Eurocode Update

Transitioning to Eurocodes
Developing Generation 2 Eurocodes

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Overview

- Introduction
- *Looking back:* Transition to Eurocodes
- *Looking forward:* Generation 2 Eurocodes

25 years with the Eurocodes

1986: graduated

1988: joined SCI

1992: tested usability of Eurocode 3

1993: lectured ‘Intro to Eurocode 3’ course

1994 - 2017: prepared design tables, software, design guides, CAL, examples etc

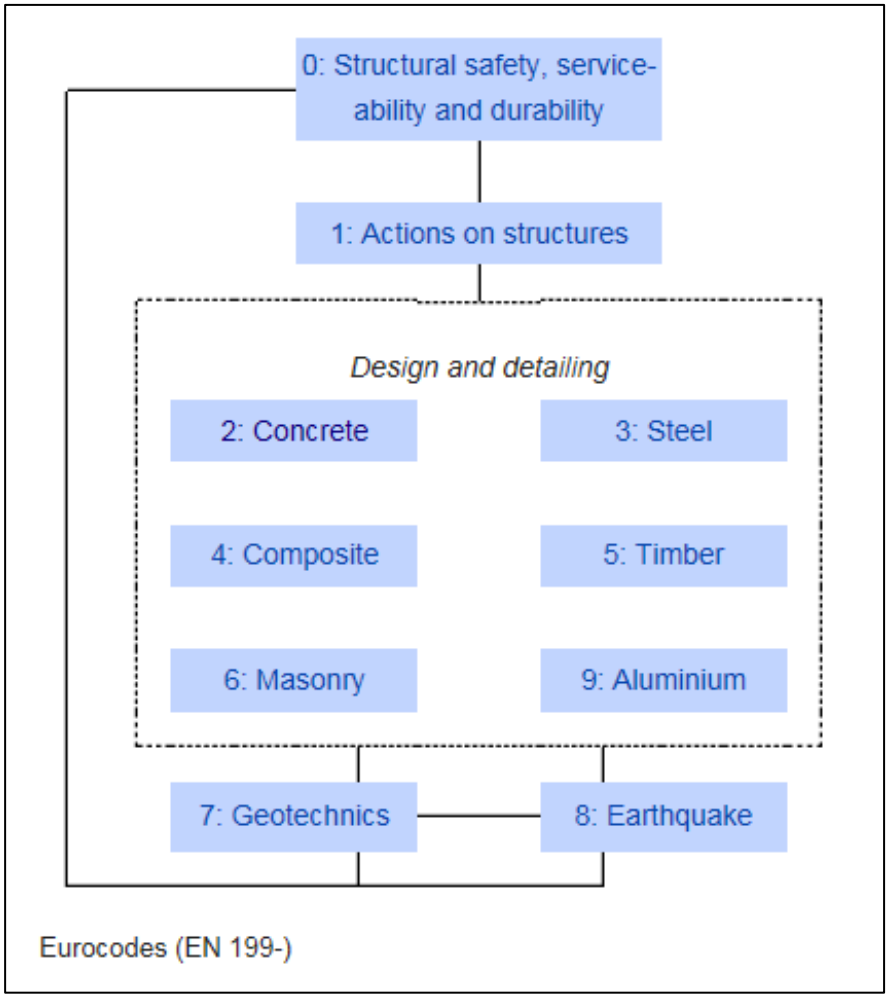
2011 - 2017: membership of WGs responsible for drafting Generation 2 Eurocodes

EUROCODES
BUILDING THE FUTURE

- Eliminate technical obstacles to trade
- Set of harmonized technical for structural design of construction works in the EU
- 10 standards and 58 parts (20 for steel!)
- All conflicting national building codes withdrawn
- Most comprehensive and technically advanced suite of standards for structural and geotechnical design in the world

Largest, longest-lasting and most complex code development effort in the world
(40+ years, several 100 M €)

Overview of Eurocodes



Integrated and consistent suite of structural design codes covering all common construction materials

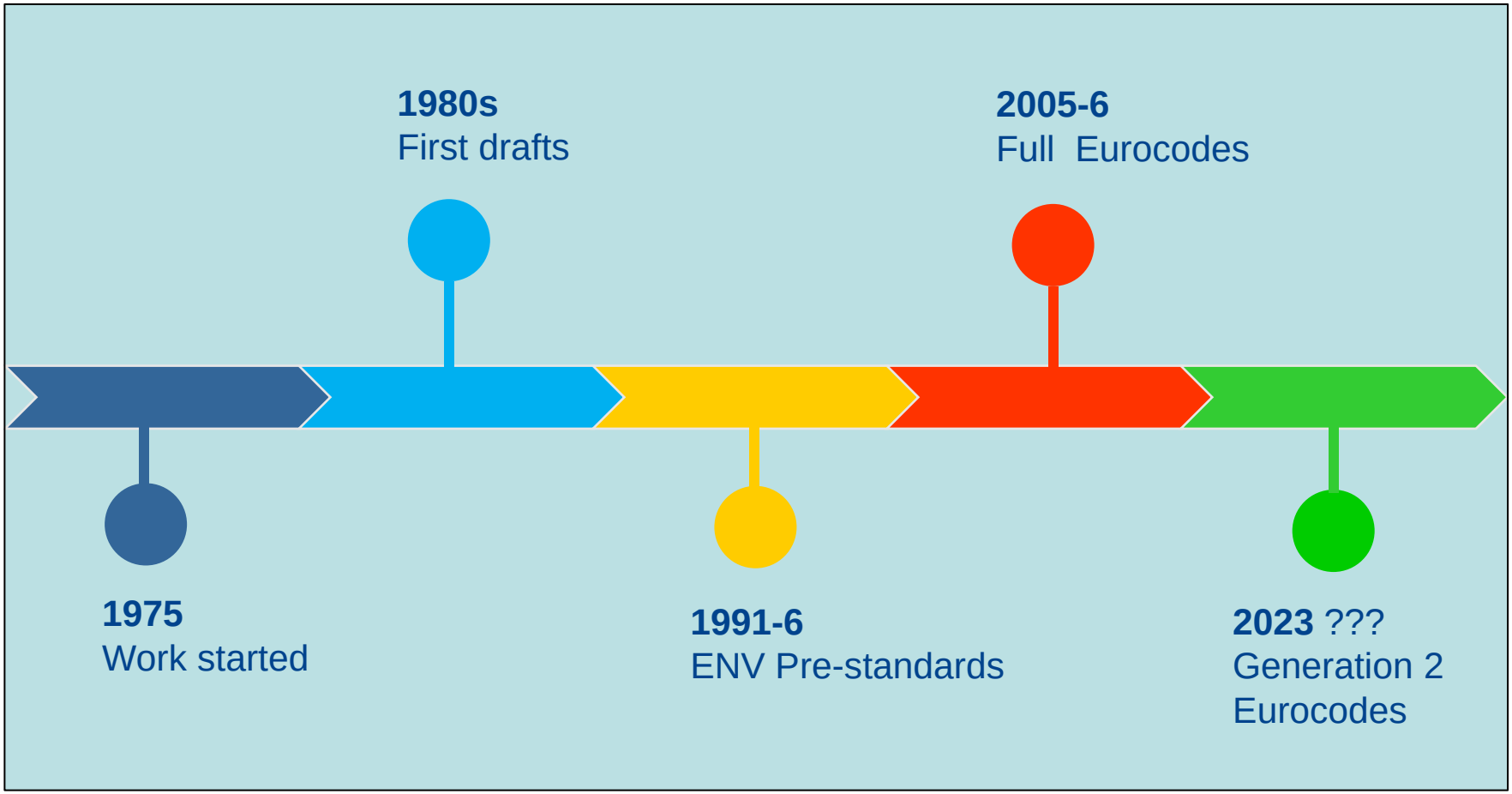
EN	Part	Title
EN 1990 Basis of structural design		(includes ANNEX A1 : Application for buildings)
	A1	ANNEX A2: Application for bridges
EN 1991 Actions on structures	1-1	General actions - Densities, self-weight, imposed loads for buildings
	1-2	General actions - Actions on structures exposed to fire
	1-3	General actions - Snow loads
	1-4	General actions - Wind actions
	1-5	General actions - Thermal actions
	1-6	General actions - Actions during execution
	1-7	General actions - Accidental actions
	2	Traffic loads on bridges
	3	Actions induced by cranes and machinery
	4	Silos and tanks
EN 1992 Design of concrete structures	1-1	General rules and rules for buildings
	1-2	General rules - Structural fire design
	2	Concrete bridges - Design and detailing rules
	3	Liquid retaining and containment structures
EN 1993 Design of steel structures	1-1	General rules and rules for buildings
	1-2	General rules - Structural fire design
	1-3	General rules - Supplementary rules for cold-formed members and sheeting
	1-4	General rules - Supplementary rules for stainless steels
	1-5	General rules - Plated structural elements
	1-6	Strength and stability of shell structures
	1-7	Strength and stability of planar plated structures subject to out of plane loading
	1-8	Design of joints
	1-9	Fatigue
	1-10	Material toughness and through-thickness properties
	1-11	Design of structures with tension components
	1-12	General - High strength steels
	2	Steel bridges
	3-1	Towers, masts and chimneys – Towers and masts
	3-2	Towers, masts and chimneys – Chimneys
	4-1	Silos
	4-2	Tanks
	4-3	Pipelines
	5	Piling
	6	Crane supporting structures
EN 1994 Design of composite steel and concrete structures	1-1	General rules and rules for buildings
	1-2	General rules - Structural fire design
	2	General rules and rules for bridges

EN	Part	Title
EN 1995 Design of timber structures	1-1	General - Common rules and rules for buildings
	1-2	General - Structural fire design
	2	Bridges
EN 1996 Design of masonry structures	1-1	General rules for reinforced and unreinforced masonry structures
	1-2	General rules - Structural fire design
	2	Design considerations, selection of materials and execution of masonry
	3	Simplified calculation methods for unreinforced masonry structures
EN 1997 Geotechnical design	1	General rules
	2	Ground investigation and testing
EN 1998 Design of structures for earthquake resistance	1	General rules, seismic actions and rules for buildings
	2	Bridges
	3	Assessment and retrofitting of buildings
	4	Silos, tanks and pipelines
	5	Foundations, retaining structures and geotechnical aspects
	6	Towers, masts and chimneys
EN 1999 Design of aluminium structures	1-1	General structural rules
	1-2	Structural fire design
	1-3	Structures susceptible to fatigue
	1-4	Cold-formed structural sheeting
	1-5	Shell structures

Part 1-2: Structural fire design

Part 2: Bridges

Eurocode Timeline



State of implementation of Eurocodes: JRC Report 2015

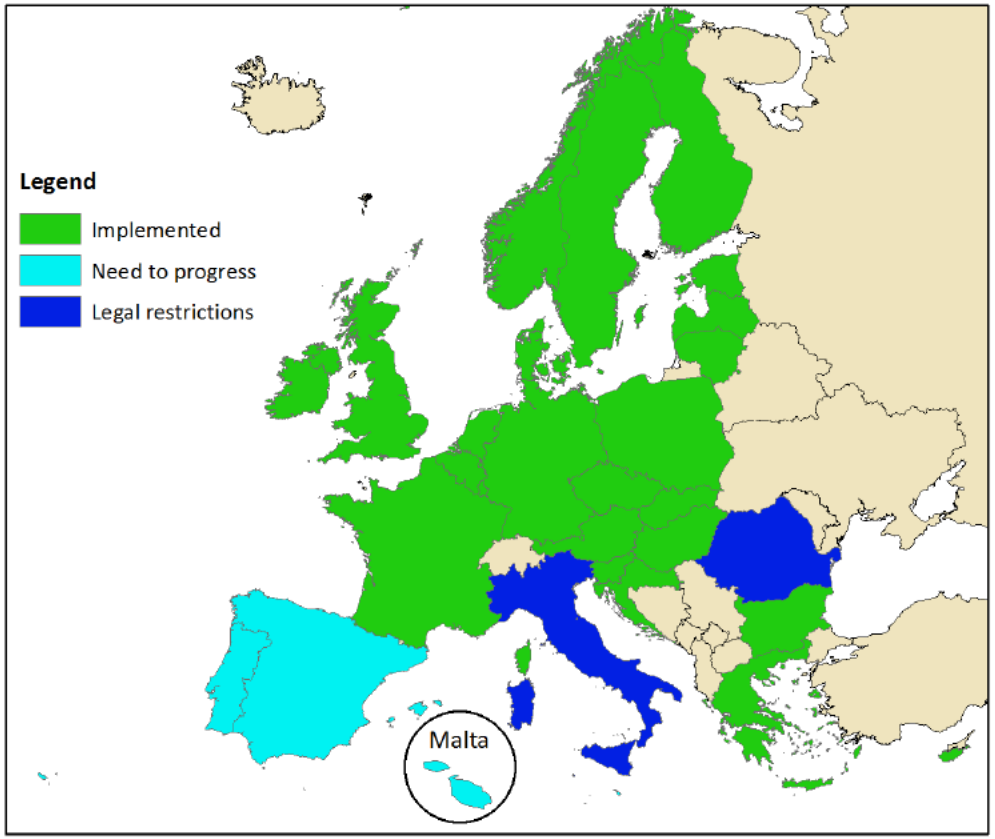
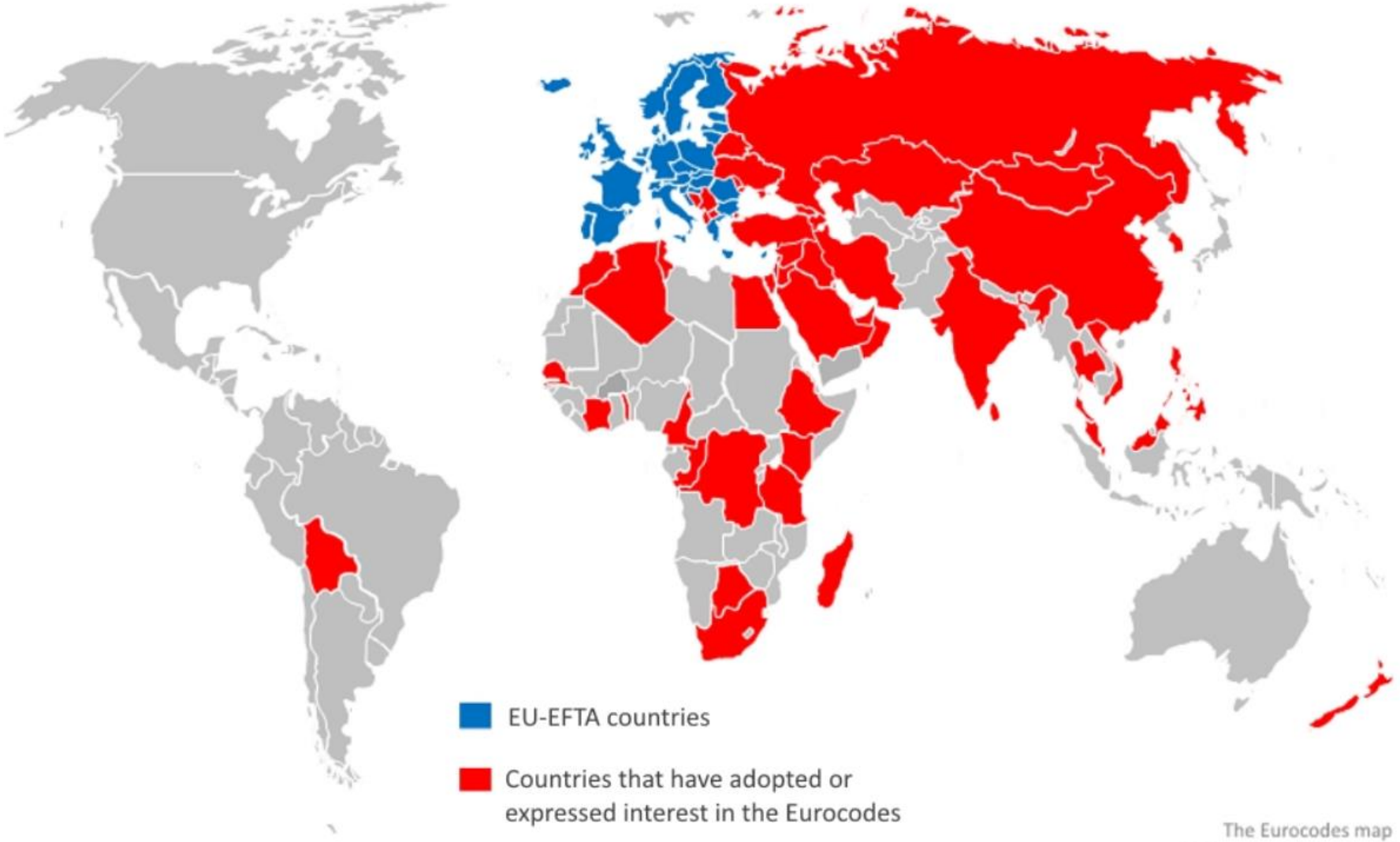


Figure 6.2. State of implementation of the Eurocodes in the EU Member States and Norway

In 83% of the analysed countries the Eurocodes are implemented. Malta, Portugal and Spain should speed the progress in adoption of National Annexes. Italy and Romania should remove the legal restrictions impeding the implementation of the Eurocodes.

Where are the Eurocodes being used?



The Eurocodes map

Fort York Pedestrian Bridges, Toronto

Transition to Eurocodes

What designers find difficult

- Names and symbols
- Finding things
- Dispersion of information between different parts
- Complexity

Eurocode 3
Larger firms have made the transition, but smaller firms are still using BS

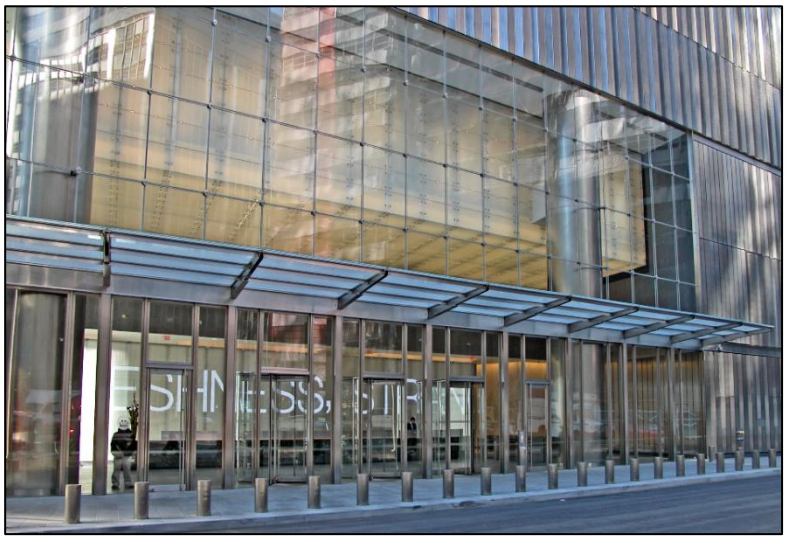
Fabricator	BS	Eurocode
Medium sized	50%	50%
Large	10%	90%
Very large	0	100%

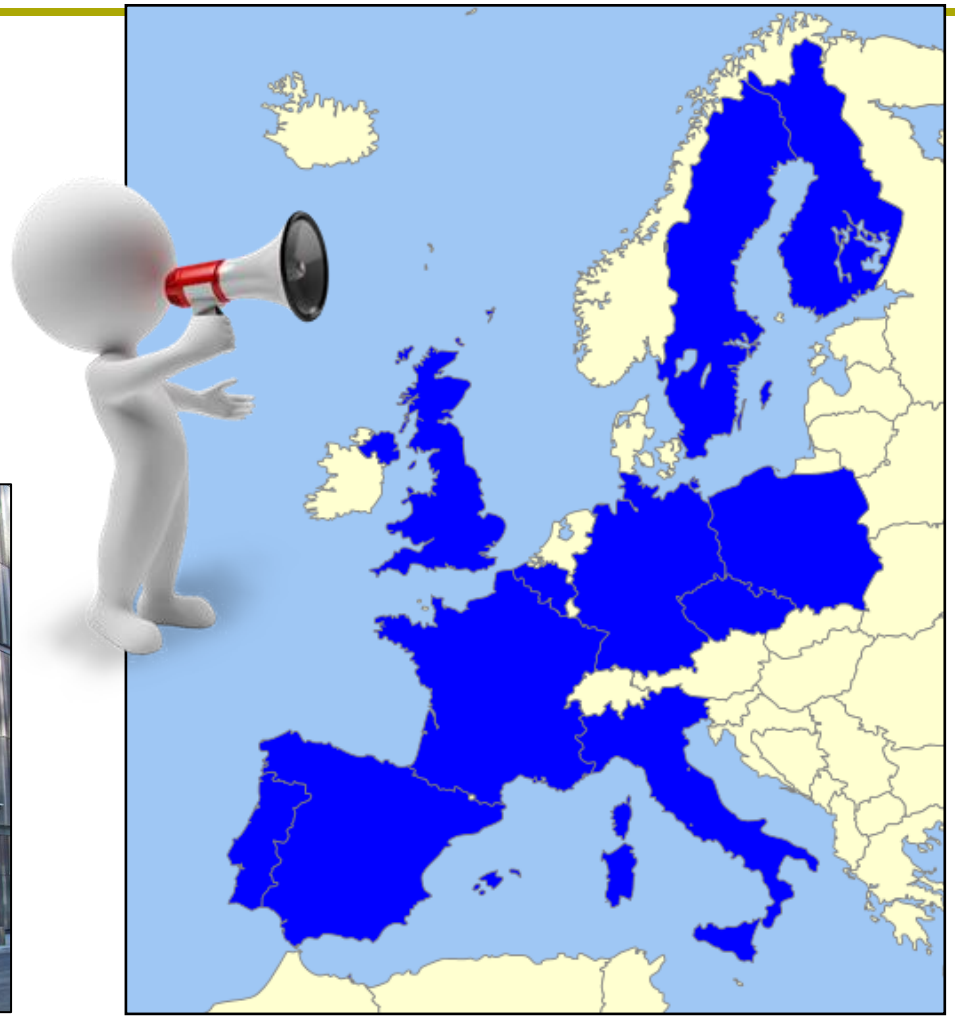
Transition to Eurocodes

Helping designers use the stainless Eurocode

PUREST: Promotion of new Eurocode rules for stainless steel

- 18 month project, finishing Dec 2017
- 12 partners from 10 European countries



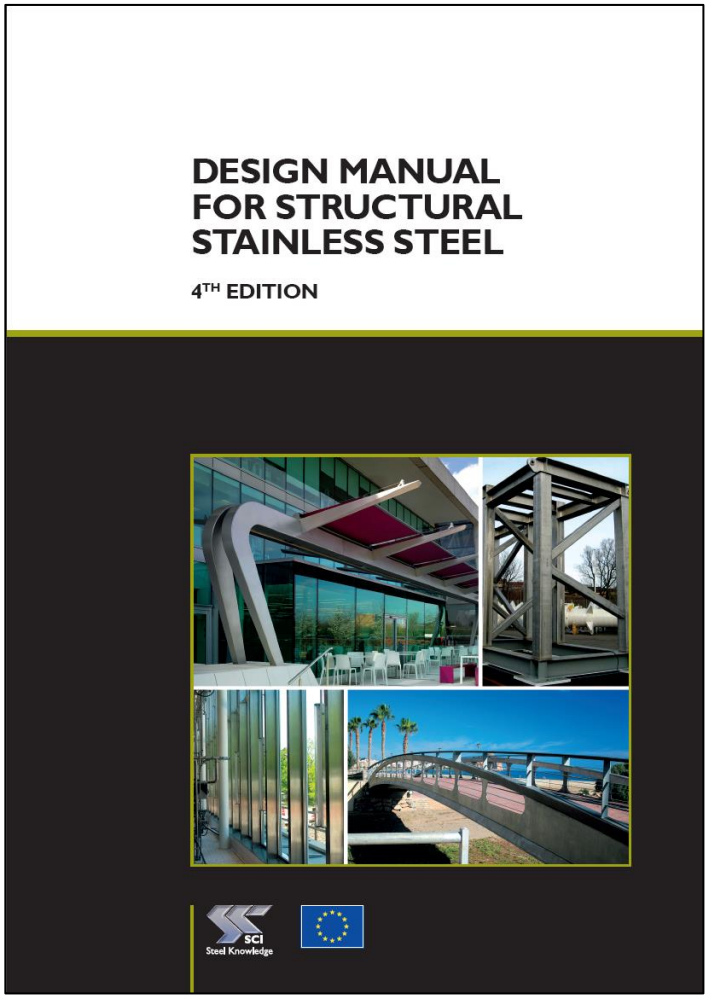


Objectives of PUREST

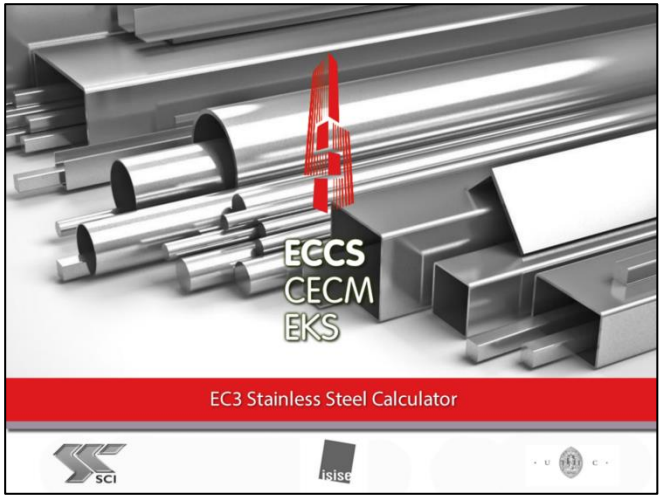
To disseminate new design guidance for structural stainless steel developed over the last 10 years:

- 4th Ed. *Design Manual for Structural Stainless Steel*,
- Translating the Design Manual into 9 languages,
- Design software and apps in accordance with the stainless Eurocode rules,
- National seminars and recorded webinars
- Developing teaching resources for engineering students.
- Articles in national engineering journals

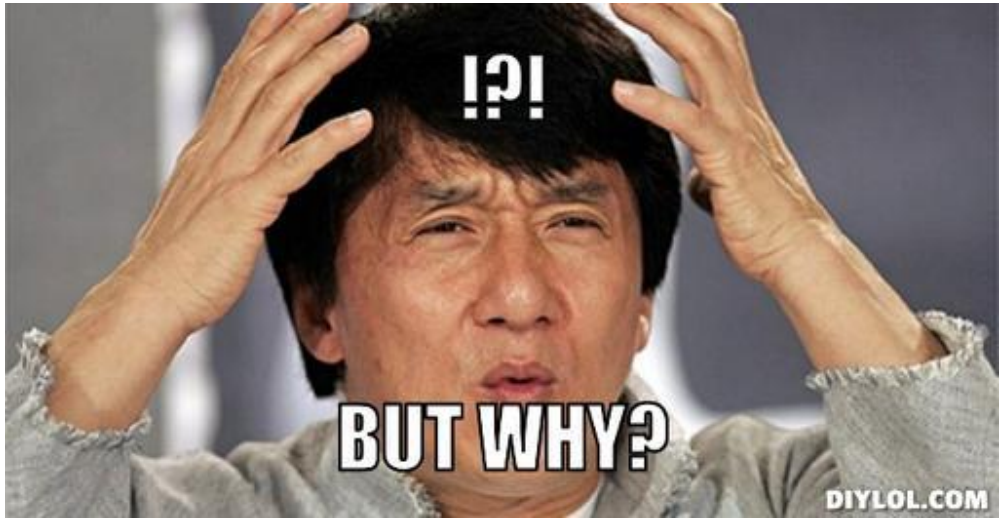
Design Manual for Structural Stainless Steel



- Recommendations
- Design Examples
- Commentary
- Software and apps



Generation 2 Eurocodes



Generation 2 Eurocodes

6 year phased work programme, started 2015

- More designer orientated
- Easier to use
  - improving clarity
  - simplifying routes through the Eurocodes
  - limiting alternative application rules
  - removing rules of little practical use
- Including state-of the-art material, based on commonly accepted results of research and validated through sufficient practical experience

Generation 2 Eurocodes are an “evolution” avoiding fundamental changes to the approach to design unless adequately justified

Systematic Review

- Do any clauses require editorial or technical correction?
- Which clauses would benefit from improvements in clarity?
- Where should the scope of the EN be extended?
- Where could the EN be shortened?
- Are there any clauses whose application leads to uneconomic construction?
- Are there any clauses whose application necessitates excessive design effort?

Who are the main user groups?

Final list of target audiences
Practitioners - Competent engineers
Practitioners - Graduates
Expert specialists
Clients
Private sectors businesses
Product Manufacturers
Other CEN/TCs
National Regulators
Educators
Software Developers

Range of needs, interests, expectations and capabilities of Eurocode users

Competent civil, structural and geotechnical engineers, typically qualified professions able to work independently in relevant fields

Generation 2 Structural Stainless Steel Eurocode EN 1993-1-4

EN 1993-1-4 Structural stainless steel

- First design code for structural stainless steel in all European countries except Germany
- Most comprehensive design code in world
- Used in development of US design guidance and Chinese design standard

- Re-wording ambiguous clauses
- Correcting errors
- Filling important gaps
- Introduce less conservative design method

Generation 2 Eurocodes: Technical committee work

In addition to design experience and state-of-the-art structural expertise in relevant field:

- Diplomacy
  (different cultures, languages, construction traditions across Europe)
- Patience and perseverance
- Willingness to compromise
- Significant time investment

Development of design rules in Generation 2 Eurocodes

Simple rules
➔ less economic

Complex rules
➔ more economic

Not ‘simple rules sell steel’ but ‘simple tools sell steel’

Generation 2 Eurocodes

New Eurocodes to look out for:

- Structural glass
- Fibre reinforced polymer
- Tensile membrane structures
- Assessment and retrofit of existing structures

How will we move from G1 to G2 Eurocodes

No-one knows!

Perhaps…..

….. all parts issued together and have a transition period when you can use either G1 or G2 Eurocode, during this period design tools can be updated

Summary

- Eurocodes are not perfect
- Substantial transition to Eurocodes over the last 10 years
- Design tools are widely available
- Generation 2 Eurocodes will be ‘better’

Thank you!