



Towards performance-based cement standards in Europe

Input workstream Low Carbon Cement – HLF Standardisation

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Introduction

Standards are essential to the well-functioning of the European internal market. This is not different for the construction sector, which heavily relies on standards to assess the performance of products placed and traded on the internal market. With the right set of standards in place, clean technologies and innovation become a key vector for decarbonisation.

This is particularly relevant for cement, as its production is highly energy and carbon intensive, being responsible for up to 8% of global and 4% of EU carbon emissions. Furthermore, European cements are among the most clinker¹ intensive ones in the world, with a so-called clinker-to-cement ratio well above the global average and no signs of improvements, and industry is not on track to meet net-zero²

Standards play a key role in bringing down the share of clinker in cement, stemming from the fact that today's recipe-based cement standards (EN 197 series) are overly prescriptive, locking-in high levels of clinker for the different cements on our markets. While such approach was convenient at a time when scientific knowledge on cement durability and strength was less progressed, it comes at the expense of innovation and decarbonisation.

Inspired by the example set by many other lead markets (US, Australia, Latin-America), a major overhaul of the European standardisation system for cements is urgently needed to create a level-

¹ Clinker is the main ingredient from traditional Portland cement from which it derives its binding properties. However, it is also the main culprit of emissions, accounting for more than 90% of the embodied carbon of cement.

² <https://www.iea.org/energy-system/industry/cement>

playing field for all existing – and emerging – cement technologies. This can be achieved by adopting a single performance-based cement standards for all common cements.

Decarbonisation and standardisation

There is growing international momentum for performance-based cement and concrete standards. It is essential that Europe follows and leapfrogs the example set by others. **Shifting to a performance-based cement standards for all common cements will:**

- 1) **Strengthen the internal market for construction products:** according to art. 1 of the CPR (current and future), the CPR “ [...] lays down conditions for the placing or making available on the market of construction products by establishing harmonised rules on how to express the performance of construction products [...]”. This performance-based approach is considered key by all stakeholders as it strengthens our internal market by removing barriers to trade, which is vital for our European industry. Construction Products Europe, representing all construction products manufacturers throughout Europe, states on the CPR that “the approach of the CPR is performance-based. This is an excellent regulatory framework for the delivery of product performance and guarantees a level playing field in the European market”.

Shifting to performance-based cement standards will – finally – align cement standards with the CPR, strengthening and deepening the European internal market. This will create new opportunities for industry and green growth.

- 2) **Foster innovation and decarbonisation in the European cement industry:** It is well-established that performance-based standards are a driver of innovation as they are technology neutral. This is obviously much less the case for prescriptive or recipe-based standards^{3,4}. As innovation is a key precondition for decarbonisation, shifting to performance-based standards is much-needed to bring European cement on track of net-zero. This is particularly relevant for cement as the biggest levers for decarbonisation sit at the material level. The mitigation potential of performance-based standards is significant (at least 50% by 2050)⁵, explaining the wide-spread support for standards reforms. It also explains why flag-ship research projects such as H2020 DETOCS (incl. FLSmidth, ARGOS, Mannok, ETH...) have devoted workstreams on performance-based standards⁶.

Shifting to performance-based cement standards is crucial to foster innovation and accelerate decarbonisation in cement production in Europe. This is vital at a time when cement industry is not on track to meet net-zero by 2050⁷.

³ <https://www.aldersgategroup.org.uk/publications/post/product-standards-crucial-to-deliver-a-strong-net-zero-industrial-base/>

⁴ <https://alliancelccc.com/wp-content/uploads/2023/05/ALCCC-REPORT-FAST-TRACKING-CEMENT-DECARBONISATION.pdf>

⁵ <https://alliancelccc.com/wp-content/uploads/2023/05/Methodology-report-Clinker-Substitution-in-the-EU-Cement-Sector.pdf>

⁶ <https://cordis.europa.eu/project/id/101119929>

⁷ <https://www.iea.org/energy-system/industry/cement>

Dispelling common myths surrounding performance-based standards

Despite the growing international momentum for performance-based standards in cement and concrete, there continue to exist many myths on the topic:

1) Performance-based standards do not have a (big) impact on decarbonisation.

This misconception stems from the fact that the impact of ASTM C1157 (US performance-based standard for hydraulic cements) has been limited thus far in terms of decarbonisation (see e.g. note CEN TC51). It needs to be pointed out, however, that this has little to do with the standard itself. Indeed, ASTM C1157 allows different novel cement types to be placed on the market, as such having a much wider scope than ASTM and CEN recipe-based cement standards. The problem, however, is situated at the level of the market uptake, more precisely the lack of reference to ASTM C1157 in project specifications (including through public procurement).

Indeed, according to the US National Ready Mix Concrete Association top 10 recommendations on sustainability, there is an urgent need to start specifying innovative cements through better procurement⁸. *“Both ASTM C595 and ASTM C1157 have been permitted in national standards such as ACI 318 and 301, ASTM C94 (ready mixed concrete), and MasterSpec for at least two decades, but most project specifications inadvertently prohibit their use by not listing them in the specification. Many legacy project specifications only list ASTM C150 (Portland cement) and don’t list ASTM C595 and ASTM C1157, mainly because project specifications are rarely updated”.*

The lack of impact in the US thus comes from the inertia in the construction value chain – which is enhanced by the complex landscape (i.e. “dual approach”) – whereby both recipe-based and performance-based cement standards coexist next to one another. So rather than the quality of C1157 itself (which is not challenged as), the complexity of the standardisation landscape in combination with the inertia of the value chain is hampering decarbonisation. **A dual approach is not desirable as it further complicates an already complex looking picture.**

This is also the reason why ASTM co-convenor on cement and concrete standards Prof. Dr. Lary Sutter clearly states in one of his recent studies that *“A performance-based approach to standard material specifications and tests provides the clearest path to achieve the changes required to contribute to achieving the goal of carbon neutral concrete by 2050. Performance provides the flexibility to adopt new materials or technologies while achieving the needed attributes in the final concrete product.”*⁹. This view aligns with the scientific consensus on the topic according to which performance-based standards greatly outperform recipe-based standards when it comes to decarbonisation.

⁸ <https://www.nrmca.org/wp-content/uploads/2022/07/Top10WaysReduceConcreteCarbonFootprint.pdf>

⁹ <https://linkinghub.elsevier.com/retrieve/pii/S000888462300217X>

2) *Performance-based standards create cascading problems for the value-chain*

A common misconception on performance-based standard is that their adoption would create cascading problems for the wider construction value chain, amongst others because they would not provide the necessary information on cement composition to end-users of cements. This is false for several reasons:

- Same level of information on composition for market actors: as per the CPR, to be able to affix the CE marking to a cement, manufacturers are today required to draw up a declaration of performance (DOP) to guarantee that the cement complies the essential characteristics of EN 197-1. Importantly, the DOPs only provides general information to the market on the performance of a product– i.e. the cement type – but no detail on the specifics of the composition. As is the case for all other construction products, more detailed product information is provided through (digital) product passports (DPP) and Environmental Performance Declarations (EPD). **A shift to performance-based standards will not change the level of information flowing into the market.** Manufacturers will continue to be able on a voluntary (and increasingly compulsory) basis to provide detailed product information – including on composition – through DPPs and EPDs. Furthermore, references to the existing cement families can be maintained on a voluntary basis – and even within a performance-based standard if needed.
- Nomenclature on types of cement: it is a misconception that a composition-based nomenclature for cements is the best/only scenario for the construction value chain to function. Indeed, looking at approaches beyond Europe, standards – both recipe-based and performance-based – tend to rely predominately on non-composition nomenclature, distinguishing cement types on the basis of their end use (or performance).. ASTM C150 (US/International recipe-based cement standard), for example, distinguishes between 6 types of cement without explicit link to composition in this part of the standard (e.g. Type I – Normal Cement, Type III – High early Strength). A similar approach is taken by ASTM C1157 (performance-based cement standard) specifying 6 types of cement. Some markets even go further in reducing the number of cement types. Australia, for example, has a recipe-based standard in which a distinction is only made between 3 types of cements. **All this shows that it is perfectly possible to organise a well-functioning construction value-chain without relying on a composition-based nomenclature for cement.**
- Proven examples and wide support within the industry: shifting from a recipe-based to a performance-based cement standardisation system is straightforward and most importantly does not create problems for the wider construction value chain. Worth highlighting in this regard are:
 - **Lessons learned from frontrunners in Latin-America**: a number of countries (e.g. Columbia, El Salvador, Guatemala and Honduras) made in recent years a successful transformation from a prescriptive to a performance-based standardisation system. It should be highlighted that this shift did not create any disruptions in the value chain – and is deemed key for further accelerating the decarbonisation of the cement industry. Today, some of these countries (e.g. Columbia) already have among the lowest clinker-to-cement ratios.

- **Strong European industry support for performance-based approach:** in Europe, we witness a strong and growing support for performance-based cement (and concrete) standards. Key advocates include the Alliance for Low-Carbon Cement and Concrete (<https://alliancelccc.com/>) – EU wide initiative - ; and national actors and initiatives including the Dutch ‘Betonakkoord’ (<https://www.betonakkoord.nl/>) Netherlands), the Flemish (Belgium) ‘ Circulair Betonakkoord’ (<https://www.betonakkoord-vlaanderen.be/>) and the French FNTP (<https://www.fnfp.fr/>). Jointly, these different initiatives represent the entire construction value chain, including key multinational end-users of cement.

3) *Dual approach is best fit to the European internal market:*

It is a myth that a dual approach – referring to a combination of recipe-based and performance-based approaches to standardisation – is most suitable for the European internal market. The underlying rationale is that this allows to maintain the best elements of the existing system, while creating a complementary new route to market for novel cements. The reality, however, is that such **dual approach should be avoided for three important reasons:**

- A dual approach adds another layer of complexity to the complex standardisation landscape. As pointed out above, countries which have a dual approach in place (e.g. US) have identified this a major obstacle for decarbonisation.
- A performance-based approach already allows to maintain the best elements of the existing standards (i.e. performance-based essential characteristics of EN 197 series). As such, there is no need to have two different and distinct approaches to cement standardisation to achieve this objective.
- A dual approach is not compliant with the CPR: as the current (and future) CPR require a performance-based approach for the CE marking of construction products (art. 1), it is important to highlight that **a dual approach to cement standardisation comes with substantial legal risks and uncertainties.** Given that legal cases created substantial delays and issues in standardisation in recent years, it is essential that any future approach to cement standardisation is watertight from a legal point of view.