of Withdrawal (DoW): Latest date **1st Generation** National Standards must be withdrawn: March 2028

2ND GENERATION OF EUROCODE 7 REORGANIZATION OF EUROCODE 7 PART 2



- Ground model is new in part 2 for the new revision
- Focus on DESIGN instead of GROUND INVESTIGATION
- Calculation models in Old Annexes → PART 3
- ROCK is included

1st generation of Eurocode 7
Geotechnical Categories are confused!

(14) Geotechnical Category 1 should o **Consequence** vely simple structures:

— for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations;

– **Consequence**

(15) Geotechnical Category 1 procedures should be used only where there is negligible risk in terms of overall stability or ground movements and in ground conditions, which are known from comparable local experienc **Complexity** ghtforward. In these cases the procedures may consist of routine meth gn and construction.

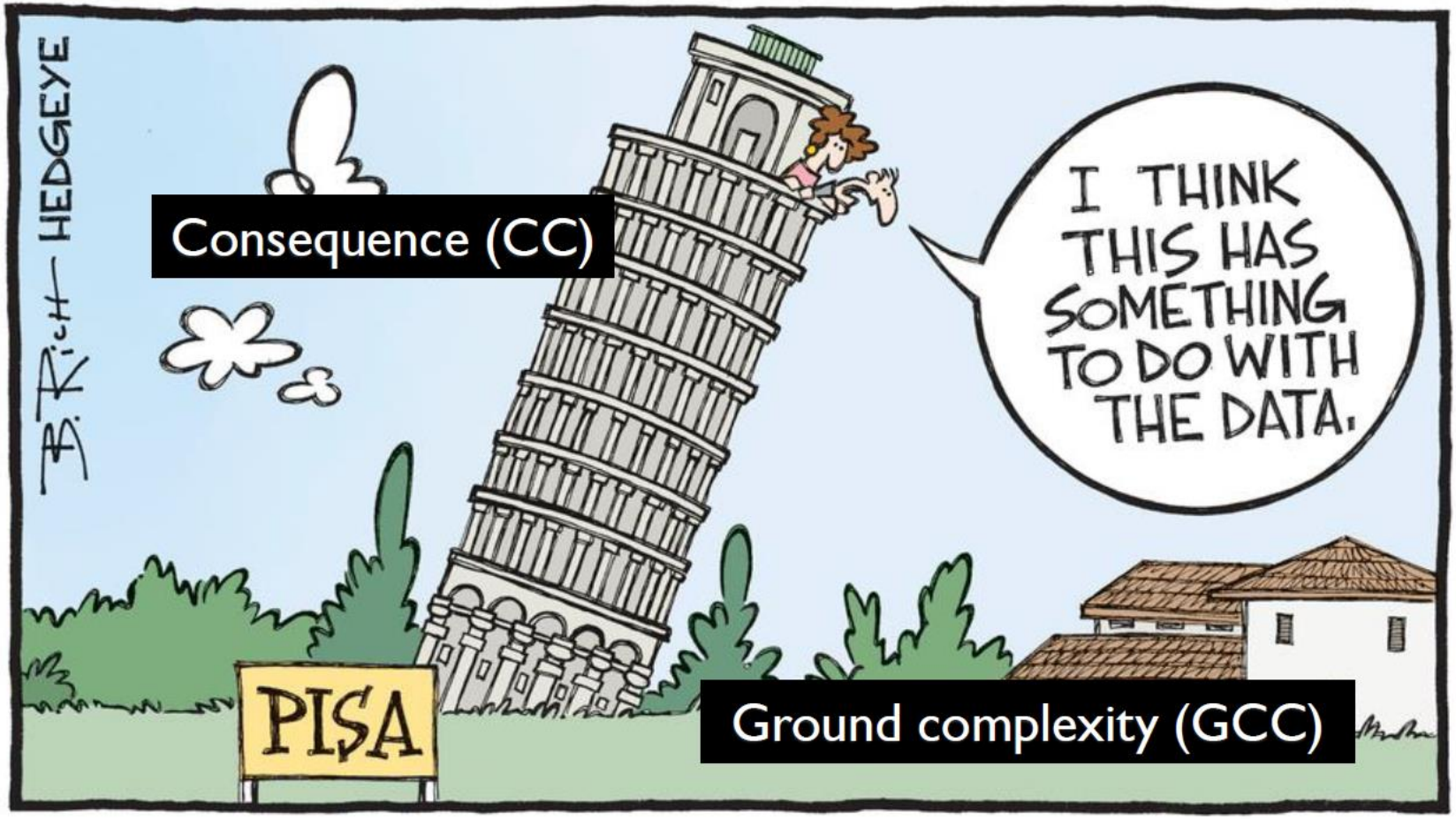
(16) Geotechnical Category 1 procedures should be used only if there is no excavation below the water table or if comparable local experience indicates that a proposed excavation below the water table will be straightforward.

(17) Geotechnical Category 2 should include conventional types o **Consequence** with no exceptional risk or dif **Complexity** loading condi

(18) Designs for structures in Geotechnical Category 2 should normally include quantitative geotechnical data and analysis to ensure that the fundamental requirements are satisfied.

(19) Routine procedures for field and laboratory testing and for design and execution may be used for Geotechnical Category 2 designs.

2nd generation of Eurocode 7
Separation of consequence and complexity



Consequence classes (From Eurocode 0)

Table 4.1 (NDP) — Qualification of consequence classes

Consequence class	Indicative qualification of consequences	
	Loss of human life or personal injury[a]	Economic, social or environmental consequences[a]
CC4 – Highest	Extreme	Huge
CC3 – High	High	Very great
CC2 – Normal	Medium	Considerable
CC1 – Low	Low	Small
CC0 – Lowest	Very low	Insignificant

[a] The consequence class is chosen based on the more severe of these two columns.

Table A.1.1 (NDP) — Examples of buildings in different consequence classes

Consequence class	Description of consequence	Examples
CC4[a]	Highest	Nuclear power plant, dams
CC3	High	Buildings or parts of buildings where a very large number of people could be affected by failure, e.g. grandstands, concert halls, high-rise buildings
CC2	Normal	Buildings or parts of buildings not covered by CC1 or CC3
CC1	Low	Buildings or part of buildings where very few people could be affected by failure, e.g. agricultural buildings, storage buildings
CC0[a]	Lowest	Elements other than structural, see 3.1.1.7.

[a] For provisions concerning CC0 and CC4, see 4.3.

2nd generation of Eurocode 7
Geotechnical complexity classes

Complexity		General features
GCC3	Higher	Any of the following applies • difficult soils • difficult geomorphologies • significant thickness of m ound • sliding ground • steep soil slopes • significant geometric variability • significant sensitivity to groundwater conditions • significant complexity of the ground-structure interaction • little experience with calculation models for the current situation
GCC2	Normal	Covers everything not contained in GCC1 or GCC3
GCC1	Lower	All the following conditions apply • uniform ground conditions and standard construction technique • isolated shallow foundatic tically applied in the zone • well established design m lable for the local conditions and the planned construction technique • low complexity of the ground-structure-interaction

Bad

Good

2nd generation of Eurocode 7
'New' Geotechnical Category = CC x GCC

Consequence Class (CC)	Geotechnical Complexity Class (GCC)		
	Lower (GCC1)	Normal (GCC2)	Higher (GCC3)
High (CC3)			GC3
Medium (CC2)		GC2	
Low (CC1)	GC1		

The Geotechnical Category determines:

- minimum amount of ground investigation
- minimum validation of calculation models
- minimum checking of design (EN 1990's *Design Check Levels*)
- minimum checking of execution (EN 1990's *Inspection Levels*)
- minimum control of execution (*Execution Classes*)
- minimum amount of monitoring
- minimum design qualification and experience levels (EN 1990's *Designer Qualification Levels*)

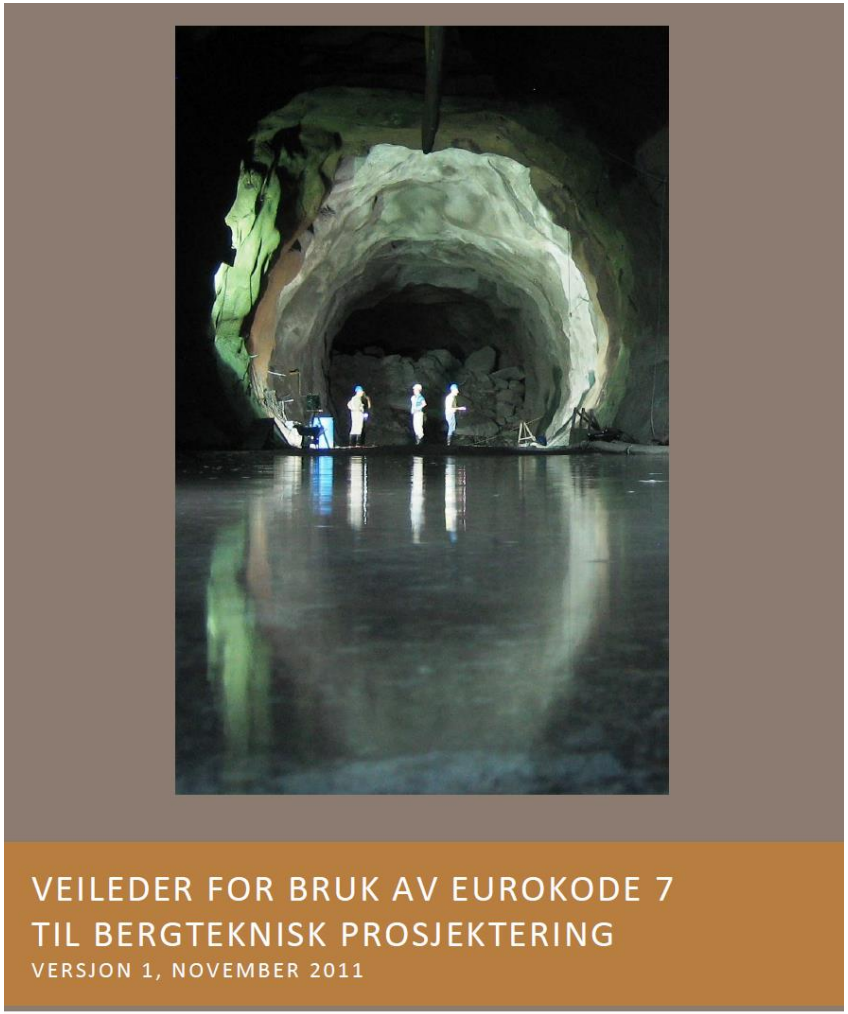
FprEN1997-3:2024.TC250 (E) March 2024

- Section 0 Introduction
- Section 1 Scope
- Section 2 Normative references
- Section 3 Terms, definitions and symbols
- Section 4 Slopes, cuttings and embankments
- Section 5 Spread foundations
- Section 6 Piled foundations
- Section 7 Retaining structures
- Section 8 Anchors
- Section 9 Reinforced fill structures
- Section 10 Soil nailed structures
- Section 11 Rock bolts and rock surface support
- Section 12 Ground improvement
- Section 13 Groundwater control measures
- Annexes

Most relevant sections for Rock Engineering

NBG Veiledning

- Very useful document for the 1st generation
- This will be an even more key document for the 2nd generation EC7
- We need input from the rock engineering branch
- One task is to use reliability based methods to derive partial factors to be used for rock



Kommentarer - 1

- National Annexes work ongoing
- Veiledning will be important
  - We will need help and support ☺
- Nordic cooperation and meetings ongoing
- Currently work underway for a study using probabilistic methods (reliability method) to back calculate partial factors that are suitable for use in rock engineering

Reliability method

Evaluation of the parameters for resisting forces

FprEN 1990:2022 (E)

NOTE 1 The target values of reliability index β for the 1-year and 50-year reference periods for persistent and transient (fundamental) and fatigue design situations in ULS for structures included in the scope of Clauses A.1 and A.2 are given in Table C.3 (NDP), unless the National Annex gives different values.

NOTE 2 The partial factors given in Clauses A.1 and A.2 are expected to lead in general to a structure with a reliability index β for 50-year reference period greater than the values given in Table C.3 (NDP) for a 50-year reference period.

Table C.3 (NDP) — Target values for reliability index β for different consequence classes (for persistent and transient (fundamental) and fatigue design situations in ULS) relevant to structures in the scope of Clauses A.1 and A.2

Consequence class[a]	1-year reference period β	50-year reference period	
		β	$P_{f,50}$
CC3	5,2	4,3	$\sim 10^{-5}$
CC2	4,7	3,8	$\sim 10^{-4}$
CC1	4,2	3,3	$\sim 10^{-3}$

[a] Regarding CC0 and CC4, see also 4.3(2) and 4.3(3).

No. of bolts	μ_{SM}	σ_{SM}	β
1	-148	289	-0,51
2	147	290	0,51
3	441	292	1,51
4	736	295	2,50
5	1030	298	3,46
6	1325	302	4,39
7	1619	307	5,28
8	1914	312	6,14
9	2208	318	6,95
10	2503	324	7,72

- In this case 6 bolts are required to satisfy a reliability index value β of 3,8 (CC2)
- The total factor of safety can be back calculated to ~3,6
- Evaluation of corresponding partial factors ~ 1,5 (for W, tan α and tan φ)

Nordisk samarbeid ved utarbeidelse av Eurokode 7

- Clear divide in different philosophies of rock engineering between northern and southern Europe, (typically defined by southern extent of the glaciers during the last ice age)
- 2013: Nordic countries started to cooperate to make sure that the geotechnical sections are also relevant to Northern Europe, e.g.
  - Restructuring of Part 2
  - Splitting of soil nails and rock bolts
- 2 meetings a year, a total of 20 meetings
- Need to make sure the standard is relevant for both hard rock and soft clay
- Hvis det settes urimelige krav som kommer urimelig ut ved nordiske grunnforhold kan det både øke byggetid og kostnader.
- Videre har samarbeidet ført til at det har vært mulig å få med Nordiske representanter i viktige komiteer og roller, noe som igjen har bedret mulighet for innflytelse og informasjon.

Conclusions

- The current standard is not perfect and neither will the new one be
- But the 2nd revision is a marked improvement upon the 1st and opens a lot of doors for rock engineering/engineering geology
- Tunnelling work can be done under parts 1 and 2
- A part 4 is currently under consideration: Design of underground structures
  - If Norway is not involved with this, then we will have ‘sør-europeiske tilstander’ (e.g. mandatory rock bolt pull out tests, systematic concrete lining (!))
- Making National Annexes suitable for Norwegian conditions will also be important work