Was bringt der neue EC7 im Bereich bewehrter Geokunststoffkonstruktionen?

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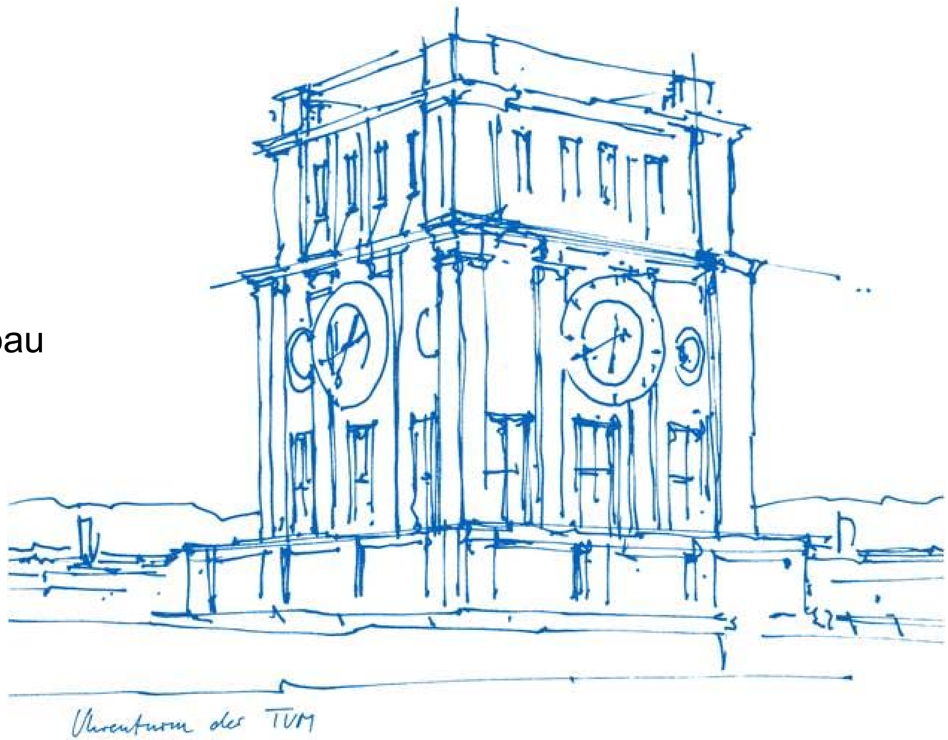


Eurocode 7 – DIN EN 1997

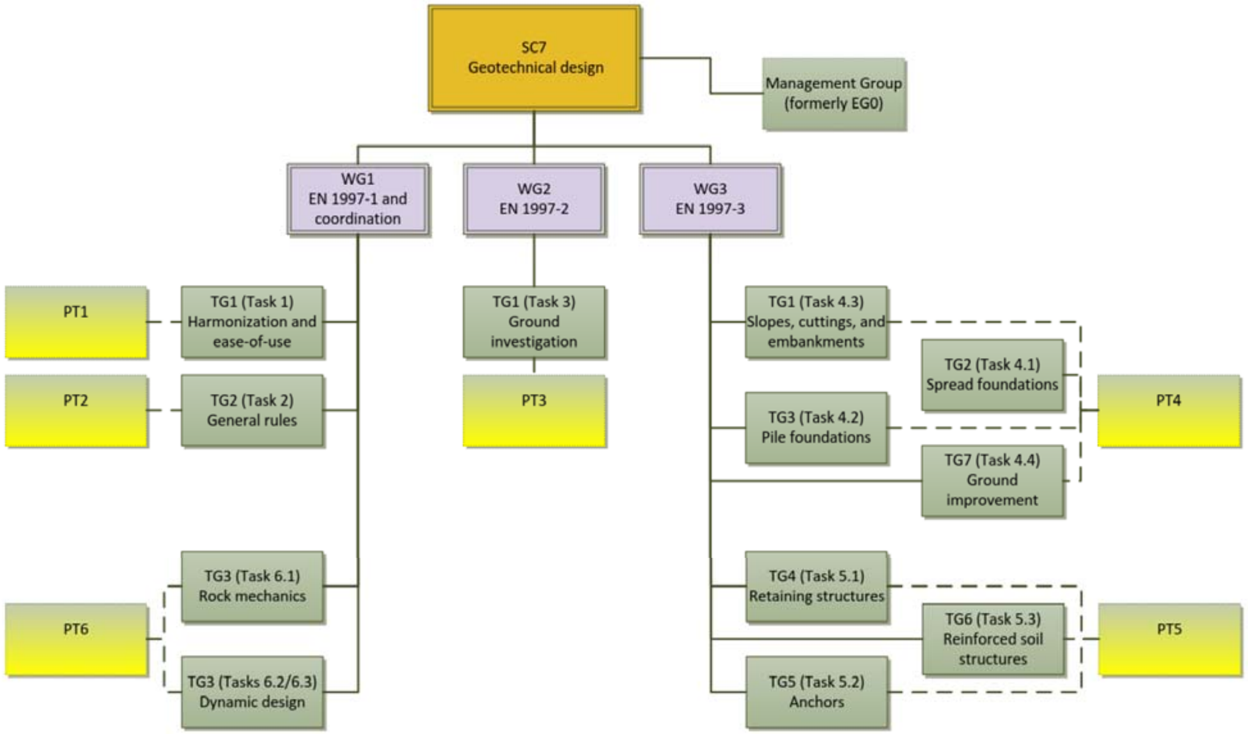


Bild **3:** Organisation des SC7 zur Überarbeitung des EC7

EC 0: Basis of structural and geotechnical design
(Grundlagen der Tragwerksplanung)

EC 7-1: General rules
(Allgemeine Regeln)

EC 7-2: Ground properties
(Baugrunduntersuchungen)

EC 7-3: Geotechnical structures
(Geotechnische Bauwerke)

prEN 1997-3:202x „Geotechnical structures“

Beginn Evoution Group EG5	**ca. 2011**	
Beginn Task Group TG6	**ca. 2017**	
Letzter Draft:	**November 2020**	(beeinhaltet 1000de von Einsprüchen zum vorigen Draft!)
Einsprüche waren bis:	**Januar 2021**	(ca. 6200 Einsprüche!)
Aktueller Draft:	**Mai 2021**	

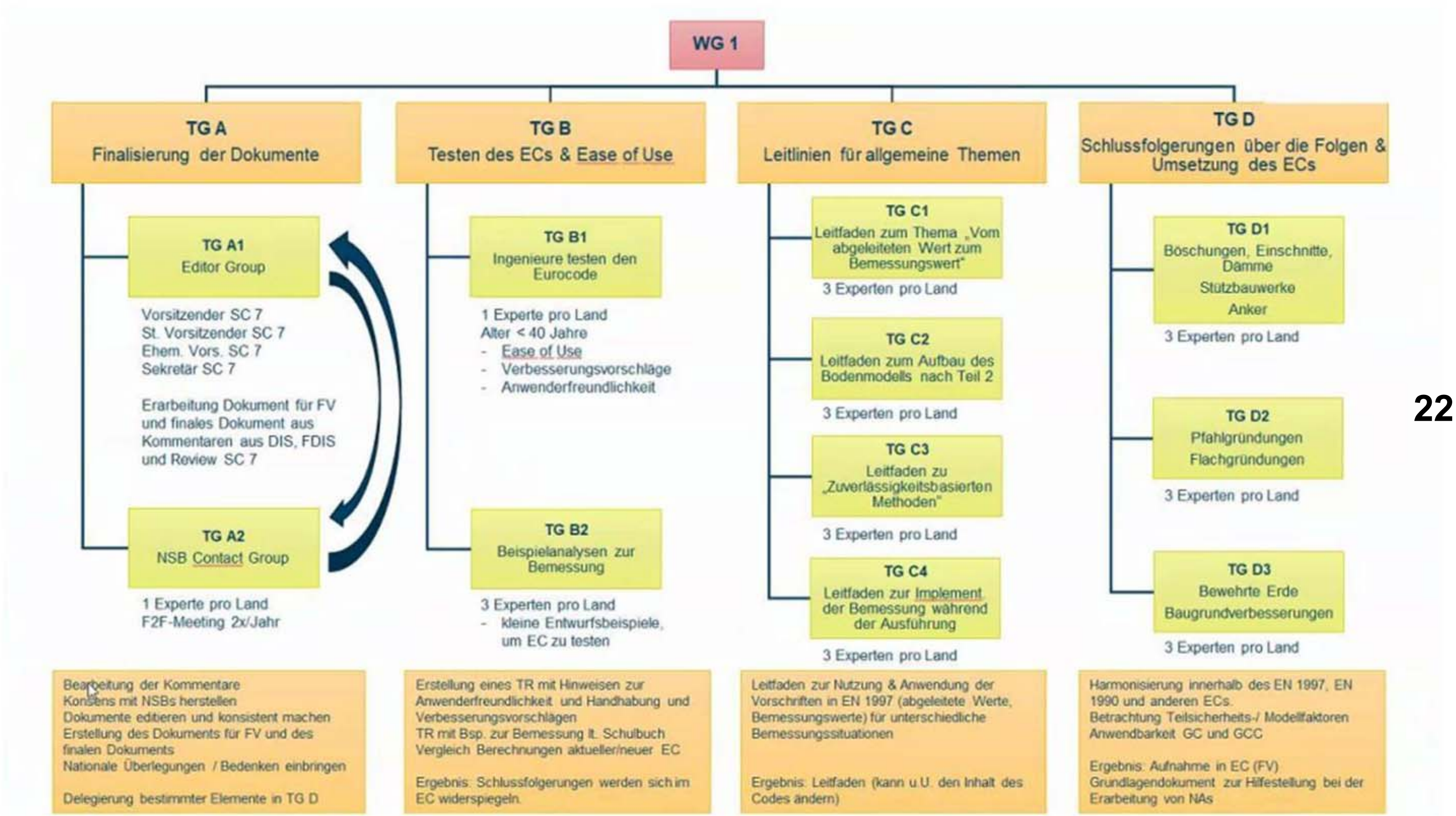
Arbeitsbeginn für

Task Group D3 – Geotechnical Structures – “Improvement”
SG 9, SG 10, SG 11 and SG 12)

Task Group B1 – Testing by next Generation engineers

Task Group B2 – Design examples analysis

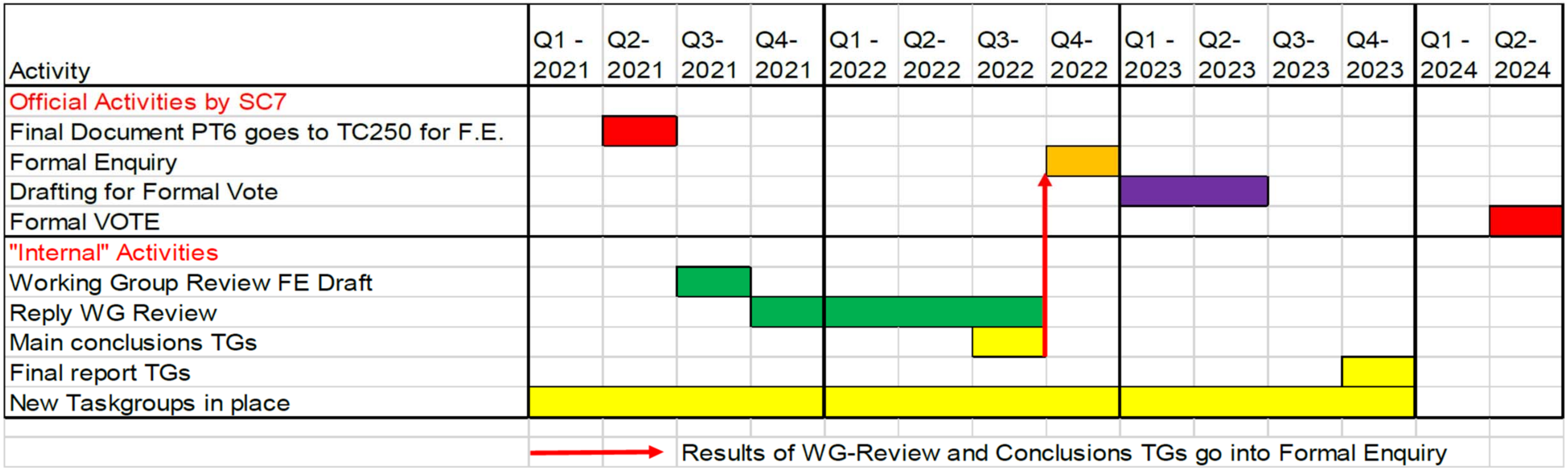
Eurocode 7 – DIN EN 1997



22 Mitglieder aus D

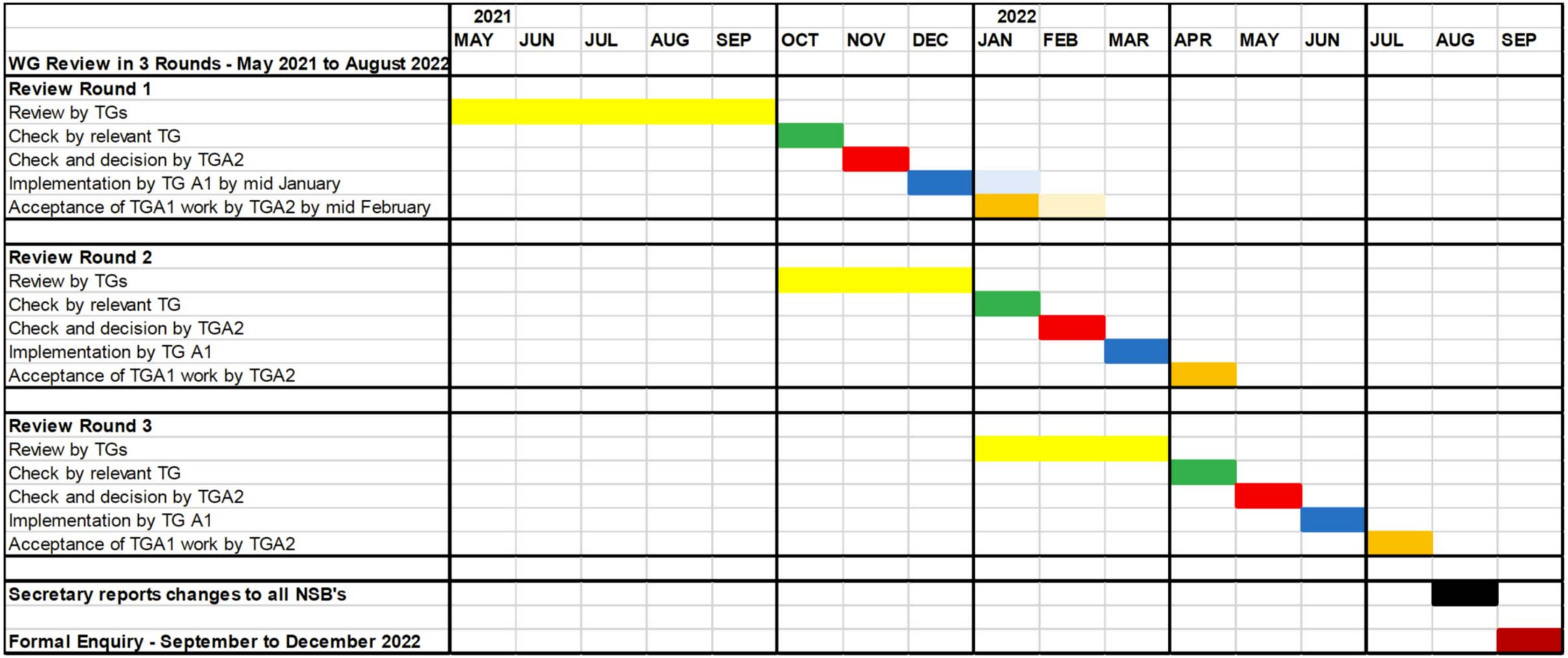
prEN 1997-3:202x „Geotechnical structures“

Vorgesehener weiterer allgemeiner Zeitplan



prEN 1997-3:202x „Geotechnical structures“

Vorgesehener weiterer Zeitplan der Arbeitsgruppen



prEN 1997-3:202x „Geotechnical structures“

9 Reinforced fill structures

9.1 Scope and field of application

9.2 Basis of design

9.3 Materials

9.4 Groundwater

9.5 Geotechnical analysis

9.6 Ultimate limit states

9.7 Serviceability limit states

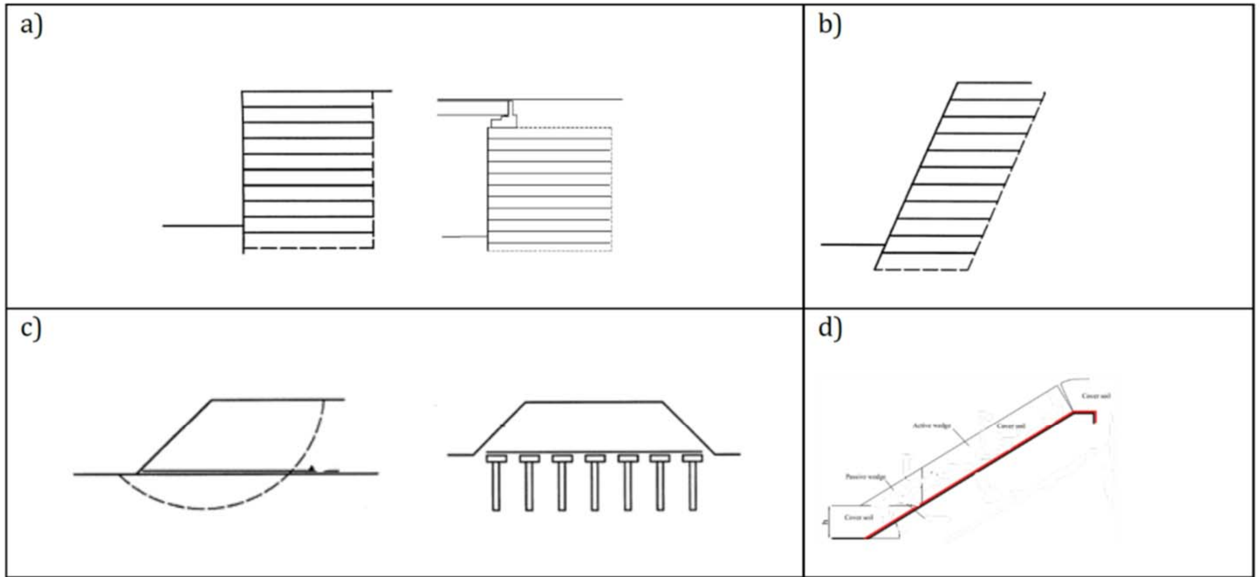
9.8 Implementation of design during excution and service life

9.9 Testing

9.10 Reporting

9 Reinforced fill structures

9.1 Scope and field of application



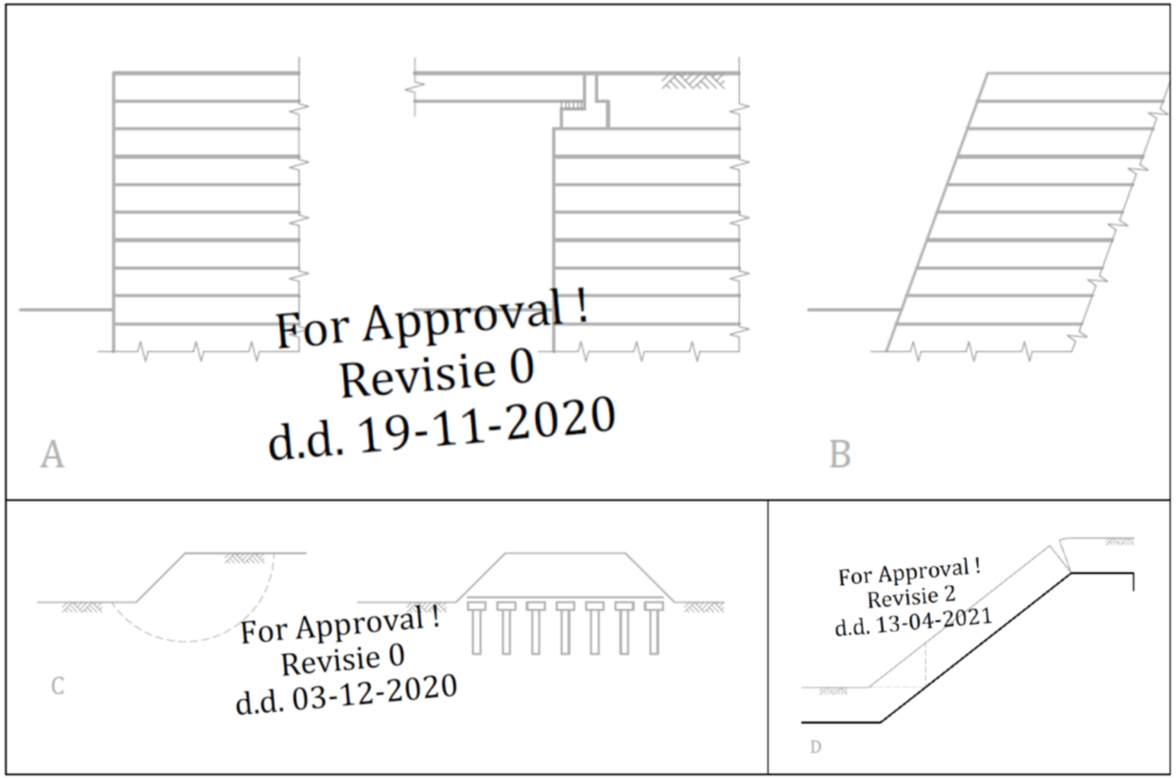
a) Reinforced wall and abutments
b) Reinforced slope
c) Basal reinforcement for embankments (including load transfer platforms over inclusions and voids overbridging)
d) Venner reinforcement
<Drafting note: The figures for this draft has been borrowed from EN 14490>

Figure 9.1 – Reinforced fill structures covered by this standard

9 Reinforced fill structures

9.1 Scope and field of application

A Reinforced wall and abutments
B Reinforced slope
C Basal reinforcement for embankments (including load transfer platforms over inclusions and voids overbridging)
D Venner reinforcement



Nicht für:
- Earthwork structures without reinforcement (clause 4 embankments)
- Design of asphalt reinforcement of pavements
- Geotextile encases columns (clause 11)

9 Reinforced fill structures

9.2.5.1 Ultimate Limit State

(1) <REQ> In addition to EN 1997-1, 8, the following ultimate limit states shall be verified for all reinforced fill structures:

- rupture of the reinforcing element;
- rupture of any connection between a reinforcing element and the facing of the structure or between the reinforcing elements themselves;
- failure along slip surfaces that pass wholly or partially through the reinforced block;
- failure at the interface between the ground and the reinforcing element from the ground beyond the assumed slip surface (pullout);
- failure by sliding between the ground and reinforcing element;
- failure by sliding between the reinforced block and its foundation;
- structural failure of any facing element;
- potential brittle failure in the reinforcing elements;
- failure of the connection between any facing elements;
- bearing failure of the foundation;
- squeezing of any weak foundation soils.
- excessive deformation in the reinforcement elements over the design life of the structure.

!!!

(2) <RCM> Potential ultimate limit states other than those given in (1) should be verified.

???

9 Reinforced fill structures

9.2.5.2 Servicability Limit State

(1) <REQ> In addition to EN 1997-1, 9, the following serviceability limit states shall be verified for all reinforced structures:

- deformations of the reinforced structure itself;
- differential settlement along the facing due to subsoil deformation;
- differential movement between facing and reinforced structure;
- deformation of the reinforced structure, which may cause serviceability limit states of nearby structures or services that rely on it;
- bulging and deformation of the face;
- cracking or spalling of precast facing panels (differential settlement or movement).

Note 220: Deformations of the reinforced structure can be caused/influenced by the elongation or postconstruction elongation of the reinforcement elements themselves

(2) <RCM> Potentiall serviceability limit states other than those given in (1) should be verified.

???

9 Reinforced fill structures

9.3 Materials

Erstmals werden die unterschiedlichen Bewehrungsmaterialien behandelt!

- Geokunststoffe
- Stahl
- Polymerbeschichtete Stahldrahtgeflechte

Bislang in EBGEO (2010) nur Geokunststoffe:

2.2.1 Geokunststoffe sind europäisch harmonisierte Bauprodukte, deren Konformität mit dem CE-Kennzeichen dokumentiert wird. Sie unterliegen in Deutschland dem Bauproduktengesetz (BauPG).

2.2.2 Rohstoffe

Für den Anwendungsbereich dieser Empfehlungen werden u. a. folgende Polymere als Ausgangsmaterialien für Geokunststoffe (in alphabetischer Ordnung) angesehen: Aramide (AR), Polyamide (PA), Polyester (Polyethylenterephtalat) (PET), Polyolefine (Polyethylen (PE, PEHD), Polypropylen (PP), Polyvinylalkohol (PVA).

9 Reinforced fill structures

9.3 Materials

9.3.2 General related to durability

(1) <REQ> Determination of the loss of strength of reinforcing elements for fills shall, for the structures intended design service life, take account of the long-term effects of sustained load in reinforcement (creep) and long-term changes in fill properites.

(2) <REQ> In addition to (1) the potential damage of the reinforcement during transport, storage and installation shall be considered.

9 Reinforced fill structures

9.3.3 Geosynthetics

(1) <RCM> In addtion to EN 1997-1, 5.3, geosynthetic reinforcing elements should comply with EN 13251.

(2) <RCM> The characteristic tensile strength of geosynthetic reinforcement, T_k should be determined in accordance with EN ISO 10319.

War SHALL, jetzt SHOULD???

9 Reinforced fill structures

9.3.3 Geosynthetics

(4) <REQ> In addition to 9.3.2 (1), a reduction factor ηgs shall be applied to the tensile strength of geosynthetic reinforcing elements to account for the loss of strength.

(5?) <REQ> The representative tensile resistance $R_{t,rep,el}$ of a geosynthetic reinforcing element shall be determined from Formula (9.1):

$$R_{\mathrm{t,rep,el}} = \eta_{\mathrm{gs}} T_{\mathrm{k}} \qquad (9.\ 1)$$

where:

T_k is the characteristic tensile strength of the reinforcing element (see (2));

η_{gs} is a reduction factor accounting for anticipated loss of strength with time and other influences.

9 Reinforced fill structures

9.3.3 Geosynthetics

(5) <RCM>The reduction factor η_{gs} should account for the adverse effect of:

- tensile creep due to sustained static load over the design service life of the structure at the design temperature;
- the adverse effects of mechanical damage during transportation, installation and execution;
- weathering;
- chemical and biological degradation of the reinforcing element over the design service life of the structure at the design temperature;
- intense and repeated loading over the design service life of the structure (fatigue); and
- joints and seams for geosynthetic reinforcing elements and polymeric coated steel woven wire mesh.

???
Warum hier?
Es gibt eigenes
Kapitel

Guidance on determination of the reduction factor is given in F.8.1 !!!

9 Reinforced fill structures

F.8.1 Reduction factors for geosynthetic reinforcing element

(1) <REQ> The value of the reduction factor for tensile strength of geosynthetic reinforcement, η_{gs} shall be determined from Formula (F.9):

$$\eta_{gs} = \eta_{cr} \cdot \eta_{dmg} \cdot \eta_{w} \cdot \eta_{ch} \cdot \eta_{dyn} \cdot \eta_{con} \quad \text{(F.9)}$$

where:

η_{cr} is a factor accounting for the adverse effect of tensile creep due to sustained static load over the design service life of the structure at the design temperature;

η_{dmg} is a factor accounting for the adverse effects of mechanical damage during transportation, installation and execution;

η_{w} is a factor accounting for the adverse effects of weathering;

η_{ch} is a factor accounting for the adverse effects of chemical and biological degradation of the reinforcing element over the design service life of the structure at the design temperature;

η_{dyn} is a factor accounting for the adverse effects of intense and repeated loading over the design service life of the structure (fatigue).

η_{con} is a factor accounting for the adverse effects of joints and seams for geosynthetic reinforcing elements and polymeric coated steel woven wire mesh.

The values of η_{cr}, η_{dmg}, η_{w}, and η_{ch} are the reciprocals of the reduction factors specified in ISO TR 20432, as RFCR, RFID, RFW, and RFCH, respectively.

9 Reinforced fill structures

9.3.4 Steel

<Drafting note: This Sub-clause will be updated based on the discussion dis AdHoc group after PT6 submission. The comments on this sub-clause will be addressed at that stage>

(1) <REQ> Reinforcement in the form of strips, bars, or rods shall comply with EN 10025-2, EN 10025-4, or EN10080, as appropriate for the type of steel used.

(2) <REQ> Reinforcement in the form of welded wire ladders or meshes shall comply with EN 10218-2, EN 10223-8, or EN 10080, as appropriate for the type of steel used.

(3) <REQ> Metallic reinforcement shall have a total extension at the maximum load A_{gt} defined in EN ISO 6892-1 of at least 5%.

(4) <REQ> If a steel reinforcing element is galvanised, the hot dip galvanized coating to steel strips, rods, bars, ladders, and welded wire meshes shall comply with EN ISO 1461.

(5) <REQ> Where steel welded wire meshes are treated with a zinc-aluminium alloy coating (Zn95Al5 or Zn90Al10) conforming to EN 10244-2, the minimum coating unit weight shall comply with Table 2 of EN 10244-2.

(6) <REQ> Stainless steel and aluminium alloys shall only be used for reinforcement if they comply with a relevant standard specified by the relevant authority or, where not specified, agreed for a specific project by appropriate parties.

…

9 Reinforced fill structures

9.3.4 Steel

(7) <REQ> The representative tensile resistance ($R_{t,rep,el}$) for steel reinforcement to use in reinforced fill structures shall be designed in agreement with one of the following apporaches:

− according to EN 1993-1-1;

− according to Forumla (9.4).

EC Stahl!

NOTE 229: Unless the National Annex gives a specific choice, the approach to be used is as specified by the relevant authority or, where not specified, as agreed for a specific project by the relevant parties.

???

Fehlt bei Geosynthetics!

9 Reinforced fill structures

9.3.4 Steel

(7) <REQ> …

$$R_{\mathrm{t,rep,el}} = \min\,(A_{\mathrm{ry}}\, f_{\mathrm{yk}};\ A_{\mathrm{ru}}\, f_{\mathrm{uk}}) \qquad (9.\ 3)$$

where

f_{yk} is the characteristic yield strength of the steel;

$R_{t,rep,el}$ representative tensile resistance;

f_{uk} is the characteristic ultimate strength of the steel;

A_{ry}, A_{ru} are the reduced cross-sectional areas of the reinforcing element at yield and ultimate resistance, respectively, allowing for the effects of potential corrosion.

9 Reinforced fill structures

9.3.5 Polymeric coated steel woven wire meshes

(1) <RCM> Reinforcement in the form of polymer coated woven wire mesh shall comply with EN 10218-2, in case of steel wire only and EN 10223-3 for the whole reinforcement product.

Stahl!

(2) <RCM> Polymeric coated steel woven wire meshes shall be treated with a zinc-aluminium alloy coating (Zn95Al5 or Zn90Al10) conforming to EN 10244-2, the minimum coating unit weight shall comply with Table 2 of EN 10244-2 and further protected by:

- PVC coating conforming to EN 10245-2; or
- PE coating conforming to EN 10245-3; or
- PET coating conforming to EN 10245-4; or
- PA coating conforming to EN 10245-5.

??? Hier shall bei Geokunststoffen should

(3) <REQ> The characteristic tensile strength of polymeric coated steel woven wire mesh reinforcement shall be determined in accordance with EN ISO 10319.

9 Reinforced fill structures

9.3.5 Polymeric coated steel woven wire meshes

(4) <REQ> The representative tensile resistance $R_{t,rep,el}$ of a polymeric coated woven wire mesh reinforcing element shall be determined from Formula (9.8):

$$R_{\mathrm{t,rep,el}} = \eta_{\mathrm{pwm}} \cdot T_{\mathrm{k}} \quad (9.8)$$

Hier Kriechen angesprochen, aber kein η ???

Where

T_k is the characteristic tensile strength of the reinforcing element;

η_{pwm} is a reduction factor accounting for anticipated loss of strength with time and other influences.

(5) <REQ> In addition to 9.3.2 (1), a reduction factor η_{pwm} shall be applied to the tensile strength of polymeric coated steel woven wire meshes to account for the loss of strength.

Guidance on determination of the reduction factor is given in F.8.2 !!!

9 Reinforced fill structures

9.3.5 Polymeric coated steel woven wire meshes

(6) <REQ> The evaluation of η_{dmg} shall account for the decrease of tensile strength at short term due to damage during transportation, installation and execution.

(7) <REQ> The evaluation of η_{cor} shall account for the loss of protection to the metallic wires caused by mechanical damage during execution to the polymeric and zinc-aluminium alloy coatings as well as to the metallic wires.

(8) <RCM> If the polymeric coated steel woven wire mesh is cut, the coating should be treated as damaged.

9 Reinforced fill structures

F.8.2 Reduction factors for ~~Polymeric coated~~ steel woven wire meshes

Fehlt! Redaktionell!

(5) <REQ> The reduction factor η_{pwm} shall be determined from Formula (9.9):

$$\eta_{\text{pwm}} = \eta_{\text{dmg}} \cdot \eta_{\text{cor}}$$

where:

η_{dmg} is a reduction factor accounting for the adverse effects of mechanical damage during transportation, installation and execution;

η_{cor} is a reduction factor accounting for the adverse effects of degradation of the element by corrosion over the design service life of the structure, corrosion being triggered by the local loss of watertightness of the polymeric coating by chemical degradation and/or the loss of the Zinc or Zinc/Aluminium layer by corrosion, where applicable

Wenn schon „Geokunststoffe“ dann auch
für alles: Test der Einzelkomponenten!

Kriechen, Anschluss, Bewitterung, Chemie/Biologie, Dynamik ???

9 Reinforced fill structures

9.3.6 Other materials

(1) <REQ> Materials other than those specified in 9.3.3, 9.3.4, and 9.3.5 shall only be used for reinforcement if they comply with a standard specified by the relevant authority or, where not specified, agreed for a specific project by appropriate parties.

Öffnung für alles?
Harmonizierung?
???

9 Reinforced fill structures

9.5 Geotechnical analysis

9.5.1 General

See EN 1997-1, 7

(1) <REQ> The external and compound stability of a reinforced fill structure, shall be analysed according to Clauses 4, 5, or 7, as appropriate, with the beneficial effect of reinforcing elements.

?!?

(2) <REQ> The internal stability of a reinforced fill structure shall be analysed according to the type of reinforced fill structure (9.5.2).

Nicht nur internal!
Passt allenfalls bei Stützkonstruktion!

(3) <REQ> Horizontal and vertical deformations of a reinforced fill structure shall be analysed according to Clauses 4, 5, or 7, as appropriate.

(4) <REQ> The execution specification shall state requriement on properties of the fill needed to fulfil the verificiation of the limit states.

(5) <PER> The compound stability of reinforced slopes, walls, and bridge abutments may be verified using a method not given in 9.5.2.1 (1) provided it has been validated against comparable experience.

(6) <REQ> Verification of the compound stability of a reinforced fill structure shall include the potential beneficial effect of any reinforcing elements.

9 Reinforced fill structures

9.5 Geotechnical analysis

9.5.2 Mode of failure for reinforced fill structures

9.5.2.1 Reinforced slopes, walls, and bridge abutments

(1) <RCM> The internal stability of reinforced slopes, walls, and bridge abutments should be verified using one or more of the following methods:

- coherent gravity method;
- tie-back wedge method;
- multiple wedge method;
- slope stability methods;
- numerical methods.

Details of som of these methods are given in Annex F.3.

(2) <PER> Other methods than those given in (1) may be used.

Bei Stützkonstruktionen:

Wieder nur „internal!“

!!!

9 Reinforced fill structures

9.5 Geotechnical analysis

9.5.2 Mode of failure for reinforced fill structures

9.5.2.1 Reinforced slopes, walls, and bridge abutments

9.5.2.2 Basal reinforcement for embankments

9.5.2.3 Load transfer platforms over rigid inclusions

9.5.2.4 Overbridging systems in areas prone to subsidence

9.5.2.5 Veneer stability

9 Reinforced fill structures

9.5 Geotechnical analysis

9.5.3 Resistance of reinforcing elements

9.5.3.1 General

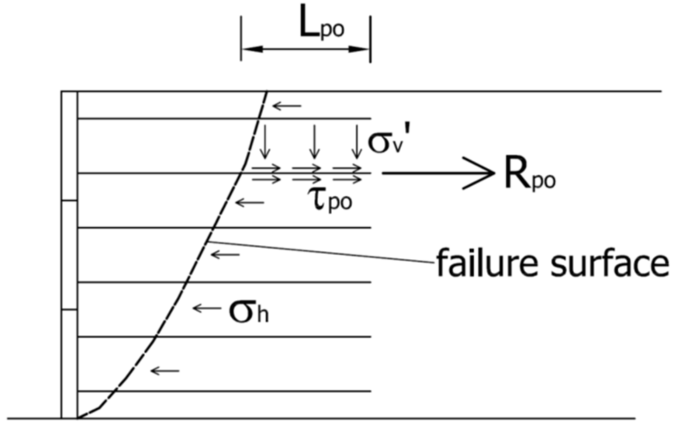
… Tensile resistance …

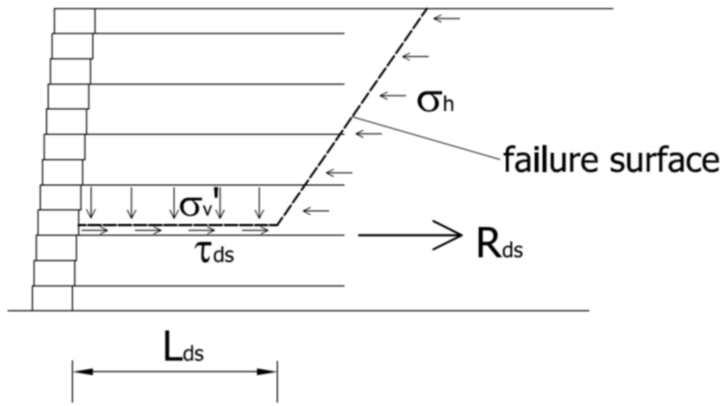
9.5.4 Pull-out resistance

9.5.4.1 General

9.5.4.2 Sheet reinforcement for fill

9.5.4.3 Discrete fill reinforcement





9.5.5 Resistance in direct shear

9.5.6 Resistance of connections

9 Reinforced fill structures

9.5 Geotechnical analysis

9.5.3.1 General

(1) <REQ> The representative tensile resistance ($R_{t,rep}$) of a reinforcing element shall be determined from Formula (9.9):

$$R_{t,rep} = \min (R_{t,rep,el}; R_{rep,po}; R_{rep,ds}; R_{rep,con}) \qquad (9.\ 11)$$

where:

$R_{t,rep,el}$ is the representative tensile resistance strength of the reinforcing element;

$R_{rep,po}$ is the representative value of the pull-out resistance mobilised along the interface between the fill and the reinforcing element;

war „ground" – fehlt jetzt für Aufstandsfläche!

$R_{rep,ds}$ is the representative value of the direct shear resistance;

$R_{rep,con}$ is the representative value of the resistance at the connection both at the point between the facing and the reinforcing element (i.e., connection device), and the reinforcement at the connection point.

9 Reinforced fill structures

9.6 Ultimate limit states

9.6.1 General

(1) <REQ> The design value of the ultimate limit state resistance of a reinforcement element shall satisfy formule

$$E_d \leq min(R_{t,d,el}; R_{d, po}; R_{d, ds}; R_{d, con})$$

where

E_d is the maximum value of the design value of the effects of actions in ultimate limit state (see 9.2.3.2);

$R_{t,d,el}$ is the design value of the resulting resistance of the reinforcement element;

$R_{d,po}$ is the design value of interface resistance between fill and reinforcement elements at the ultimate limit state (pullout);

$R_{d,ds}$ is the design value of direct shear mobilised along the interface between the fill or ground and the reinforcing element;

$R_{d,con}$ is the design tensile resistance of a connection for geosynthetics or polymer woven wire mesh.

9 Reinforced fill structures

9.6 Ultimate limit states

9.6.2 Verification by the partial factor method

9.6.2.1 Rupture of the reinforcing elements (tensile)

9.6.2.1.1 Geosynthetics

(1) <REQ> The design tensile resistance ($R_{td,el}$) of a geosynthetic reinforcing element shall be determined from Formula (9.18):

$$R_{td,el} = \frac{R_{t,rep,el}}{\gamma_{Rd,re}\gamma_{M,re}}$$

where:

$R_{t,rep,el}$ is the representative tensile resistance of the reinforcing element;

$\gamma_{M,re}$ is a partial factor, given in 9.6.2.6;

$\gamma_{Rd,re}$ is a model factor accounting for additional uncertainty owing to extrapolation of measured strengths to the design service life.

9 Reinforced fill structures

9.6 Ultimate limit states

<Drafting note: This Sub-clause will be updated based on the discussion dis AdHoc group after PT6 submission. The comments on this sub-clause will be addressed at that stage>

9.6.2.1.2 Steel reinforcement for fill

(1) <RCM> The design tensile resistance ($R_{td,el}$) of steel reinforcement should comply with EN 1993-1-1

(2) <PER> As an alternative, for steel reinforcement complying with EN 10025-2 or EN 10080, the design tensile resistance ($R_{td,el}$) may be determined from Formula (9.21):

$$R_{\mathrm{td,el}} = min\left(\frac{A_{\mathrm{ry}} f_{\mathrm{yk}}}{\gamma_{\mathrm{Rd,0}}\gamma_{\mathrm{M0}}}; \frac{A_{\mathrm{ru}} f_{\mathrm{uk}}}{\gamma_{\mathrm{Rd,2}}\gamma_{\mathrm{M2}}}\right)$$

Where

f_{yk}	is the characteristic yield strength of the steel;
f_{uk}	is the characteristic ultimate strength of the steel;
A_{ry} and A_{ru}	are the reduced cross-sectional areas defined in 9.3.2.3;
γ_{M0} and γ_{M2}	are partial factors whose values are specified in EN 1993-1-1;
$\gamma_{Rd,0}$ and $\gamma_{Rd,2}$	are model factors that take account of the degree to which the strength of the steel reinforcing element is mobilized in a reinforced soil structure.

9 Reinforced fill structures

9.6 Ultimate limit states

9.6.2.1.3 Polymeric coated steel woven wire mesh

(1) <REQ> The design tensile resistance (Rtd,el) of polymeric-coated woven wire mesh reinforcing element shall be determined from Formula (9.25):

$$R_{\mathrm{td,el}} = \frac{R_{\mathrm{t,rep,el}}}{\gamma_{\mathrm{Rd}} \gamma_{\mathrm{M,pwm}}}$$

where:

$R_{t,rep,el}$ is the representative tensile resistance of the reinforcing element;

$\gamma_{M,pwm}$ is a partial factor, given in 9.6.2.5;

γ_{Rd} is a model factor accounting for additional uncertainty owing to extrapolation of measured strengths to the design service life.

Note 251 A method to determine the value of γ_{Rd} is given in ISO TR 20432, where it has the symbol f_s.

9 Reinforced fill structures

9.6 Ultimate limit states

?!?

9.6.2.6 Partial factors

Table 9.3 (NDP) – Partial factors for the verification of resistance of reinforced fill structures for fundamental (persistent and transient) design situations

Verification of	Partial factor on		Symbol	Values of the partial factors
Overall and compound stability	See clause 4			
Bearing resistance and sliding	See clause 5			
Overturning	See clause 7			
Pull-out failure of reinforcing elements	Pull-out resistance of	sheet fill reinforcement	$\gamma_{R,po,gs}$	1,25
		discrete fill reinforcement	$\gamma_{R,po,dis}$	1,25
		polymeric coated steel wire mesh reinforcement	$\gamma_{R,po,pwm}$	1,25
Direct shear failure along interface	Resistance to direct shear along interface for sheet fill reinforcement		$\gamma_{R,ds}$	1,25

9 Reinforced fill structures

9.6 Ultimate limit states

9.6.2.6 Partial factors

Table 9.3 (NDP) – Partial factors for the verification of resistance of reinforced fill structures for fundamental (persistent and transient) design situations

Rupture Reinforcing element	Tensile strength of	geosynthetic reinforcement	$\gamma_{M,re}$	1,1
		steel reinforcement	γ_{M0}, γ_{M2}	specified in EN 1993-1-1
		steel reinforcement	$\gamma_{M,re}$	1,2
		polymeric coated steel wire mesh reinforcement	$\gamma_{M,pwm}$	1,25
Rupture Connections between reinforcing elements	Tensile strength of polymeric coated steel wire mesh reinforcement		$\gamma_{R,con}$	1,25
	Tensile strength of polymeric coated steel woven wire mesh connection			1,35
	Geosynthetic			1,35
Rupture Connections to facing	Tensile strength		$\gamma_{R,con}$	1,35

9 Reinforced fill structures

9.6 Ultimate limit states

9.6.2.6 Partial factors

Table 9.3 (NDP) – Partial factors for the verification of resistance of reinforced fill structures for fundamental (persistent and transient) design situations

So war es schon mal –
ist so auch wieder versprochen!!!

1,0 oder not factored

Verification of	Partial factor on	Symbol	Material factor approach (MFA)	Resistance factor approach (RFA)
All situations	Actions and effects of actions	γ_F and γ_E	DC3[1]	DC4[1]
	Ground properties	γ_M	M2[2]	M1[2]
Reinforcing element Rupture, resistance factors	Tensile strength of geosynthetic reinforcement	$\gamma_{Rd,re}$	1,0	1,2
	Tensile strength of steel reinforcement	$\gamma_{Rd,0}$	1,0	1,0
	Tensile strength of steel reinforcement	$\gamma_{Rd,2}$	1,0	1,0
	Tensile strength of polymeric coated steel wire mesh reinforcement	$\gamma_{Rd,pwm}$	1,0	1,2
Reinforcing element Rupture, material factors	Tensile strength of geosynthetic reinforcement	$\gamma_{M,re}$	1,2	1,0
	Tensile strength of steel reinforcement	γ_{M0}	EN 1993-1-1	
	Tensile strength of steel reinforcement	γ_{M2}	EN 1993-1-1	
	Tensile strength of polymeric coated steel wire mesh reinforcement	$\gamma_{M,pwm}$	1,2	1,0

9 Reinforced fill structures

9.6 Ultimate limit states

9.6.2.6 Partial factors

Table 9.3 (NDP) – Partial factors for the verification of resistance of reinforced fill structures for fundamental (persistent and transient) design situations

Verification of	**Partial factor on**	**Symbol**	**Material factor approach (MFA)**	**Resistance factor approach (RFA)**
Pull-out failure of reinforcing elements	Pull-out resistance of reinforcing elements	$\gamma_{R,\mathrm{po}}$	1,25	1,25
Direct shear failure along interface	Resistance to direct shear along interface	$\gamma_{R,\mathrm{ds}}$	1,25	1,25
Connection between reinforcement and facing element	Reinforcement strength at connections	$\gamma_{\mathrm{con,el}}$ $\gamma_{\mathrm{connector}}$ $\gamma_{\mathrm{con,fac}}$	$\gamma_{\mathrm{Rd,re}}$ $\gamma_{M,re}$ for geosynthetic reinforcement (this table) $\gamma_{\mathrm{Rd,2}}.\gamma_{M2}$ for steel reinforcement (this table and EN 1993-1-8)	

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9 Reinforced fill structures

- 9.1 Scope and field of application
- 9.2 Basis of design
- 9.3 Materials
- 9.4 Groundwater
- 9.5 Geotechnical analysis
- 9.6 Ultimate limit states
- 9.7 Serviceability limit states
- 9.8 Implementation of design
- 9.9 Testing
- 9.10 Reporting

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10 Ground reinforcing elements

10.1 Scope and field of application

10.2 Basis of design

10.3 Materials

10.4 Groundwater

10.5 Rock bolts

10.6 Soil Nailing

10.7 Wire mesh

10.8 Sprayed concrete

10.9 Facing element

10.10 Reporting

Problem:

Nach wie vor Sammlung von Hinweisen zu „Bewehrungselementen“
Muss geändert werden in „Bauweise“:

Soil nailed and rock bolted structures

Facing zu Clause 9

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Annex F (informative) Reinforced fill structures

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Annex F (informative) Reinforced fill structures

F.5 Calculation models for load transfer platform over rigid inclusions

F.5.1 General

F.5.2 Hewlett and Randolph method

F.5.3 EBGEO method

F.5.4 Concentric Arches method

F.6 Calculation models for embankments over voids

F.7 Veneer reinforcement Ground reinforcing elements

F.8 Durability, reduction factor for tensile strength

F.8.1 Reduction factors for geosynthetic reinforcing element

F.8.2 Reduction factors for steel woven wire meshes

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Zusammenfassung und Ausblick

Cons

- Zeitaufwand enorm, 1000de Einsprüche
- ständiges vor und zurück, Zeitschiene sehr fragwürdig
- noch viele Ungereimtheiten
- „Ease of use“ sicher nicht gewährleistet
- Jetzt Bearbeitung in neuen Gruppen, die Hintergrund, Historie und nationale Befindlichkeiten vielleicht nicht kennen

Pros

- Bodenbewehrung in EC7 dann „offiziell“
- Geokunststoffe, Stahl und „coated meshes“ separat aufgeführt und behandelt!
- Deutsche Sichtweise weitgehend umgesetzt
- vieles in „NDP“ bzw. im Anhang => kann national angepasst werden – aber: international kritisch!

Absolute Aufmerksamkeit gefordert!