

Eurocodes evolution: preparing for the second generation

Steve Denton and Mariapia Angelino provide an overview of the background, status and transition timetable for the second-generation EN Eurocodes that are in development.

Introduction

The Institution of Structural Engineers, in its report to the then Office of the Deputy Prime Minister in 2004, described the implementation of the Structural Eurocodes (EN 1990–EN 1999) as ‘the biggest change to codified structural design ever experienced in the UK’.

The first generation of the EN Eurocodes were published between 2002 and 2007 and represented the culmination of over 30 years of collaborative international development. Since the withdrawal of conflicting British Standards in March 2010, the Eurocodes have become the primary suite of standards used for structural and geotechnical design in the UK.

Following the introduction of these new standards across Europe, many countries sought a period of stability for practising engineers. For this reason, there have been very few major amendments to the first-generation suite. There has, however, been a very substantial international programme to develop the second generation of the EN Eurocodes. This major, coordinated revision of all Eurocode parts will include significant updates and new parts.

The first of the second-generation standards has now been released to National Standardisation Bodies (NSBs). Work is well advanced to ensure that the complete second-generation suite will be released by early 2026. A backstop date of early 2028 has been set by which time all countries are obliged to withdraw their first-generation documents.

Although changes to most of the standards that are used in day-to-day practice will therefore likely be some way off, it is important to start to prepare for the transition

and understand what is happening, why and when. The purpose of this article is therefore to explain the objectives and status of the Eurocodes evolution programme. It focuses on activities at a European level, with the intention that future articles will cover national implementation.

Responsibility for Eurocodes

Responsibility for the Eurocodes resides with CEN Technical Committee 250 (CEN/TC 250). CEN, the European Standardisation Body, has 34 full NSB members, including BSI. All CEN members are bound by CEN rules and all CEN standards are developed in accordance with CEN internal regulations.

CEN/TC 250 is highly active, with approaching 100 formal subcommittees, working groups and task groups. National representation on these committees and working groups is provided through NSBs, with NSBs generally having mirror committees to help establish national positions. In the UK, the key national mirror committees are BSI B/525, covering building and civil engineering structures, and BSI B/526, which covers geotechnics.

Each CEN Technical Committee has a secretariat provided by one of the NSBs. The secretariat of CEN/TC 250 is provided by BSI. This is a crucial role and the support provided by BSI is exemplary. Coupled with the Chair of CEN/TC 250 being from the UK, and UK representation and engagement across all CEN/TC 250 activities being strong, the UK has been an influential voice in the evolution of the Eurocodes.

Evolution programme

Mandate M515 EN

A major stimulus for the Eurocodes

evolution programme has been Mandate M515 issued by the European Commission (EC) at the end of 2012. Crucially, this mandate unlocked the potential for financial support for the evolution programme from the EC and European Free Trade Association (EFTA). It also affirmed the high level of importance that the EC and EFTA place in the Eurocodes and set expectations for the work to be done.

The mandate recognised that long-term confidence in the Eurocodes relies upon their ability to evolve. As such, they must embrace new methods, new materials, new regulatory requirements and new societal needs, fostering more economic and sustainable design and construction.

The total funding provided by the EC and EFTA to support the evolution of the Eurocodes was over €11M, making it the largest standardisation programme ever of its type by funding level.

CEN/TC 250 work programme

In response to Mandate M/515, CEN/TC 250 established a panel to prepare its technical response detailing the overall planned work programme. This programme was split into four overlapping phases to enable the interdependencies between standards and drafting work to be managed and coordinated effectively.

In addition, CEN/TC 250 undertook formal ‘systematic reviews’ of all existing Eurocode parts, through which all CEN members had the opportunity to comment on and recommend changes to the existing standards. This important and extensive feedback was integrated into the detailed CEN/TC 250 work programme and helped shape the scope of updates and new developments.

CEN/TC 250's response to Mandate M/515 contained clear descriptions of the standards to be reviewed in each phase, together with associated background, reasons for the change, key benefits and outputs. Key updates in the work programme included extension of current rules for the assessment of existing structures, strengthening of requirements for robustness, and considerations of relevant impacts of climate change on structural and geotechnical design.

New developments included a new Eurocode on structural glass, new CEN Technical Specifications for design of fibre-polymer composite structures and tensile surface structures, and new Eurocode parts on atmospheric icing and actions from waves and currents on coastal structures.

To help deliver the work programme, over 70 funded project teams containing five or six experts were established, working to a defined brief under the direction of CEN/TC 250 and the relevant CEN/TC 250 subcommittee or working group. The leadership and membership of these project teams was decided through open international competitions. Three calls for experts were held: in 2015 for phase 1, in 2016 for phase 2, and in 2017 for phases 3 and 4. The Netherlands's NSB, NEN, organised the call for experts, administered the associated contracts

and has led the reporting required to the EC and EFTA. Working in tandem with BSI, NEN has thus made a significant contribution to the programme.

CEN/TC 250 objectives

At the outset, CEN/TC 250 unanimously agreed two overarching objectives to guide its decisions and priorities for the evolution work: first, to enhance the ease of use of the Eurocodes; and second, to achieve an exemplary level of international consensus.

Enhancing ease of use

CEN/TC 250's vision for the second generation of Structural Eurocodes is 'to create a more user-orientated suite of design standards that are recognised as the most trusted and preferred in the world'.

To support this vision, in 2013, the Chair of CEN/TC 250 established a Chair's Advisory Panel ('CAP on ease of use') to develop recommendations for the approach to be taken to enhance ease of use. The 15 members of this CAP provided a balance between Eurocodes stakeholders, with a strong representation from practitioners. The recommendations of this CAP were unanimously endorsed by CEN/TC 250 and have been instrumental to CEN/TC 250's efforts to meet users' needs.

The CAP recommended that a clearly defined primary target audience

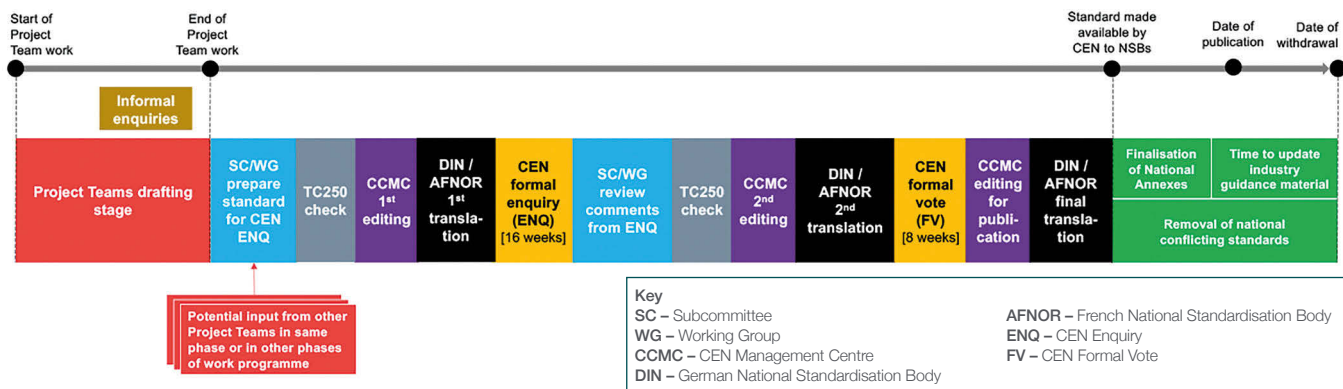
be agreed to guide all those authoring Eurocodes. This primary target audience was defined as '*Practitioners – Competent engineers: Civil, structural and geotechnical engineers, typically qualified professionals able to work independently in relevant field*'. In addition, nine further categories of users were identified and, for each category, a statement of intent to meet users' needs was agreed (**Table 1**).

CEN/TC 250 adopted a series of governing principles and priorities to guide drafting. These included general aims like enhancing understandability, navigation, consistency between the Eurocodes, and avoiding fundamental changes to design approach or structure unless adequately justified. More specific aims included providing clear guidance for common design cases, providing adequate freedom for innovation, and improving consistency with product standards.

Additionally, CEN/TC 250 put in place a broad array of innovations and activities to promote enhancements in ease of use. These have included: establishing the role of M/515 Technical Reviewer to scrutinise evolving drafts and make recommendations to enhance clarity and consistency; developing comprehensive guidelines and examples to augment CEN's drafting rules; and holding multiple 'informal' enquiries on drafts to collect

Table 1: Categories of Eurocode users and CEN/TC 250 statements of intent

Category of Eurocode user	CEN/TC 250 statement of intent to meet users' needs
Practitioners – Competent engineers	We will aim to produce Standards that are suitable and clear for all common design cases without demanding disproportionate levels of effort to apply them
Practitioners – Graduates	We will aim to produce Eurocodes that can be used by Graduates where necessary supplemented by suitable guidance documents and textbooks and under the supervision of an experienced practitioner when appropriate
Expert specialists	We will aim not to restrict innovation by providing freedom to experts to apply their specialist knowledge and expertise
Product manufacturers	Working with other CEN/TCs we will aim to eliminate incompatibilities or ambiguities between the Eurocodes and Product Standards
Software developers	We will aim to provide unambiguous and complete design procedures. Accompanying formulae will be provided for charts and tables where possible
Educators	We will aim to use consistent underlying technical principles irrespective of the intended use of a structure (e.g. bridge, building) and that facilitate the linkage between physical behaviour and design rules
National regulator	We will endeavour to produce standards that can be referenced or quoted by National Regulations
Private sector businesses	We will continue to promote technical harmonisation across European markets in order to reduce barriers to trade
Clients	We will produce Eurocodes that enable the design of safe, serviceable, robust and durable structures, aiming to promote cost-effectiveness throughout their whole lifecycle, including design, construction and maintenance
Other CEN/TCs	We will engage proactively to promote effective collaboration with those other CEN/TCs that have shared interests



feedback from users via NSBs, through which thousands of constructive comments have been received.

Exemplary levels of consensus

Achieving consensus is fundamental to CEN/TC 250’s ambitions and a real challenge given the scale, complexity and international impact of the Eurocodes and the evolution programme. Many specific initiatives have been enacted to help build consensus, including CEN/TC 250 unanimously agreeing behavioural expectations and a five-step process to help resolve differences of view.

Ultimately, the formal votes taken by NSBs on the final drafts of the Eurocodes will confirm whether or not the exemplary levels of consensus achieved are indeed exemplary. Current indications are encouraging, however. During hundreds of formal decisions taken by CEN/TC 250 through NSB voting associated with the execution of the work programme to date, of the many, many thousands of votes cast, direct negative votes have been measured in single digits.

Development process

The development process for each Eurocode part is based on CEN rules and consists of a series of stages (Figure 1). After the finalisation of the work by the Project Teams, the relevant subcommittee or working group starts the preparation of the standard for CEN formal enquiry (ENQ), when NSBs

↑ **FIGURE 1:** Eurocode development process

officially comment on the draft prEN standard. Prior to ENQ, the prEN draft is checked by the CEN/TC 250 Chair and Secretary, reviewed by the CEN editorial team and translated into French and German.

In addition, as noted previously, to support ease of use and consensus-building objectives, during the project team drafting stage, CEN/TC 250 undertook multiple additional informal enquiries for all Eurocode parts to collect and respond to comments on interim drafts.

After ENQ, comments made by NSBs are addressed by the relevant subcommittee or working group, which prepares the final EN draft. After further checks, editing and translation, the CEN Formal Vote (FV) is launched. This is when NSBs submit their final vote on whether they agree the draft standard.

Where we are now?

CEN/TC 250 has developed a comprehensive publication schedule and planner to track progress at all stages of the Eurocode development. The 78 Project Teams appointed for the four phases of the work programme have all completed their work. CEN ENQs and FVs are happening twice a year: March and September for ENQ; April and October for FV.

The first ENQ was launched in 2019 for EN 1996-1-1. In the same year, the first FV was launched for CEN/TS 17440 on assessment of existing structures. To date, 26 ENQs and 15 FVs have been launched.

standards made available to NSBs, by early 2026.

In parallel with this intensive period of finalisation and formal acceptance of the second-generation Eurocodes, CEN/TC 250 is initiating communication activities to help with the transition to the new standards. For example, general presentations have been prepared outlining the key changes to each of the Eurocodes. These are available from the JRC Eurocode website (<https://eurocodes.jrc.ec.europa.eu/2nd-generation/>).

In addition, a series of ‘Eurocodes Evolution Explained’ videos is being produced and plans have been developed for detailed technical briefings.

At a national level, new national annexes need to be developed and transition plans enacted by relevant authorities, and these topics will be covered in future articles. But in the meantime, the current suite of first-generation Eurocodes remain the applicable standards for structural and geotechnical design and should continue to be used.

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What’s next?

Twenty-five Eurocode parts are expected to go to ENQ in 2023, including most parts of EN 1991, EN 1993, EN 1995 and EN 1998. Eleven Eurocode parts are expected to go to FV in 2023, including the new CEN/TS 19102 on tensioned membrane structures. As noted in the introduction, all FVs will be concluded, and the new

REFERENCE

1) Institution of Structural Engineers (2004) National strategy for implementation of the structural Eurocodes: design guidance. Report prepared for the Office of the Deputy Prime Minister, London: IStructE