Overview of Eurocode Introduction

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In March 2010, all British Standards that conflict with the Eurocodes will be withdrawn

‘Implementation of the European Directive covering procurement procedures for public bodies in the transport sector will require publicly funded works to be designed to the Structural Eurocodes once national standards are withdrawn’

Rail Group Standard: GC/RT 5112

"The implementation of the structural eurocodes … is the biggest change to codified structural design ever experienced in the UK"

IStructE report to ODPM

PB's role in Eurocodes

- Managing Contractor for "Implementation of Eurocodes – Phase 2" for the Highways Agency
  - Studies and implementation strategy
  - Pilot and trial designs, calibration, impact assessment
  - Development of National Annexes
  - Development of Eurocodes-aligned DMRB, BSi PDs, etc.
- BSi and CEN Committee Membership
- Strategic advice to structure owners
- Training development, seminars, public meetings

Agenda

- Background to Eurocode development
- Overview of Eurocodes and National Annexes
- Related European Standards
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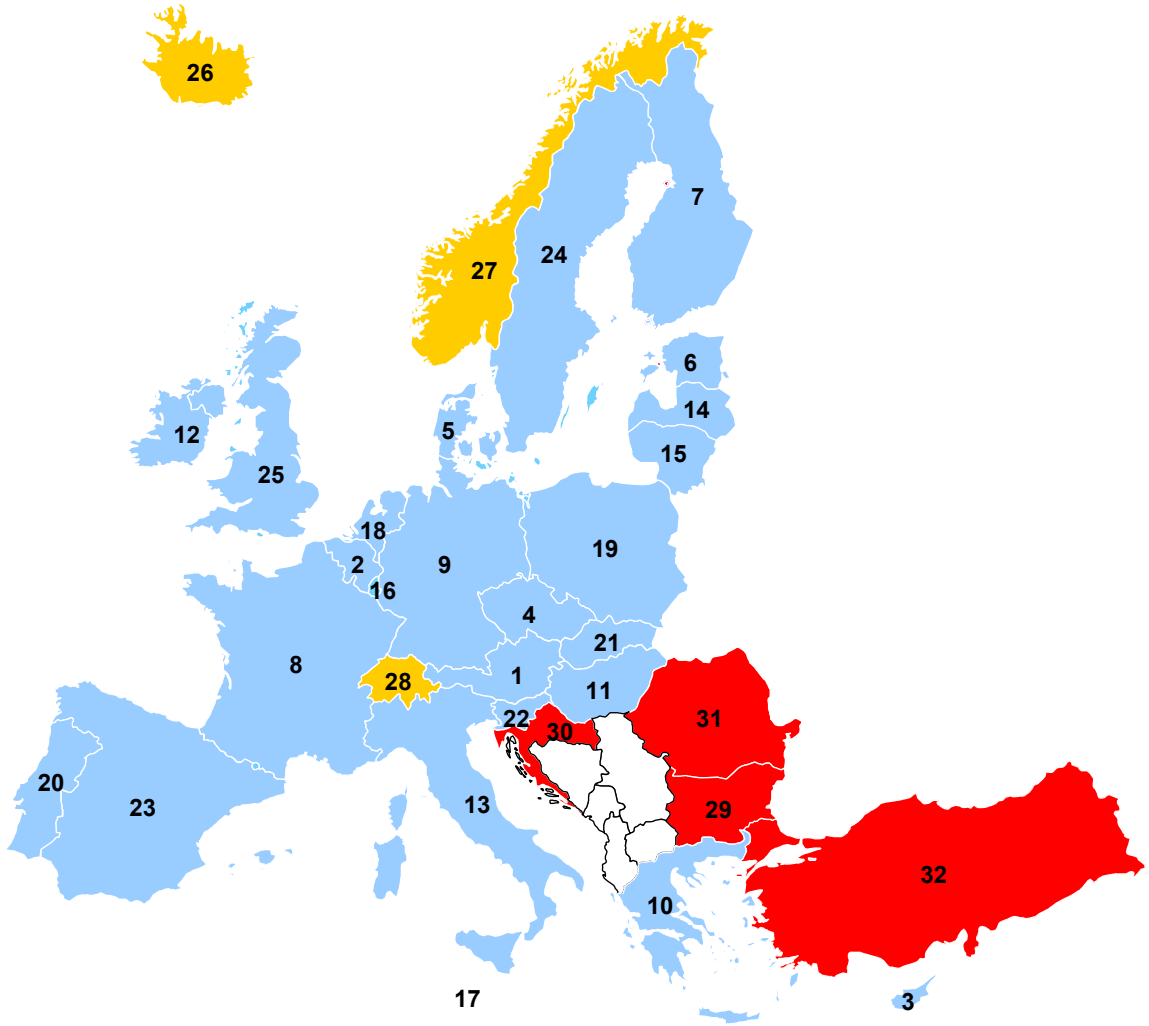


	EU Countries	
1	Austria	7.60
2	Belgium	10.00
3	Cyprus	0.70
4	Czech Republic	10.30
5	Denmark	5.00
6	Estonia	1.60
7	Finland	5.00
8	France	56.00
9	Germany	79.00
10	Greece	10.00
11	Hungary	11.00
12	Ireland	3.50
13	Italy	58.00
14	Latvia	2.60
15	Lithuania	3.60
16	Luxembourg	0.40
17	Malta	0.40
18	Netherlands	15.00
19	Poland	38.00
20	Portugal	10.50
21	Slovakia	5.30
22	Slovenia	5.30
23	Spain	39.30
24	Sweden	8.50
25	United Kingdom	57.10
	EU Total	**443.70**

	EFTA Countries	
26	Iceland	0.25
27	Norway	4.25
28	Switzerland	6.70
	EFTA Total	**11.20**

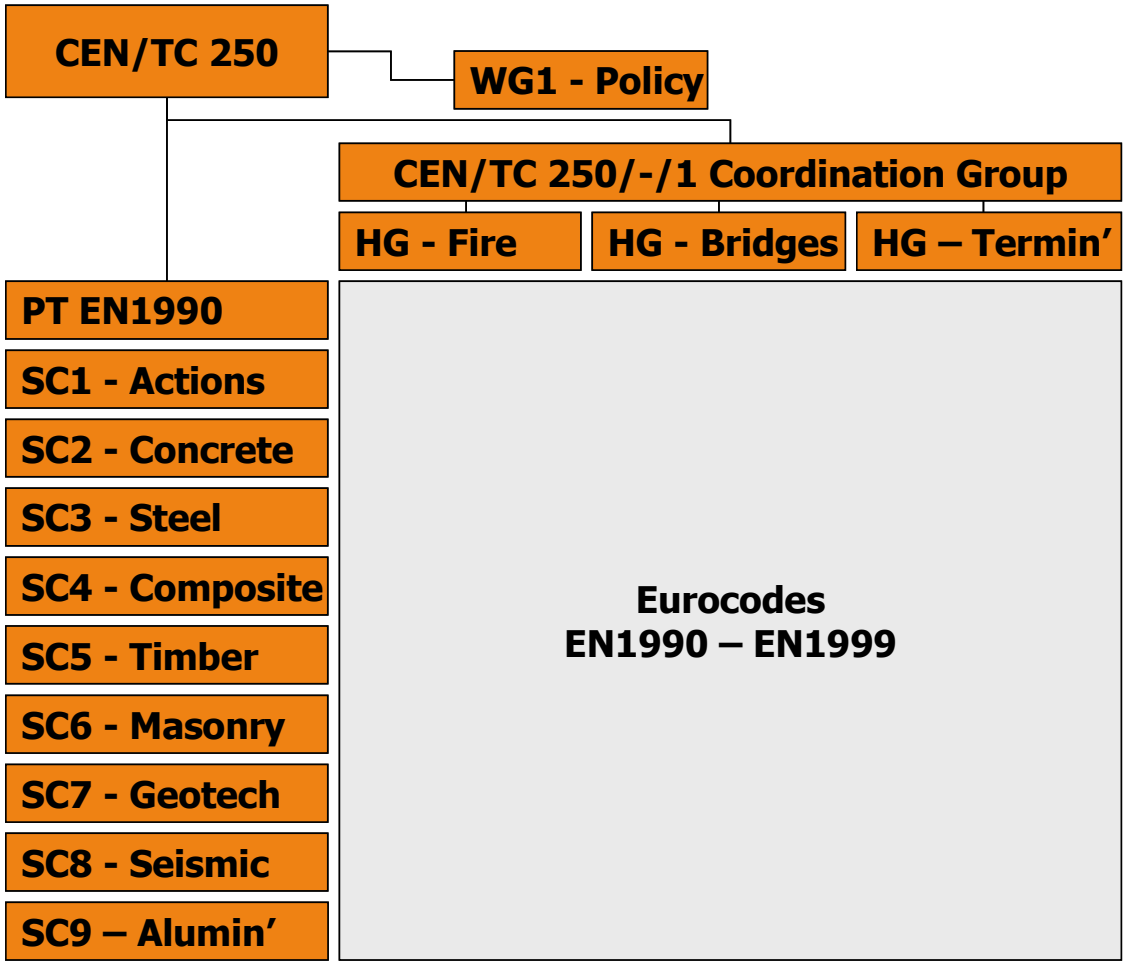
	Candidate Countries	
29	Bulgaria	8.20
30	Croatia	4.80
31	Romania	22.50
32	Turkey	63.90
	Candidate Total	**99.40**

Population Total in Millions:	**554.30**

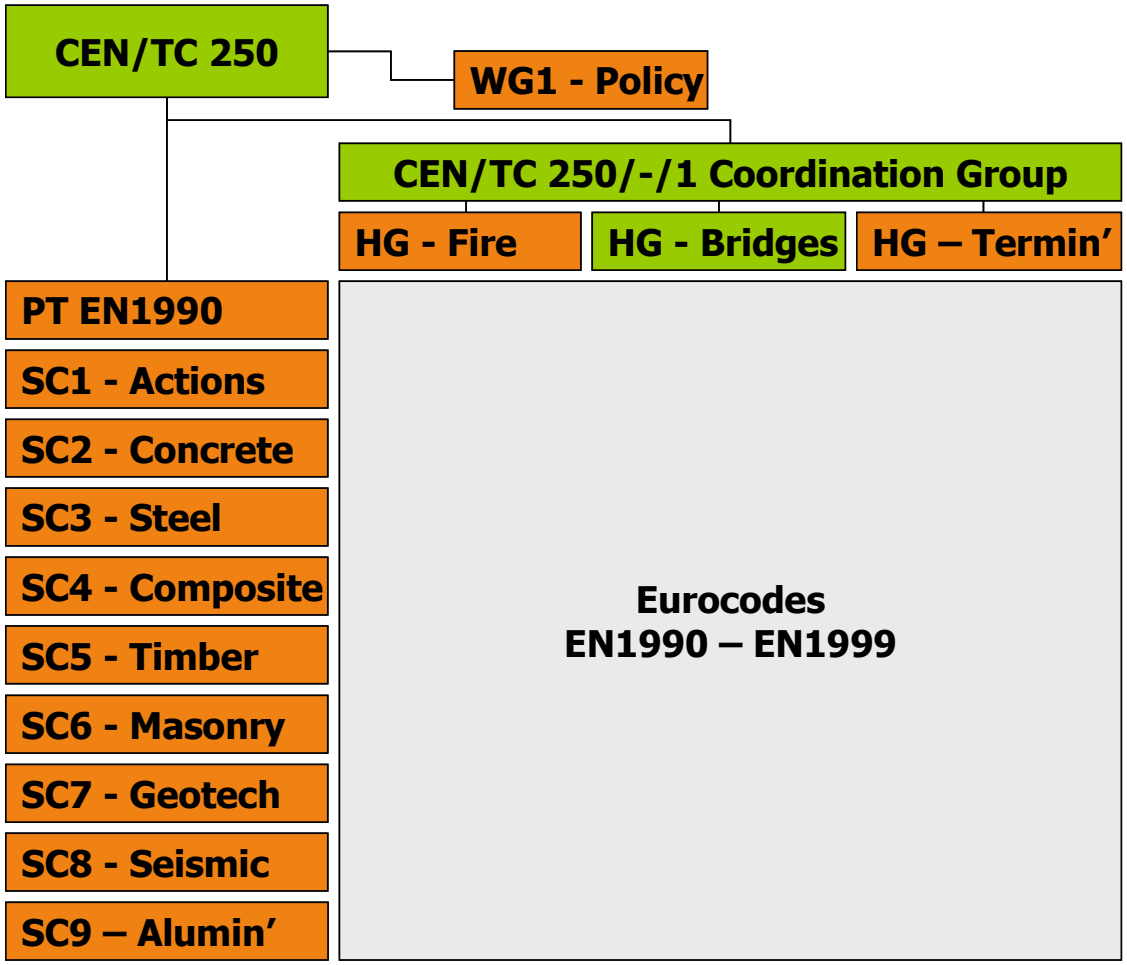
CEN - Comité Européen de Normalisation

- European committee for standardisation
- Founded 1961
- 28 members
- Eurocodes drafted by subcommittees under CEN/TC250
- Most project teams included UK experts
- Eurocodes only adopted after positive vote by CEN members

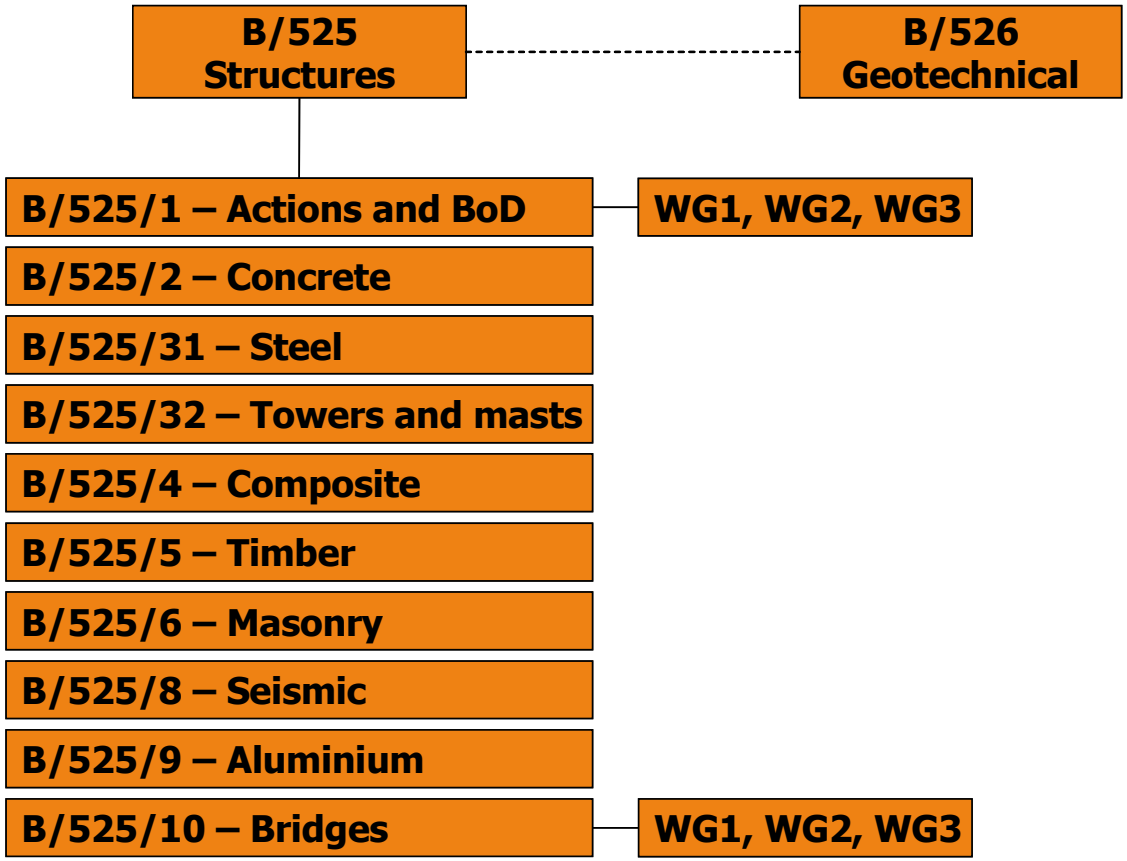
CEN Committee Structure



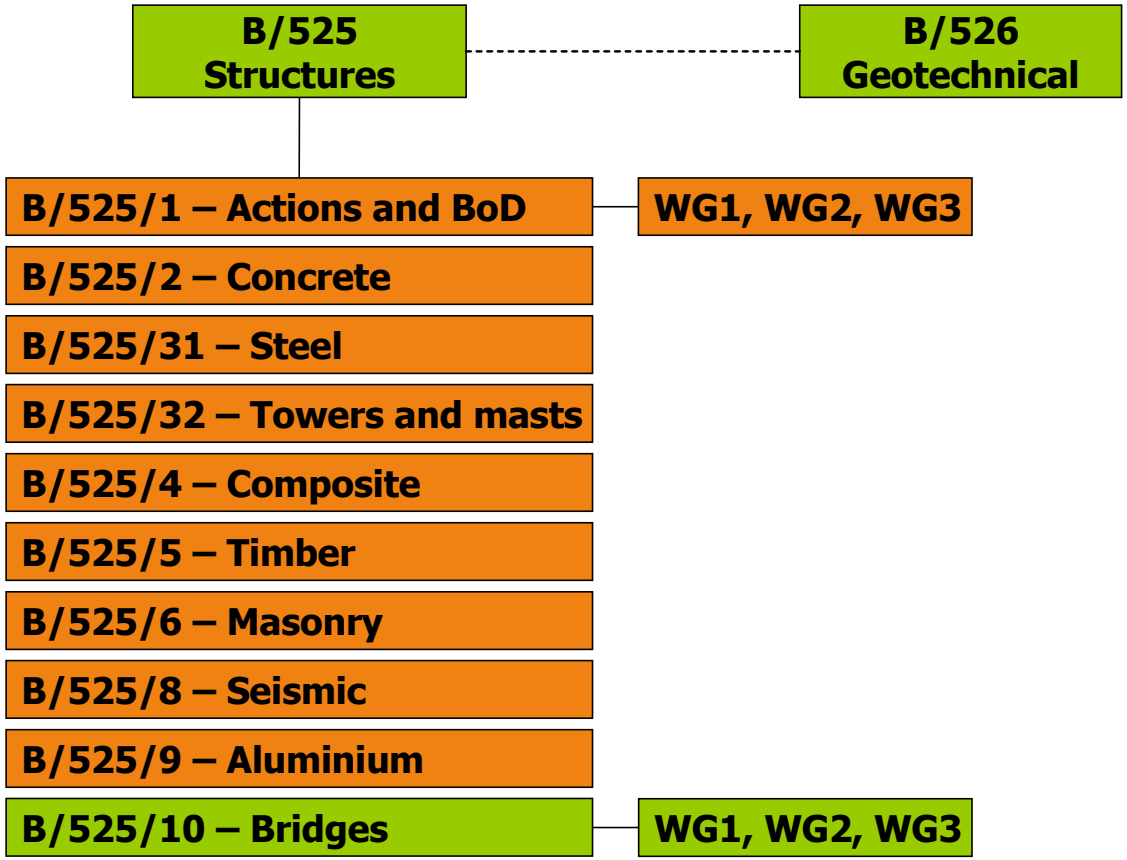
CEN Committee Structure



BSi Committee Structure (2008)



BSi Committee Structure (2008)



History of development

- Eurocodes have been in development since mid 1970s
- Suite of ‘pre-standards’ (BS ENV) introduced in 1990s
- Pre-standards being replaced by ‘Euro-Norm’ standards (BS EN)

Why are we changing?

- Common technical standards in European Economic Area eliminate barriers to trade
- Improve the competitiveness of the European construction market
- Open market for construction products
- Related to two major EU directives…

EU directives

- Public Procurement Directive
  - Common technical specifications
- Construction Products Directive
  - Compliance of building and civil engineering works with the Essential Requirements on mechanical resistance and stability
  - Framework for drawing up harmonised technical specifications

Assessments

- UK has comprehensive, mature assessment standards:
  - BD 21/01 for highway bridges
  - NR/GN/CIV/025 for rail underbridges
- Eurocodes do not cover assessment
- Continue to use existing assessment standards
- Long term aim to develop Eurocode for assessment

What benefits will they bring?

- Dependent upon effectiveness of implementation
- Key opportunities:
  - Best Value
  - Best Practices
  - Innovation

Best value

- Removal of barriers to trade of products and services; harmonisation of products
- Single suite of Standards
- Common understanding and vocabulary; common design criteria
- Shared investment in software and design-aid development
- Latest materials technologies
- Combined effort to resolve issues, and embrace improvement opportunities

Best practices

- Eurocodes based on most up to date research; at the forefront of technology
- Rational and consistent framework
- Demand understanding from designers
- Provide flexibility and opportunity to apply advanced methods
- Challenge past thinking; revisit assumptions
- Alignment of structural and geotechnical design

Innovation

- Promote understanding and knowledge development
- Enhance scope for innovation; choices offered to designers
- Greater effectiveness of R&D investment
- Diversity of technical solutions available; use of testing, performance evidence and probabilistic methods

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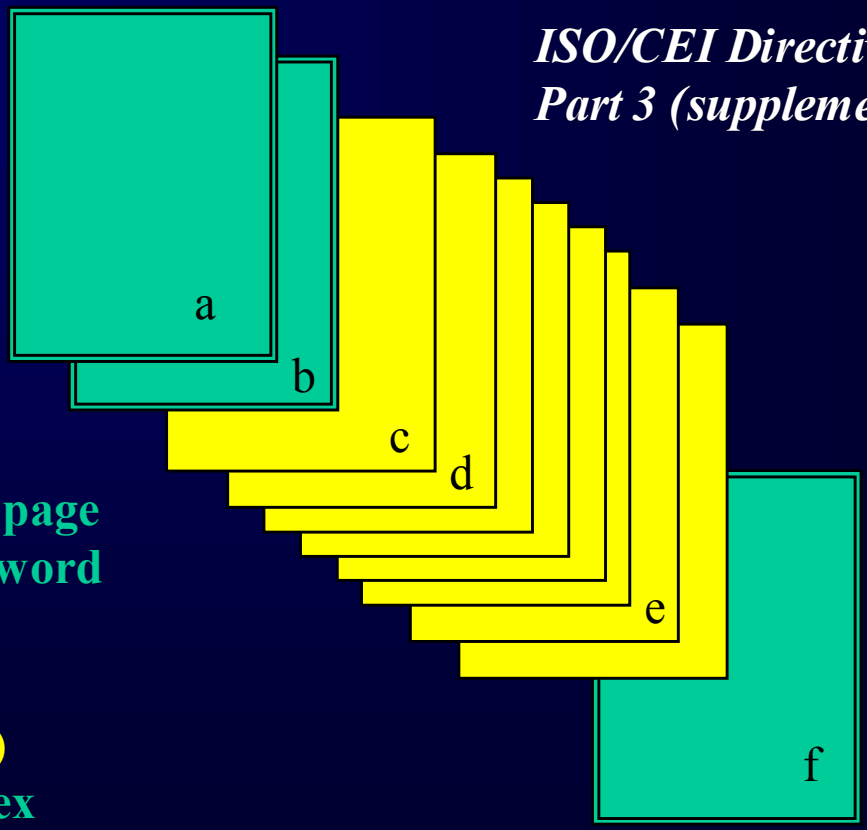
What are the Eurocodes?

- Structural Eurocodes:
  - 10 standards in 58 parts for the design of structures inc. buildings, bridges, chimneys, masts and towers, dams etc.
  - For bridge design, 24 parts are needed
- accompanied by:
  - National Annexes (nationally determined parameters)
  - Published Documents (Non-Contradictory Complimentary Information)
  - Product Standards (specification of construction products)
  - Execution Standards (construction requirements, workmanship)

Elements of the national publication of a European Standard

ISO/CEI Directives Part 3 (supplement)

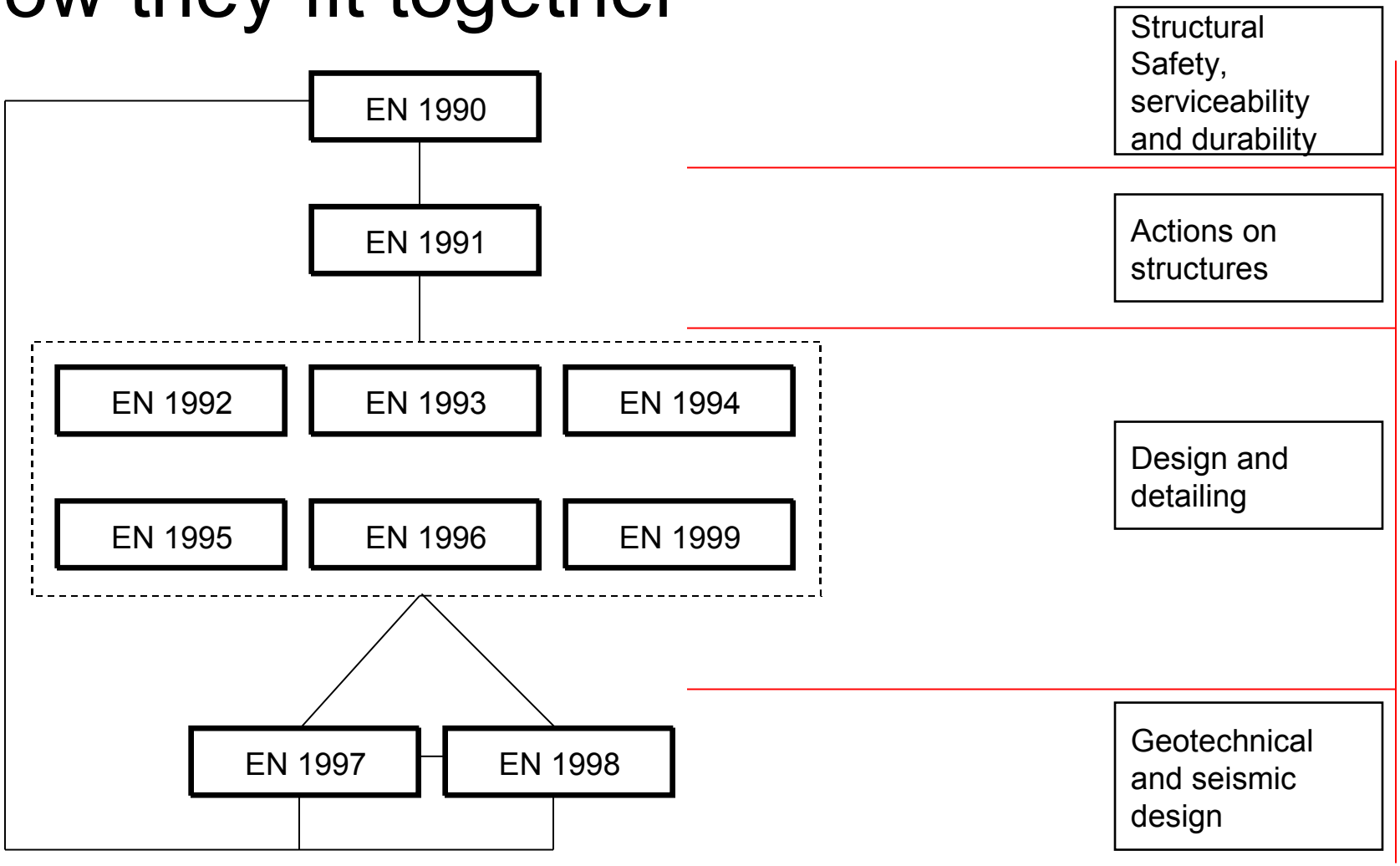


a	National title page
b	National foreword
c	EN title page
d	EN text
e	EN Annex(es)
f	National annex

These are the Eurocodes

EN 1990	Eurocode: Basis of structural design
EN 1991	Eurocode 1: Actions on structures
EN 1992	Eurocode 2: Design of concrete structures
EN 1993	Eurocode 3: Design of steel structures
EN 1994	Eurocode 4: Design of composite structures
EN 1995	Eurocode 5: Design of timber structures
EN 1996	Eurocode 6: Design of masonry structures
EN 1997	Eurocode 7: Geotechnical design
EN 1998	Eurocode 8: Design for earthquake resistance
EN 1999	Eurocode 9: Design of aluminium structures

How they fit together



Eurocodes for bridge design

BASIS OF STRUCTURAL DESIGN

EN 1990 : Basis of Structural Design
Annex A2 to EN1990

Eurocodes for bridge design

ACTIONS	
EN 1991-1-1:	Densities, self weight and imposed loads
EN 1991-1-3:	Snow loads
EN 1991-1-4:	Wind actions
EN 1991-1-5:	Thermal actions
EN 1991-1-6:	Actions during execution
EN 1991-1-7:	Accidental actions
EN 1991-2:	Traffic loads on bridges

Eurocodes for bridge design

STEEL

EN 1993-1-1: General rules and rules for buildings
EN 1993-1-5: Plated structural elements
EN 1993-1-8: Design of joints
EN 1993-1-9: Fatigue
EN 1993-1-10: Brittle fracture
EN 1993-1-11: Tension components
EN 1993-2: Rules for bridges

EN 1993-5: Piling

Eurocodes for bridge design

CONCRETE

EN 1992-1-1: General rules and rules for buildings
EN 1992-2: Bridges

Eurocodes for bridge design

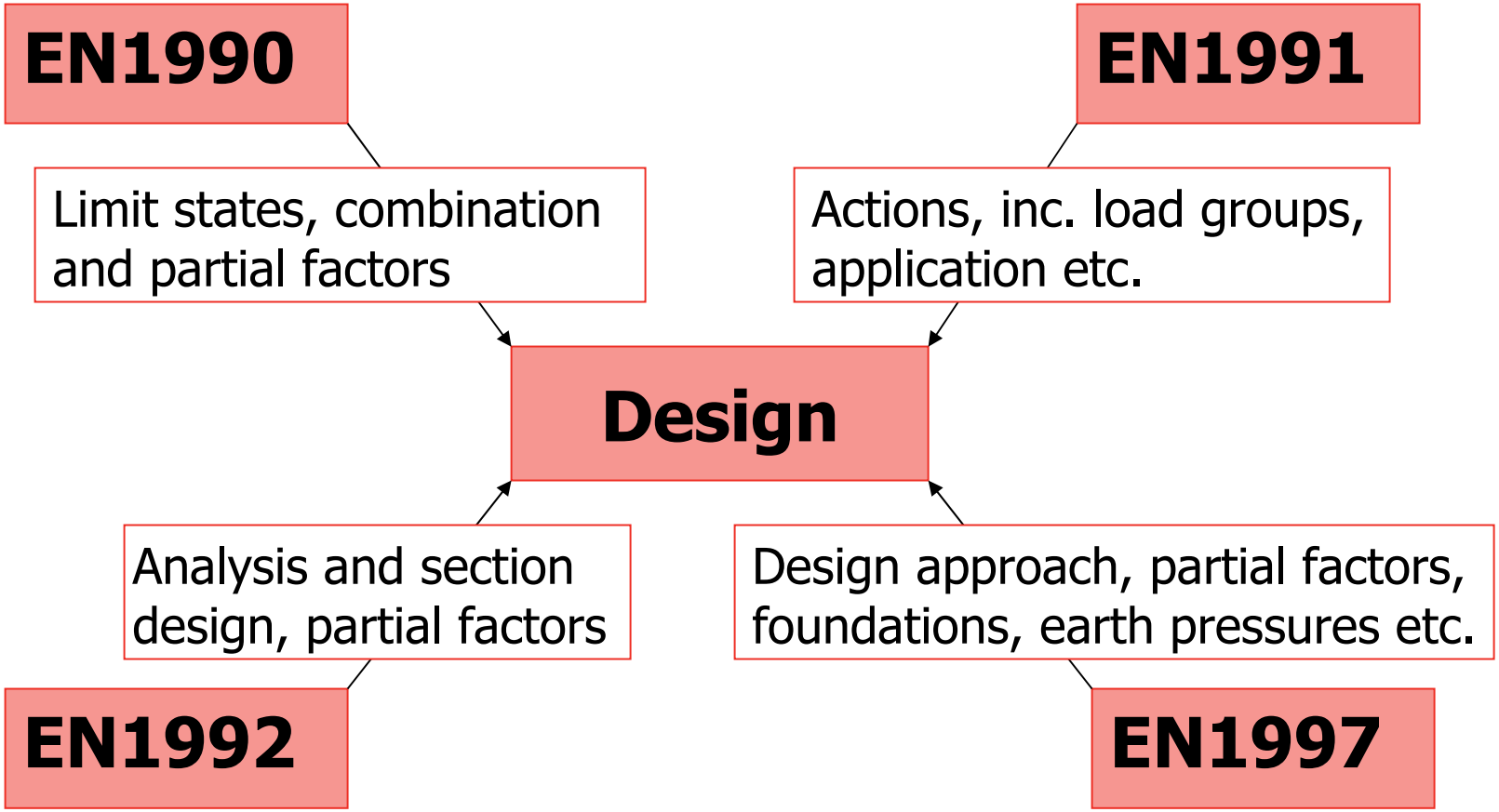
COMPOSITE STEEL AND CONCRETE

EN 1994-2: General rules and rules for bridges

Eurocodes for bridge design

GEOTECHNICAL
EN 1997-1: Geotechnical Design

Eurocodes required for a concrete bridge design



Layout of Eurocodes

	EN 1992-1-1 & EN 1992-2 Concrete bridges	EN 1993-1-1 & EN 1993-2 Steel bridges	EN 1994-2 Composite bridges
Section 1	General	General	General
Section 2	Basis of design	Basis of design	Basis of design
Section 3	Materials	Materials	Materials
Section 4	Durability and cover to reinforcement	Durability	Durability
Section 5	Structural analysis	Structural analysis	Structural analysis
Section 6	Ultimate limit states	Ultimate limit states	Ultimate limit states
Section 7	Serviceability limit states	Serviceability limit states	Serviceability limit states
Section 8	Detailing of reinforcement and prestressing tendons	Fasteners, welds, connections and joints	Precast concrete slabs in composite bridges
Section 9	Detailing of members	Fatigue assessment	Composite plates in bridges
Section 10	Additional rules for precast concrete	Design assisted by testing (EN 1993-2 only)	
Section 11	Lightweight concrete		
Section 12	Plain and lightly reinforced concrete		
Section 13	Design for the execution stages (EN 1992-2 only)		

Core sections
Material-specific sections

National Annexes

- Each Eurocode Part has a National Annex (NA) which must be used in conjunction with the Eurocode Part
- NAs can only contain parameters left open for national choice (Nationally Determined Parameters or NDPs):
  - Values and/or classes where alternatives are given in EN
  - Country specific data (e.g. snow maps)
  - Procedure to be used when Eurocode allows options (e.g. method of analysis)

National Annexes

EN1992-1-1: Clause 6.2.3(2)

(2) The angle θ should be limited.

Note: The limiting values of $\cot\theta$ for use in a Country may be found in its National Annex. The recommended limits are given in Expression (6.7N).

$$1 \leq \cot\theta \leq 2{,}5 \qquad (6.7N)$$

UK National Annex to EN1992-1-1: NDP for Clause 6.2.3(2)

6.2.3 (2)	Limiting values of $\cot\theta$	$1 \leq \cot\theta \leq 2{,}5$	$1 \leq \cot\theta \leq 2{,}5$, except in elements in which shear co-exists with externally applied tension (i.e. tension caused by restraint is not considered here). In these elements, $\cot\theta$ should be taken as 1,0.

Current progress of publication

- All 58 parts have been published by BSi as BS EN standards, of which 24 are related to bridge design
- 43 NAs published, 20 of them bridge-related
- Remaining NAs should be published by mid-2009
- It is anticipated that all 24 bridge-related NAs will be available early 2009

From Now to 2010 …

- Many NAs are under final editing
- Once the relevant NAs are published, UK will enter the “coexistence” period, during which both the Eurocodes and the British Standards can be used
- In March 2010 all conflicting British Standards will be withdrawn

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Wider family of European Standards

Eurocodes

EN1990 – EN1999

Design

Wider family of European Standards

Eurocodes

EN1990 – EN1999

Design

Product standards

Products, materials and testing

Wider family of European Standards

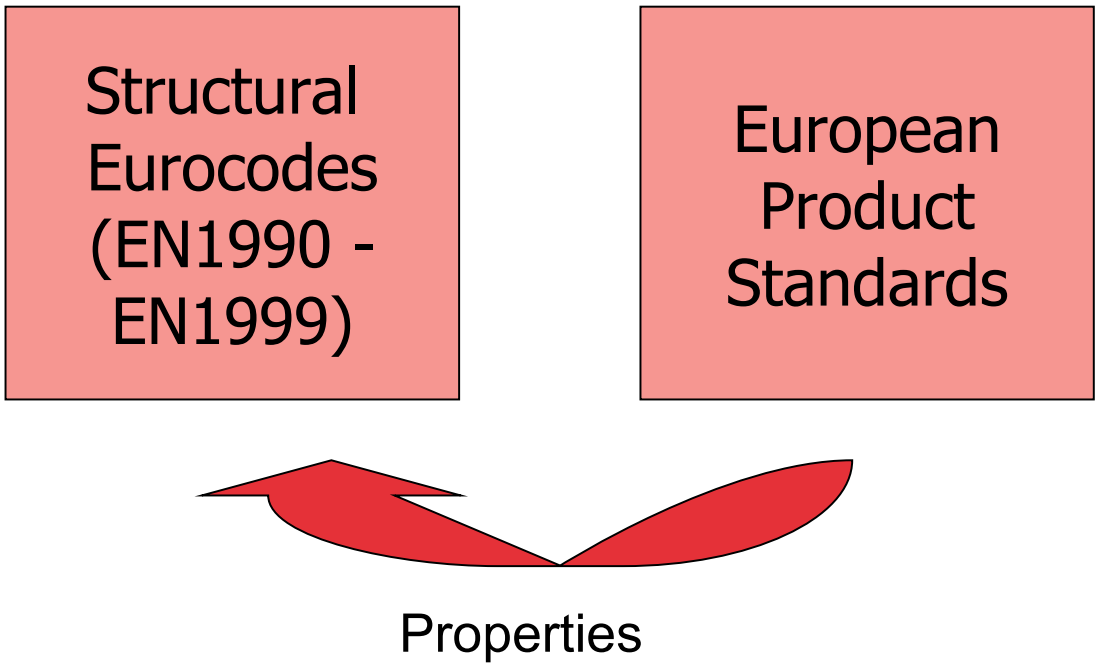
Eurocodes	Execution standards	Product standards
EN1990 – EN1999	(e.g. EN1090, EN13670)	
Design	Construction specification	Products, materials and testing

Structural Eurocodes and Products Standards

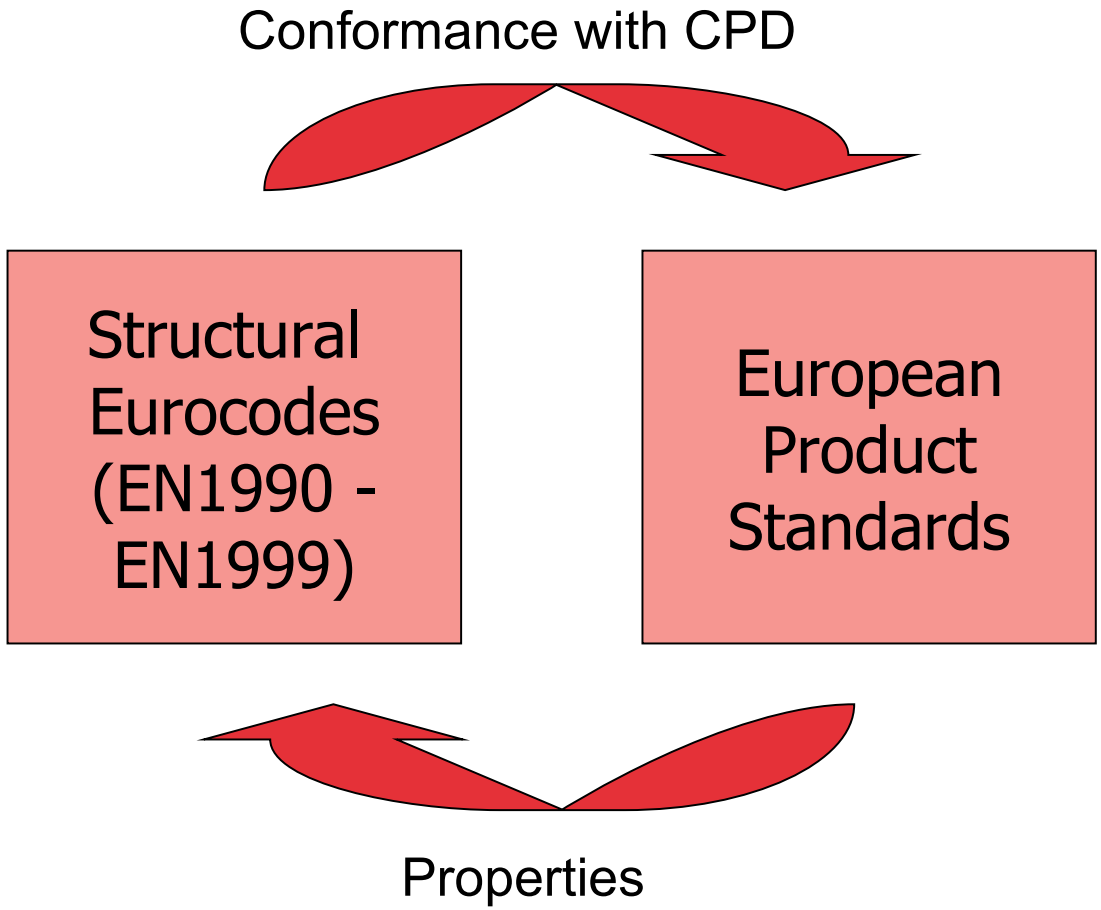
Structural Eurocodes (EN1990 - EN1999)

European Product Standards

Structural Eurocodes and Products Standards



Structural Eurocodes and Products Standards



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Conclusions

- Eurocodes have been in development for around 30 years
- Comprehensive suite of design Standards for building and civil engineering works, including geotechnical design
- Integrated within wider family of European Product and Execution standards
- Conflicting National Standards will be withdrawn in March 2010
- Major period of transition for civil and structural engineers