16TH EUROPEAN CONFERENCE ON
EARTHQUAKE ENGINEERING THESSALONIKI
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EUROCODE 8
EVOLUTION OR REVOLUTION?

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CONTENTS

- A bit of history
- Organisation of the work
- Objectives of the work
- Some topics to be developed
- A little deeper in some topics

A bit of history

Treaty of Rome 1957

COUNCIL DIRECTIVE
public works 1971

European Commission 1976

First Eurocodes drafts

Transfer of the Eurocodes programme to CEN 1989

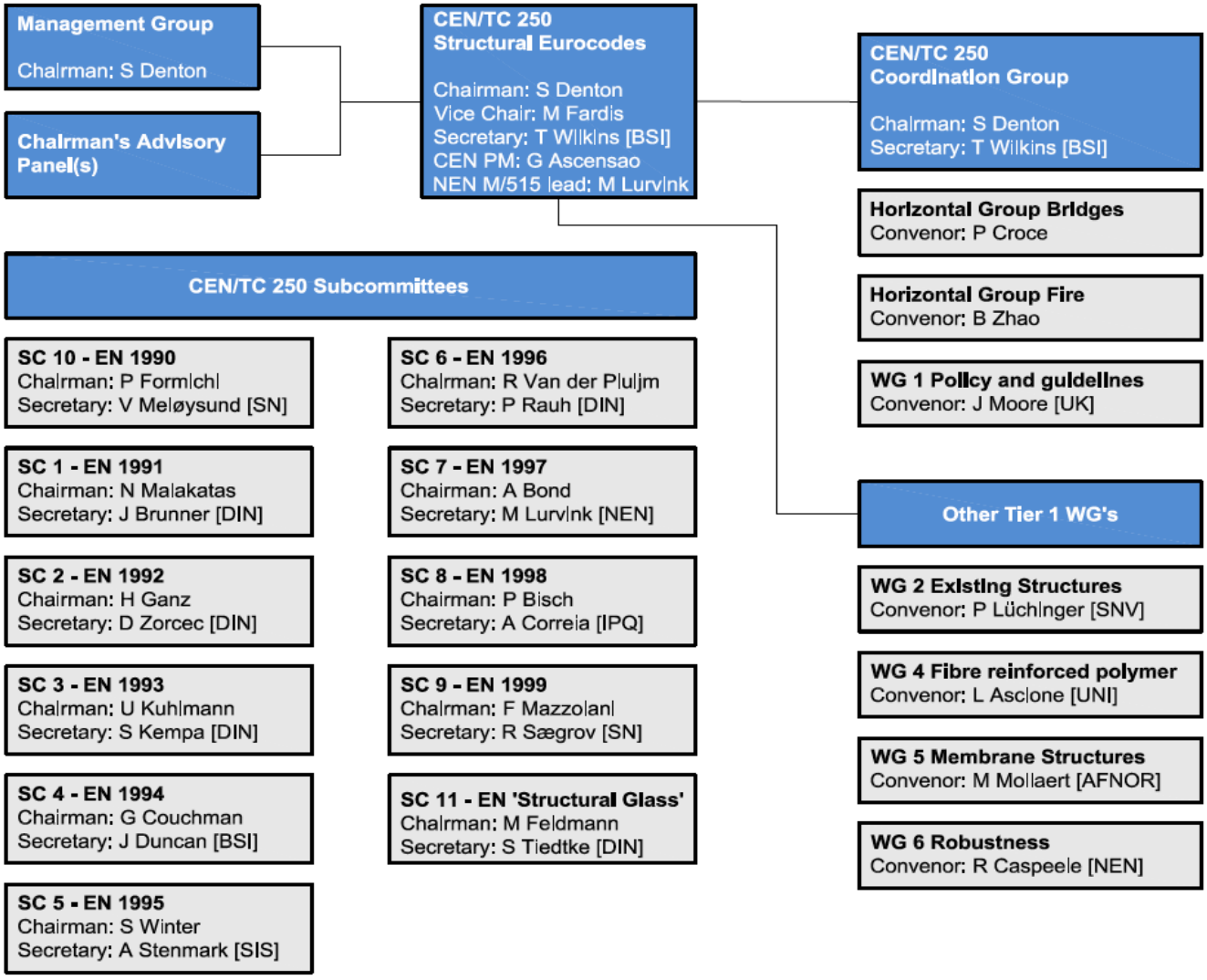
1994 ENVs

2003 ENs 1st generation

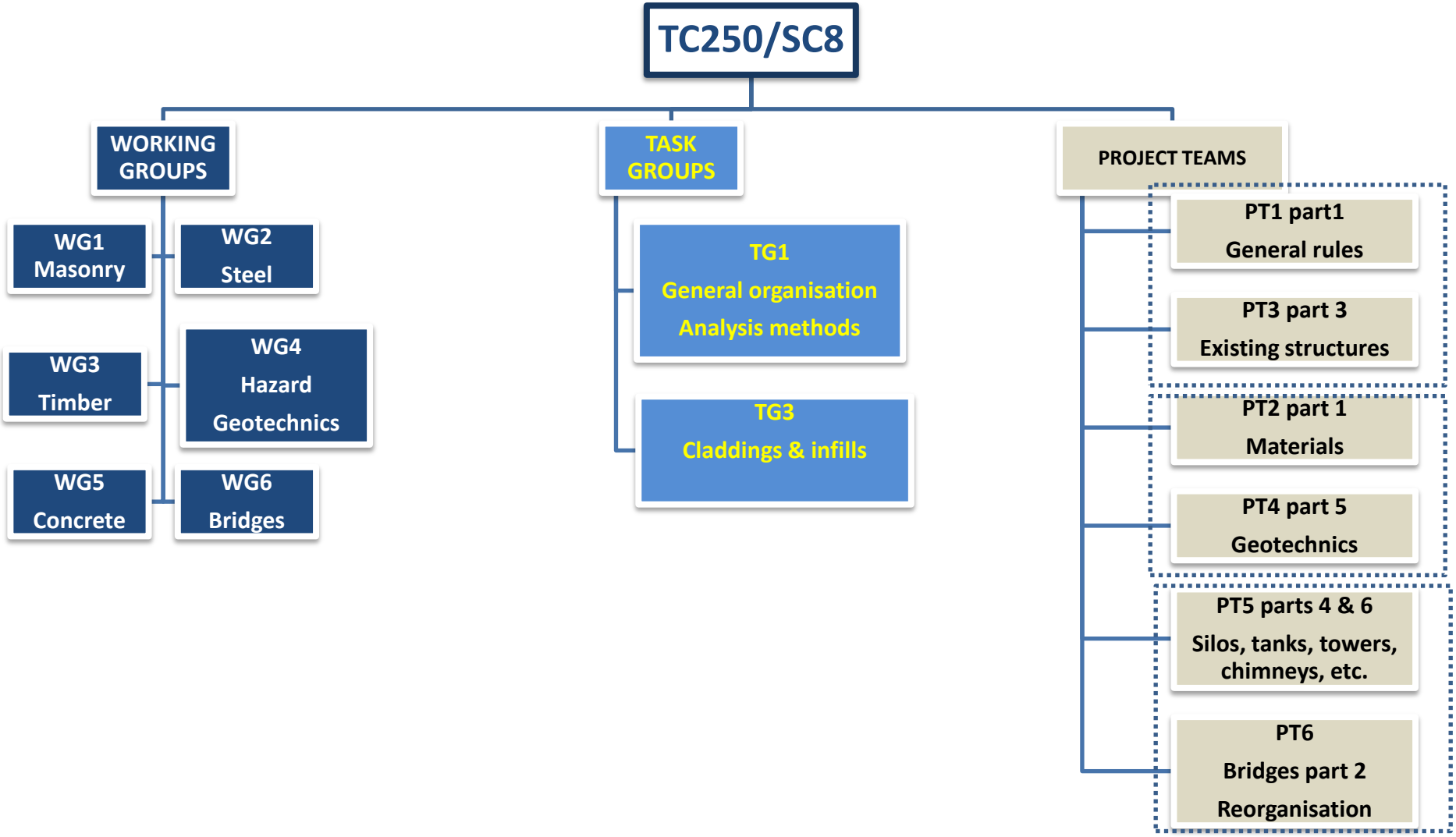
Mandate M/515 2022?

ENs 2nd generation

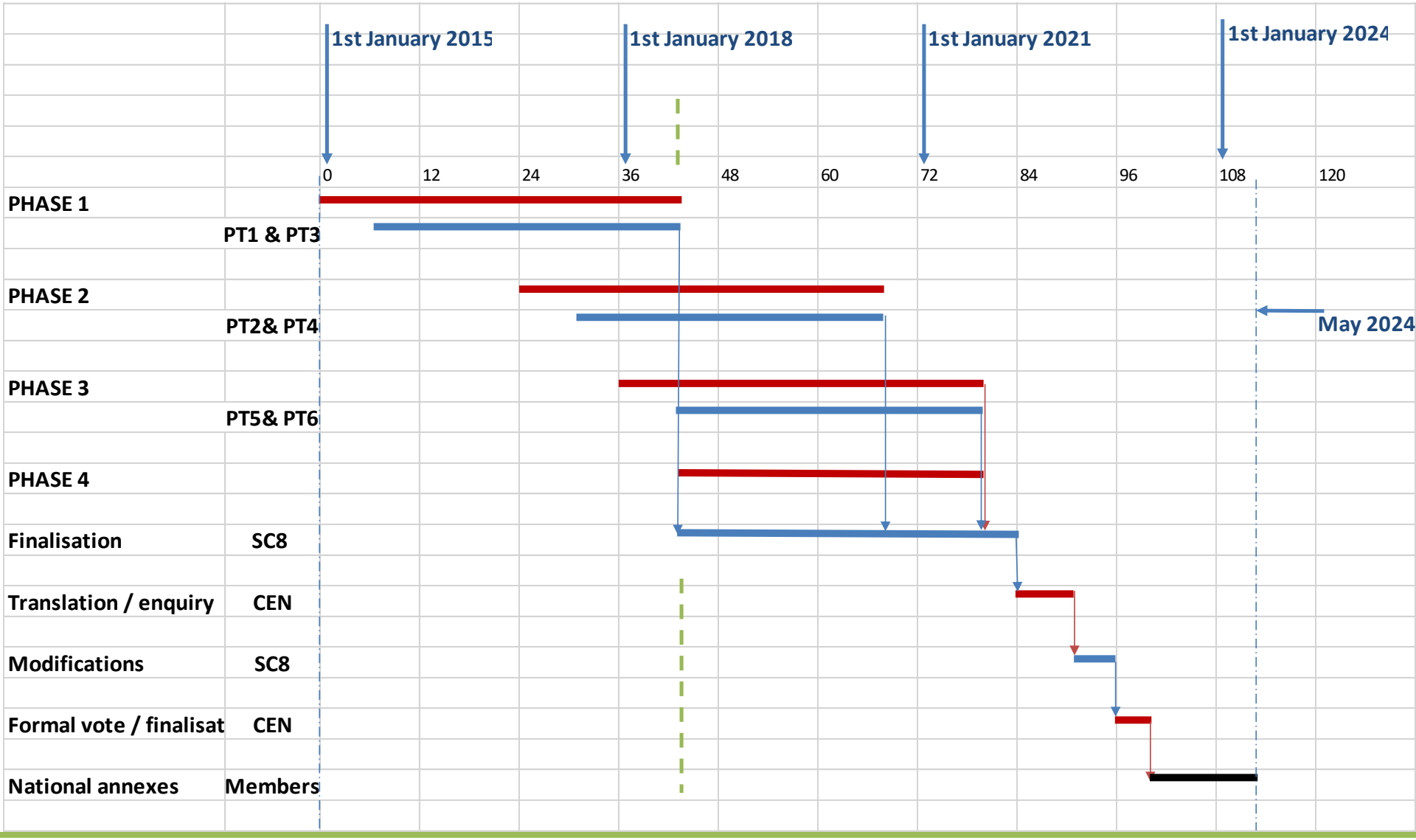
Organisation of CEN/TC250



Organisation of CEN/TC250/SC8



2nd generation of EUROCODES – Time schedule



Purpose of the Eurocodes revision

- To satisfy the Mandate given to CEN by the European Commission for:
  - ✓ Simplifying the use of Eurocodes
  - ✓ Convergence in harmonization
  - ✓ Covering new topics
- To take into account the results of the systematic review from CEN members

Reduction of NDPs

PRINCIPLES:

- ✓ **NDPs linked to Safety (e.g. partial factors) are legitimate**
- ✓ **NDPs linked to physical models should be avoided**
- ✓ **Economy may be considered**

EC8 part	1st generation	2nd generation
EC8-1 general	18	11
EC8-3	7	6
EC8-1 materials	39	⇒ 4?
EC8-5	3	2

Ease of use

PRINCIPLES of "ease of use":

- ✓ Improve clarity
- ✓ Simplify routes through the code
- ✓ Avoid rules of little practical use
- ✓ Avoid alternative procedures
- ✓ Take into account feedback from users

♥ Primary target = competent design engineer

➲ Include state-of-the-art material commonly accepted and validated with practical experience

➲ Do not cover the complex cases

➲ Re-organisation of Eurocode 8

Structure of EUROCODE 8

ENV	EC8 1st generation	EC8 2nd generation
1-1 General rules	1 General rules & buildings	1 General rules
1-2 Buildings		? New buildings
1-3 Materials		
1-4 Existing buildings	3 Existing buildings	3 Existing buildings
2 Bridges	2 Bridges	2 Bridges
3 Towers, masts & chimneys	6 Towers, masts & chimneys	4 Other structures
4 Silos, tanks & pipelines	4 Silos, tanks & pipelines	
5 Foundations & retaining structures	5 Foundations & retaining structures	5 Geotechnical works

Verb forms

- "shall" means a requirement strictly to be followed in order to conform to the Eurocodes and from which no deviation is permitted
- "should" gives a strong recommendation. Subject to national regulation and any relevant contractual provisions, alternative approaches could be appropriate where technically justified
- "may" indicates a course of action permissible within the limits of the Eurocodes

➲ Restrict PRINCIPLES to Objectives / Performance / Concepts

Some topics to be developed (M/515)

EC8 part	Topic
1	European seismic zonation and definition of seismic action
	Displacement based design and criteria (materials)
	Base isolation, additional damping, new technologies
	Aluminium
	Review ductility classes
	Flat slabs
	New structural types (steel, composite, timber)
	Infill panels and claddings

Some topics to be developed (M/515)

EC8 part	Topic
2	Integral bridges, cable stayed bridges
3	Analysis, knowledge levels, materials (capacity)
	Bridges
5	Soil-structure interaction
	Design of shallow and deep foundations
4, 6	Mainly update

Limit states

1st GENERATION

PARTS 1 & 2	PART 3
	NEAR COLLAPSE
NO COLLAPSE	SIGNIFICANT DAMAGE
DAMAGE LIMITATION	DAMAGE LIMITATION

2nd GENERATION

	Limit state
ULS	NEAR COLLAPSE (NC)
	SIGNIFICANT DAMAGE (SD)
SLS	DAMAGE LIMITATION (DL)
	OPERABILITY (OP)

Consequence classes

1st GENERATION IMPORTANCE CLASSES

PART 1	PART 2
I	I
II	II
III	III
IV	

2nd GENERATION CONSEQUENCE CLASSES (EC0)

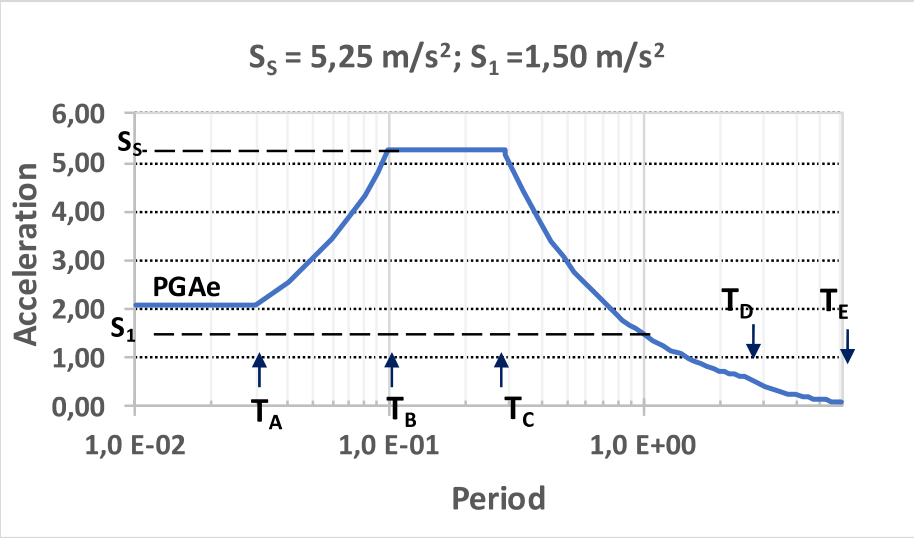
CC1
CC2
CC3a
CC3b

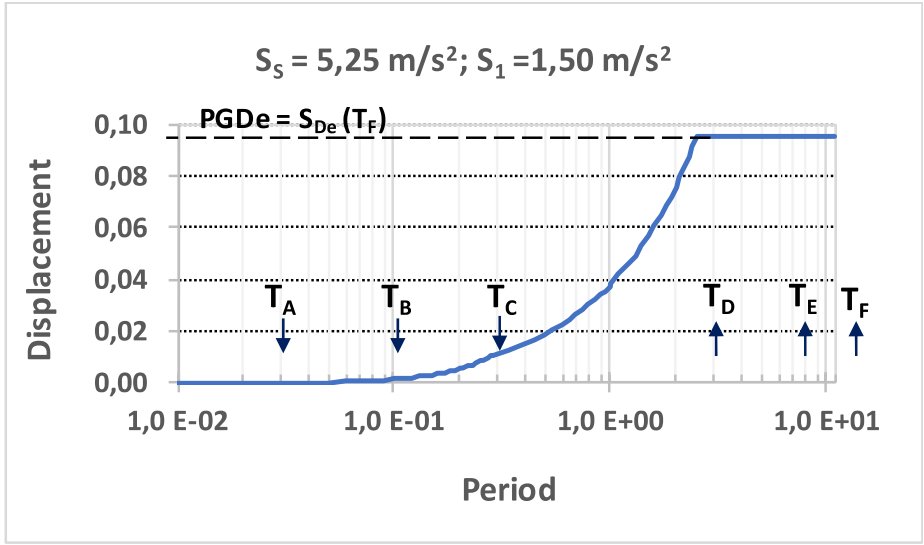
Safety choices for buildings (NDPs)

Return periods in years				
Limit state	Consequence class			
	CC1	CC2	CC3-a	CC3-b
NC	800	1600	2500	5000
SD	250	475	800	1600
DL	50	60	60	100

Performance factors				
Limit state (LS)	Consequence class (IC)			
	CC1	CC2	CC3-a	CC3-b
NC	1,2	1,5	1,8	2,2
SD	0,8	1	1,2	1,5
DL	0,4	0,5	0,5	0,6

Seismic action





Site classification

Table 5.1 Standard site categorisation

	Ground class	stiff	medium	soft
Depth class	$v_{s,H}$ range / H_{800} range	800 m/s > $v_{s,H}$ ≥ 400 m/s	400 m/s > $v_{s,H}$ ≥ 250 m/s	250 m/s > $v_{s,H}$ ≥ 150 m/s
very shallow	$H_{800} \leq 5$ m	A	A	E
shallow	5 m < $H_{800} \leq 30$ m	B	E	E
intermediate	30 m < $H_{800} \leq 100$ m	B	C	D
deep	$H_{800} > 100$ m	B	F	F

Site classification

ALTERNATIVE IDENTIFICATION METHODS

- Correspondence between geotechnical characterisation of soil materials (SPT, laboratory, pressuremeter, CPT), range of shear wave velocities, and ground class
- Site categorization based on $v_{s,H}$ and f_0 (fundamental frequency of the soil deposit)
- Correspondence between the simplified geological description of the soil deposit and the site category
- Site specific study

Site amplification factors

Table 5.4. Site amplification factors F_α and F_β for the standard site categories of Table 5.1.

Site category	F_α		F_β	
	H_{800} and $v_{s,H}$ available	Default value	H_{800} and $v_{s,H}$ available	Default value
A	1,0	1,0	1,0	1,0
B	$\left(\frac{v_{s,H}}{800}\right)^{-0,25r_\alpha}$	1,20	$\left(\frac{v_{s,H}}{800}\right)^{-0,70r_\beta}$	1,60
C		1,35		2,25
D		1,50		3,20
E	$\left(\frac{v_{s,H}}{800}\right)^{-0,25r_\alpha\frac{H}{30}\left(4-\frac{H}{10}\right)}$	1,70	$\left(\frac{v_{s,H}}{800}\right)^{-0,70r_\beta\frac{H}{30}}$	3,0
F	$0,90\cdot\left(\frac{v_{s,H}}{800}\right)^{-0,25r_\alpha}$	1,35	$1,25\cdot\left(\frac{v_{s,H}}{800}\right)^{-0,70r_\beta}$	4,0

Regularity of buildings and torsion

- ❑ Criteria for regularity in plan removed
- ❑ Criteria for regularity in elevation simplified

TORSION

- ✓ Accidental eccentricity removed
- ✓ Minimum eccentricity required
- ✓ Definition of torsionally flexible (based on effective mass)

Methods of analysis

❑ FORCE BASED APPROACH (with q factor)

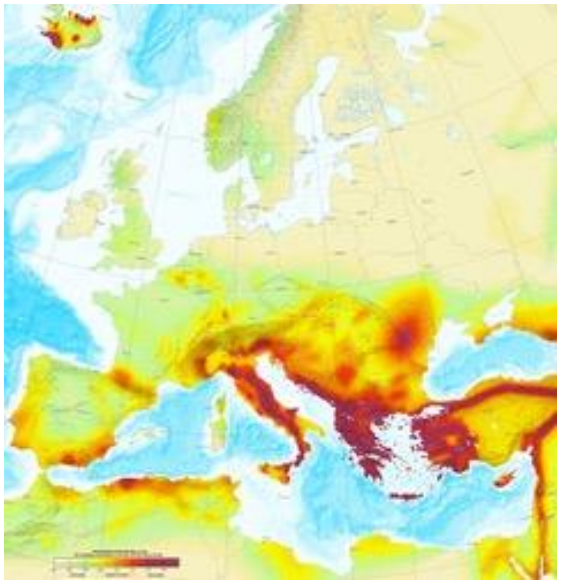
- ✓ Lateral force method extended (with the Rayleigh method)
- ✓ Multimodal analysis

$$q = q_R \, q_S \, q_D$$

❑ DISPLACEMENT BASED APPROACH

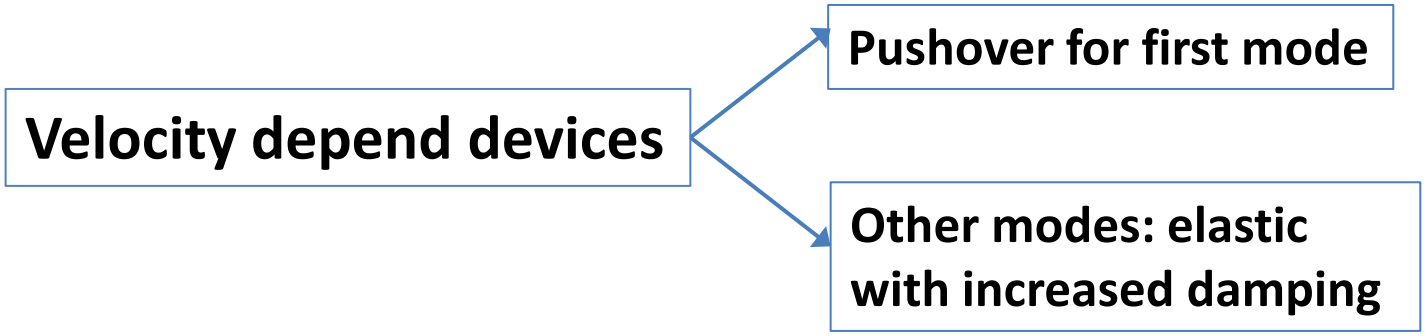
- ✓ Pushover analysis (with torsion and influence of higher modes)
- ✓ Time history analysis

Ductility classes



Linear elastic design, force approach (q = 1)	
DC1	Overstrength capacity (q = 1,5)
DC2	Overstrength capacity, local deformation capacity and local energy dissipation capacity
DC3	Ability of the structure to form a global plastic mechanism at SD limit state

Structures with distributed energy dissipation




THANK YOU
FOR YOUR
ATTENTION