Mineral Products Association

The Trade Association for the Aggregates, Asphalt, Cement, Concrete, Dimension Stone, Lime, Mortar and Industrial Sand Industries

UK adaptation of Global Cement and Concrete Association (GCCA) Global Ratings for Low Carbon and Near Zero Concrete

February 2025

1.0 Executive Summary

This paper provides the UK adaptation of the GCCA numerical ratings in units of embodied carbon dioxide equivalent per cubic metre of product (ECO_2e /m^3) also referred to as Global Warming Potential (GWP), for "low carbon" and "near zero" carbon emissions concrete product for the purposes of procurement.

2.0 Background

In 2021, The Global Cement and Concrete Association published its 2050 Cement and Concrete Industry Roadmap for Net Zero Concrete, the collective commitment of the world's leading cement and concrete companies. These companies called for stimulation of demand for low-carbon cement and concrete products through public procurement policy. Part of any such procurement policy is ratings for low carbon and near-zero cement and concrete.

GCCA has chosen to work with the Clean Energy Ministerial Industrial Deep Decarbonisation Initiative (IDDI) to create a set of globally applicable ratings for concrete.

The IDDI is a global coalition of public and private organisations. One of the key ambitions of IDDI is consistent ratings for low carbon and near-zero cement, concrete and steel. The IDDI employs the International Energy Agency (IEA) ratings for low carbon and near zero cement and crude steel as a robust starting point, and is contributing to processes to develop, refine and extend them as needed.

The key principles that IDDI require for ratings are:

- same concept of banding as used for cement and steel: i.e., bands E to A with progressively lower carbon footprints down to a near zero emissions band
- a system that can be used in all countries for procurement
- a system that enables all countries to report progress and enables comparison between countries through use of common banding levels.

3.0 Global Ratings for Low Carbon and Near Zero Emissions Concrete

The global ratings for concrete product, presented in Figure 1, comprise 7 bands including the near zero emissions and global reference thresholds. The band values in GWP units of (ECO_2e /m^3) are plotted against concrete compressive strength. Concrete product is defined as readymixed concrete and precast (factory made) concrete[1] and concrete masonry elements.

To establish the Global Reference Threshold for concrete, data was collected from major cement-producing countries (provided in Appendix A). This data was used to determine carbon footprint thresholds for each country based on "good practice Ordinary Portland Cement (CEM I/OPC)"[2] and "good practice concrete mix designs"[3]. These country-specific thresholds were then combined, weighted by each country's cement output, to create a global threshold. The selection of "good practice" Ordinary Portland Cement (CEM I/OPC) prioritises clarity and accessibility, especially for countries less advanced in low-carbon cement adoption.

1 Precast products are often different products from those formed from readymixed concrete. Precast concrete EPDs account for reinforcement, moulds and casting. Comparison and targets should always be applied to functionally equivalent products.

2 "Good practice OPC/CEM I" is defined as the average net GWP minus one standard deviation.

3 "Good practice concrete mix designs" for a range of concrete products (different strengths), is defined in terms of best use of cement (i.e. least weight of cement per unit volume produced whilst meeting necessary performance).

To estimate the Near Zero Emissions Product Threshold for concrete by 2050, the following assumptions were made: clinker content in cement will be reduced to 0.52, cement's carbon footprint will align with IEA near-zero definition, and cement usage per unit volume of concrete will decrease by 14% through advancements in admixtures, a shift to 56-day compressive strength, and performance testing. The 14% reduction is applied to an average cement content based on current mixes, weighted by each country's cement output. Additionally, all other materials, transport, and manufacturing processes will have zero carbon footprint.

After establishing the global reference threshold (top of Band E) and the near-zero emissions threshold (bottom of Band A), five equal bands (A to E) are defined between these points. Additionally, two more bands are recommended: Band F, which extends above Band E, and Band G, which has no upper limit, covering all concrete products not included in Bands A to F. These extra bands ensure that all concrete products and producers are included in the procurement process, allowing countries flexibility in their use.

Environmental Product Declarations (EPDs) are the preferred method for measuring a product's carbon footprint in low-carbon procurement because they offer established standards that simplify comparisons across construction materials. With a global infrastructure for creating and verifying EPDs, they provide a consistent and reliable approach. Each EPD includes a GWP indicator, making carbon footprint assessment straightforward. Additionally, construction professionals are more familiar with EPDs than other methods, and the transparency provided by EPD standards and Product Category Rules (PCRs) ensures clear ratings of environmental impacts throughout a product's life cycle.

To compare against the global thresholds (Figure 3.1) the GWP of the concrete product first needs to be calculated according to the EPD methodology and more specifically:

- Standards: EN 15804+A2, PCR-001 - Cement and building lime (EN 16908) and PCR-003 - Concrete and concrete elements (EN 16757)
- Database: Ecoinvent
- Scope: cradle to gate (A1-A3)
- Waste CO_2e accounting as per ISO 21930 and EN 15804+A2: i.e. "Polluter Pays Principle" emission accounting adopted but methane avoidance not taken into account.

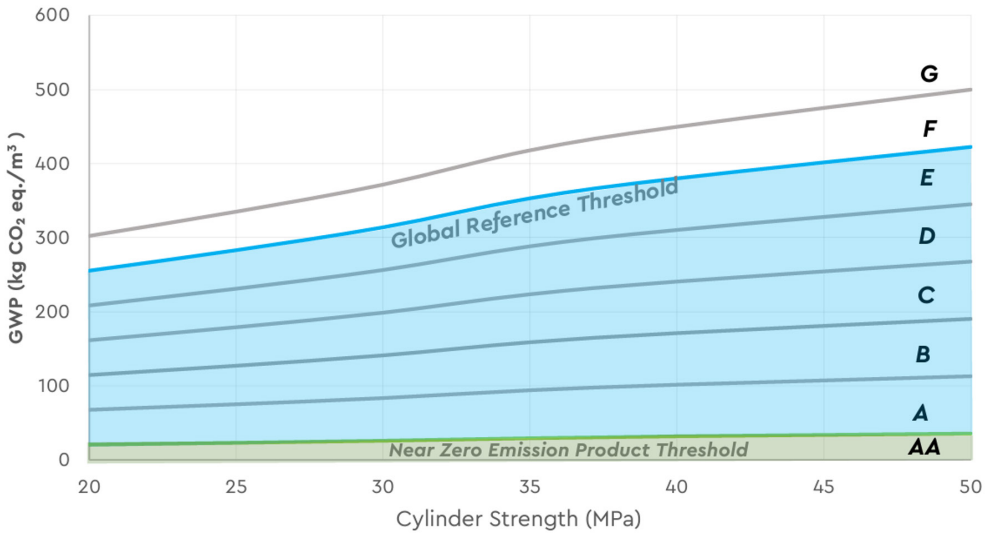

Figure 1 – Global Ratings for Low Carbon and Near Zero Emissions Concrete

According to EPD standards ISO 21930:2017 and EN 15804, the environmental impacts of using secondary (non-waste) fuels must be included in a cement EPD. However, when waste is used as fuel, its environmental impacts are assigned to the original product system that generated the waste, in line with the 'polluter pays' principle. This means that the EPD for cement should report the emissions after subtracting those related to the co-processing of waste. The EPD verifier is responsible for ensuring that the fuel classified as waste meets the necessary criteria. This reporting is referred to as "net".

In some countries, there might be different approaches to EPD reporting. For example, some might not subtract emissions related to the co-processing of waste, ("gross" reporting), or they might credit the cement with avoided methane emissions. In such cases, an adaptation process can be used to adjust the global threshold values.

4.0 UK Adaptation

The UK takes a distinct approach to EPD reporting in relation to waste emissions. Unlike some global practices, emissions from the co-processing of fossil waste are not deducted; instead, a "gross" value is reported as the primary Global Warming Potential (GWP) indicator.

While aligned with global standards such as EN 15804 and cradle-to-gate impact assessments, the UK adaptation addresses specific differences in waste emissions accounting (reporting "gross" GWP), concrete strength notation (cylinder vs. cube strength), and an extended strength range. This adaptation ensures compatibility with UK EPD practices while maintaining global consistency and comparability across GWP bands from AA to G.

Importantly, the adaptation does not introduce new or UK-specific bands. Instead, it adjusts the presentation of existing bands to reflect gross GWP reporting, ensuring that local EPDs align with the UK's version of global bands.

To facilitate these adaptations, the GCCA collaborated with the Mineral Products Association (MPA). Data was gathered from UK cement manufacturers, focusing specifically on CEM I "gross" and "net" GWP EPD values.

Band E modification

An analysis of gross and net GWP values for 6 CEM I EPDs published by 5 UK cement producers revealed a weighted average difference of 10.25%. This percentage was used to adjust the Band E value for the UK by increasing the contribution of cement emissions in a specific concrete strength by 10.25% and adding all other A1-A3 emissions associated with concrete production.

For instance, the GCCA global Band E value for a 20 MPa (cylinder concrete) is 255 kg CO_2 eq./m^3. Of this, 233.4 kg CO_2 eq./m^3 is attributed to cement (net GWP value), while 21.6 kg CO_2 eq./m^3 accounts for all other A1-A3 emissions. By increasing the net GWP cement value (233.4 kg CO_2 eq./m^3) by 10.25% and adding 21.6 kg CO_2 eq./m^3, the modified Band E value for the UK is derived.

Band AA modification

The Band AA, or near-zero concrete band, is based on theoretical values and assumptions, reflecting the 2050 target. To adjust the near-zero concrete threshold, the values were increased by approximately 25 kg CO_2 eq./t of cement. This adjustment accounts for emissions from waste incineration, assuming a 15% use of alternative fuels derived from waste by 2050.

After establishing the modified Band E and Band AA values, five equal bands (A to E) are defined between these points.

The global ratings are directly applicable in countries where concrete strength is reported in cubic terms. In the UK, however, concrete is typically described using both cubic and cylinder strengths. For example, a C20/25 concrete refers to a cylinder strength of 20 MPa and a cubic strength of 25 MPa. To accommodate this, the x-axis of the definition graphs was modified to display both strength values.

For concrete strengths below 20 MPa and above 50 MPa, GWP values were extrapolated due to the lack of available data. The assumed slopes for these strength ranges are consistent with the Universal Classification scheme, which is based on theoretical mix designs.

The adapted ratings for the UK are presented in Figure 2.

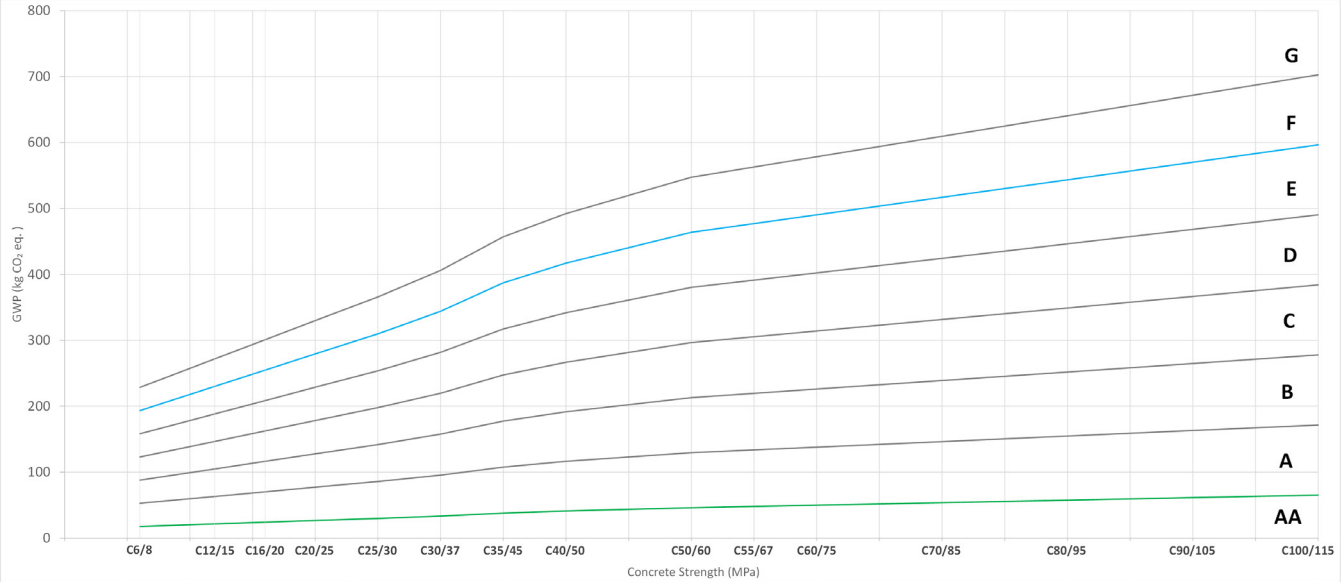

Figure 2 – UK Adaptation: Global Ratings for Low Carbon and Near Zero Emissions Concrete

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The Mineral Products Association is the trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and industrial sand industries.

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