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NEXT GENERATION OF EUROCODE 3

EVOLUTION BY IMPROVEMENT AND HARMONIZATION

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Overview

Structure and Overview on Eurocode 3

Further Developments of Eurocode 3

Organization SC3

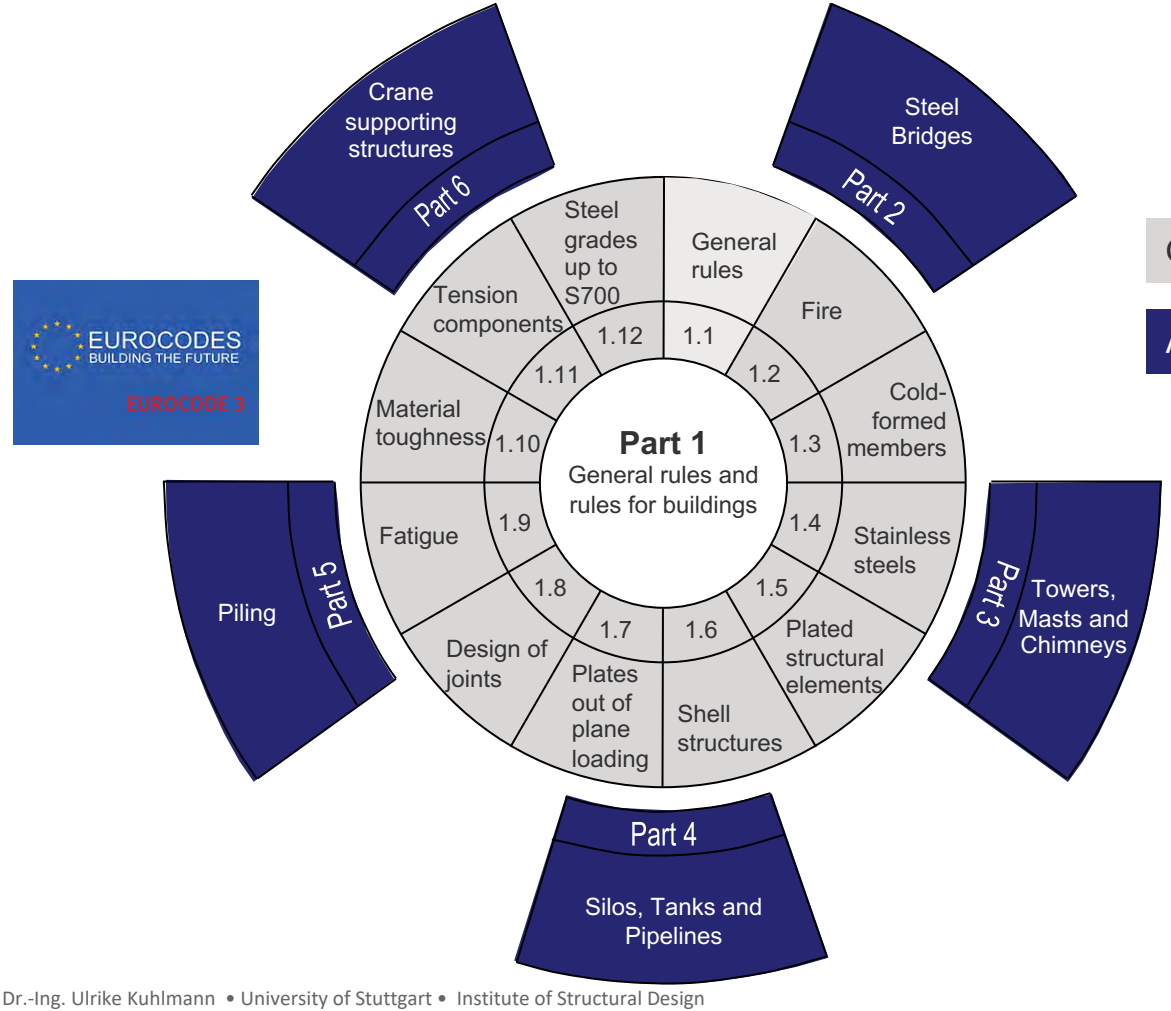
Procedure for the Revision of Eurocode 3

Technical Review of Selected Code Rules

- EN 1993-1-1
- EN 1993-1-8
- EN 1993-1-13
- EN 1993-1-14

Summary and Conclusions

Structure and Overview on Eurocode 3



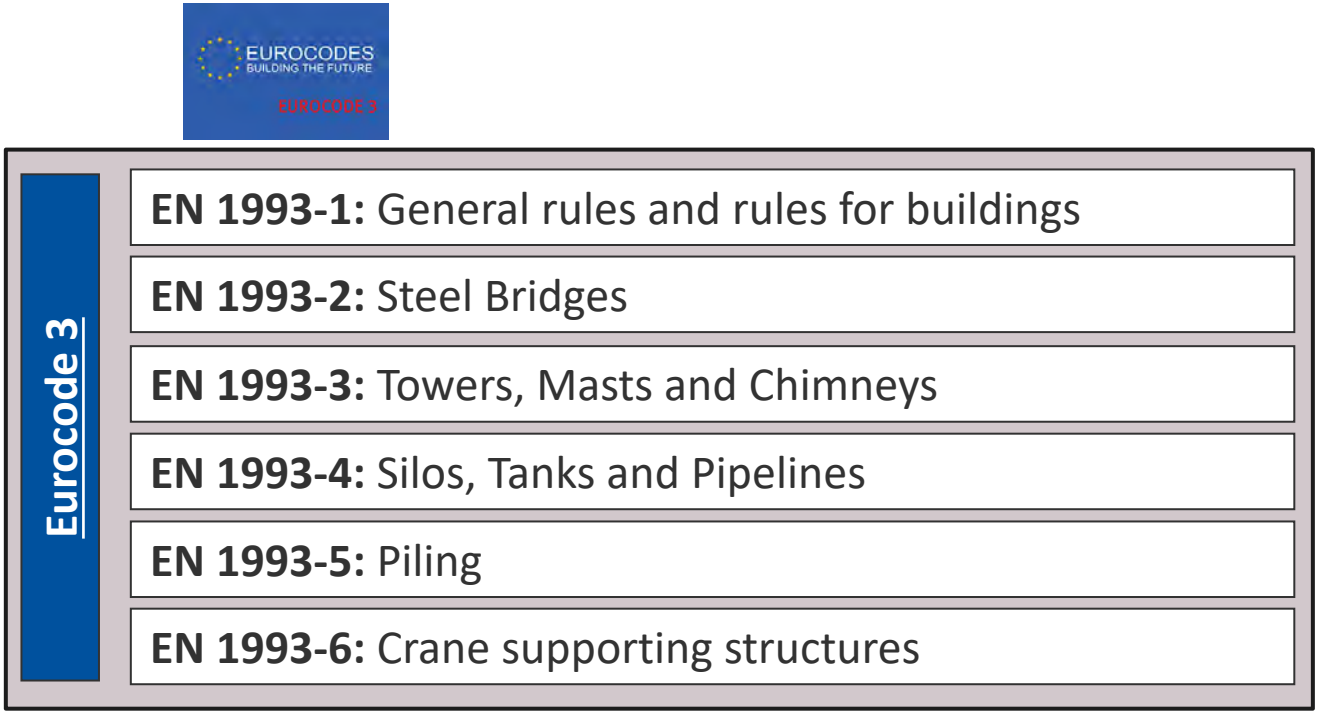
EUROCODES
BUILDING THE FUTURE
EUROCODE 3

General parts (12 parts)

Application parts (8 parts)

Application parts
→ "Master" for use of General parts and other Eurocodes

Structure and Overview on Eurocode 3



Structure and Overview on Eurocode 3

→ General Parts

EN 1993-1

- **EN 1993-1-1:** General rules and rules for buildings
- **EN 1993-1-2:** Structural fire design
- **EN 1993-1-3:** Supplementary rules for cold-formed members and sheeting
- **EN 1993-1-4:** Supplementary rules for stainless steels
- **EN 1993-1-5:** Plated structural elements
- **EN 1993-1-6:** Strength and stability of shell structures
- **EN 1993-1-7:** Plated structures subject to out of plane loading
- **EN 1993-1-8:** Design of joints
- **EN 1993-1-9**
- **EN 1993-1-10:** Material toughness and through-thickness properties
- **EN 1993-1-11:** Design of structures with tension components
- **EN 1993-1-12:** Additional rules for the extension of EN 1993 up to steel grades S700

→ EN 1993-1-1 and EN 1993-1-8 are of **central importance**

Structure and Overview on Eurocode 3

Nationale Regelwerke	DIN EN 1993														
	-1-									-2	-3-		-4-		-6
	1	3	4	5	6	8	9	10	11		1	2	1	2	
DIN 18800-1	X					X			X						
DIN 18800-2	X	X		X											
DIN 18800-3	X			X											
DIN 18800-4	X				X										
DIN 18801	X			X		X			X						
DIN 18807-1		X													
DIN 18807-2		X													
DIN 18808						X									
DIN 18914													X		
DIN 4119-1														X	
DIN 4119-2														X	
DIN V 4131	X					X	X				X				
DIN 4132	X					X	X								X
DIN V 4133	X					X	X					X			
DIN FB 103	X			X		X	X	X	X	X					
DASt-Ri 009								X							
DASt-Ri 014								X							
DASt-Ri 015	X			X											
DASt-Ri 016	X	X													
DASt-Ri 017	X				X										
Z-30.3-6			X												

[Schilling, S.: Stahlbaunormen – Anwendung der DIN EN 1993-1-1. Stahlbaukalender 2013]

Example of replacement of 21 national German standards, DASt-Richtlinien and similar by 20 parts of Eurocode 3

Scope exceeds rules for buildings:
- **Facades and light weight structures,**
- **Silos, tanks, masts, towers,**
- **Crane runways, chimneys,**
- **Steel- and composite bridges…..**

Advantages:
Common code structure
Uniform state of the art
Uniform reference to EN 1991
…

Aims for Revision

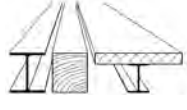
- **Inclusion of latest development**: Extension to new materials, new products, new methods and new market requirements

- **Improvement and Harmonization of existing rules**: Reduction of Nationally Determined Parameters (NPDs) of existing Eurocode parts

- **Enhanced Ease of Use**

  Enhancing ‘ease of use’ of existing Eurocodes by:

  i. improving the clarity
  ii. simplifying routes through the Eurocodes
  iii. limiting, where possible, the inclusion of alternative application rules;
  iv. avoiding or removing rules of little practical use in design



Further Developments of Eurocode 3

- **Withdrawal of part EN 1993-4-3:** Eurocode 3 - Design of steel structures - Part 4-3: Pipelines

➢ Adoption of Withdrawal

- **Many other EN standards for pipelines for a specific common purpose**
- **no suggestions for amendments have been made**

It seems that this standard is not really needed

- **TS 1993-4-301:** Eurocode 3 - Penstocks

➢ Adoption of a preliminary work item CEN/TS 1993-4-301

- **Penstocks are high pressure water pipelines used in hydro-electric applications**
- **TS will be developed based on Austrian NA**

➢ **Enhanced Ease of Use**
avoiding or removing rules of little practical use in design

Further Developments of Eurocode 3

- **Merge of EN 1993-3-1 and EN 1993-3-2:** Eurocode 3 - Design of steel structures - Part 3-1: Towers, masts and chimneys

- **SC3 Decision 25/2014**

- A lot common sections and application rules
- Partially no clear differentiation between rules for towers, masts or chimneys
- One family of tall wind sensitive structures

- **Improvement and Harmonization of existing rules**: Reduction of Nationally Determined Parameters (NPDs) of existing Eurocode parts
- **Enhanced Ease of Use**
  i. improving the clarity
  ii. simplifying routes through the Eurocodes

Further Developments of Eurocode 3

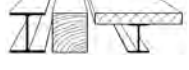
- **EN 1993-1-12: Additional rules for the extension of EN 1993 up to steel grades S700**

- **Design Rules of Part 1-12 integrated in 1-1, 1-5, 1-8, 1-9 and 1-10**

Integration of previous rules in EN 1993 Part 1-12 to EN 1993-1-1

- Extension of the material tables for high-strength steels up to **f_y = 700 N/mm²**
- Integration of the product standard **EN 10149**
- Adaption of the requirements on the **ductility** and for **plastic design**
- Adaption for **tensile elements**
- Extension **of buckling curves**

- **Enhanced Ease of Use**
  i. improving the clarity
  ii. simplifying routes through the Eurocodes



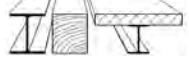
Further Developments of Eurocode 3

➢ EN 1993-1-12: Additional rules for the extension of EN 1993 up to steel grades S960

➢ New scope and a new title for EN 1993-1-12

- ➢ Possible extension of rules for steel grades **stronger than S700 and up to S960** in future (not within Mandate)
- ➢ Change title into "Design of steel structures - Part 1-12: Additional rules for steel grades up to S960" for the revised version
- ➢ New scope: Additional rules for design using steel grades stronger than S700 and up to S960.

➢ **Inclusion of latest development**: Extension to new materials, new products, new methods and new market requirements



Further Developments of Eurocode 3

- **New part EN 1993-7:** Eurocode 3 - Design of steel structures – Part 7: Sandwich Panels (not within Mandate)

- **Development within a new WG21 of SC3**

- **Decision 03/2018 taken by CEN/TC 250/SC 3 on 2018-03-22**

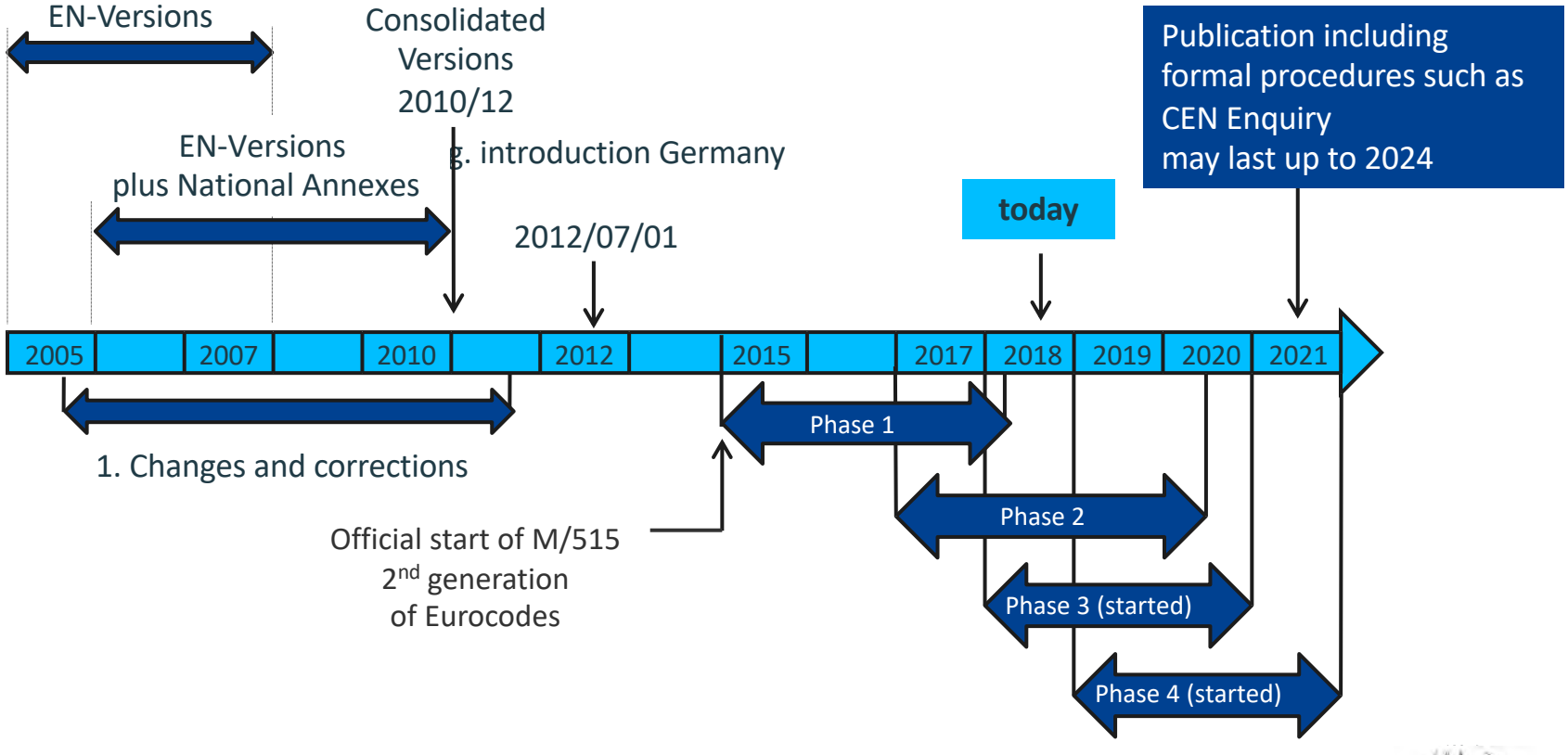
  Preliminary scope: EN 1993 7 determines rules on design procedures for factory made, double skin steel faced insulating sandwich panels, which are intended for discontinuous laying of panels in the following applications:

  a) roofs and roof cladding;
  b) external walls and wall cladding;
  c) walls (including partitions) and ceilings within the building envelope.

- **Inclusion of latest development**: Extension to new materials, new products, new methods and new market requirements

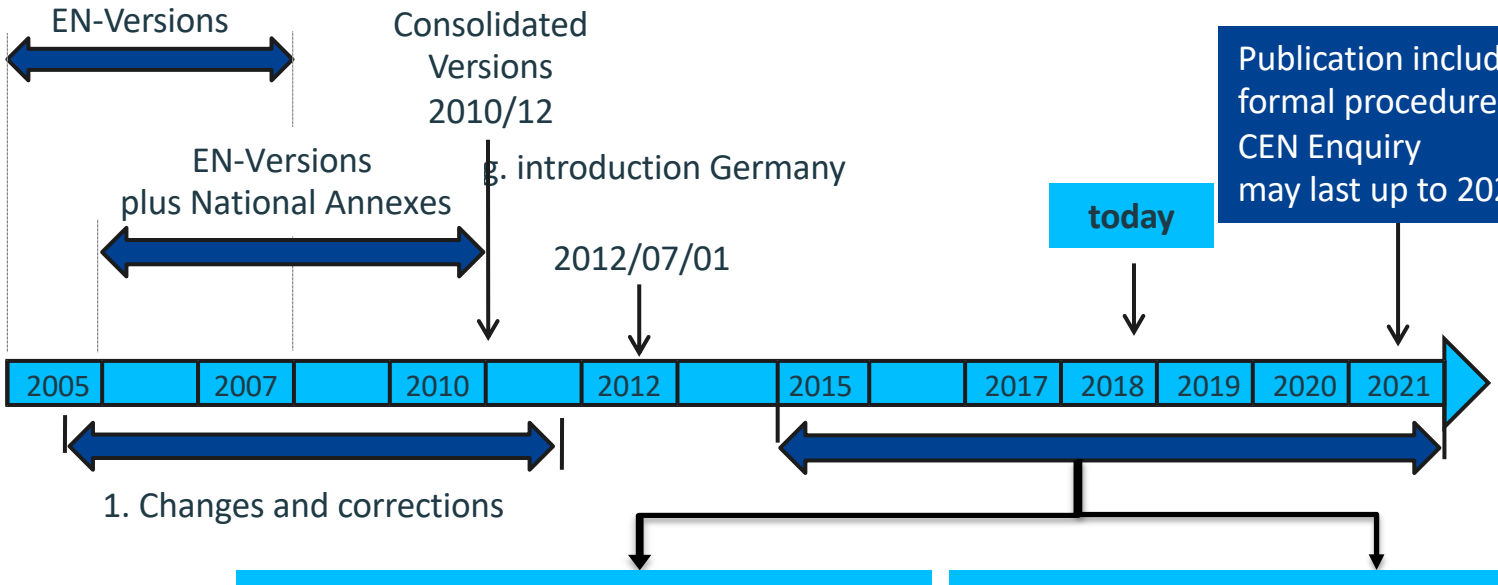
Organization of SC3

➢ Overview and time schedule



Organization of SC3

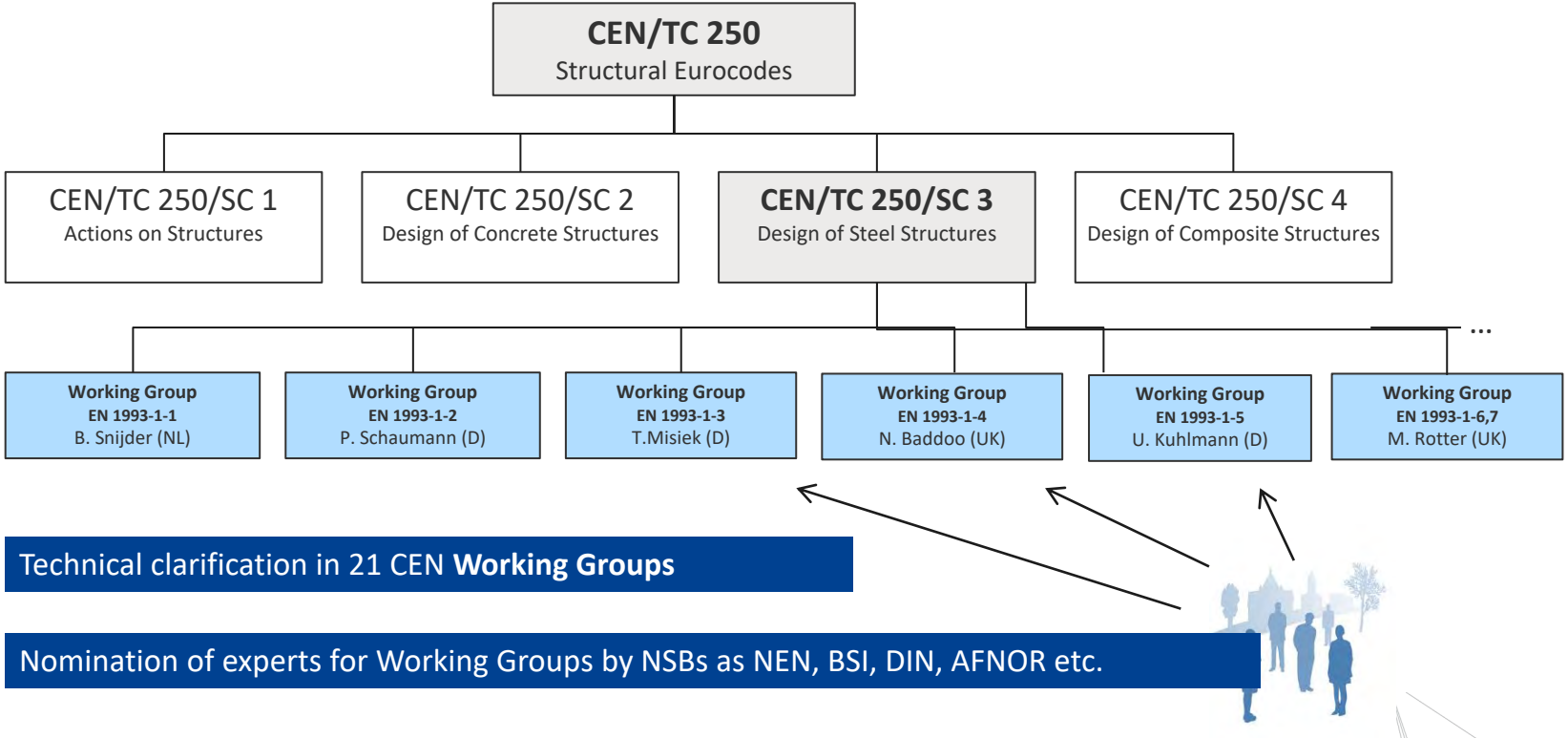
➢ Overview and time schedule



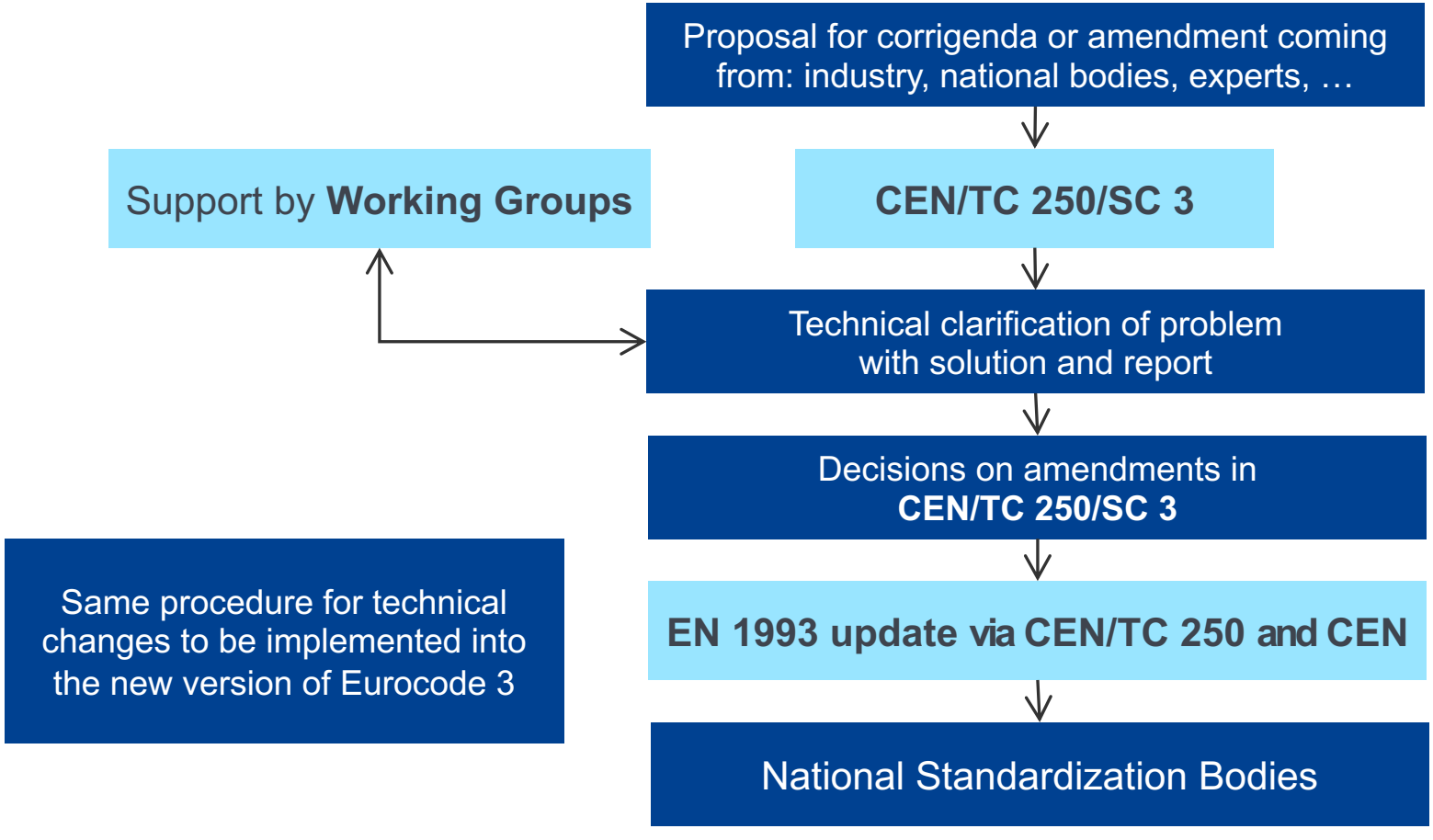
General revision and maintenance	Further developments
➢ Call for „Systematic Review“	➢ EU Mandate M/515
➢ 5-year review according CEN	➢ 2015 – 2022
➢ Subcommittees and Working Groups	➢ Project teams (PT)

Organization of SC3

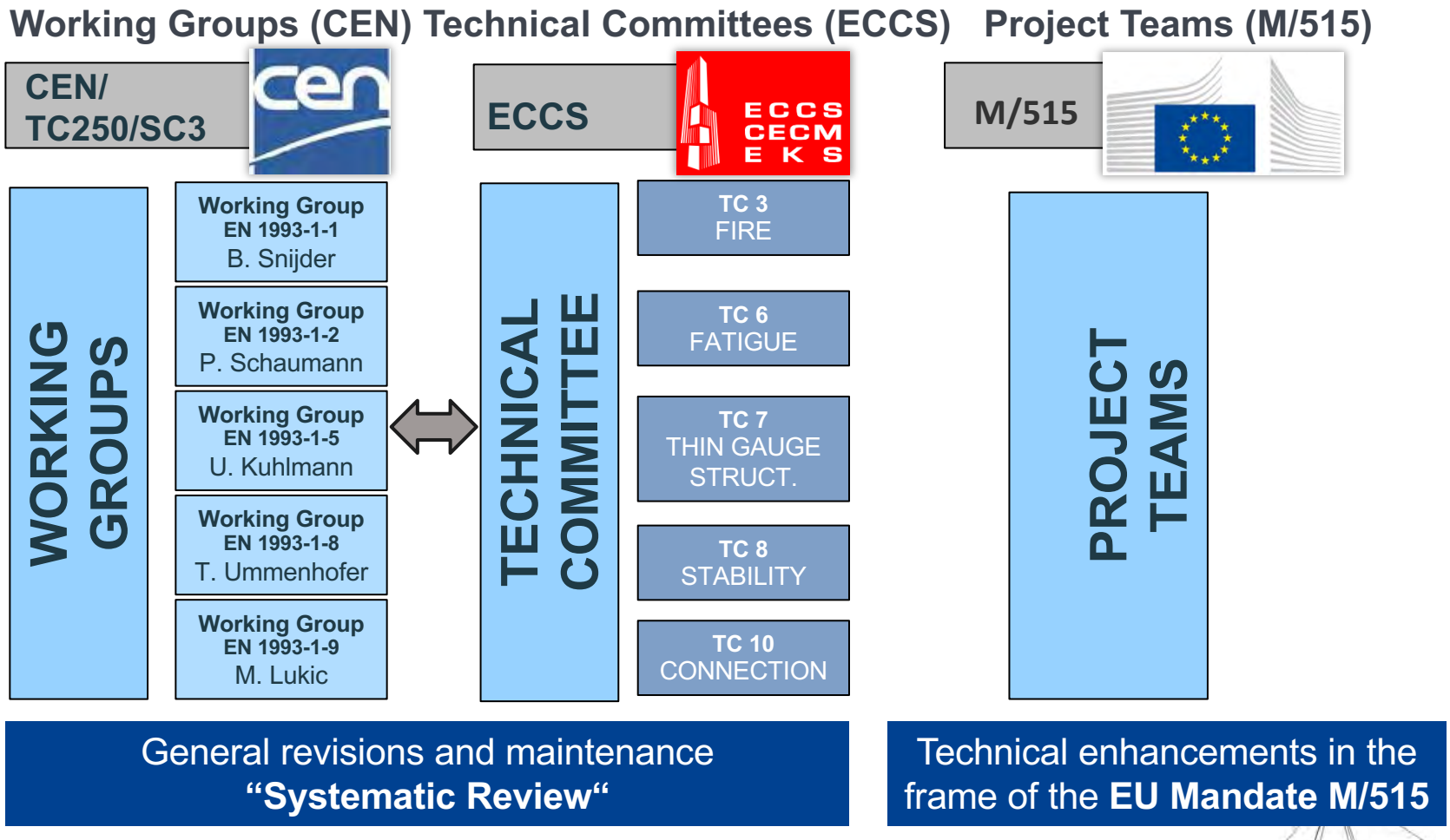
➢ **Evolution, Maintenance and Revision by CEN/TC250/SC3 „Design of Steel Structures“ with support of Working Groups**



Organization of SC3



Organization of SC3



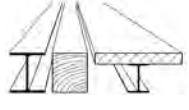
Procedure for the Revision of Eurocode 3

➢ Systematic Review

➢ Approach of addressing comments from Systematic Review

➢ Answering scheme as decided within SC3 meeting Oct. 2014

(1)	Accepted (PT):	Editorial and obvious mistakes that can be directly dealt by PT
(2)	Accepted (WG):	Relevant comment that need to be dealt and further elaborated by WG, and probably accepted by SC3 decision
(3)	Rejected:	In this case a reason should be given, e.g. demand is against policy of “clarity” and “ease of use”,…
(4)	Clarification (WG):	Comment that cannot easily be answered and needs further considerations and discussions in WG
(5)	Decided (SC3):	Comment and issue that is already treated by SC3 and decided as “basket”-decision, no discussion again
(6)	Under discussion (WG):	Comment and issue that is already under discussion within WG and may have reached already a certain status of agreement which should not be rolled up again.



Procedure for the Revision of Eurocode 3

➢ Systematic Review

Phase 1

- EN 1993-1-1
- EN 1993-1-8

Final Draft commented

Phase 2

- EN 1993-1-12
- EN 1993-1-2

Classification finalized and decided

Phase 2

- EN 1993-1-3
- EN 1993-1-5
- EN 1993-1-6
- EN 1993-1-7

Classification finalized and decided

- EN 1993-1-4
- EN 1993-1-9
- EN 1993-1-10
- EN 1993-1-11
- EN 1993-2

Classification finalized and decided

Phase 3 + Phase 4

- EN 1993-4
- EN 1993-5
- EN 1993-6

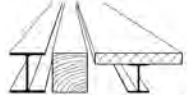
Classification finalized and decided

Phase 4

- EN 1993-3

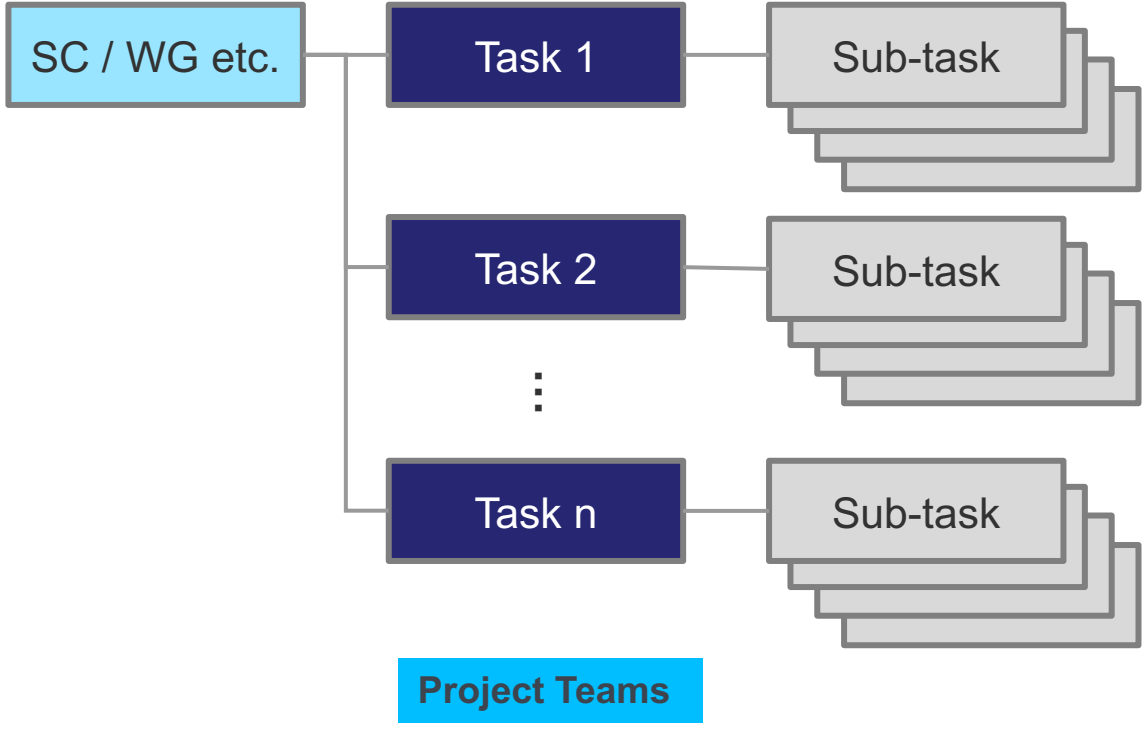
Classification finalized and decided at SC3 meeting in Oct. 2018

Phase 4



Procedure for the Revision of Eurocode 3

➢ **Mandate 515: Structure of tasks and subtasks**

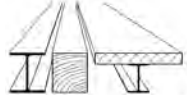


Procedure for the Revision of Eurocode 3

➢ SC3 Mandate Tasks

➢ 13 single tasks for 20 parts of EN 1993 were agreed

Task-Ref.	Task-Phase	Corresponding Part of EN 1993	Task-Name	Number of Sub-tasks	Sub-tasks (Prio 1)	Responsible
SC3.1	1	EN 1993-1-1	Design of Sections and Members according to EN 1993-1-1	7	4	B. Snijder
SC3.2	1	EN 1993-1-8	Joints and Connections according to EN 1993-1-8	11	7	T. Ummenhofer
SC3.3	2	EN 1993-1-3	Cold-formed members and sheeting. Revised EN 1993-1-3	8	5	T. Misiek
SC3.4	2	EN 1993-1-5	Stability of Plated Structural Elements. Revised EN 1993-1-5	7	4	U. Kuhlmann
SC3.5	2	EN 1993-1-6, -1-7	Harmonization and Extension of Rules for Shells and Similar Structures. Revised EN 1993-1-6 and EN 1993-1-7	5	3	M. Rotter
SC3.6	2	EN 1993-1-2	Fire design of Steel Structures. Revised EN 1993-1-2	8	4	P. Schaumann
SC3.7	3	EN 1993-1-4	Stainless Steels. Revised EN 1993-1-4	5	3	N. Baddoo
SC3.8	3	EN 1993-1-9	Steel Fatigue. Revised EN 1993-1-9	9	5	M. Lukic
SC3.9	3	EN 1993-1-10	Material and Fracture. Revised EN 1993-1-10	7	4	B. Kühn
SC3.10	4	EN 1993-2 EN1993- 1-11	Steel bridges and tension components. Revised EN 1993-2 and EN 1993-1-11	7	4	L. Davaine H. Friedrich
SC3.11	4	EN 1993-3	Consolidation and rationalization of EN 1993-3	4	2	J. Rees
SC3.12	4	EN 1993-4	Harmonisation and Extension of Rules for Storage Structures. Revised EN 1993-4-1 and EN 1993-4-2	6	3	M. Rotter
SC3.13	4	EN 1993-5, EN 1993-6	Evolution of EN 1993-5 Piling and EN 1993-6 Crane supporting structures	11	6	C.Prüm/ U. Kuhlmann



Procedure for the Revision of Eurocode 3

➢ Distribution of 13 SC3-Tasks

- 2 Tasks (EN 1993-1-1 and EN 1993-1-8) in Phase 1 as basis, where all the other parts are dependent on
- 4 Tasks in Phase 2, mainly basic parts concerning stability
- 3 Tasks in Phase 3, mainly basic parts concerning fatigue, toughness and material
- 4 Tasks in Phase 4, application parts for bridges, silos, masts and tower etc.

➢ Main issues

- Further development in view of reduction of NDPs, clarity and ease of use
- Harmonizing of content, Harmonizing of different parts of Eurocode 3
- Keep main structure and content for reliability

Procedure for the Revision of Eurocode 3

➢ SC3 publication plan

Decision 20/2018 taken by CEN/TC 250/SC 3 on 2018-10-25
CEN/TC 250/SC 3 agreed on the following time table:

- Phase 1 drafts available in June 2018, final technical approval in SC3 October 2018, start of CEN-Enquiry-Phase October 2019
- Phase 2 drafts available in June 2020, final technical approval in SC3 October 2020, start of CEN-Enquiry-Phase March 2021
- Phase 3 drafts available in June 2021, final technical approval in SC3 October 2021, start of CEN-Enquiry-Phase March 2022
- Phase 4 drafts available **in February 2022**, final technical approval in SC3 October 2022, start of CEN-Enquiry-Phase March 2023

➢ Final technical approval of drafts in order to conclude discussions, give reliable documents for further developments of other parts and ensure transparent procedure for “final changes”

Procedure for the Revision of Eurocode 3

➢ Procedure for Phase 1 drafts

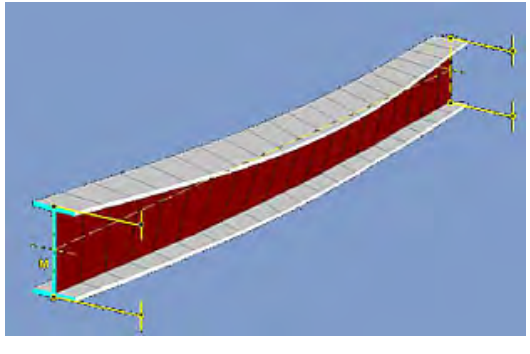
- ➢ Final technical approval on the drafts of EN 1993-1-1 at the last SC3 meeting and EN 1993-1-8 at the next SC3 meeting
- ➢ Editorial changes possible during preparation of drafts by DIN for CEN-Enquiry; Reference group/Editorial panel established in WG1 and WG8 give advice or seek confirmation of WGs if needed
- ➢ Until October 2019: Possibility to submit **urgent** technical amendments to relevant WGs, if positive decision in WGs, sent to SC3 and if positive decision in SC3, implemented in the draft for CEN-Enquiry
- ➢ Start of CEN-Enquiry-Phase October 2019

Technical Review of Selected Code Rules

➢ EN 1993-1-1: General rules and rules for buildings

➢ Further developments on the example of EN 1993-1-1

- Simplification of the stability rules
- Unification of the rules between general and application parts
- Reduction of the rules in particular for lateral torsional buckling



EN 1993-1-1: 2005 (E)

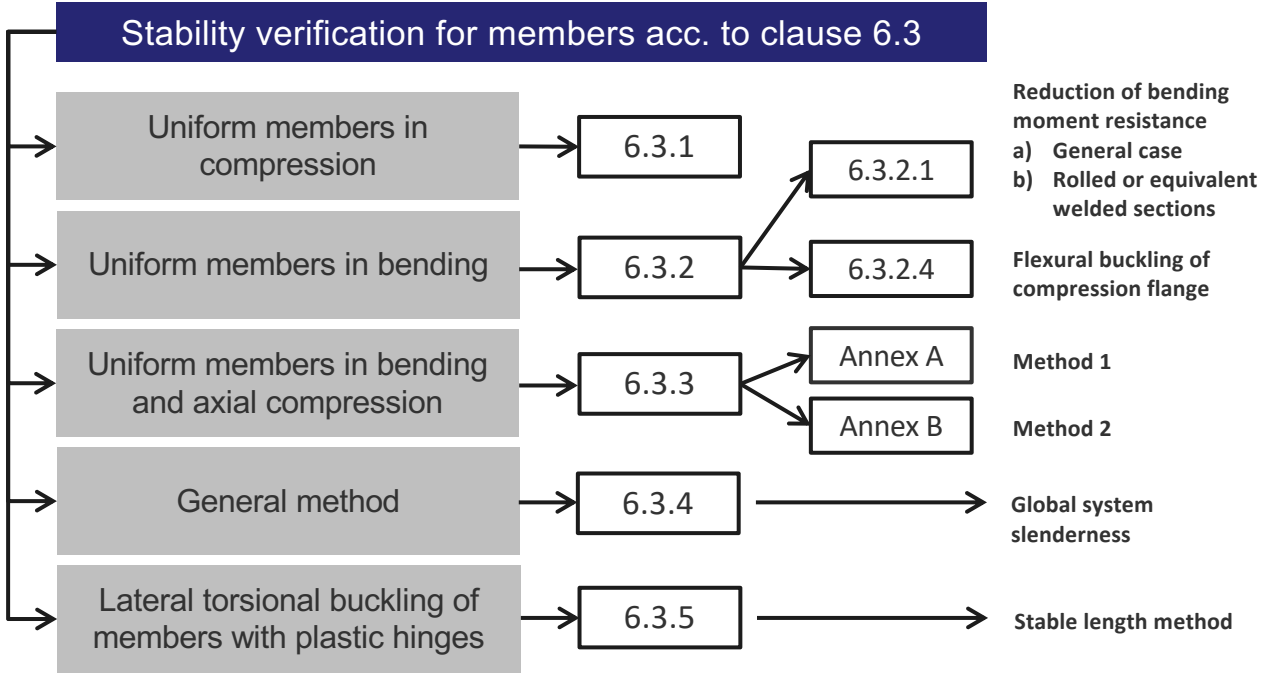
Annex A [informative] – Method 1: Interaction factors k_{ij} for interaction formula in 6.3.3(4)

Table A.1: Interaction factors k_{ij} (6.3.3(4))

Interaction factors	Design assumptions: elastic cross-sectional properties class 3, class 4	Design assumptions: plastic cross-sectional properties class 1, class 2
k_{yy}	$C_{my} C_{mLT} \frac{\mu_y}{1 - \frac{N_{Ed}}{N_{cr,y}}}$	$C_{my} C_{mLT} \frac{\mu_y}{1 - \frac{N_{Ed}}{N_{cr,y}}} \frac{1}{C_{yy}}$
k_{yz}	$C_{mz} \frac{\mu_y}{1 - \frac{N_{Ed}}{N_{cr,z}}}$	$C_{mz} \frac{\mu_y}{1 - \frac{N_{Ed}}{N_{cr,z}}} \frac{1}{C_{yz}} 0{,}6 \sqrt{\frac{w_z}{w_y}}$
k_{zy}	$C_{my} C_{mLT} \frac{\mu_z}{1 - \frac{N_{Ed}}{N_{cr,y}}}$	$C_{my} C_{mLT} \frac{\mu_z}{1 - \frac{N_{Ed}}{N_{cr,y}}} \frac{1}{C_{zy}} 0{,}6 \sqrt{\frac{w_z}{w_y}}$
k_{zz}	$C_{mz} \frac{\mu_z}{1 - \frac{N_{Ed}}{N_{cr,z}}}$	$C_{mz} \frac{\mu_z}{1 - \frac{N_{Ed}}{N_{cr,z}}} \frac{1}{C_{zz}}$
Auxiliary terms:		
$\mu_y = \frac{1 - \frac{N_{Ed}}{N_{cr,y}}}{1 - \chi_y \frac{N_{Ed}}{N_{cr,y}}}$	$C_{yy} = 1 + (w_y - 1)\left[\left(2 - \frac{1{,}6}{w_y} C_{my}^2 \bar{\lambda}_{max} - \frac{1{,}6}{w_y} C_{my}^2 \bar{\lambda}_{max}^2\right) n_{pl} - b_{LT}\right] \geq \frac{W_{el,y}}{W_{pl,y}}$	
	with $b_{LT} = 0{,}5\, a_{LT} \bar{\lambda}_0^2 \frac{M_{y,Ed}}{\chi_{LT} M_{pl,y,Rd}} \frac{M_{z,Ed}}{M_{pl,z,Rd}}$	
$\mu_z = \frac{1 - \frac{N_{Ed}}{N_{cr,z}}}{1 - \chi_z \frac{N_{Ed}}{N_{cr,z}}}$	$C_{yz} = 1 + (w_z - 1)\left[\left(2 - 14 \frac{C_{mz}^2 \bar{\lambda}_{max}^2}{w_z^2}\right) n_{pl} - c_{LT}\right] \geq 0{,}6 \sqrt{\frac{w_z}{w_y}} \frac{W_{el,z}}{W_{pl,z}}$	
	with $c_{LT} = 10\, a_{LT} \frac{\bar{\lambda}_0^2}{5 + \bar{\lambda}_z^4} \frac{M_{y,Ed}}{C_{my} \chi_{LT} M_{pl,y,Rd}}$	
$w_y = \frac{W_{pl,y}}{W_{el,y}} \leq 1{,}5$	$C_{zy} = 1 + (w_y - 1)\left[\left(2 - 14 \frac{C_{my}^2 \bar{\lambda}_{max}^2}{w_y^2}\right) n_{pl} - d_{LT}\right] \geq 0{,}6 \sqrt{\frac{w_z}{w_y}} \frac{W_{el,y}}{W_{pl,y}}$	
$w_z = \frac{W_{pl,z}}{W_{el,z}} \leq 1{,}5$	with $d_{LT} = 2\, a_{LT} \frac{\bar{\lambda}_0}{0{,}1 + \bar{\lambda}_z^4} \frac{M_{y,Ed}}{C_{my} \chi_{LT} M_{pl,y,Rd}} \frac{M_{z,Ed}}{C_{mz} M_{pl,z,Rd}}$	
$n_{pl} = \frac{N_{Ed}}{N_{Rk} / \gamma_{M1}}$		
C_{my} see Table A.2		
$a_{LT} = 1 - \frac{I_t}{I_y} \geq 0$	$C_{zz} = 1 + (w_z - 1)\left[\left(2 - \frac{1{,}6}{w_z} C_{mz}^2 \bar{\lambda}_{max} - \frac{1{,}6}{w_z} C_{mz}^2 \bar{\lambda}_{max}^2\right) n_{pl} - e_{LT}\right] \geq \frac{W_{el,z}}{W_{pl,z}}$	
	with $e_{LT} = 1{,}7\, a_{LT} \frac{\bar{\lambda}_0}{0{,}1 + \bar{\lambda}_z^4} \frac{M_{y,Ed}}{C_{my} \chi_{LT} M_{pl,y,Rd}}$	

Technical Review of Selected Code Rules

➢ EN 1993-1-1: Stability rules – member buckling



➢ prEN1993-1-1: Reduction of number of alternatives (from 7 to 3)

Technical Review of Selected Code Rules

- prEN 1993-1-1: General rules and rules for buildings

- flow-chart added on methods of structural analysis

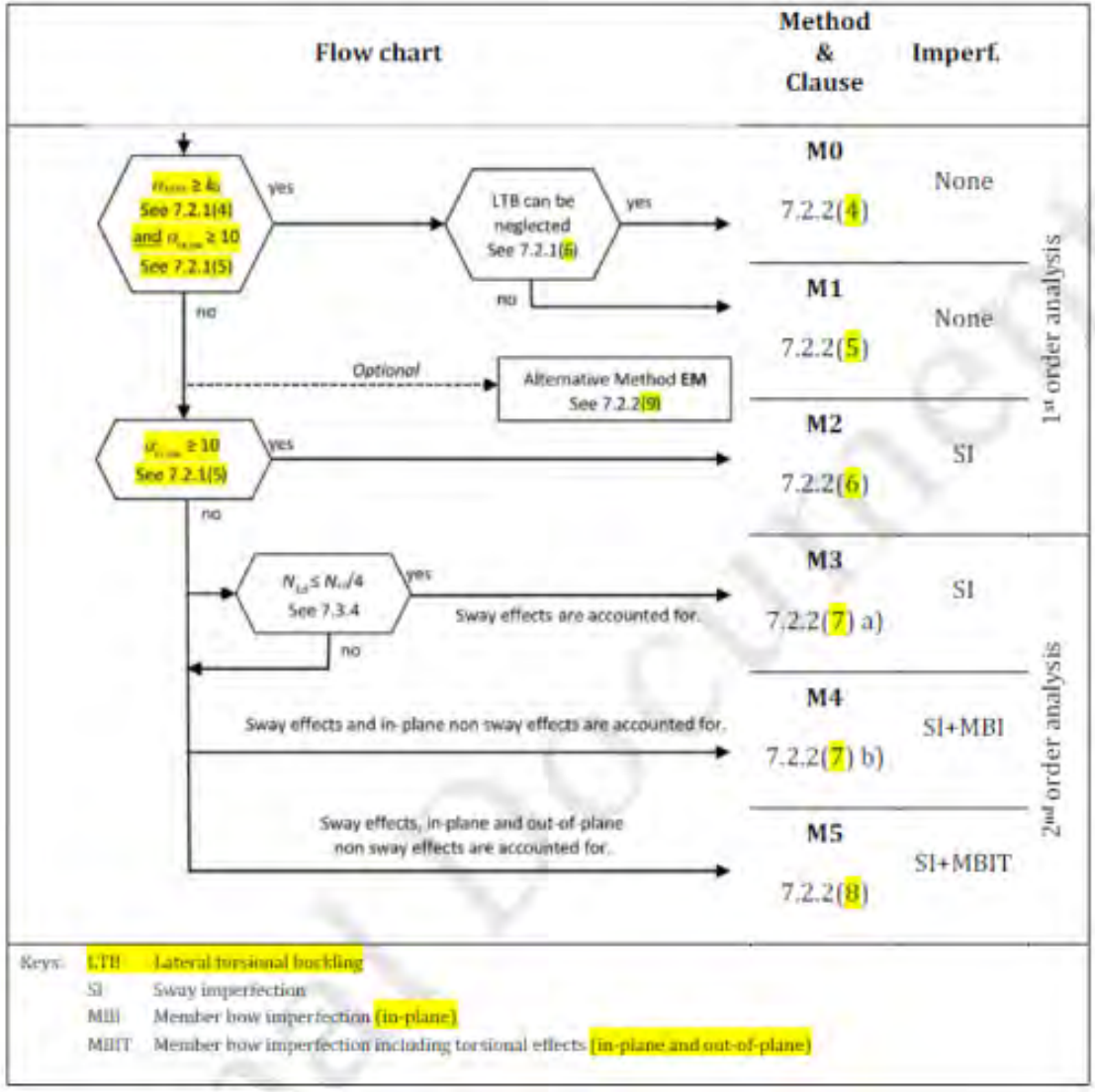


Figure 7.3 — Methods of structural analysis applicable to ultimate limit state design checks

Technical Review of Selected Code Rules

➢ prEN 1993-1-1: General rules and rules for buildings

➢ Relation to EN 1090

Annex A
(normative)

Selection of Execution Class

A.1 Scope and field of application

(1)P This Annex shall be used to select an appropriate execution class in accordance with 4.1.2.

To obtain the reliability of the completed works required according to EN 1990 an appropriate execution Class shall be selected. This annex forms the basis for this selection.

➢ No change to existing procedure, see EN 1993-1-1 Annex C

Technical Review of Selected Code Rules

➢ prEN 1993-1-1: General rules and rules for buildings

➢ Relation to EN 1090

Table A.1 — Selection of execution Class based on the type of loading (EXC)

Reliability Class (RC) or Consequence Class (CC)	Type of loading	
	Static, quasi-static or seismic DCL[a]	Fatigue[b] or seismic DCM or DCH[a]
RC3 or CC3	EXC3[c]	EXC3[c]
RC2 or CC2	EXC2	EXC3
RC1 or CC1	EXC1	EXC2

[a] Seismic ductility classes are defined in EN 1998-1: Low = DCL; Medium = DCM; High = DCH.

[b] See EN 1993-1-9.

[c] EXC4 may be specified for structures with extreme consequences of structural failure.

Technical Review of Selected Code Rules

➢ Draft EN 1993-1-1 Annex E

➢ New informative Annex E: **Basis for the calibration of partial factors**

Annex E
(informative)

Basis for the calibration of partial factors

- Annex E not for direct use in design rules
- For the choice of γ_{M1} = 1.0 there are the following conditions:
  - For the steel the statistical values of Table E.1 and E.2 have to be guaranteed
  - The material values of product standards have to be used instead of Table 5.1

Technical Review of Selected Code Rules

➢ Draft EN 1993-1-1 Annex E

Table E.1 — Assumed variability of material properties

Parameter	Steel grade	Mean value X_m	Coefficient of variation	Characteristic value $X_{k,th}$	Design value $X_{d,th}$
Yield strength, f_y	S235, S275	1,25 $R_{eH,min}$[a]	5,5%	1,14 $R_{eH,min}$[a]	1,06 $R_{eH,min}$[a]
	S355, S420	1,20 $R_{eH,min}$[a]	5,0%	1,11 $R_{eH,min}$[a]	1,03 $R_{eH,min}$[a]
	S460	1,15 $R_{eH,min}$[a]	4,5%	1,07 $R_{eH,min}$[a]	1,00 $R_{eH,min}$[a]
	Above S460	1,10 $R_{eH,min}$[a]	3,5%	1,04 $R_{eH,min}$[a]	1,00 $R_{eH,min}$[a]
Ultimate tensile strength, f_u	S235, S275	1,20 $R_{m,min}$[a]	5,0%	1,11 $R_{m,min}$[a]	1,03 $R_{m,min}$[a]
	S355, S420	1,15 $R_{m,min}$[a]	4,0%	1,08 $R_{m,min}$[a]	1,02 $R_{m,min}$[a]
	S460 and above	1,10 $R_{m,min}$[a]	3,5%	1,04 $R_{m,min}$[a]	1,00 $R_{m,min}$[a]
Modulus of elasticity, E	All steel grades	210000 N/mm²	3,0%	200000 N/mm²	192000 N/mm²

➢ NOTE The values in Tables E.1 and E.2 represent the materials and products currently available on the European market satisfying the relevant European product standards

Technical Review of Selected Code Rules

➢ Draft EN 1993-1-1 Annex E

Table E.2 — Assumed variability of dimensional parameters

Dimension type	Parameter	Mean value X_m	Coefficient of variation	Characteristic value $X_{k,th}$	Design value $X_{d,th}$
Outer dimensions of cross-section	Depth h	1,0 h_{nom} [a]	0,9%	0,98 h_{nom} [a]	0,97 h_{nom} [a]
	Width b	1,0 b_{nom} [a]	0,9%	0,98 b_{nom} [a]	0,97 b_{nom} [a]
	Outer diameter d of circular hollow section	1,0 d_{nom} [a]	0,5%	0,99 d_{nom} [a]	0,98 d_{nom} [a]
Plate thickness	I- and H-sections: flange thickness, t_f	0,98 $t_{f,nom}$ [a]	2,5%	0,95 $t_{f,nom}$ [a]	0,91 $t_{f,nom}$ [a]
	I- and H-sections: web thickness, t_w	1,0 $t_{w,nom}$ [a]	2,5%	0,96 $t_{w,nom}$ [a]	0,93 $t_{w,nom}$ [a]
	fabricated hollow sections, thickness, t	0,99 t_{nom} [a]	2,5%	0,95 t_{nom} [a]	0,92 t_{nom} [a]
	cold-formed				
	heavy plates, thickness, t	0,99 t_{nom} [a]	2,5%	0,95 t_{nom} [a]	0,92 t_{nom} [a]

[a] nominal dimensions according to the applicable product standard or specification.

➢ Discussion with ECISS/TC103 how to transfer into steel codes has started

Technical Review of Selected Code Rules

➢ Further developments on the example of EN 1993-1-8

➢ Load bearing capacity of **fillet welded connections** of high strength steels

- ➢ Weld strength function

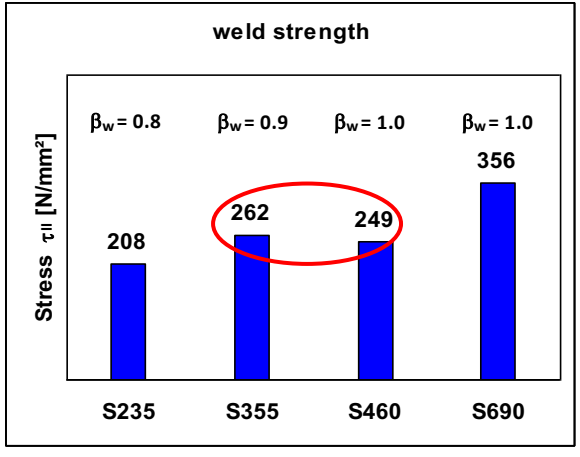
$$\tau_{w,Rd} = \frac{f_{u,k} / \sqrt{3}}{\beta_w \cdot \gamma_{M2}}$$

$f_{u,k}$ tensile strength of base metal

β_w correlation factor

→ prEN 1993-1-8: modified correlation factor with **equal** parent and filler metal strength

- ➢ S460: $\beta_w = 0{,}85$
- ➢ S690: $\beta_w = 1{,}10$



→ Improved design specifications also for steel grades up to 700 N/mm²

Technical Review of Selected Code Rules

➢ prEN 1993-1-8: Design of Joints

➢ Load bearing capacity of **fillet welded connections** of high strength steels

Parent metal Filler metal

$$\sigma_{w,Rd} = \frac{0.25 \cdot f_{u,PM} + 0.75 \cdot f_{u,FM}}{\beta_{w,mod} \cdot \gamma_{M2}}$$

modified correlation factor that depends on the filler metal strength

Filler metal strength class	$\beta_{w,mod}$ [-]	$f_{u,FM}$
42	**0.89**	500
46	**0.85**	**530**
69	**1.09**	**770**
89	**1.19**	940

- ➢ Possibilities to cover mismatch-effects
- ➢ Undermatching may have advantages regarding ductility, weldability, quality

➢ For fillet welded connections of steel grades ≥ S460 and with different parent and filler metal strength

Technical Review of Selected Code Rules

➢ prEN 1993-1-8: Design of joints

➢ Restructuring of Chapter 5 and 6

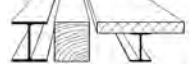
Restructure the existing Chapter 6, that the principles are to be kept in Chapter 6 and the details of the components are to be moved into a normative annex.

Decision No. 21/2015

CEN/TC 250/SC 3 agrees to the following amendment given in document N2187 AM-1-8-2015-001:
The Component Method will be retained in EN 1993-1-8. The existing content of Chapter 6 (Component Method) will be restructured so that it clearly describes the procedure and the basic principles in the main text and that details of the components will be given in a new normative annex.

➢ Enhanced Ease of Use

i. improving the clarity
ii. simplifying routes through the Eurocodes



Technical Review of Selected Code Rules

➢ prEN 1993-1-8: Design of joints

Restructuring of Chapter 5 and 6

Existing structure Chapter 5 and 6

- 5 Analysis, classification and modelling
- 6 Structural joints connecting H or I sections

Final Draft prEN1993-1-8 (N2678) for Chapter 5 (7) and 6 (8) and Annexes

- 7 Structural analysis
- 6 Structural joints connecting H or I sections

- **Annex A (Normative). Structural properties of basic components**
- **Annex B (Normative). Application rules for moment-resisting beam-to-column joints and splices**
- **Annex C (Normative). Application rules for simple connections**
- **Annex D (Normative). Application rules for column bases**

Technical Review of Selected Code Rules

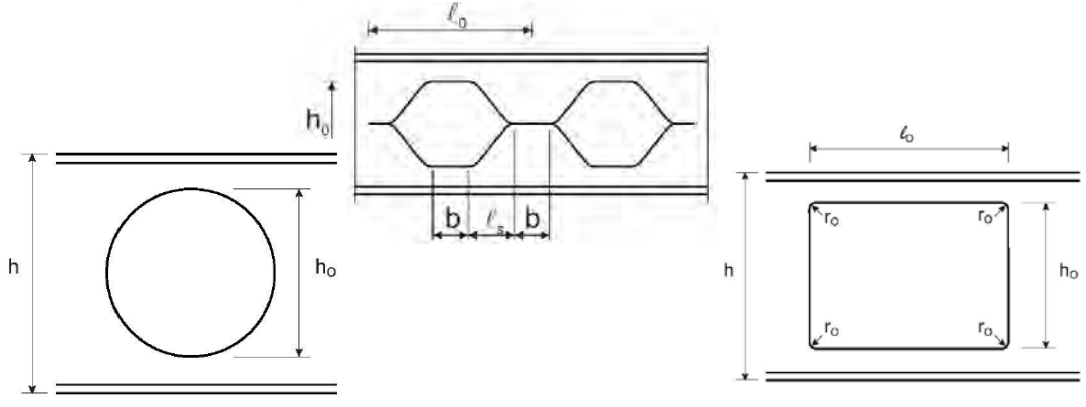
➢ EN 1993-1-13: Steel beams with web openings

Extension of code rules where gaps were existing:

- Beams with large web openings

SC4.T2: Composite beams with **large web openings** (Phase 1)

Steel beams with web openings (**EN 1993-1-13 (SC3/WG 20)**)
Composite beams with web openings in (rules in EN 1994)



Technical Review of Selected Code Rules

- **New part EN 1993-1-14:** Eurocode 3 - Design of steel structures - Part 1-14: Design assisted by finite element analysis

Scope of EN 1993-1-14

- rules on the use of finite element analysis and other numerical methods
- for verifying ultimate limit states, serviceability limit states and fatigue of steel structures.

General expectations EN 1993-1-14

- Based on the current standard parts and added materials which are ready and validated for FE calculations and simulations.
- **Define the framework** of FE design methods
- Give rules to all necessary design methods possible – in a compatible way of model – analysis – design.
- **Specific design rules can be given in relevant standard parts**.
- Harmonization with all the specific parts: EN1993-1-1 – EN 1993-1-9
- Expected size of the document (40-50 pages).

Technical Review of Selected Code Rules

- **New part EN 1993-1-14:** Eurocode 3 - Design of steel structures - Part 1-14: Design assisted by finite element analysis

Scope of EN 1993-1-14

- rules on the use of finite element analysis and other numerical methods
- for verifying ultimate limit states, serviceability limit states and fatigue of steel structures.

- Draft developed by Adhoc Group FE composed of members of 8 SC3/Working Groups, SC9 and SC8
- Only code rules on the use of finite element analysis and other numerical methods,
- Background document planned as Technical Report

Summary and Conclusions

➢ Summary of procedure

➢ Principles for the future development of Eurocode 3

- Principles have been accepted by SC3 at an early stage of development which are in conformity with TC250 aims of **Reduction of NDPs and Ease of Use**

➢ Technical issues to be extensively discussed and decided

- Development of amendments by the relevant experts of the CEN/TC250/SC3 Working Groups
- Allow for sufficient discussion and clarification in TC250/SC3 and in National Mirror Groups

➢ Clear decisions as guidance for Project Team Work

- Transparent decisions of SC3 form a reliable basis for work of Project Teams

Summary and Conclusions

- **Aims**
  - harmonized and user-friendly design rules
- **Modern Eurocodes**
  - Necessary basis for complex problems
  - Easy-to-use rules for standard cases (80%)

Let us work together and influence development

- Create codes for the future -

Thank you for your attention!