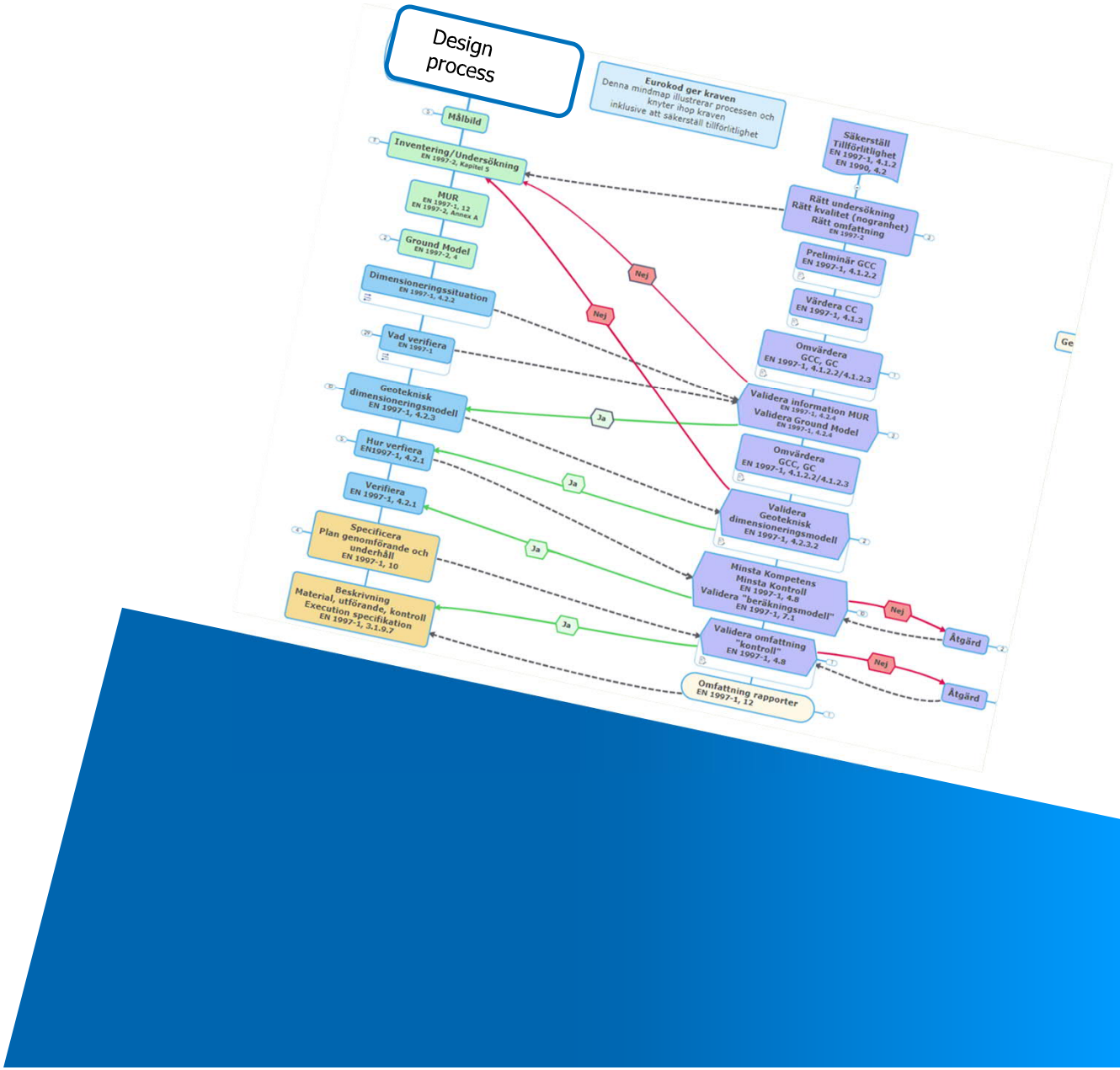
Uusi Eurokoodi 7

Panu Tolla

Väylävirasto

28.9.2023



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Trafikledsverket

EN1997 Geotekninen suunnittelu

Osa 1: Yleiset säännöt

CEN/TC 250/SC 7 **N 1720**

CEN/TC 250/SC 7 "Eurocode 7 - Geotechnical design"
Secretariat: **NEN**
Secretary: **Kraijema Geert Mr**

FprEN 1997-1 FV draft send to TC250

Document type	Related content	Document date	Expected action
General / Other		2023-08-16	INFO

Osa 2: Ground properties

Maaperän(?) ominaisuudet

CEN/TC 250/SC 7 **N 1722**

CEN/TC 250/SC 7 "Eurocode 7 - Geotechnical design"
Secretariat: **NEN**
Secretary: **Kraijema Geert Mr**

FprEN 1997-2 FV draft send to TC250

Document type	Related content	Document date	Expected action
General / Other		2023-08-16	INFO

Osa 3:Geotekniset rakenteet

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 1997-3

September 2022

ICS 91.010.30; 93.020 — Will supersede EN 1997-1:2004

English Version

Eurocode 7 - Geotechnical design - Part 3: Geotechnical structures

1. Luiskat, leikkaukset, penkereet
2. Anturaperustukset
3. Paaluperustukset
4. Tukiseinät & -muurit
5. Ankkurit
6. Lujitemaa rakenteet
7. Maanaulatut rakenteet
8. Kalliopultit
9. Pohjanvahvistus
10. Pohjaveden hallinta

Ref. No. prEN 1997-3:2022 E

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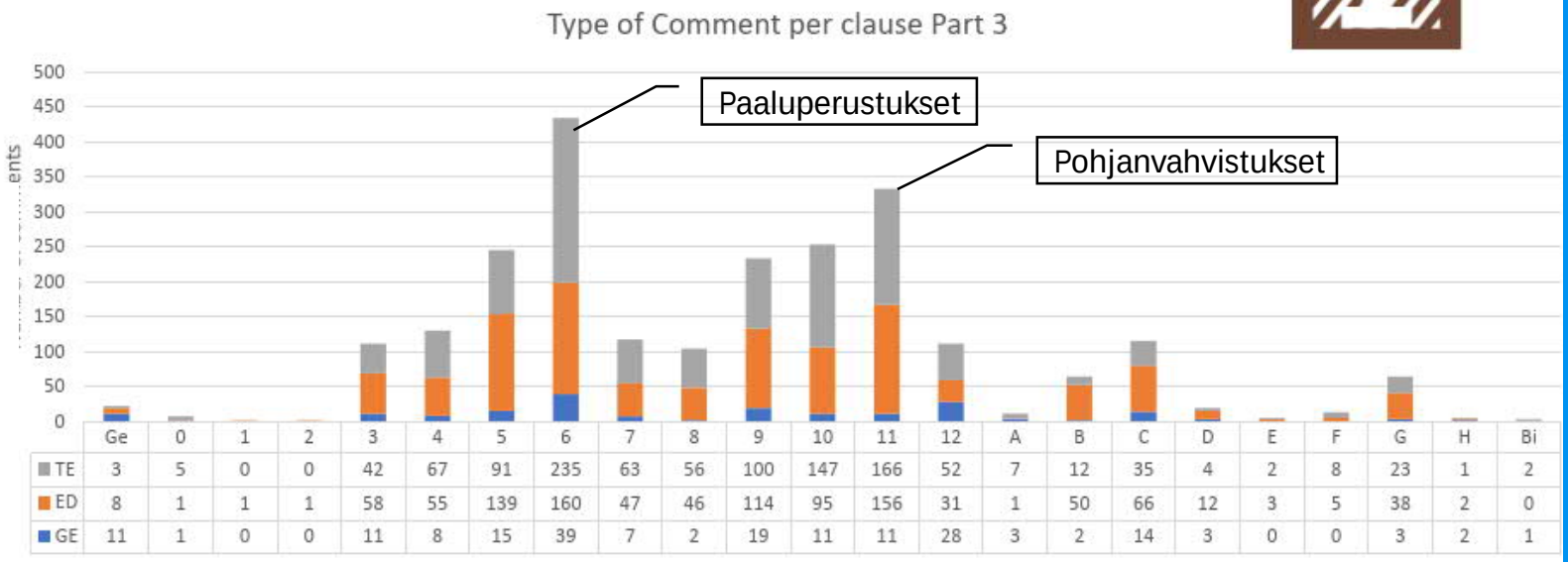
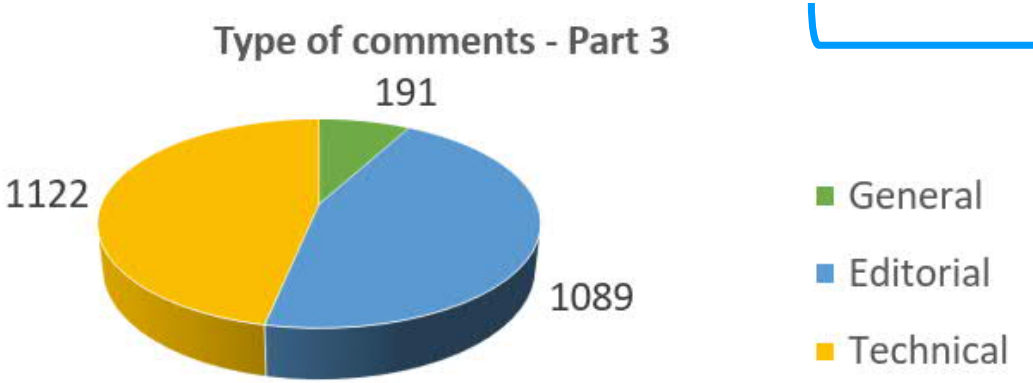
Trafikledsverket

Comments on Formal Enquiry Draft – EN1997-3

Total number of comments: 2402

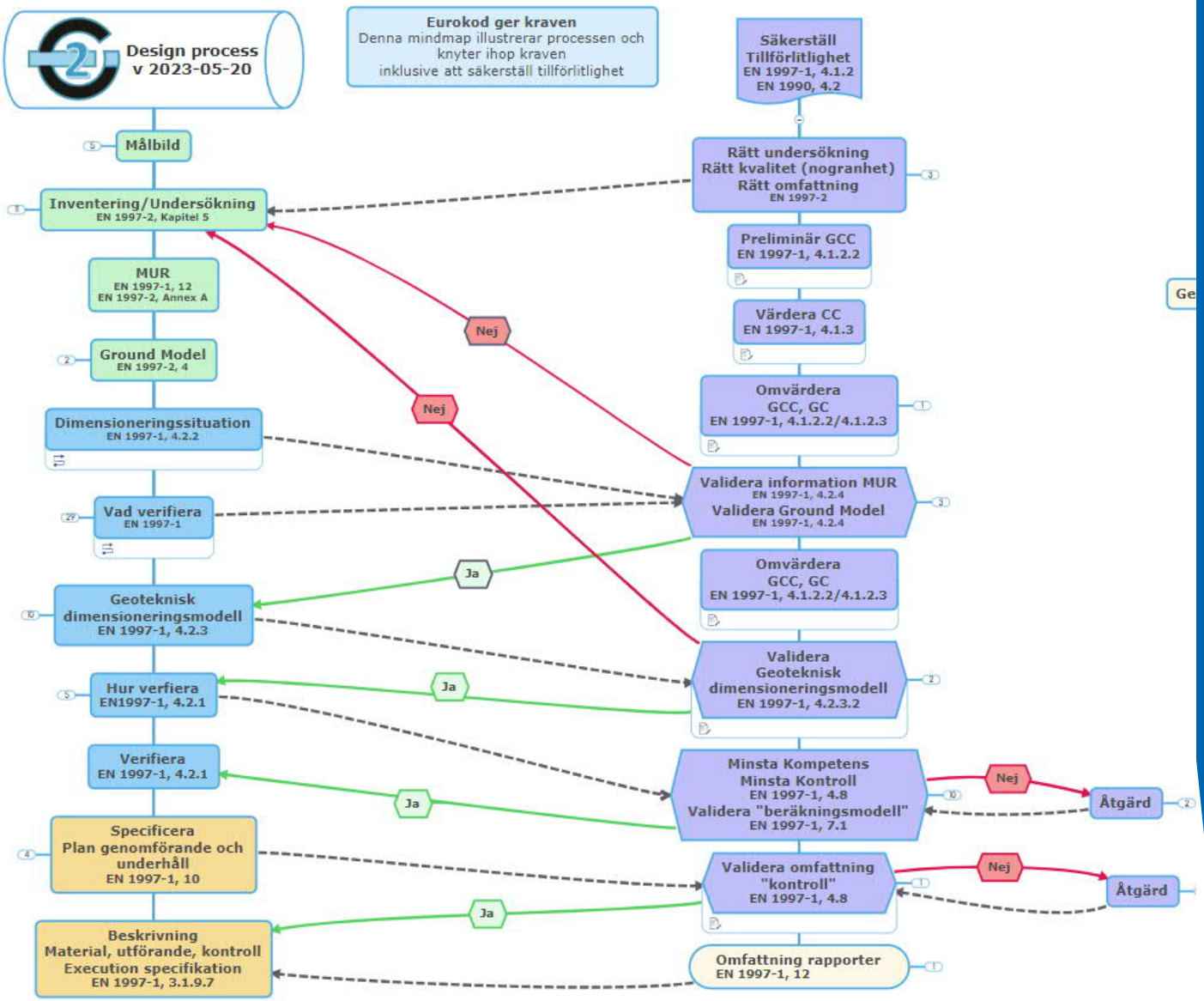


	Ge	0	1	2	3	4	5	6	7	8	9	10	11	12	A	B	C	D	E	F	G	H	Bi
TE	3	5	0	0	42	67	91	235	63	56	100	147	166	52	7	12	35	4	2	8	23	1	2
ED	8	1	1	1	58	55	139	160	47	46	114	95	156	31	1	50	66	12	3	5	38	2	0
GE	11	1	0	0	11	8	15	39	7	2	19	11	11	28	3	2	14	3	0	0	3	2	1



/Adriaan van Seters 2023/

Mitoitus-prosessi EN1997-1



/Gunilla Franzen 2023/

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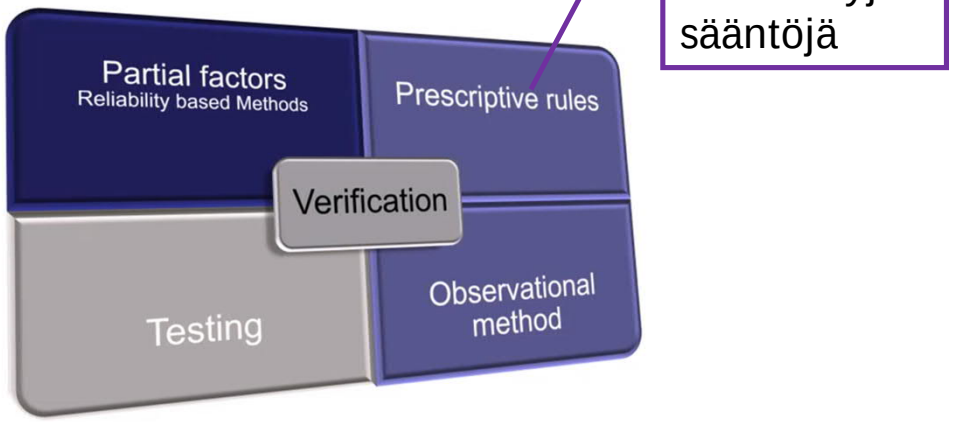
EN1997:202X muutoksia

Tasapuolisesti

Geoteknisen rakenteen mitoitus



ennakkoon määriteltyjä sääntöjä

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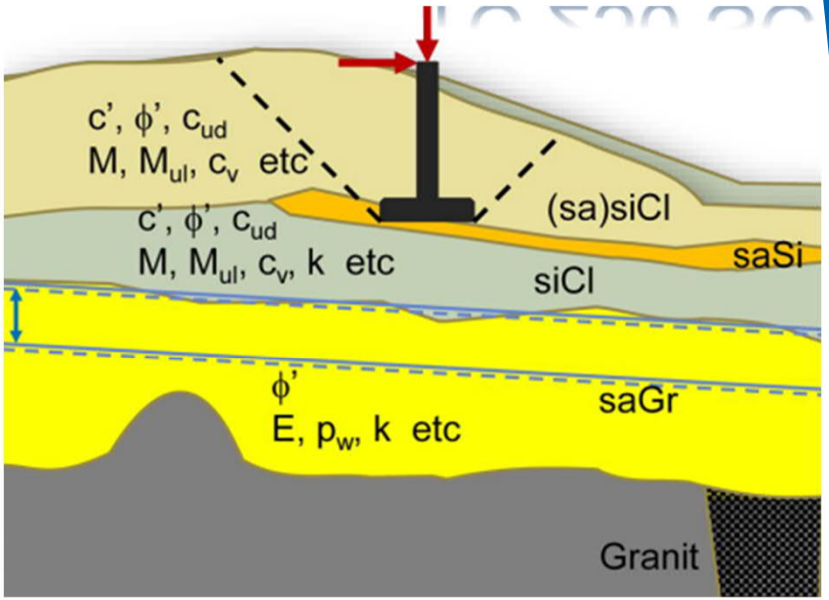
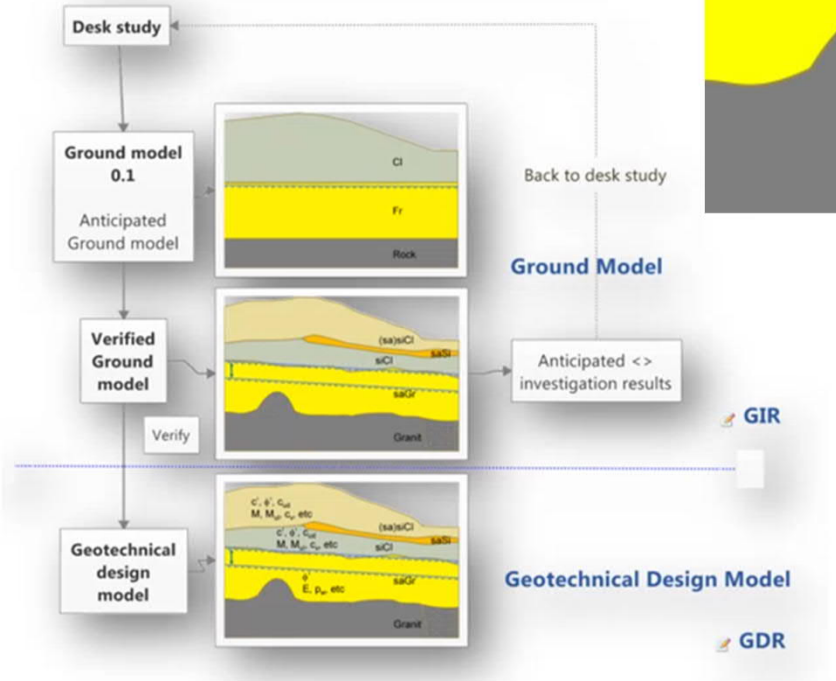
Ground model





/Gunilla Franzen 2018/

Väylävirasto
Trafikledsverket

EN1997 The framework of the reliability system

CC

Table 4.3(NDP) — Examples of geotechnical structures in different Consequence Classes

Consequence class	Description of consequence	Examples
CC4	Highest	— Critical infrastructures; — Geotechnical structures whose integrity is of vital importance for civil protection[a]; — Areas with significant landslide hazards.
CC3	Higher	— Retaining walls and foundations supporting public buildings, with high exposure; — Man-made slopes and cuts, retaining structures with high exposure; — Major road/railway embankments, bridge foundations that can cause server interruption of service in emergency situations; — Geotechnical structures with a primary navigational ~~function~~[b]27ccupanc; — Underground constructions with large occupancy.
CC2	Normal	All geotechnical structures not classified as CC1, CC3, or CC4
CC1	Lower	— Retaining walls and foundations supporting buildings with low occupancy; — Man-made slopes and cuts, in areas where a failure will have low impact on the society; — Minor road/railway embankments not vital for the society; — Underground structures with occasional ~~occupancy~~[c]27ccupancy.
CC0	Lowest	Not applicable for geotechnical structures

[a] Examples of Geotechnical structures whose integrity is of vital importance for civil protection is road/railway embankments with fundamental role in the event of natural disasters, earth dams connected to a [illegible] plants, levees, tailing dams and earth dams with extreme consequences upon failure, foundation [illegible] and major harbour structures.

[b] Examples of Geotechnical structures with primary navigational function is marking or protec

[c] Examples of underground structures with occasional occupancy is culverts not supporting m major roads.

K_F, K_M factor (vain CC)

GCC

Table 4.1(NDP) — Selection of Geotechnical Complexity Class

Geotechnical Complexity Class	Complexity	General features
GCC 3	Higher	**Any** of the following apply: — considerable uncertainty regarding ground conditions — highly variable or difficult ground conditions — significant sensitivity to groundwater and surface water conditions — significant complexity of the ground-structure interaction
GCC 2	Normal	GCC2 applies if GCC 1 and GCC3 are not applicable
GCC 1	Lower	**All** the following conditions apply: — negligible uncertainty regarding the ground conditions — uniform ground conditions — low sensitivity to groundwater and surface water conditions, — low complexity of the ground-structure-interaction
NOTE The terms 'considerable', 'significant', 'highly', etc. are relative to any comparable experience that exists for the particular geotechnical structure, design situation, and ground conditions.		

GC

Table 4.2(NDP) — Relationship between Geotechnical Category, Consequences Class, and Geotechnical Complexity Class

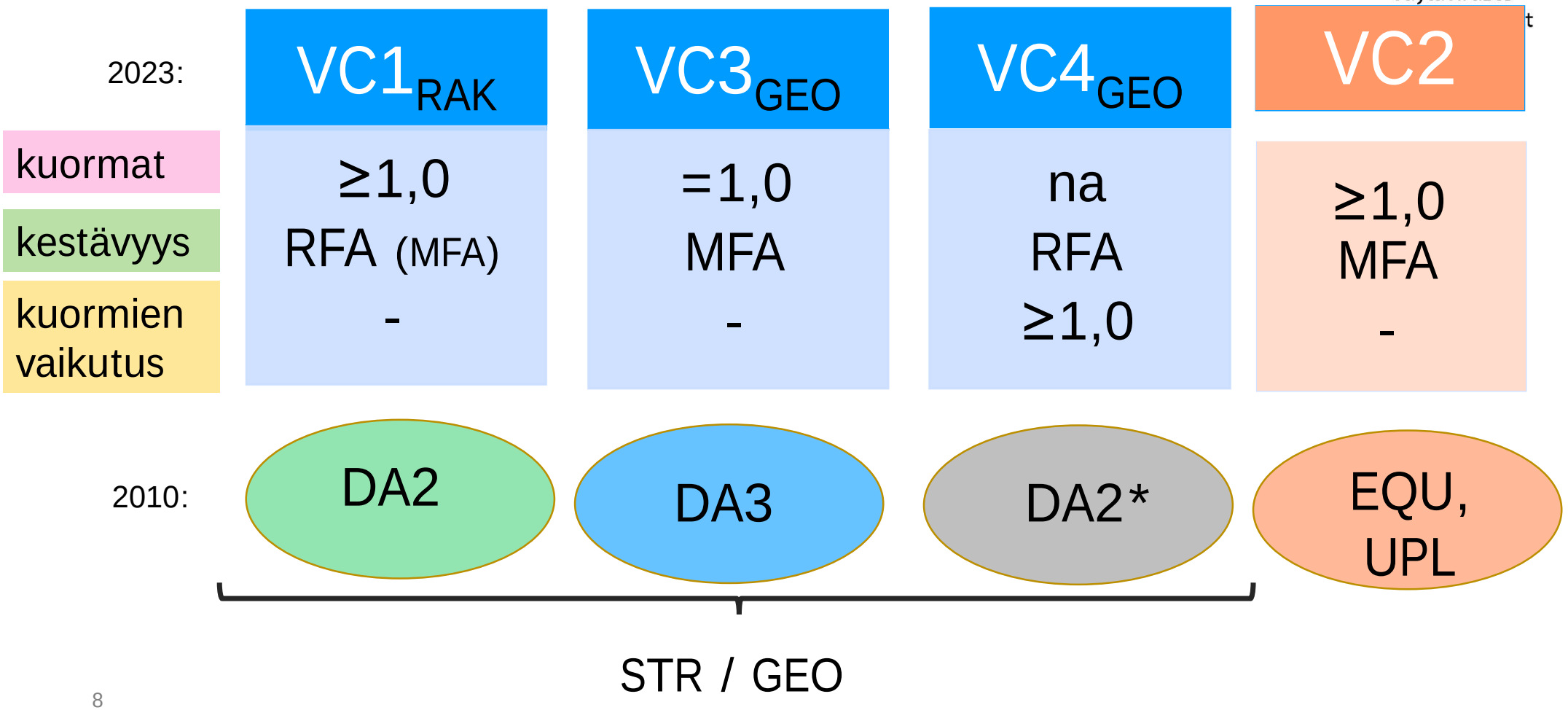
Consequence Class (CC)	Geotechnical Complexity Class (GCC)		
	Lower (GCC1)	Normal (GCC2)	Higher (GCC3)
Higher (CC3)	GC2	GC3	GC3
Normal (CC2)	GC2	GC2	GC3
Lower (CC1)	GC1	GC2	GC2

- ❑ Pohjatutkimukset
- ❑ Validointi:
  - GIR
  - GDM
  - Calculation model
- ❑ Pätevyys/laatu (EN1990):
  - Suunnittelija
  - Laadunhallinta: DCL, DQL, IL Raportointi
- ❑ Työselitys: valvonta, seuranta

kaikki (NDP)!

Murtorajatilan tarkistus, laskennallinen

Väylävirasto



Anturaperustuksen geotekninen kapasiteetti (MRT)

/prEN 1997-3:202x F.E. with agreed CRs (v2022:5)/

Table 5.2 — (NDP) Partial factors for the verification of ground resistance of spread foundations for fundamental (persistent and transient) design situations

Verification of	Partial factor on	Symbol	Material factor approach (MFA), either both combinations (a) and (b) or the single combination (c)			Resistance factor approach (RFA), either combination (d) or ©[c]	
			(a)	(b)	('c)	(d)	('e)
Overall stability	See Clause 4						
Bearing and sliding resistance	Actions and effects-of-actions	γ_F and γ_E	VC1[a]	VC3[a]	VC1[a]	VC1[a]	VC4
	Ground properties	γ_M	M1[b]	M2[b]	M2[b]	Not factored	
	Bearing resistance	γ_{RN}	Not factored			1,4	
	Sliding resistance	γ_{RT}	Not factored			1,1	

[a] Values of the partial factors for Verification Cases (VCs) 1, 3, and 4 are given in prEN 1990:2021 Annex A.

[b] Values of the partial factors for Sets M1 and M2 are given in prEN 1997-1:2022, Table 4.7.

[c] Use combination (d) except where specified otherwise in 5.6.6 (2) and (3)

(NDP)!

(2) If the resistance factor approach is used to determine the bearing resistance of spread foundations under inclined loading, Verification Case 4 may be used instead of Verification Case 1, provided the condition in Formula (5.18) is satisfied:

$$T_{rep} \leq 0{,}2N_{rep} \qquad (5.18)$$

where

T_{rep} is the representative value of the force acting tangential to the foundation base;

N_{rep} is the representative value of the force acting normal to the foundation base, considered as a favourable action.

muuta – ei NDP:

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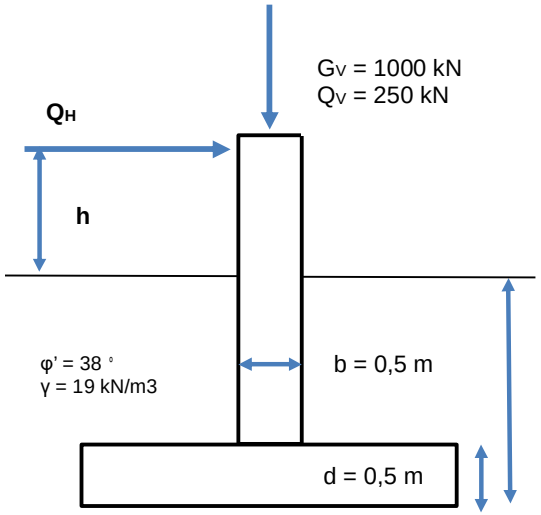
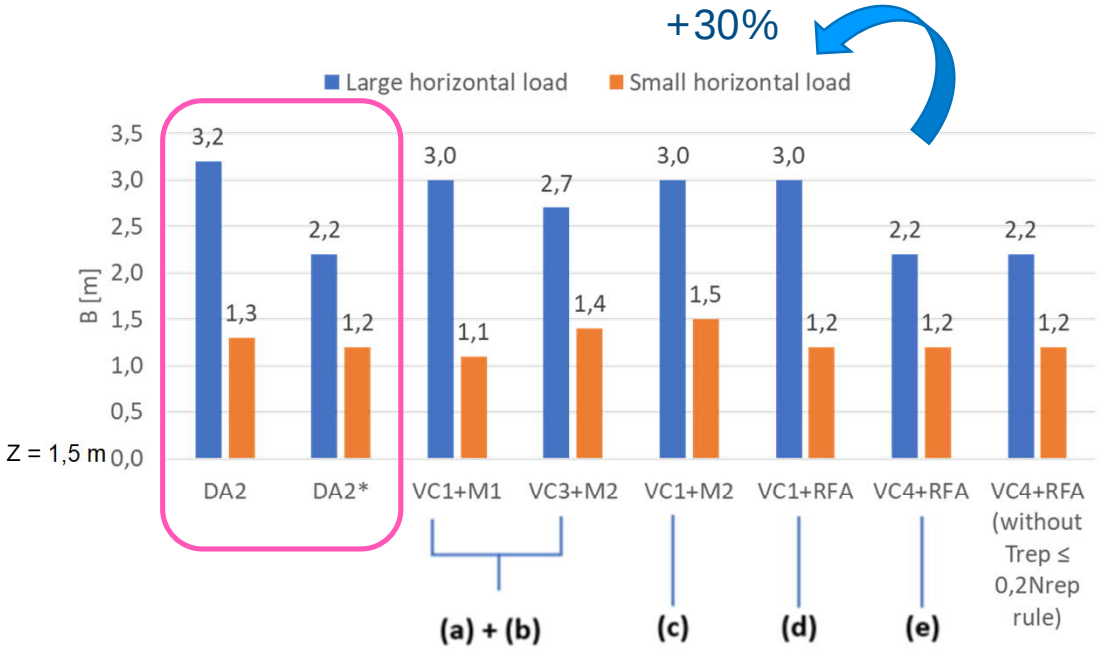
Trafikledsverket

Tiivis moreeni (ϕ' = 38 °, γ = 19 kN/m^3), ei pohjavettä



	Q_H [kN]	h [m]
Vaakakuorma suuri	150	4
Vaakakuorma pieni	50	2



e/B	0,32	0,32	0,32	0,32	0,32	0,32	0,32	0,32
BC ODF	3,08	1,43	4,06	1,52	1,79	2,90	1,50	1,50
Sliding ODF	3,76	3,28	4,46	3,95	3,57	4,06	4,92	4,92
T/N							0,13	0,13
e/B	0,21	0,14	0,23	0,15	0,16	0,21	0,14	0,14
BC ODF	1,21	1,08	1,19	1,14	1,18	1,08	1,06	1,06
Sliding ODF	8,99	8,92	10,83	10,22	8,94	9,91	13,39	13,39
T/N							0,05	0,05

/Riku-Matti Kurki, Ramboll 2023/

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Trafikledsverket

Numeeriset mallit

- Ohittaa EN1997-3?
- Koskee rakennemalleja
- Vastaa ”DA1-1 & -2” tai ”DA3
- NDP

/FprEN 1997-1:2023.TC250 (E)/

Table 8.1 (NDP) — Procedure for verification of ultimate limit states with numerical models

			Factoring approach - See 8.2(1)		
			Output VC4 + M1	**Input VC3 + M2 (Recommended)**	**Input VC3 + M2 (Alternative)**
			See 8.2 (1), (9), (10)	**See 8.2 (1) and (6)**	**See 8.2 (1) and (7)**
Construction Stage 1 (CS1)			**Step 1[c] Representative Step**	**Step 1[c] Representative Step**	**Step 1[c]** ---
	Input	Piezometric level or groundwater pressure	Representative values		Not applicable Go directly to Step 2
		Ground properties	Representative Values		
		Structural element properties	Representative Values		
		External actions	Representative Values		
	Output	Movements	[a]		
		Structural forces	[a]		
			Step 2 ULS Verification Step	**Step 2 ULS Verification Step**	**Step 2 ULS Verification Step**
	Input	Piezometric level or groundwater pressure	Design level[b]	Design level [b]	Design level [b]
		Ground properties	Design values by M1 combination	Partial factors M2[d]	Design values by M2 combination
		Structural element properties	Representative values	Representative values	Representative values
		External actions	Design values by VC4 combination	Design values by VC3 combination	Design values by VC3 combination
	Output	Verification of ground failure	See 8.2(9) and (10)	ULS verified if equilibrium is attained in the ground with no failure of the structure	ULS verified if equilibrium is attained in the ground with no failure of the structure
		Verification of structural failure	Design values (E_d) obtained by applying γ_E to calculation results See 8.2(9) and (10)	Design values (E_d) obtained directly from calculation results See 8.2(8)	Design values (E_d) obtained directly from calculation results
CS2			Continue in the same way through any subsequent stage (CS2, CS3, etc.)		

a These output values can be used for SLS verifications

b "The design piezometric level" can be obtained by applying a deviation to the representative piezometric level as stated in 6.4.1 (1), second bullet

c The start of Step 1 of any given Construction Stage continues from the end of Step 1 of the preceding Construction Stage

d Usually in this step, the analysis performs a strength reduction and the ULS verification is checked, as set in 8.2 (6). If the analysis cannot perform strength reduction or apply different material factors to different geotechnical units, then Step 2 also continues from Step 1 of the preceding Construction Stage using design material properties determined with partial factors from Set M2

kaikki (NDP)!

EC0 määrää:
Yhdistely, Sensitivity Class...

/SFS EN 1990:2023/

Table A.1.7 (NDP) — Combination factors for buildings

Action	ψ_0	ψ_1	ψ_2
Imposed loads in buildings (see EN 1991-1-1):			
Category A: domestic, residential areas	0,7	0,5	0,3
Category B: office areas	0,7	0,5	0,3
Category C: congregation areas	0,7	0,7	0,6
Category D: shopping areas	0,7	0,7	0,6
Category E: storage areas	1,0	0,9	0,8
Category F: traffic area, vehicle weight ≤ 30 kN	0,7	0,7	0,6
Category G: traffic area, 30 kN < vehicle weight ≤ 160 kN	0,7	0,5	0,3
Category H: roofs accessible for normal maintenance and repair only	0,7	0	0
Construction loads (see EN 1991-1-6)	1,0	-	-
Snow loads on buildings (see EN 1991-1-3):			
— Finland, Iceland, Norway, Sweden;	0,7	0,5	0,2
— remainder of CEN Member States, for sites located at altitude H > 1 000 m a.s.l.;	0,7	0,5	0,2
— remainder of CEN Member States, for sites located at altitude H ≤ 1 000 m a.s.l.	0,5	0,2	0
Wind actions on buildings (see EN 1991-1-4)	0,6	0,2	0
Temperature (non-fire) in buildings (see EN 1991-1-5)	0,6	0,5	0
Icing (see EN 1991-1-9)	0,5	0,2	0
Water actions[a] (see 6.1.3.2)	-	-	-
Waves and currents (see EN 1991-1-8)			

[a] The combination value for water actions can be based on a 10 % probability that it is exceeded during a one-year reference period.

kaikki (NDP)!

Table A.1.12 —Classification of structural sensitivity to foundation movement

Structural sensitivity class	Description of sensitivity
SSC5	Highest
SSC4	High
SSC3	Normal
SSC2	Low
SSC1	Lowest

Table A.1.15 (NDP) — Suggested maximum permitted tilt of foundations for different structural sensitivity classes

Structural sensitivity class	Description of sensitivity	Maximum tilt[a] $\omega_{Cd,SLS}$
SSC5	Highest	0,1 %
SSC4	High	0,2 %
SSC3	Normal	0,3 %
SSC2	Low	0,4 %
SSC1	Lowest	0,5 %

[a] For the definition of foundation tilt, see EN 1997-1.

Table A.1.13 (NDP) — Suggested maximum permitted differential settlement of foundations for different structural sensitivity classes

Structural sensitivity class	Description of sensitivity	Maximum differential settlement[a] $\Delta s_{Cd,SLS}$
SSC5	Highest	10 mm
SSC4	High	15 mm
SSC3	Normal	30 mm
SSC2	Low	60 mm
SSC1	Lowest	100 mm

[a] For the definition of differential settlement of foundations, see EN 1997-1.

Raportointijärjestelmä

Annex B
(informative)

Contents of reports

B.3 Ground Investigation Report

(1) FprEN 1997-2:2024, Annex A shall apply.

B.4 Geotechnical Design Report

B.4.1 General content

(1) The Geotechnical Design Report should include, but is not limited to, the following information:

1. Project information
   a. Project name;
   b. Proposed structure and its use and location (coordinates and reference system);
   c. Normative references;
   d. Reference to the GIR, Ground Model, and other sources of information.
2. Evaluation of available information
   a. Desk study;
   b. Site inspection;
   c. In-situ and laboratory testing;
   d. Other relevant investigations and studies;
   e. Validation of information obtained from GIR (4.2.4).
3. List/sketch geotechnical structures for evaluation
   a. Geotechnical structures for consideration;
   b. Evaluation of the alternatives;
   c. Choice of main alternatives, and motive for abandoning the other.
4. Basis of design
   a. Design situations (4.2.2);
   b. Limit states considered (8, 9);
   c. Actions and combinations of actions (4.3.1);
   d. Geotechnical reliability, Consequence Class (GCC, GC) (4.1.2.2, 4.1.2.3);
   e. Ground Model (see FprEN 1997-2:2024, Clause 4);
   f. Geotechnical Design Model, including evaluation of representative values (4.3.2) and validation of GDM (4.2.3);
   g. Impact within the zone of influence (4.2.5);
   h. Aspects in relation with robustness (4.1.4), design service life (4.1.5), durability ((1)) and sustainability (4.1.7);
   i. Any restrictions (loading, vibration, deformation, etc.);
   j. Any assumptions or simplifications;
   k. Verification method with corresponding selections and justification:
      i. For verification by calculation
         – Applicable design case and partial factors;
         – Validation of chosen calculation model (7.1).
      ii. For verification by testing
         – Reference to performed and planed testing.
      iii. For verification by prescriptive rules
         – Reference to selected prescriptive rules.
      iv. For verification by Observational Method
         – Selection of design variants for analyses.
5. Geotechnical Analyses
   a. Estimate of the expected range of results;
   b. Documentation of analyses;
   c. Sensitivity analyses;
   d. Evaluation of results;

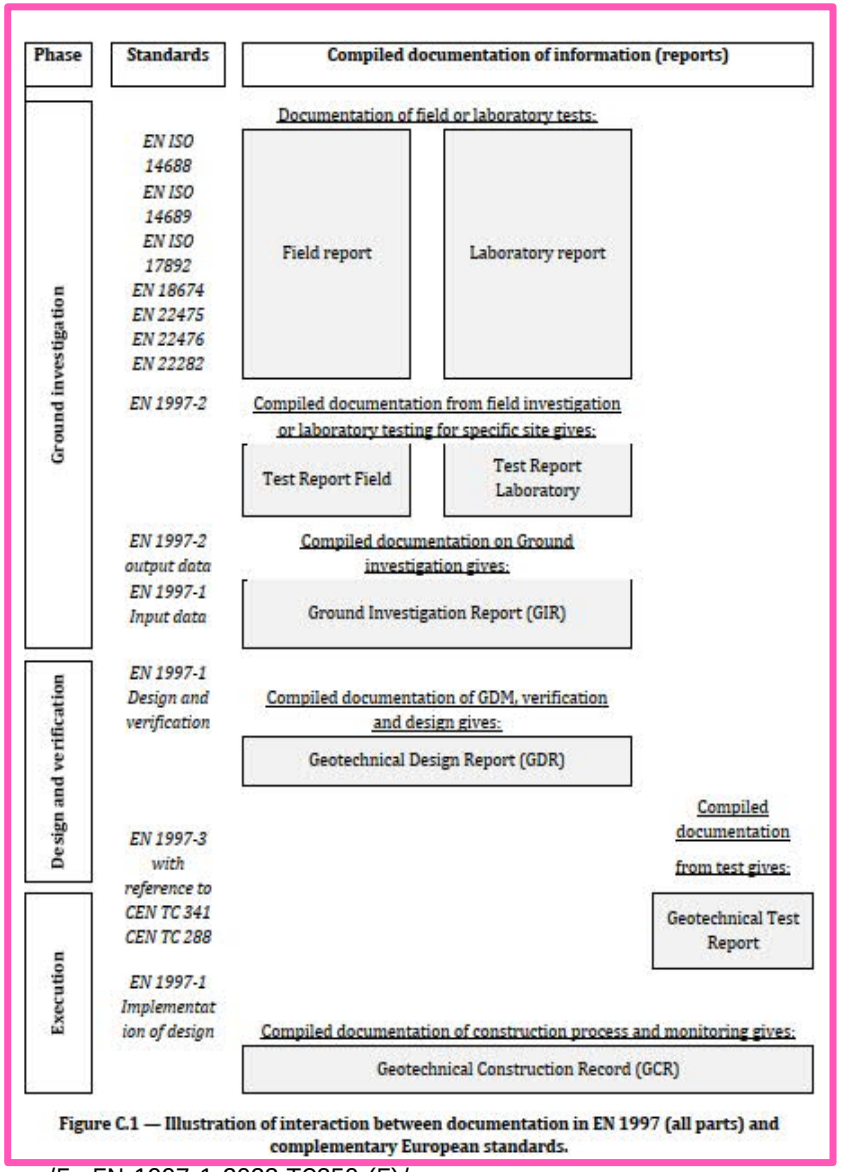

Figure C.1 — Illustration of interaction between documentation in EN 1997 (all parts) and complementary European standards.

/FprEN 1997-1:2023.TC250 (E)/

Väylävirasto
Trafikledsverket

Yhteenveto

- Uusi Eurokoodi 7 määrittelee suunnitteluprosessin kulun ja sisällön
- Prosessin vaiheet on kaikki kansallisesti määritettävissä
  - Prosessin määrittely kansallisesti mahdollista, - mutta turhaa?
  - Prosessin vaiheet erittäin työläitä määritellä ja räätälöidä: ”buildigs and civil engineering works”
- Rajatilamitoitus säilyy. Laskennallisessa mitoituksessa VC:t nykyisen kaltaisia
  - MFA/RFA on selkeämmin erotettu kuormien faktorointia määrittävistä VC1...VC4
  - Jos ”GEO” tehdään VC3 (MFA) tai VC4 (RFA) ja ”STR” VC1, joudutaan määrittämään mitoituskuormat kullekin erikseen eli rajapintana olisi kuormien edustavat arvot
- Myös muut menetelmät (testaaminen, seurantamenetelmä, suunnittelusäännöt) otettava huomioon ja määriteltävä
- Rajapinta Eurokoodi 0 kirkastettava ja sen NA tehtävä yhteist**yössä**
- Eurokoodi7:n kansallinen liite on mittavaharjoitus
  - Resurssit?
  - YM ja LVM liitteiden yhdistäminen?

	NDP	REQ	RCM	PER	YM Asetus	YM-ohje
EN1997-1	13	18	5	5	2	22
EN1997-2	1	4	7	1	2	4
EN1997-3	30	19	19	10	1	21
yht	**44**	**41**	**31**	**16**	**5**	**47**

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Trafikledsverket