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RESTORED TO GLORY

Advanced repair techniques return
Saltdean Lido to its 1930s heyday

PERMEABLE PAVING

SuDS as a key part of holistic design,
embracing 'sponge city' principles

IRISH CONCRETE SOCIETY AWARDS

The Church of Oak Distillery – 'a refined
palette of concrete finishes'



“Despite the CO₂ emissions associated with transportation, importing into the UK is still a very efficient use of the granulate – which is a traded commodity that benefits the UK economy – for a number of reasons.”

The production of CEM I Portland cement (PC) is energy intensive and produces high levels of CO₂, from the calcination of limestone and the fuels used to heat the kiln.

Heidelberg Materials UK has invested heavily to reduce process emissions through improved efficiencies and by increasing the amount of alternative fuels used. The company is also developing carbon capture and storage facilities, which will prevent these emissions from entering the atmosphere.

However, until this technology is widely available, developing and using supplementary cementitious materials (SCMs), which reduce the CO₂ impact of concrete by replacing some of the cement content, remain vital to minimising carbon emissions.

GGBS – a by-product of iron and steel-making – is one of the best-known SCMs. It has been used for over a century, with the first British Standard for Portland blast-furnace cement having been published in 1923^(1,2).

HIGH REPLACEMENT LEVEL

GGBS can be used almost anywhere where concrete is needed and can replace a substantial part of the PC content in concrete – up to approximately 70% but it can be even higher in special applications. It is this high replacement level that means GGBS is the most effective SCM in terms of delivering carbon reduction as others, such as fly ash, calcined clays and limestone fines, can only be used to lower replacement levels without impacting on the performance of the concrete.

Clarity on the environmental performance of Heidelberg Materials UK's GGBS – evoBuild low-carbon GGBS (previously known as Regen GGBS) – has been provided with a new Environmental Product Declaration (EPD). It has been published by EPD programme operator EPD-Norge, in accordance with EN 15804⁽³⁾. It also confirms

the global warming potential (GWP) of evoBuild low-carbon GGBS, including an economic allocation for the granulate and the emissions from transport of imported granulate, is 155kgCO₂e/t. This compares with 840kgCO₂e/t for the average GWP from CEM I in the UK⁽⁴⁾.

The use of GGBS is also proven to increase the long-term durability of concrete, further cutting a project's environmental impact by reducing the amount of repair and maintenance needed and extending the service life of concrete structures.

It provides enhanced resistance to both ettringite and thaumasite forms of sulfate attack and lowers ingress of chlorides into a structure. GGBS also minimises the risk of alkali-silica reaction, provides better resistance to acid attack and reduces the risk of thermal cracking in large concrete pours by lowering the heat generated during curing.

DIMINISHED STEEL MAKING

In recent years, the UK's domestic iron and steel-making industries have diminished and now just one steel works with blast-furnace operations remains in Scunthorpe. As a result, Heidelberg Materials needs to import granulated blast-furnace slags from other countries.

Yet, despite the CO₂ emissions associated with transportation, importing into the UK is still a very efficient use of the granulate – which is a traded commodity that benefits the UK economy – for a number of reasons.

Countries not already producing GGBS at scale are unlikely to invest in grinding infrastructure in an era when blast-furnace iron and steel production is on a decreasing trend. If the granulate is not traded, it will be stockpiled and, because it contains calcium oxide – so is a latent hydraulic, rather than purely pozzolanic, material – it will lose reactivity over time.

As a result, either stockpiled granulate needs to be ground more finely, which demands extra energy and creates greater wear on the

mills, or the binder content of the concrete needs to be increased to achieve the same strength level for a given blend ratio.

Also, in most cases, better and more efficient GGBS is made by blending several sources of granulate. This is because the composition of many granulates is not ideal and can even be prohibitive in making a single-granulate GGBS. If it is seawater quenched, for example, the chloride levels might be far too high; high levels of titanium affect grindability, low v-ratios and glass count affect reactivity, and high alumina levels can be prohibitive with regard to concrete durability.

TRANSPORT

In addition, as the UK is a small island with several deep-sea ports, it can accommodate large, 40,000-tonne ships to efficiently import granulate to grinding facilities, which are all based in coastal regions. The UK also tends to have shorter inland transport distances than other countries, helping to keep transport-related CO₂ emissions to a minimum.

Heidelberg Materials UK has been importing granulate for decades and has wide experience of producing GGBS from a variety of sources. Through its parent company, it has access to the global granulate market for both long-term contracts and spot requirements.

The anticipated long-term trend of a reduction in global blast-furnace steel-making cannot be ignored. However, Heidelberg Materials UK has a safe and secure supply for its anticipated granulate demand for at least the next decade. To satisfy the changing demand for lower-carbon concrete solutions, the company is also proactively assessing and developing future SCM options, which include calcined clays and natural pozzolans. **C**

References:

1. CLEAR, C. UK Procedures for the Use of Additions as Part of Cement in Concrete. *Proceedings of the XVII ERMCO Congress*, Istanbul, 2015.
2. BRITISH STANDARDS INSTITUTION, BS 146. *Specification for Portland blastfurnace cement*. BSI, London, 1923.
3. BRITISH STANDARDS INSTITUTION, BS EN 15804. *Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products*. BSI, London, 2012+A2:2019, under review.
4. MINERAL PRODUCTS ASSOCIATION, Fact Sheet 18. *Embodied CO₂e of UK cements*. MPA, London, 2025.

MAIN IMAGE:

evoBuild low-carbon GGBS.

INSET:

GGBS is used in applications such as Blackpool's sea defences.

STILL THE BEST SCM

Ground-granulated blast-furnace slag (GGBS) has been used as a cement replacement product for over a century in the UK. **Phil Matthew** of **Heidelberg Materials UK** explains why it is the best supplementary cementitious material (SCM) for delivering carbon reduction.



(Photo: Andrew Stagg)