Specifying concrete for a sustainable built environment

The Government's commitment to net zero carbon for UK is to achieve the goal by 2050. To make a genuinely positive impact to global climate change this needs to be achieved without significant carbon leakage – where we use products that emit their carbon elsewhere. The timeline of 2050 to some is not soon enough, but for many it is a significant challenge. For concrete, important strides have been achieved already (as ten years of industry reporting indicates) but there are demands for more action and faster results across all sectors and industries. ***Guy Thompson*** *of* ***The Concrete Centre*** *reports.*

Concrete is an essential contributor to our current and future built environment, so while industry assembles a coherent package of strategies and innovations to deliver the net zero challenge, those specifiers, clients, contractors and users of our buildings need to ensure that concrete is used as efficiently as possible now. This is not just a material issue but also encompasses how we build, use, maintain and re-employ our new and old concrete structures to best effect. Nevertheless, the fact that metrics for measurement of some of these categories are less available doesn't diminish the need for their collection and subsequent action nor their inclusion in our whole-life evaluation.

Specifying Sustainable Concrete

The Concrete Centre guide *Specifying Sustainable Concrete*[1] is one of the company's most downloaded publications, providing guidance to enable the project team to balance the desire to specify concrete with low environmental impacts, while ensuring that its other performance parameters are optimised. Originally published in 2011, it has undergone periodic updates and minor revisions. A new version will be published in March 2020 to include the latest data and information to update specifiers.

While this guide aims to inform the specification of low-carbon concrete that is appropriately optimised to achieve a truly sustainable building or infrastructure solution, it is now recognised that concrete specification is but a part of the answer. These considerations need to be balanced with other key criteria required by a life-cycle analysis approached on a whole-life basis, taking into account: material-efficient engineering design solutions; construction methodologies; in-use operational benefits (such as thermal mass and the potential for energy savings); the potential for reuse or repurposing; as well as end-of-life outcomes.

All of these are key attributes to which concrete can contribute.

Thus, the focus on embodied carbon becomes an investment decision considering the whole life of the building, as well as using the material to its best advantage to save carbon now, while even lower-carbon concrete solutions are in development that will play a part in the journey to net zero carbon.

Concrete's role in delivering a sustainable built environment through the performance benefits of durability (long life), robustness (strength and low maintenance), fire resistance, thermal mass (energy efficiency), acoustic performance and climate change resilience (flood and extreme weather), and support for a healthy indoor environments – together with design excellence (potential for a reduced need for applied finishes) – is increasingly recognised and used by design teams in the delivery of the most sustainable projects and infrastructure.

Concrete is a versatile and natural material, and designers can use it efficiently to deliver structure and other functions of integrated designs. In addition, concrete and its constituents have other strong sustainability credentials; for example, they are local to the UK and many have been certificated to the highest, most demanding responsible sourcing Standards.

Sustainability factors

These are among the many sustainability factors that result in designers choosing concrete. Sustainability is about optimising economic, social and environmental issues. Many assessment tools and methodologies have been developed to provide measurement and comparison. The shortcoming of generalised tools is that they are general and specific geographical or project constraints may not be accounted.

A challenge for all assessments is in weighting the different factors that often have different units of measurement; for example, how does one compare biodiversity, health and safety and transportation CO_2 emissions? Therefore, it is accepted good practice for designers to not simply follow a tick-box mentality in their use of assessment tools but to understand the factors and take a holistic and whole-life view of sustainability when considering their project in a whole-life context.

Whole-life thinking calls for a longer-term perspective. Specification decisions and carbon measurement must consider the operational performance of a building or structure, its flexibility to adapt to user needs and its recycling at the end of life, as well as the materials used in its construction.

While embedded carbon from manufacturing processes associated with concrete may be easier to calculate (unlike many imported materials), alone it fails to address some critical factors that are of key importance when assessing the true environmental impact of buildings and infrastructure over their lifetime. Clients need to have a far greater appreciation of the fact that buildings must last longer and may have multiple uses over their life cycle.

The European Standard for concrete BS EN 206[2] and its UK complementary Standard, BS 8500[3] in themselves do not yet contain any provisions for specifying sustainability.

Sustainability cannot be separated from performance. Concrete is a unique material in that the specifier has the ability to directly influence the constituent parts of the mix to ensure an optimum carbon footprint that meets the performance criteria and addresses the design imperatives of resource and energy efficiency within a whole-life context, which also addresses the precepts of a circular economy. ■

References:

1. CONCRETE CENTRE. *Specifying Sustainable Concrete*. MPA–The Concrete Centre, London, 2019, available at: *https://bit.ly/2RTecwY*.
2. BRITISH STANDARDS INSTITUTION, BS EN 206. *Concrete. Specification, performance, production and conformity*. BSI, London, 2013+A1:2016.
3. BRITISH STANDARDS INSTITUTION, BS 8500. *Concrete. Complementary British Standard to BS EN 206. Part 1 – Method of specifying and guidance for the specifier. Part 2 – Specification for constituent materials and concrete*. BSI, London, 2015+A2:2019.
4. BUILDING RESEARCH ESTABLISHMENT, BES 6001. *Framework Standard for Responsible Sourcing*. BRE Environmental & Sustainability Standard, Issue 3.1, Watford, 2016.

Key guidance for specifying sustainable concrete

- The balance between the reduction of embodied CO_2 of concrete and the design, specification, construction method and contract programme need to be considered at an early stage.
- Only specify BES 6001[4] responsibly sourced concrete and reinforcement.
- Consider specifying strength at 56 days rather than the conventional 28 days, where appropriate.
- Specify concrete with a wider range of cement types/combinations selected from Table 1 from BS 8500-2[3].
- Use of cementitious additions can both reduce the embodied CO_2 of concrete and influence its visual appearance. When aesthetics is critical, specify the cement/combination to achieve colour consistency.
- Specify the strength required from producers with product conformity certification.
- Permit the use of admixtures. Admixtures can be used to enhance sustainability credentials and reduce the eCO_2 of concrete, as well as modifying its physical properties.
- The specification of recycled and secondary aggregates may not be the most sustainable option. Recycled aggregates should generally only be specified when they are locally available, otherwise CO_2 transportation impacts are likely to exceed the intended benefits.
- Permit the use of recycled or secondary aggregates but do not over specify. BS 8500 already allows producers to use up to 20% of recycled aggregates in many concretes.
- Specify the largest maximum aggregate size conducive to achieving efficient placing and full compaction.

Reception hall at AHMM's White Collar Factory.