Los Eurocódigos de 2ª Generación

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El mandato M515 de la Comisión Europea a CEN (2015-2022)

Desarrollo de la segunda generación de Eurocódigos con los objetivos siguientes:

- ✓ Reducción de parámetros nacionales
- ✓ Mejora de la facilidad de uso
- ✓ Incorporación de conocimientos nuevos que den lugar a innovaciones en el proyecto y la construcción y que ayuden a mejorar la sostenibilidad de las estructuras. En particular se solicita la inclusión de nuevas áreas: estructuras existentes, uso de vidrio estructural, FRP y estructuras de membrana
- ✓ Desarrollo de Documentos de respaldo
- ✓ Inclusión de medidas para afrontar el cambio climático

¿Qué se entiende por "facilidad de uso"?

FORMULACIONES MÁS SENCILLAS

Ayuda a calcular, pero está reñido con la sostenibilidad

DOS VISIONES CONTRAPUESTAS

FORMULACIONES CONSISTENTES

Ayuda a entender

¿Cómo se consiguió la “facilidad de uso”?

- ✓ Limitando el volumen
- ✓ Introduciendo tablas en lugar de textos
- ✓ Manteniendo modelos de cálculo consistentes
- ✓ Expresando magnitudes en términos significativos, por ejemplo, tensiones en lugar de fuerzas
- ✓ Reorganizando Tablas que establecen límites por los conceptos que está detrás del límite (ejemplo límites a la fisuración)

¿Cómo se consiguió la "facilidad de uso"?

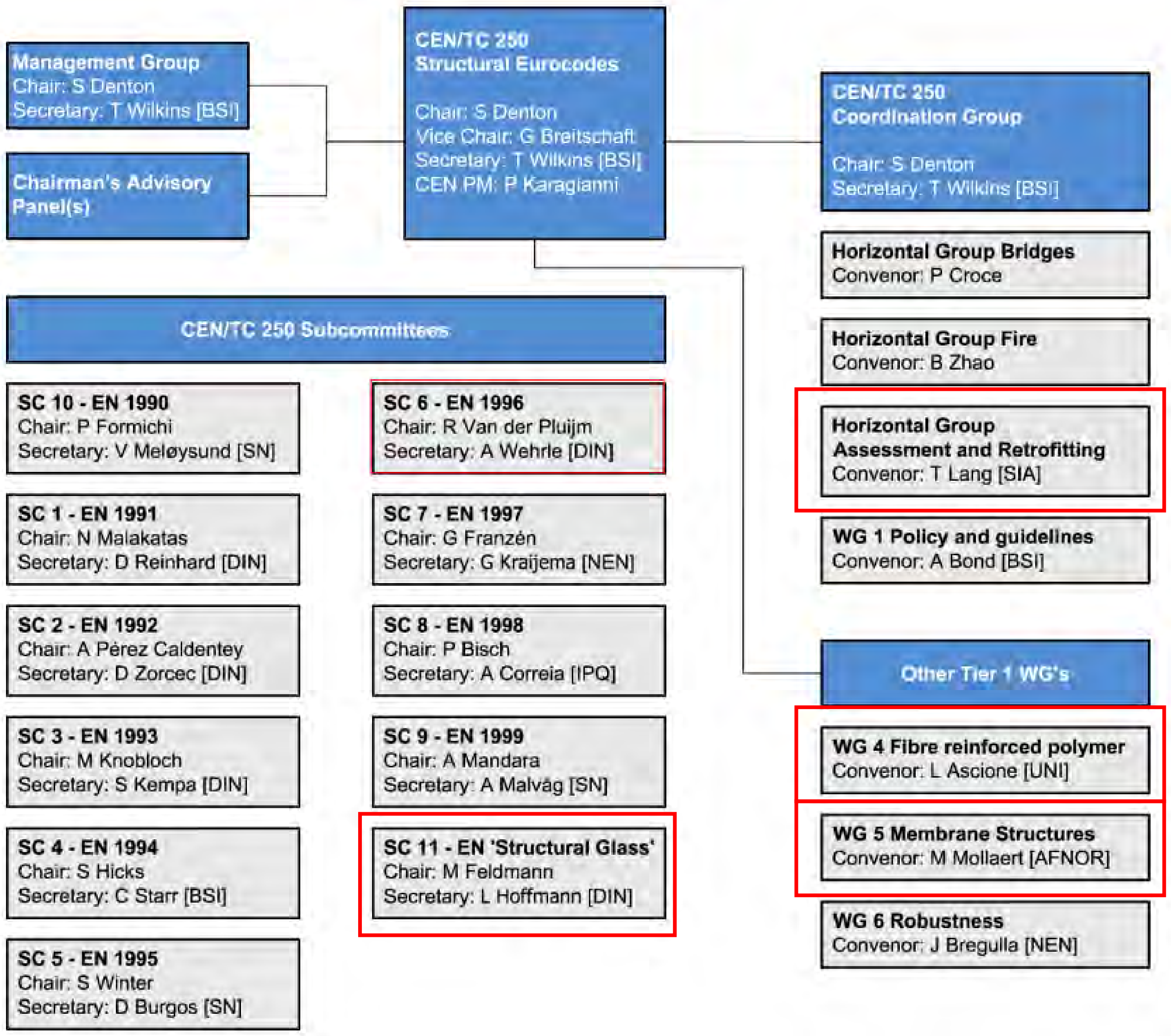
Table 9.1 (NDP) — Verifications, stress and crack width limits for appearance

Verification	**Calculation of minimum reinforcement according to 9.2.2**	**Verification of crack width according to 9.2.3**	**Verification of reinforcement stresses to avoid yielding at SLS**
Combination of actions for calculating σ_s	Cracking forces according to 9.2.2	Quasi-permanent combination of actions	Characteristic combination of actions
Limiting value of crack width $w_{lim,cal}$ or stress σ_s	$\sigma_s \leq f_{yk}$	$w_{lim,cal} = 0{,}4$ mm $\sigma_s \leq f_{yk}$	$\sigma_s \leq 0{,}8f_{yk}$ $\sigma_p \leq 0{,}8f_{pk}$
NOTE Crack widths are verified at the member surface unless the National Annex gives a different location.			

Table 9.2 (NDP) — Verifications, stress and crack width limits for durability

Exposure Class	**Reinforced members and prestressed members without bonded tendons and with bonded tendons with Protection Levels 2 or 3 according to 5.4.1(4)**		**Prestressed members with bonded tendons with Protection Level 1 according to 5.4.1(4) and pretensioned members.**		
	combination of actions		**combination of actions**		
	quasi-permanent	**characteristic**	**quasi-permanent**	**frequent**	**characteristic**
X0, XC1	–	–	–	$w_{lim,cal} = 0{,}2\ \text{mm} \cdot k_{surf}$	–
XC2, XC3, XC4	$w_{lim,cal} = 0{,}3\ \text{mm} \cdot k_{surf}$		Decom-pression [b]	$w_{lim,cal} = 0{,}2\ \text{mm} \cdot k_{surf}$	
XD1, XD2, XD3 XS1, XS2, XS3		$\sigma_c \leq 0{,}6f_{ck}$ [a,c]	–	Decompression[b]	$\sigma_c \leq 0{,}6f_{ck}$ [a,c]
XF1, XF3 XF2, XF4	–				

¿Cómo se abordan los contenidos nuevos?



¿Cómo se abordan los contenidos nuevos?

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JRC SCIENCE FOR POLICY REPORT

Prospect for European Guidance for the Structural design of Tensile Membrane Structures

Support to the implementation, harmonisation and further development of the Eurocodes

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Guidance for European Structural Design of Glass Components

Support to the implementation, harmonization and further development of the Eurocodes

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EDITORS

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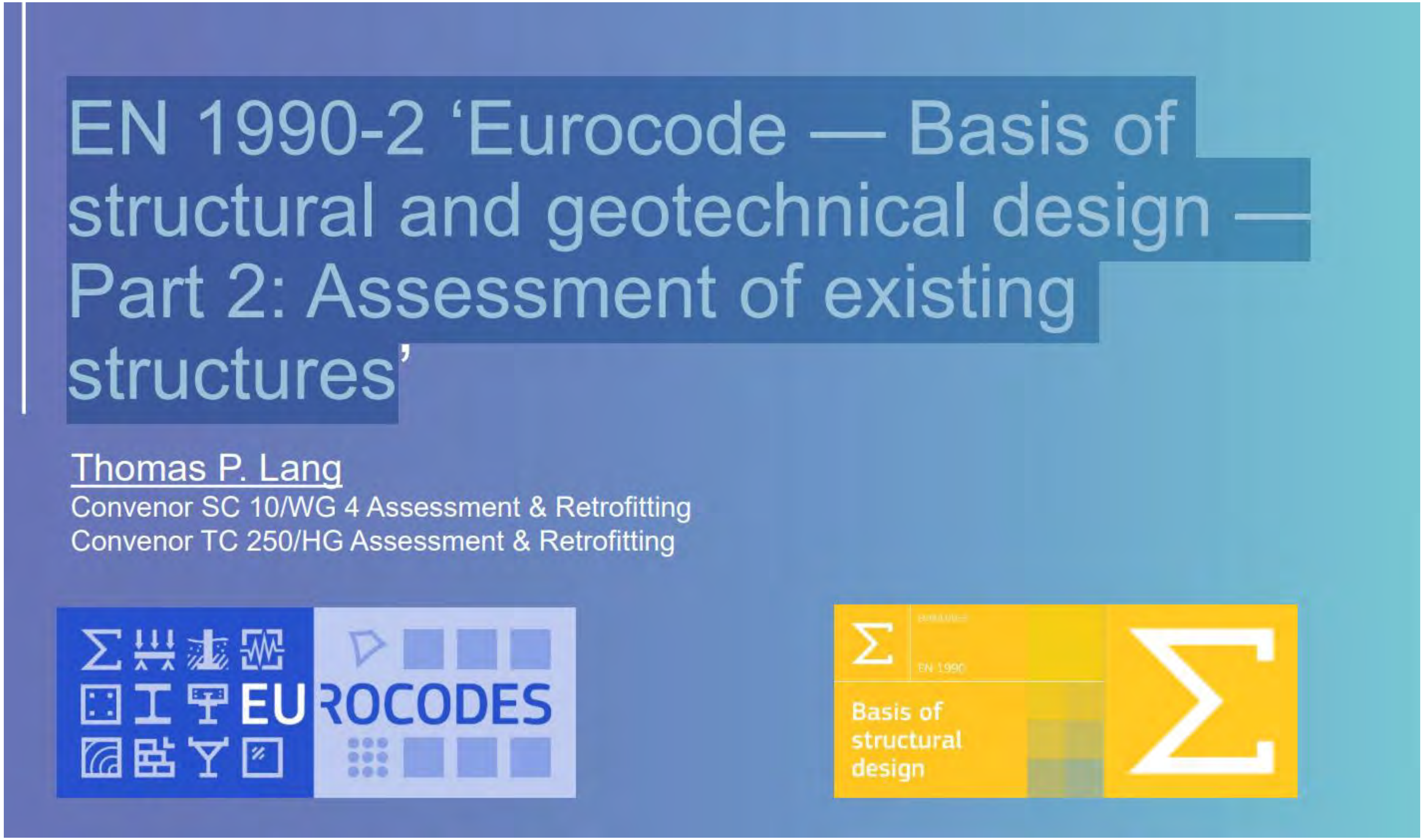
2014

Joint Research Centre

Report EUR 26439 EN

¿Cómo se abordan los contenidos nuevos?



+ANEJOS EN CADA EUROCÓDIGO REFERENTE A UN MATERIAL

¿Cómo se abordan los contenidos nuevos?

CEN/TS 19101: Design of fibre-polymer composite structures

CEN/TS 19102: Design of tensioned membrane structures

¿Cómo se aborda el cambio climático?

Se modifican las acciones climáticas: viento, nieve, temperatura, basándose no en datos históricos sino en proyecciones climáticas derivadas de modelos climáticos

Buena parte del trabajo tiene que hacerse a nivel de los anejos nacionales

Los Eurocódigos ofrecen la posibilidad de utilizar “climate enhancement factors” que afectan a los coeficientes parciales de las acciones climáticas

¿Cómo se aborda el cambio climático?

3 Advanced methodologies for developing future-proofed climatic action maps in structural design

Climate mapping for structural design across Europe forms the foundation for defining the loads and environmental actions that buildings and infrastructure must withstand. These are codified in the Eurocodes, a set of 10 European technical standards that provide common rules for the structural design of buildings, other civil engineering works, and construction products. The widespread international adoption of the Eurocodes, along with their extensive harmonisation among the European Committee for Standardisation (CEN) Member States, contributes to more uniform safety levels in the built environment and reduces barriers arising from national practices, facilitating the free circulation of construction products and engineering services within the EU and abroad.

3.1 Overview of climate mapping in structural design and integration of climate change projections

Within the Eurocodes, EN 1991 (Eurocode 1: Actions on structures)[36] dedicates three specific parts to climatic actions—snow (EN 1991-1-3:2003)[37], wind (EN 1991-1-4:2005)[38], and thermal (EN 1991-1-5:2003)[39]. Each part defines characteristic values for these actions, typically based on statistical analysis of historical climate data using probabilistic methods. These values represent extreme conditions expected for a given return period—often 50 years—and are designed to ensure safety and serviceability under severe weather conditions.

The characteristic values included in the National Annexes for climatic actions are not fixed in the Eurocodes. Instead, their determination is delegated to each country through National Annexes, enabling Member States to define Nationally Determined Parameters (NDPs)[40] that reflect local climatic, geological, and construction conditions. However, many of the current European climatic action maps used for this purpose now outdated, often relying on station-based observations that lack spatial uniformity, do not extend beyond the 1990s (and thus do not reflect recent or projected climate changes), are processed using different probabilistic approaches, and feature varying update cycles.

Moreover, climate change introduces new variability and extremes in temperature, wind, and snow patterns, which are not captured in the legacy climatic action maps. As structures built today are expected to last 50 to 100 years, it is essential that structural design standards reflect not just historical climate but also projected future conditions. For example, a building designed in 2025 must remain safe under climatic conditions that will prevail in 2075 or beyond. For these reasons,

[36] European Commission: Joint Research Centre, Eurocodes: Building the future, Eurocode 1: Actions on structures, accessed 20 May 2025, https://eurocodes.jrc.ec.europa.eu/EN-Eurocodes/eurocode-1-actions-structures

[37] EN 1991-1-3:2003. Eurocode 1: Actions on Structures—Part 1–3: General Actions—Snow Loads; CEN, Brussels, Belgium.

[38] EN 1991-1-4:2005. Eurocode 1: Actions on Structures—Part 1–4: General Actions—Wind Actions; CEN, Brussels, Belgium.

[39] EN 1991-1-5:2003. Eurocode 1: Actions on Structures - Part 1–5: General Actions—Thermal Actions; CEN, Brussels, Belgium.

[40] European Commission: Joint Research Centre, Database of Nationally Determined Parameters, accessed 20 May 2025, https://eurocodes.jrc.ec.europa.eu/resources-tools/database-nationally-determined-parameters

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4 Harmonising climate data: protocols for consistent future mapping

This section presents the latest developments in climate datasets and analytical tools that support climate-resilient design in alignment with the second generation of Eurocodes (2G Eurocodes). By leveraging these advanced resources, we aim to provide a robust foundation for climate-informed decision-making and future-oriented structural design. This section is closely linked with Chapter 3 (advanced methodologies for developing future-proofed climatic action maps in structural design) and Chapter 5 (fortifying design standards for climate change resilience).

4.1 A brief intro to climate change scenarios

Climate change projections with climate models require information about future emissions or concentrations of greenhouse gases, aerosols, ozone-depleting substances, and land use over time. This information can be provided by scenarios, which are internally consistent projections of these quantities based on assumptions of how socio-economic systems could evolve over the 21st century.

Figure 2 illustrates the climate change cause–effect chain, from anthropogenic emissions to changes in atmospheric concentration, resulting in alterations in Earth's energy balance ('forcing'), which then drive global and regional climate changes and ultimately affect climatic impact-drivers.

In its Fifth Assessment Report (AR5), the Intergovernmental Panel on Climate Change (IPCC, 2014) introduced a new set of scenarios called Representative Concentration Pathways (RCPs), which replaced the earlier Special Report on Emissions Scenarios (SRES). These RCPs were created using Integrated Assessment Models (IAMs), which combine elements such as economic growth, population trends, energy use, and simplified climate dynamics. The IAMs generate emissions projections that are then used to produce greenhouse gas (GHG) concentration time series, either by passing through simplified climate models or directly within Earth System Models that simulate biogeochemical processes.

The RCPs encompass a broad spectrum of climate mitigation possibilities, distinguished by their respective radiative forcing values by the year 2100. This set includes one strong mitigation scenario (RCP2.6) aiming for a low radiative forcing of approximately 2.6 W/m^2, two intermediate stabilization pathways (RCP4.5 and RCP6.0), and one high-emission baseline scenario (RCP8.5), which assumes no climate policy and results in a forcing level around 8.5 W/m^2.

For the Sixth Assessment Report (AR6, IPCC 2023), the IPCC adopted a new framework based on Shared Socioeconomic Pathways (SSPs) (Meinshausen et al. 2020), developed to represent diverse future global socio-economic trajectories and policy environments. The SSPs include greenhouse gas concentration datasets from 2015 onward across nine distinct scenarios. Five of these were highlighted in AR6:

— SSP1-1.9, which aligns most closely with the 1.5°C target of the Paris Agreement (Paris Agreement, United Nations 2015);

— SSP1-2.6 '2 °C scenario', a strong mitigation pathway with a radiative forcing of 2.6 W/m^2 by 2100;

— SSP2-4.5, a 'middle-of-the-road' scenario;

— SSP3-7.0, a moderate-to-high emission scenario reflecting regional rivalry and limited cooperation;

Compromiso de CEN/TC250

- Adquirido en 2020
- Completar la 2ª Generación de Eurocódigos cumpliendo con los siguientes objetivos:

  ✓ Mejorar la facilidad de uso
  ✓ Alcanzar niveles ejemplares de consenso internacional
  ✓ Terminar a tiempo (Nov. 2025)

DoA: Marzo 2026
DoP: Sept. 2027
DoW: Marzo 2028

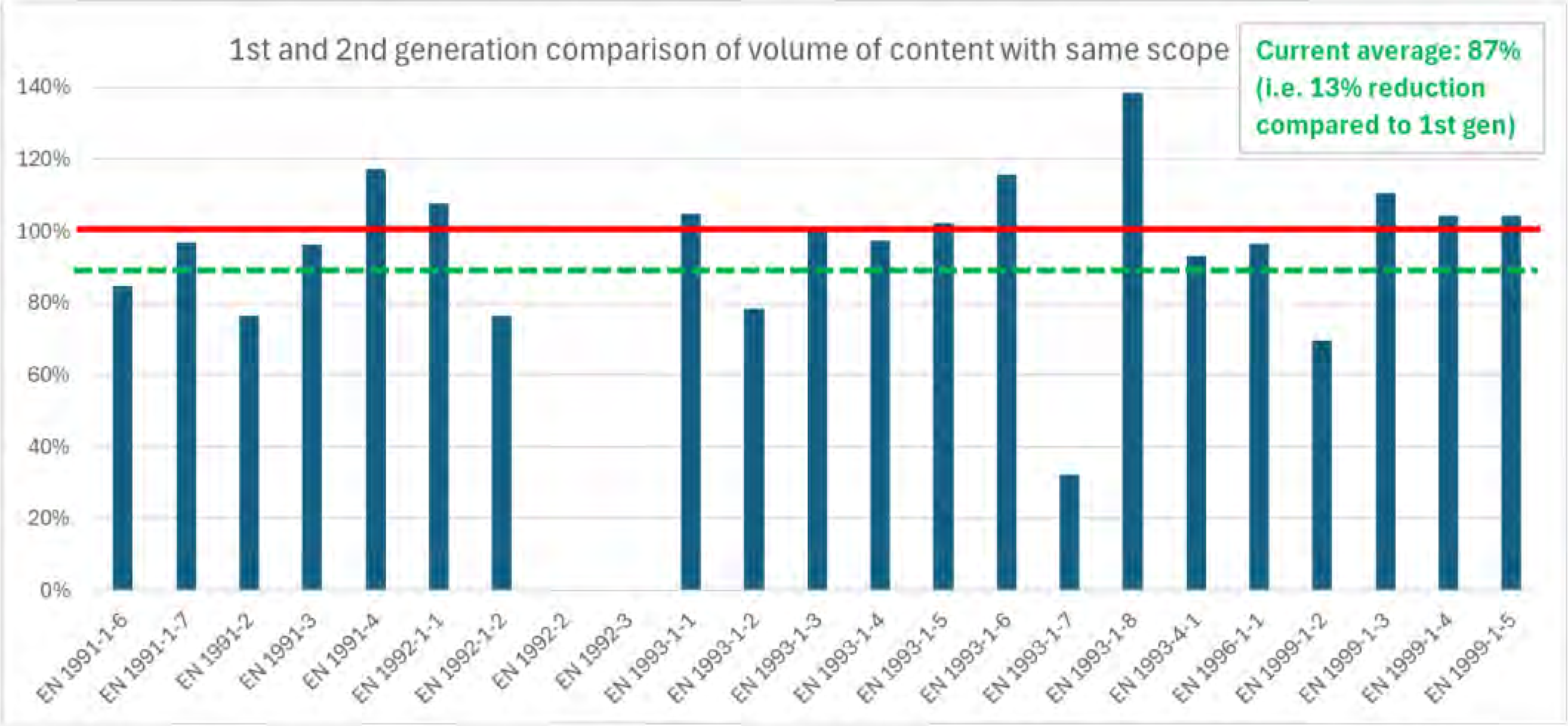
Compromiso de CEN/TC250

Chairman's introduction

- ✓ Enhanced Ease of Use
- ✓ Exemplary levels of international consensus
- ✓ … Delivered to schedule

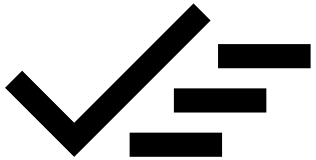
Tomado de las presentaciones de Steve Denton, Presidente CEN/TC250

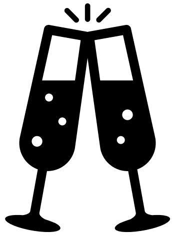
Compromiso de CEN/TC250



Compromiso de CEN/TC250

- ✓ Reducción del 30% en NDPs
- ✓ Reducción del 13% en el número de páginas
- ✓ Completado a tiempo
- ✓ Sólo un 0.3% de votos negativos





Compromiso de CEN/TC250

- Documentos de respaldo que justifican cada uno de los cambios

Por ejemplo, el BD 1992-1-1 tiene 880 páginas

cen	CEN/TC 250/SC 2 "Eurocode 2: Design of concrete structures"	**CEN/TC 250/SC 2 N2087** Date: 31. March 2023

Background document to FprEN 1992-1-1:2023-04 (Formal-Vote-Draft):

Eurocode 2 - Design of concrete structures - Part 1-1: General rules and rules for buildings, bridges and civil engineering structures

Content list

CEN/TC 250/SC 2 N2087

Content list — Background to FprEN 1992-1-1:2023

CEN/TC 250/SC 2 N2087

Content list — Background to FprEN 1992-1-1:2023

Formato de la 2ª Generación de Eurocódigos: XLM

- Permite extraer de cada documento:

  - ✓ Términos y definiciones
  - ✓ Símbolos y definiciones
  - ✓ Referencias a un documento hecho por los demás documentos
  - ✓ Referencias hechas por un documento a los demás documentos

↓

FACILITA ACTUALIZACIONES Y VERIFICACIÓN DE LA CONSISTENCIA

ACTIVIDADES DE DIFUSIÓN (JRC)

The Second Generation Eurocodes

Key changes and benefits through design examples

Online, 3-5 June 2025

2025 Eurocodes workshop by JRC

Tuesday, 3 June

- Welcome and introductions
- Eurocodes overview
- Basis of structural and geotechnical design
- Actions on structures
- Design of masonry structures
- Design of tensioned membrane structures
- Design of timber structures

Wednesday, 4 June

- Eurocode 2: Design of concrete structures
- Geotechnical design
- Design of steel structures
- Design of composite steel and concrete structures
- Design of structures for earthquake resistance

Thursday, 5 June

- Structural glass
- Design of fibre-polymer composite structures
- Design of aluminium structures

https://eurocodes.jrc.ec.europa.eu/events/second-generation-eurocodes-key-changes-and-benefits-through-design-examples

2025 Eurocodes workshop by JRC

- > 1800 registrations
- > 60 countries
- > 200 participants from third countries: Balkans, ASEAN, Africa, Switzerland, UK, …

ACTIVIDADES DE DIFUSIÓN (JRC)

Se prevé un segundo evento presencial como los de 2008 (Bruselas) y 2009 (Viena) organizados para la difusión de la 1G en 2027 (DoP)

ACTIVIDAD ACTUAL: EL PROCESO DE ENMIENDAS

¿POR QUÉ?

- ✓ Actualización de referencias
- ✓ Abordar comentarios recibidos en la fase de voto formal
- ✓ Corrección de errores detectados en los procesos de traducción o en la elaboración de ejemplos de aplicación
- ✓ Erratas que no se pudieron corregir tras el voto formal

ACTIVIDAD ACTUAL: EL PROCESO DE ENMIENDAS

- ✓ Conlleva fases de encuesta y voto formal
- ✓ Sólo se pueden hacer comentarios sobre los cambios propuestos
- ✓ Se admiten las propuestas de enmienda si el número de cambios técnicos afecta a menos de un 5% de los párrafos
- ✓ Si el número de cambios técnicos está entre el 5% y el10%, requiere aprobación específica de CCMC (CEN-CENELEC Management Centre)
- ✓ Si se supera el 10% $\rightarrow$ revisión
- ✓ Debe completarse el 30/09/2027