



15 September 2026

THE FUTURE OF GREEN DEVELOPMENT IS GREY. AND A BIT MESSY!

TBBD's Ben Sanders gives the inside track on the low-carbon concrete trial at Symmetry Park Biggleswade.

It may be a surprise to some to learn that concrete is the most widely used material on the planet after water. Cement production alone accounts for around 8% of global carbon dioxide emissions – more than aviation and shipping combined. For us as an Industrial and Logistics (I&L) developer these are statistics we can't ignore.

Warehouse schemes typically use more concrete and steel than developments of similar value in other property sectors, like office, residential or retail. The concrete in large warehouse floor slabs, 50m service yards and the foundations for a portal frame all adds up – if we're serious about reducing the embodied carbon in our buildings, concrete must be part of the conversation.

Investors increasingly expect this too. Embodied carbon is a genuine factor in how logistics schemes are assessed by the institutions that fund and own them. While it's fair to say it isn't always a high priority for occupiers, that shouldn't be a reason to ignore it. Being a responsible developer means looking for ways to build more sustainably, regardless of who's asking.

That's the thinking behind the low-carbon concrete trial we've been running on one of our recent developments.

Symmetry Park Concrete Trial

We chose to target yard slab concrete mixes in this trial and used a section of the estate road as our testbed. By pouring bays of experimental concrete within the tarmac roadway, we have kept the test samples within the Landlord's ownership to allow us to monitor them over their lifespan and to collect data in a location where it is suitable to experiment, without exposing occupiers to any risk.

Working with materials specialist Joe Quirk from our contractor VolkerFitzpatrick, and our embodied carbon gurus James Ball and James Lomas Holt from Ridge, we set out to explore design options that could meaningfully cut the embodied carbon in concrete mix designs without adversely impacting their structural performance.

While there are a multitude of potential low-carbon options available, it's a challenge to find material options that are both robust in engineering and design terms, and also widely-available in the commercial market.

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Cement is the key target here. The primary ingredient in cement is limestone, which needs to be chemically broken down using extreme heat to create lime needed for cement clinker. This process releases carbon dioxide and requires intense heat, demanding enormous amounts of energy, normally produced from burning heavy, carbon-intensive fossil fuels. It's estimated that cement production accounts for around 80% of concrete's total emissions, so reducing it is the single biggest lever available.

Although alternative low-carbon binders, such as Pulverised Fuel Ash (PFA) and Ground Granulated Blast-Furnace Slag (GGBS) (waste products from coal-fired power stations and iron and steel manufacturing respectively), are widely used in the industry, their low rate of strength gain limits the proportion of how much of each can be used in most mixes. And yes, I know that there are questions around the long-term availability of PFA and GGBS, as the industrial processes needed to produce these products decarbonise, but given the UK Government's recent take-over of British Steel's Basic Oxygen Furnace (BOF) plant, I think the supply of GGBS at least is probably guaranteed for the time being.

Our initial plan was to look at materials such as calcined clay as a binder replacement and graphene as a strength enhancer, but we simply couldn't source either of them in the quantities we needed – the supply chains for these materials aren't yet built for projects at our scale. So instead, we looked at ways to reduce the carbon in our standard concrete mixes through simple changes that can be easily replicated anywhere in the country by our usual supply chain.

We set out to lay one reference bay of standard Pavement Quality 2 (PAV2) concrete with two bays of experimental lower-carbon mixes. Our first experimental batch simply increased the size of the aggregate from 20mm to 40mm, thereby reducing the quantum of grout (therefore cement) required. Our second trial mix, an Alkali Activated Cementitious Material (AACM) went further; it's effectively a mix containing a very low Ordinary Portland Cement (OPC) content, replaced with an unusually high proportion of GGBS and PFA, along with an accelerator to help the mix cure within acceptable timelines. The 40mm aggregate mix didn't pose too many challenges, but the AACM mix definitely wasn't straightforward; the first mix attempt cured so quickly that it was unworkable, and the contractors couldn't place it, meaning that it was broken out the next day and sent for crushing. A modified second mix design was better but still cured much more quickly than the standard concrete mixes our teams are used to working with, giving the installers a significant challenge. The result? Not the best-finished bay of concrete I've ever seen, despite the team's best efforts!

Watch this space

The good news is that both of those mixes showed healthy reductions in embodied carbon when compared with the benchmark PAV2 yard slab mix – the 40mm aggregate mix was 12% lower and the AACM mix showed a 58% reduction in carbon. And so far, both trial areas have successfully withstood

loads from the construction phase. While we're unlikely to start adopting the AACM mix for service yards without significant further work to modify the mix design, it's given TBBD invaluable data to start planning for our next trial. And we're already looking into whether a 40mm aggregate mix can be more widely adopted.

The real test is long-term performance under traffic loads, and with some units on the park still unoccupied, we don't have that yet. So rather than start the clock now, we'll monitor all three panels for 12 months from when the surrounding units are occupied and the roads are carrying their planned daily use.

We don't have all the answers yet, and we won't pretend the trial has been seamless. But that's rather the point. If developers like us aren't willing to test, fail, adapt and try again on these design and carbon challenges, then embodied carbon reduction will remain a talking point rather than a practice. We'll share our experiences as the trial continues, as well as any learning that comes out of our planned next round of trials. Watch this space.

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Notes to Editor

About Tritax Big Box Developments

Tritax Big Box Developments (TBBD) is a Tritax Big Box REIT associated company dedicated to logistics development. TBBD specialises in identifying and securing strategic land, developing large-scale, best-in-class logistics facilities that meet the evolving needs of modern businesses.

Tritax Big Box REIT plc

About Tritax Big Box REIT plc

Tritax Big Box REIT plc (ticker: BBOX) is the largest listed investor in high-quality logistics warehouse assets and controls the largest logistics-focused land platform in the UK. Tritax Big Box targets attractive

and sustainable returns for shareholders by investing in and actively managing existing built investments and land suitable for logistics development. The Company focuses on well-located, modern logistics assets, typically let to institutional-grade clients on long-term leases with upward-only rent reviews and geographic and client diversification throughout the UK. Additionally, having adopted a “power first” approach, the Company has recently secured its first data centre development opportunities (amounting to over 250MW), and has a pipeline of c.1-gigawatt of further opportunities, offering the potential to deliver exceptional returns on an accelerated basis.

The Company is a real estate investment trust to which Part 12 of the UK Corporation Tax Act 2010 applies, is listed on the Official List of the UK Financial Conduct Authority and is a constituent of the FTSE 100, FTSE EPRA/NAREIT and MSCI indices.

Further information on Tritax Big Box REIT is available at trifaxbigbox.co.uk