Precast & Masonry 2024

The Power of AI

Art of Mixology

Concrete Masonry - A truly local product

Mineral Products Association

Contents

The local and sustainable construction product

KPI data collected for 2022 covered 128 production sites that manufactured 16 million tonnes of precast and masonry products and employed nearly 10,000 full time equivalent members of staff. Our estimate is that this represents approximately 70% of UK's precast and masonry production.

Certification and management systems
Over 88% of production sites certified to both ISO 9001 and ISO 14001.

Resource efficient
Waste to landfill has reduced by 78% since 2012 to 360 grammes per tonne.

Road to net zero
Factory CO_2 emissions reduced by 46% since 2010.

Innovation
Use of lower carbon cements has reached 25.7% of all cementitious materials.

Energy efficient
56% of electricity used in precast and masonry factories is from renewable sources.

Local
Transport CO_2 of less than 5kg CO_2e/ tonne.

Welcome

The UK construction industry stands at a pivotal juncture, grappling with economic instability and an urgent mandate to innovate toward sustainability.

Amidst this complex backdrop, the precast concrete and masonry sectors face unique challenges that demand both strategic resilience and forward-thinking solutions. It is not just changes in the economic landscape we must contend with but politics too. At time of writing the Prime Minister has just fired the starting gun on the July 2024 election campaign. Our two major political parties have shifted into election mode, with soundbites and pledges a plenty.

This is the perfect opportunity to set out our own precast and masonry manifesto for a sustainable sector, fit for the future. A sector that is equipped to deal with short, medium and long-term challenges.

Our Precast and Masonry pledges:

1. Transition to lower carbon products
2. Provide quality data to support decarbonisation
3. Champion innovation and digitalisation
4. Promote social value in partnership with local supply chains
5. Call for material neutrality in policy and regulation
6. Source materials responsibly and improve the UK's self-sufficiency for construction materials

Unlike some of our political contemporaries we are already well on our way to deliver. For example, members are investing in R&D to optimise mix designs in line with the new version of BS 8500, a topic explored on page 18. Data from our annual KPI data collection shows that lower carbon, supplementary cementitious material (SCM) use, particularly the inclusion of limestone fines, is rising significantly. And not only are lower carbon mixes available, but innovative products are also available that capture carbon.

Alongside decarbonisation activities, the sector is committed to accurate data provision. Through our work with OneClickLCA, members all have access to a market leading LCA tool and many are producing third party verified EPDs for their products. Within the MPA we are also refreshing our sector EPDs with masonry and precast EPDs due to follow those published for cement and ready-mixed concrete.

Innovation is perhaps our greatest strength; as shown in the sector's use of Artificial Intelligence (A.I). Through partnerships with universities the sector is delivering research into topics ranging from, novel cementitious materials, pipe bedding efficiencies, reductions in microplastics and floating offshore wind. In the precast sector we are also proud to work with Derby University on their apprenticeship programme to bring the next generation into our industry.

We do however face external challenges, especially in housing where timber's perceived sustainability benefits have turned the heads of policymakers eager to meet environmental commitments. However, we will continue to lobby hard to uphold the principles of material neutrality, a theme explored later in this publication. Government should not ignore the long-term advantages of masonry, such as durability, fire resistance and thermal mass.

The masonry sector has responded to the government timber roadmap by highlighting its strengths and addressing misconceptions about its environmental impact. Investing in sustainable masonry practices, such as using low-carbon cement and incorporating recycled materials, should remove questions of a disparity in sustainability performance. Moreover, the industry should emphasize the circular economy benefits and resilience of masonry structures, which offer superior longevity and require less maintenance compared to timber.

Finally, it is important that we highlight the important role our sector plays in both our national and local economies. Local supply chains, responsibly sourced materials and community outreach all contribute to the social value delivered by the MPA membership.

We aren't standing for election but by investing in sustainable practices, embracing digital technologies and fostering collaborative partnerships, our sector can not only overcome current challenges but also pave the way for a more robust and environmentally responsible future.

Mark Shepherd | *Director, Mineral Products Association*

The Power of AI

MPA's Matthew Butcher has a chat with Dr. Ross McWhirter, Lead R&D Engineer at FP McCann explores the use of AI in precast concrete manufacturing.

Matthew Butcher [Open chat]

ChatGPT, I need to write an article on the applications of artificial intelligence (AI) in the precast concrete sector, can you help me?

ChatGPT

Absolutely, AI is revolutionising the precast concrete sector with its applications across various stages of production, from design to manufacturing and quality control. Here's a simplified list of AI applications in precast concrete manufacturing: Quality Control, Design Optimisation, Predictive Maintenance, Supply Chain Management, Energy Efficiency, Robotics and Automation.

Matthew Butcher

A varied and exciting list but to get more detail we need to turn to a human expert in the precast sector. Thankfully Dr Ross McWhirter, Lead R&D Engineer in AI at FP McCann has joined the chat to give us the lowdown how AI is being used across the precast concrete production process.

Dr Ross McWhirter joined the chat

Matthew Butcher

Ross, how is AI being used to optimise precast concrete manufacture? Can you tell me what is being done at FP McCann?

Dr Ross McWhirter

FP McCann has been working on AI solutions within our precast concrete factories for almost three years within our R&D department. Automated software systems have been produced to target the entire production line for multiple products ranging from inspection of raw materials to final-stage quality assurance.

Through the application of high-resolution camera arrays, the properties of raw aggregate can be measured using advanced computer vision algorithms. This data is processed by AI models trained on company production data designed to optimise the concrete mix recipes. Through this, adjustments can be made to production mixes in real-time to improve resource efficiency, reduce waste and eliminate carbon emissions from downstream processing.

We are also developing AI solutions for high-precision measurement of the energy usage of production machinery. Typical energy monitoring operates on timescales of 30 minutes and accounts for the global energy consumption of the factory. This lacks the spatial and temporal resolution to identify events associated with a raw material issue or specific machinery faults in real-time.

Using an in-house platform of networked energy sensors, our precast factory in Northern Ireland is monitoring the power usage of the individual motors and pumps of multiple critical production machines with a resolution of 10 seconds. Working simultaneously with the production computer control system, an AI platform processes the significant volume of data in real-time so that anomalous events are quickly identified, classified, and highlighted to production staff.

These data-driven decision-making systems are providing a pathway to hybrid smart factories for precast concrete production. The combination of human expertise and the data collection and processing power of automated AI systems is allowing for reduced power consumption, reduced production downtime and improvements to the production processes.

An example of this process is the predictive maintenance of production machinery where multiple anomalous events in a specific component are detected, and maintenance can be commissioned prior to failure. This minimises production downtime and reduces material waste from defective production due to mechanical faults.

Matthew Butcher

What about quality control, a major benefit of precast manufacture traditionally. What role can AI play there?

Dr Ross McWhirter

Computer vision and AI are already a big part of the manufacturing quality assurance process in many industries such as food production lines and waste recycling. At FP McCann, the production lines for concrete pipes and concrete roof tiles were identified as ideal locations to develop this technology due to high volume production.

Our pipe test lines are now using AI-powered camera systems capable of measuring the 3D geometry of the spigot and sockets of every pipe identifying tolerance issues. Digitising the 3D profile of the pipe also allows a computer vision AI model to scan for surface defects throughout the pipe without requiring time-consuming scans.

Meanwhile, the new concrete tile factory at Cadeby, England, operates production lines creating tiles at a rate of up to 140 tiles per minute. A high-resolution camera AI system has been developed which can image the tiles, identify defects, and perform real-time quality assurance decisions in under 200 milliseconds enabling a consistent, trackable, and transparent quality assurance process on these production lines.

Matthew Butcher

Thanks Ross, it is clear that the applications for AI will only continue to grow as technology improves. But AI is just one tool in a much wider digital future for construction.

Over the last decade, a digital revolution across the construction sector has continued to build momentum, leading to advancements in Building Information Modelling (BIM) and Modern Methods of Construction (MMC).

At the heart of all these technologies is data. There is significant potential for AI systems to be able to utilise this data as a tool for further innovation. With every construction project a potential data source, there lies an opportunity for the industry, supply chain and its clients to analyse and benefit from the insights generated.

AI will provide the ability to advise designers and engineers on the best methods and materials to use on projects, and perhaps even eventually indicate the optimal structure for a given brief from a technical, economic and sustainability perspective.

As Dr McWhirter explained AI is already being used to optimise concrete mixes, which will drive increased productivity as well as continue to facilitate low carbon decision making.

The potential dangers of AI

The UK concrete and cement sector is part of a minerals industry which employees more than 80,000 people. It's essential that jobs are protected, and we use AI technology ethically and responsibly.

One much publicised risk of AI systems is its ability to inadvertently perpetuate or amplify biases of data samples.

In construction there is the threat that this could lead to material biases bolstered by incorrect or incomplete datasets. It is imperative that the application of AI in construction is on the grounds of up-to-date, accurate data, especially in the realm of embodied carbon.

In a sector decarbonising as quickly as the UK concrete and cement industry it is vital that the latest data is used in sustainability assessments, be they carried out by human or machine.

A positive future

Provided AI is used responsibility it will be a powerful tool in construction and precast concrete with its offsite factory-controlled environment is ideally placed to capitalise.

To end let's go back to Ross for his views on AI's future potential. Ross where do you see the use of AI and digitalisation going within the sector in the next 10 years?

Dr Ross McWhirter

I can only see the demands for this technology increasing. The adoption of these technologies is going to be required by concrete manufacturers to remain competitive in this sector. With customers asking more questions about sustainability and environmental efforts, efficiency improvements will be mandatory whilst cement remains a primary component to concrete production.

Innovations in sensor and computing technology will lead to fully automated smart factories. Real-time digital twins, computer models of the current factory conditions, will be constantly analysed by AI models. Like how AI learned how to play games like Chess and Go, these algorithms will be able to make and test thousands of decisions per second on a wide range of production issues at a rate beyond the most experienced human operators.

ChatGPT

Is there anything else I can help you with?

Matthew Butcher

Show me videos of cats running through fresh concrete and leaving paw prints.

Google it -

King's Cross " landscraper" HQ a precast concrete marvel

Client:	**Google**
Project Team:	**Lendlease & Permasteelisa UK**
Contractor:	**Explore Manufacturing part of Laing O'Rourke**
Explore Manufacturing Project Value:	**£21m**
Completion:	**2024**

“It’s a testament to what can be accomplished when we embrace challenges and push the boundaries of prefabrication & offsite construction.”

As you pull into either King’s Cross or St Pancreas stations you can’t help but notice Google’s new KGX1 UK headquarters.

It is designed by BIG and Heatherwick Studio and is located at the heart of one of the most exciting and recently redeveloped neighbourhoods in north London. Dubbed the “landscraper” the striking building is 330m (1,082ft) in length making it longer than the height of the Eiffel Tower or the 310m height of The Shard. In an age of hybrid or home working it is developments like this, with approximately 80,000sq m (861,100sq ft) of office space, that have the potential to pull people back to the city post-covid. Among the features available to Google’s workforce are extensive landscaped roof terraces, a running track and a swimming pool.

The project reflects Google’s unique approach to the creation of a large headquarters building in an urban environment. Upon completion Google’s King’s Cross campus will be able to house approximately 7,000 employees. Thus, strengthening the economy of the so-called Knowledge Quarter, a new world-class centre for research. Architecturally, the development is a testament to hybrid design, but it is the four rings of the precast concrete facade that really catch the eye.

Also known as ‘Platform G’, the structure isn’t a gateway to Hogwarts, but you would be forgiven for being spellbound by the flowing concrete lines. The concrete facade is designed as a non-rain screen concrete façade, difficult from an engineering perspective due to the section profiles, span and finish requirements. The units are heavy blasted which can take up to eight hours to complete individually. The variation in panel type was also a challenge as Stephen Anthony, Technical Leader at Explore Manufacturing explained, “As the panels transition down the length of the building from Zone 1 on the south to Zone 5 on the north elevations they went from overhung to underhung panels creating different tapers to each panel that had subtle mould adaptions. Along with the varying geometrical shapes the aesthetic requirement was to have 3 different finishes on the surfaces of the panels” Together the façade panelling makes up the four eye catching rings of the building which tie other elements like the glazing and timber mullions together.

Ben Corlett, Contracts Leader at Explore Manufacturing, echoed why the KGX1 facade wasn’t your average precast project. “The project’s success hinged on achieving consistent aesthetics across a range of complex geometries and varying panel orientations with dramatic tapers. By tailoring the concrete mix, blast depths and utilising advanced mould designs, we were able to achieve some incredible geometries and fantastic finishes. It’s a testament to what can be accomplished when we embrace challenges and push the boundaries of prefabrication & offsite construction.”

As is to be expected from a multi-billion-pound tech giant, digitalisation and building information modelling (BIM) were requirements from the outset. The early involvement of specialist offsite concrete contractors, Explore Manufacturing part of Laing O'Rourke, meant that prefabrication could be baked into the model at an early stage. By choosing precast concrete the developer was able to capitalise on a number of benefits unique to this form of modern method of construction (MMC).

Although MMC can be associated with the installation of lightweight materials, the production of precast concrete panels for both floor, facade and structural units has been tried and tested over many years, with concrete MMC delivering significant advantages over lightweight construction. Concrete is an inherently non-combustible material with the highest fire safety rating of class A1, reducing risk and providing more reliable construction and greater confidence to clients.

The offsite structural components consisted of bespoke pre-stressed floor slabs, stairs and walls, removing the requirement for mass insitu pours on an access restricted site. This moved labour and risk off site to a more controlled environment. The fact that these were produced in factory conditions resulted in architecturally presentable, blemish and mark free soffits.

The main structure itself consists of five structural cores, from which steel trusses span outwards at the top which in turn support the rest of the steel structure. Installing the precast concrete facade required counterbalance frames which allowed units to be installed level. This is important as when the centre of gravity rotates most precast façade units also rotate slightly when lifting.

The offsite approach also allows for programme optimisation with 'just-in-time' delivery of units ready for installation. All required elements from a fully digital construction model can be planned into production schedules, meaning that Explore were able to meet the delivery and access demands of an urban setting in the heart of London.

The internal structure and floor design is also a unique feature with every third floor stretching the full width of the building. These major levels are constructed using ribbed/inverted/raked pre-stressed architectural slabs and are stepped along the length of the building, with the varying heights sweeping down towards the station elevation. Concrete's contribution to the internal flow of the building doesn't end there with Explore also delivering a bespoke architectural feature staircase.

Between the concrete floor slabs, additional floor cassettes of cross-laminated timber (CLT) have been utilised. With these floors set back from the external glazing, the office space is opened to create double or even triple height workspaces, not only maximising daylight but also increasing flexibility of use.

Any issues related to fire performance due to the inclusion of CLT are mitigated by using it in a hybrid design with concrete's fire resistance and resilience allowing a circular economy approach with longer-life, low carbon assets that can be designed for change of use, disassembly and even element reuse. Indeed, the sustainability aspect of the CLT's inclusion will become less and less important as concrete decarbonises.

The UK concrete and cement industry is decarbonising faster than the UK economy as a whole, successfully reducing emissions based on 1990 levels by more than 53%. Currently, the UK concrete and cement industry accounts for around 1.5% of UK carbon dioxide emissions, five times lower than the global average where cement accounts for around 7% of emissions.

The sector plans to deliver net zero using a blend of approaches: decarbonised electricity and transport networks, fuel switching, greater use of low-carbon cements and concretes as well as Carbon Capture, Use or Storage (CCUS) technology for cement manufacture.

Within the precast sector specifically substantial progress toward decarbonisation is being made, with the introduction of more carbon efficient mixes and more low carbon solutions across the value chain.

What Explore have managed to achieve here is truly a marvel of urban construction. Using their extensive experience of digital offsite construction the client now has a flagship presence dominating the landscape of King's Cross.

For more information on the project and the benefits of concrete visit:

www.laingorourke.com/company/our-businesses/explore-manufacturing

Concrete Masonry – A truly local product

Local has never been more important.

Whether aiming to reduce carbon emissions by limiting the transportation of construction materials to site, supporting the people and economy of an area or building a resilient supply chain which isn't reliant on imports, local thinking is key.

With this in mind, a reliable supply of masonry products is closer than you think...

This map shows the location of MPA Masonry members' manufacturing sites. In most cases, there will be several production facilities close to where most construction takes place – major UK cities. Given the strong regional spread of our manufacturer's bases, even in rural developments, there will be very few instances where masonry products would have to travel any significant distances to meet construction needs.

Low site wastage

A study by circular economy consultants, Reusefully Ltd, in 2023 assessed levels of concrete block and ready-mixed concrete wastage on construction sites and found it to be significantly lower than estimates developed by WRAP Net Waste over 15 years ago. Feedback indicated that the amount of dense, aerated and lightweight block site wastage on site does not exceed 5% and can be as low as 3% where good waste practices are implemented on site.

Delivery distance

Concrete masonry is truly a local product. Not only does this map illustrate just how close suppliers are but in industry standards such as the RICS Whole Life Carbon Standard revision in 2023, masonry is finally characterised correctly as having an average delivery distance of just 80km. This is a significant reduction from industry perceptions, as original estimates included in RICS 2017 LCA guidance document assessed blocks as traveling up to 300km on a radial delivery.

The quintessential local supplier

For over 62 years, Mona Precast (Anglesey) Ltd have been producing the highest quality, sustainable concrete products for the construction industry.

Mona Precast is a family business and are proud of their dedicated team, where many of their employees have been employed for over 30 years and are a major factor in the success of the business. To maintain customer service at the highest-level, Mona Precast operates its very own dedicated transport fleet of Euro 6 lorries for clean and sustainable deliveries. Rigid and draw bar vehicles deliver to builders' merchants and construction sites nationwide.

The company, based on the Isle of Anglesey / Ynys Mon, has manufactured blocks to construct thousands of quality homes throughout Wales and England over the past six decades. Mona Precast has also supplied products for many landmarks and essential buildings such as hospitals, H M Coastguard, schools and hospitality sites, including the highest building in Wales, the café at the top of Snowdon / Y Wyddfa.

Mona Precast run two high capacity and fully automated production lines. The KVM Plant produces building blocks, bricks and an extensive range or decorative products. The KVM plant is complemented by a Columbia block plant which produces a wide range of concrete building blocks. Both plants only require a single operator to oversee the entire production process from batching materials through to the final packaging. Mona Precast also have several secondary finishing lines including a bush hammer plant, a shot blasting line, a table saw and a Columbia block splitting line.

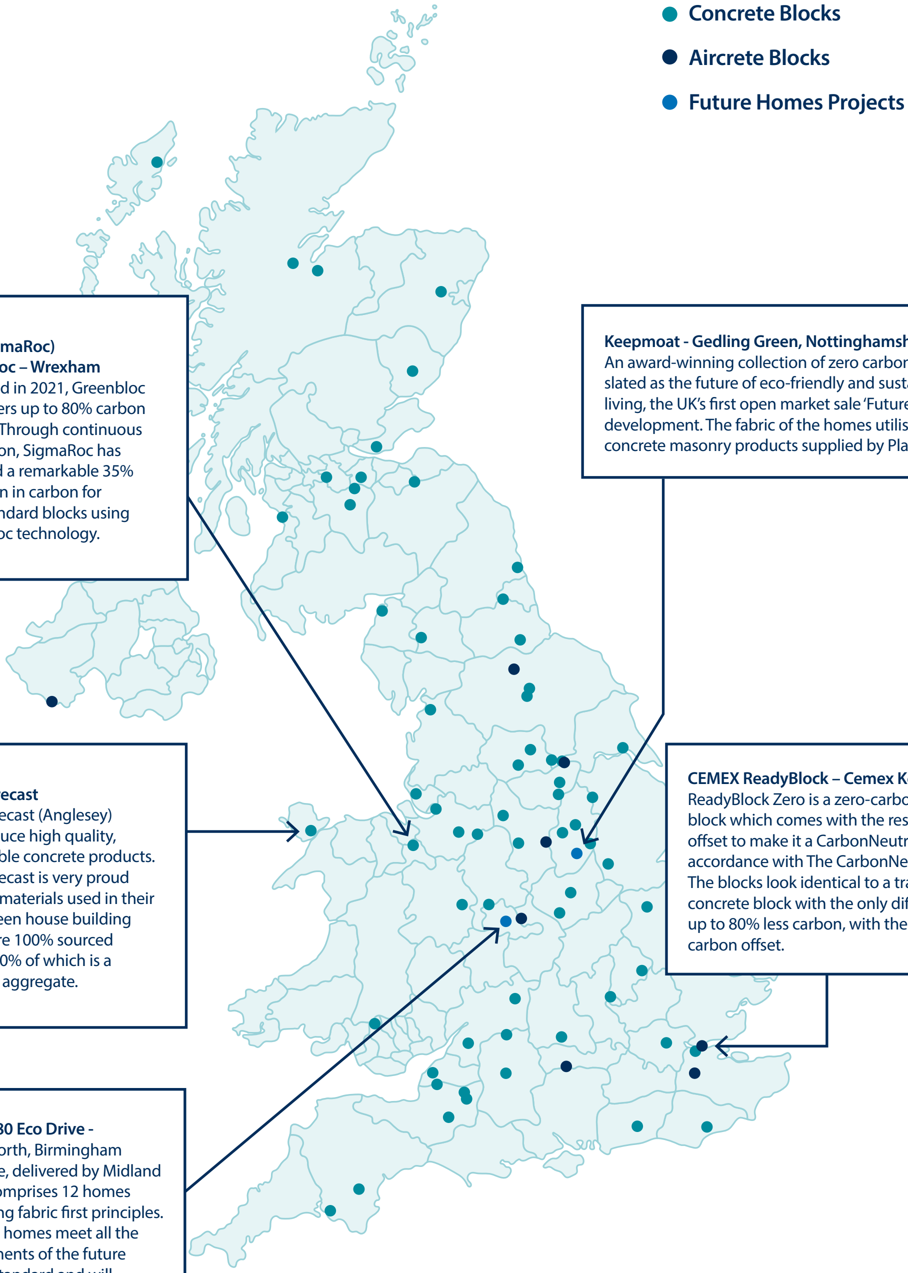
The factory also produces an extensive range of wet cast products including Mona Mega Blocks, Jersey Barriers, and special, bespoke products.

Quality and sustainability have always been at the heart of Mona Precast, being both ISO 9001 and ISO 14001 accredited for many years. Producing high quality products in a safe, clean, and sustainable manner is what every member of staff strives for and achieves every day.

Mona Precast is very proud that the materials used in their Monagreen house building blocks are 100% sourced locally, 80% of which is a recycled aggregate. Combined with the Advanced Manufacturing Facility and a circular recycling system incorporated into the factory, the manufacturing process ensures zero waste into land fill and zero fuel or energy used in the curing process. This continual investment in efficiency results in a plant that produces precision concrete products in a safe, environmentally friendly, sustainable and world class factory.

To find out more about Mona Precast and its renowned collection of sustainable products and advanced facility, please contact a member of their helpful team.

Mona Precast (Anglesey) Ltd
Isle of Anglesey
www.monaprecast.co.uk



CCP (SigmaRoc)
Greenbloc – Wrexham
Launched in 2021, Greenbloc Ultra offers up to 80% carbon savings. Through continuous innovation, SigmaRoc has achieved a remarkable 35% reduction in carbon for their standard blocks using Greenbloc technology.

Keepmoat - Gedling Green, Nottinghamshire
An award-winning collection of zero carbon ready homes, slated as the future of eco-friendly and sustainable living, the UK's first open market sale 'Future Homes' development. The fabric of the homes utilise traditional concrete masonry products supplied by Plasmor Ltd.

Mona Precast
Mona Precast (Anglesey) Ltd produce high quality, sustainable concrete products. Mona Precast is very proud that the materials used in their Monagreen house building blocks are 100% sourced locally, 80% of which is a recycled aggregate.

CEMEX ReadyBlock – Cemex Kent
ReadyBlock Zero is a zero-carbon concrete block which comes with the residual CO_2 offset to make it a CarbonNeutral® product, in accordance with The CarbonNeutral Protocol. The blocks look identical to a traditional concrete block with the only difference being up to 80% less carbon, with the remaining carbon offset.

Project 80 Eco Drive -
Handsworth, Birmingham
Eco Drive, delivered by Midland Heart, comprises 12 homes built using fabric first principles. The new homes meet all the requirements of the future homes standard and will produce a 75 to 80% reduction in carbon emissions compared to currently accepted levels.

Product Buyers Guide

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Aerated Products																			■			■							■	
Agricultural Products			■							■	■	■				■		■	■	■				■				■		
Arch, Portal & Box Structures	■		■															■	■	■										
Architectural Dressings									■				■				■	■	■					■						
Basement Units									■									■	■	■				■						
Beam & Block Floors		■		■			■	■	■										■	■		■		■				■		■
Bespoke & Specialist Products	■		■	■					■					■		■	■	■	■	■				■						■
Block Paving		■			■	■					■								■							■				
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Bridge Beams, Abutments & Gantries	■		■														■	■	■	■										
Cast Stone Architectural Units									■				■				■							■						
Composite & Double Tee Floors			■															■												
Concrete Blocks		■		■	■		■	■			■				■	■			■	■	■			■	■	■			■	
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Concrete Frame Products	■		■						■		■		■				■	■	■	■										■
Decorative Internal Surfaces				■																										
Decorative Paving		■				■					■				■		■		■											
Dock Leveller Pits	■								■		■									■										
Ducts, Conduits & Markers																■				■				■						
Façade Cladding									■		■		■				■	■	■	■				■						
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Flat Pack Systems									■																					
Flood Defence Products	■		■						■							■	■	■	■					■						
Foundation Blocks		■		■	■						■								■		■	■	■		■				■	
Foundation Units & Piles																	■													
Garden Products		■				■					■								■					■						
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Interlocking Concrete Blocks		■														■								■			■			■
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Lift Shafts																		■		■				■						
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Rail Products	■		■			■		■						■		■		■	■					■						
Retaining, Revetment & Crib Walls	■		■						■	■	■					■	■		■	■				■						
Road Surface Drainage										■						■				■										
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Structural Walls			■						■		■		■			■	■	■	■	■				■				■		
Street Furniture & Bollards									■							■	■			■				■						
Tunnel Linings	■		■															■	■	■										
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Water Treatment & Storage Tanks	■									■		■						■	■	■				■						
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1. ABM Precast Solutions
2. Aggregate Industries
3. Banagher Precast Concrete
4. Besblock
5. Breedon Group
6. Brett Landscaping
7. Broome Bros (Doncaster)
8. CEMEX UK
9. Cornish Concrete Products
10. Craven Concrete
11. Creagh Concrete Products
12. Cross Concrete Flooring
13. Decomo UK
14. Delta Bloc UK
15. E&JW Glendinning
16. Elite Precast
17. Evans by Shay Murtagh Precast
18. Explore Manufacturing
19. Forterra Building Products
20. FP McCann
21. Geo Quarries
22. H+H UK
23. Hillhouse Quarry Group
24. Ibstock Concrete
25. Interfuse Blocks
26. Laird Bros
27. Levenseat
28. Lynx Precast
29. Mannok
30. Mansfield Sand Company
31. Marshalls
32. Mona Precast
33. Naylor Concrete Products
34. Newlay Concrete
35. O'Reilly Precast
36. PACADAR UK
37. Patersons Quarries
38. Plasmor
39. Plean Precast Limited
40. Precast Products Group
41. Robeslee Concrete
42. S. Morris
43. Skene Concrete Products
44. SATEBA
45. Stowell Concrete
46. Tarmac Building Products
47. Techrete
48. Thakeham Tiles
49. Thomas Armstrong Group
50. Thorp Precast
51. TT Concrete Products
52. WDL Concrete Products
53. Woodside Cast Stone

Why Material Neutrality is important on the road to net zero

UK Concrete's Chris Leese discusses why material neutrality is so important in the UK house building sector and why, when it comes to decarbonisation, Government should focus on outcomes not ideology.

Outcomes or ideology

There is a real risk that policymakers and some building designers can often base their decisions on perceptions, not facts, about timber and concrete.

This can lead to misconceptions around the supposed benefits of timber in construction contrasted against the perceived problems that concrete creates for our natural world.

The Government can and should avoid unduly and artificially inflating demand for timber for construction and should instead be informed by the accurate assessments of new buildings' whole life carbon emissions and taking a 'material neutral' approach that supports all low-carbon building materials, including low-carbon concrete and masonry products.

The debate around material neutrality was brought to the forefront with the publication, by the Government, of a roadmap for boosting the use of timber in house building. The motivation for the roadmap may be a genuine desire to decarbonise construction, however, it risks drifting into ideology over outcome.

The roadmap indicates that an increase in demand for timber can be encouraged by strong market signals from Government and a conscious shift from industry to use alternative materials. This 'shift to alternative materials' sends the signal that the sustainable low carbon choice is to build homes from timber, and this is contested as not being based on fact. Studies have shown that the whole life carbon of timber and masonry homes is comparable (ref NHBC Foundation?).

Housing is identified as an opportunity for this material switch as it is seen as a lower risk sector. Timber in high rise construction can be limited due to concerns about its performance in fire, and the use in infrastructure is made more difficult due to the long design life often required. But there are also performance concerns when timber is used in housing, including resilience to fire and escape of water.

Any material bias can lead to the creation of 'myths' around the carbon benefits of timber construction being perpetuated and comparison based on rhetoric rather than data.

A binary discussion on any material being good or bad does not reflect the complexity of the climate change debate, or how best to achieve a sustainable built environment. The increased use of lower carbon materials is an essential part of any sustainability strategy, as is resource use, local supply chains, social impact and biodiversity. The concrete sector is committed to improving its performance and providing data to support in material design and specification.

Is increased demand for timber sustainable?

The timber in construction roadmap states 'We must also ensure that any increases in the use of timber are sustainable and do not contribute to greater rates of global forest degradation or deforestation'.

The World Bank has forecast that the global demand for timber could quadruple by 2050 in part due to demand for timber in construction. According to joint analysis conducted by Defra with the timber industry, UK timber demand would increase by between 0.2 million m3 and 1.3 million m3 for sawn timber (requiring an increase of sawn wood supply of 2 to 14%) if the proportion of UK low-rise residential buildings built with timber frame increased from around 17% today to 40% by 2050.

The UK is already the third largest net importer of timber and wood products in the world. The roadmap calls for imported timber to be from sustainable sources, but this misses an important reality - that increased afforestation is desperately needed to combat climate change and protect biodiversity. That includes halting deforestation and protecting standing forest rather than replacing it with commercial forestry.

In a scenario where demand for wood could quadruple, where is this extra timber coming from? Even if the UK construction industry does source sustainably certified timber, timber demand from elsewhere could be displaced to unsustainable or illegal sources, exacerbating global deforestation. Using low carbon materials in their country of origin has to be the first and most sustainable choice.

Achieving net zero housing and material neutrality

Based on the seven priority themes stated in the timber in construction roadmap, there are areas where I am sure we all agree and should be applied to all construction materials.

1. Improving whole life carbon data

The minerals sector believes in transparent accounting for the impacts of its own materials through the publication of Environmental Product Declarations (EPDs). We therefore fully support the publication of reliable data on all construction materials including the impact of harvesting wood products.

We believe that more transparency is needed on how Life Cycle Inventories (LCI) for timber products are developed and whether comprehensive consumption data (accounting for total adhesives use, offcuts, etc) are used, whether appropriate economic allocation methods are used for forestry, sawmill and kiln-drying operations, and whether the carbon data used for timber products ingredients such as adhesives is comprehensive, reflective of physical reality, and supported by EPDs in accordance with EN 15804. Without good quality data for all construction materials incorrect conclusions can be drawn on their relative impact, resulting in less sustainable decision making.

2. The safe, sustainable use of construction materials

Building safety and occupant safety is of course a priority. Performance standards should not be compromised by material bias. Material specification should be appropriate for the application and performance required.

3. Increasing skills, capacity, and competency across the supply chain

The minerals industry is one of Britain's largest manufacturing sectors employing over 80,000 people. The UK concrete and masonry sector has a roadmap to net zero and continues to invest as part of a transition to a net zero economy. Concrete and masonry are regionally manufactured products with national coverage supporting local jobs and communities across the UK.

4. Increasing the sustainable supply of construction materials

The concrete industry has adopted BES 6001 as a responsible sourcing certification, with over 90% of UK concrete being accredited to BES 6001.

An International Panel on Climate Change (IPCC) working group report on carbon mitigation strategies, shows that decisions on whether to leave forests alone, re- or deforest can have "a much larger impact" than switching construction materials to timber. The goal to increase the tree canopy and woodland cover in England to 16.5% by 2050 is fully supported by the mineral products sector but this should be linked to reforestation as standing forest to sequester carbon.

The impact of harvesting can be substantial as forest soils can emit significant amounts of CO_2 immediately after harvesting. The World Resource Institute (WRI) predicts that with the expansion in timber use and harvesting, forestry harvesting emissions could be as high as 4.2 billion tonnes of CO_2e, equivalent to 10% of recent annual global emissions of CO_2.

It is also important to recognise the competing demands on a very limited available land area in the UK. Reforestation will have to compete with agriculture and housing to name just two.

5. Addressing fire safety and durability concerns

Concrete is non-combustible, robust and durable. Residential buildings and buildings occupied by vulnerable residents should prioritise occupant safety.

Timber is combustible and can contribute to fire spread with impacts on the structural stability of buildings which can inhibit evacuation and fire response procedures. The potential delamination (splitting apart into layers) of engineered mass timber can also contribute to the unpredictability of fire outbreaks.

6. Increasing collaboration with insurers, lenders, and warranty providers

Behaviour change is important for the adoption of lower carbon concrete products and innovations to support a net zero economy. But performance requirements need to be established and met by new products.

Principles of material neutrality should apply to the insurance market. Assessments should be made based on risk. Insurers, lenders and warranty providers are accountable to their shareholders and market forces should determine cover and rates rather than Government pressure for higher risk products.

7. Promoting innovation and high performing construction systems

The mineral products sector supports innovation and improvements offered by the appropriate deployment of modern methods of construction (MMC). Innovation is happening across production and construction methods and is a material neutral term.

Masonry construction continues to demonstrate that it can meet the highest performance requirements for carbon, fire, acoustics, escape of water and more. We strive for continuous improvement in our sector and throughout the built environment. We believe this is achieved through collaboration, provision of guidance and data to inform design and specification and based on principles of material neutrality.

Art of Mixology

We are entering a bold new age of mix design. Last year's revision to British Standard BS 8500 was the biggest change to traditional concrete mixes since the 1980s, opening the door to a wide range of multi-component cements.

Concrete mixes can now contain a range of proportions of CEM I and limestone fines, in addition to GGBS or fly ash, potentially reducing the sector's carbon emissions by 1 million tonnes a year.

For precasters, this opens up a world of possibilities for optimising mixes. "What the standard facilitates is flexibility," says the Mineral Products Association's Gareth Wake. "As long as you can show that the combination conforms to a BS 8500 classification, you can mix those proportions as much as you like." Any innovation also has a tendency to foster more innovation – as mixes become more complex and less Portland cement-based, companies will explore new technologies for maintaining finish, consistency and early strength gain – the critical factor in precasters' 24-hour production cycles. Derek Russell, technical director at Techrete, sees it as a watershed moment: "The standards have been the same for so long, so this is a great opportunity for the industry to question everything we're doing."

In many ways, architectural precast manufacturers are at the sharp end of mix innovation. While all precasters are having to find new ways of matching the early strength gain of Portland cement, cladding specialists also have to manage changes to colour or texture caused by the addition of secondary cementitious materials (SCMs). "We're all doing trials with different mixes," says Dale Brown at Evans Concrete Products. "From an architectural point of view, it all depends on the colour of the mix – that's the driver."

At Techrete, Russell estimates that about 200 mixes have been trialled over the past six months to ensure that the company can exactly match its existing range of products using multi-component cements, often accelerated with admixtures – "We've had to rebuild every mix from the ground up." Despite the time and investment involved, he believes there have been widespread advantages, beyond decarbonisation: "In the factory, they've often realised that these low-carbon mixes are better in terms of workability. Then they ask us, can you fix this other mix as well?" Architects can see the benefits too: as companies upgrade their facilities to accommodate new mixes and admixture tanks, they are able to more finely control pigment and consistency, leading to more precise and controlled finishes (see box).

In the world of visual concrete, it's becoming clear that there is no one-size-fits-all solution to decarbonisation, but rather a constant process of balancing Portland cement and SCMs and trying to reduce the overall volume of concrete required, all depending on the specific architectural vision. "That's the level of detail we go into on every project now," says Russell. "It's like an artisanal recipe."

For non-architectural precast, BS 8500 poses different challenges. One intriguing part of the revised standard is the inclusion of a CEM III/C designation, for concretes that contain up to 95% cement replacements. This prompts the question: how much Portland cement does precast concrete really need to achieve the requisite early strength gain, and how much can chemical admixtures take up the slack? "There's almost a bit of an industry battle to see who can get to the lowest carbon embodiment while staying within the standards," says Ian St. Hilaire, technical sustainability director at SigmaRoc, which last year produced a cement-free, carbon-negative block (see box).

"Technologists do have the ability to completely swap out cement and achieve exactly the same performance at an early age, as well as meeting requirements for late-age strength, freeze-thaw resistance, corrosion and exposure classes." Not that it's simply a case of replacing all cement: "Total embodied carbon is what's key. Some cement-free technologies may have higher carbon embodiment than an 80% cement-replacement mix, for example, because their technology uses other high-carbon materials."

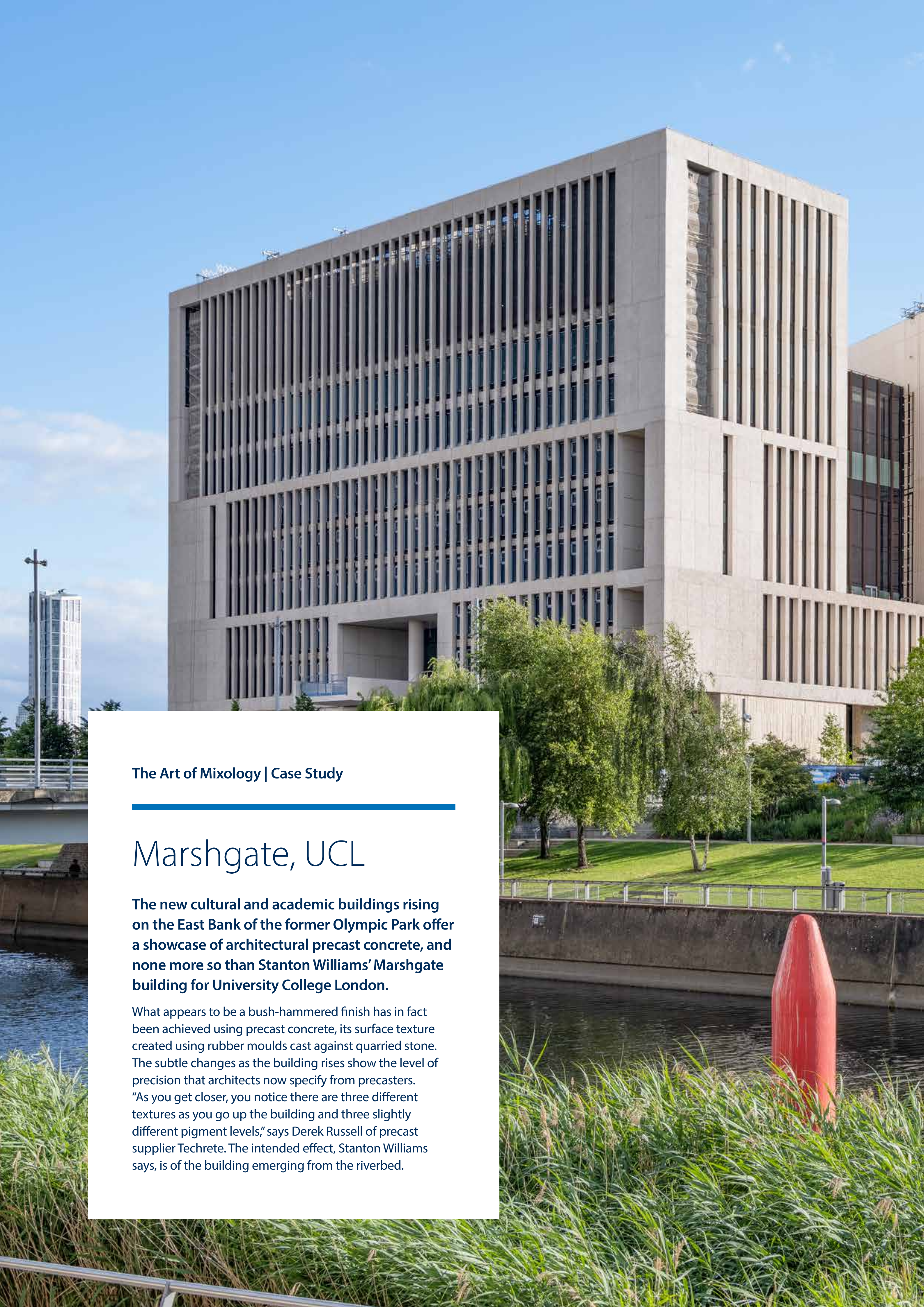
As manufacturers compete to scale up such innovations and deliver them affordably, it is likely to drive further advances. Work is in progress to create a "flexi" British standard to facilitate the use of alkali-activated cementitious materials (AACMs) and other innovative binders. Graphene-enhanced admixtures are another significant development, and have already been shown to improve early tensile and flexural strength, as well as durability and fire resistance.

In terms of SCMs, the Imperial College-based start-up Seratech has developed a process that creates silica powder from the mineral olivine, which it claims can create carbon-negative concrete (see box). Trials of calcined clay – a significant waste stream from brick manufacture and mineral quarries – have revealed performance that compares favourably with fly ash, albeit with relatively slow strength gain that may be more suited to ready-mix applications. An interesting variation on this approach is being pioneered by the HS2 rail project, which is working on a circular process that involves taking the material excavated by its tunnel-boring machines, calcining it on site and then using it as a binder on new infrastructure elements, potentially including precast tunnel segments.

Some of the most exciting developments involve the use of upcycled concrete. Although demolition-waste concrete has long been recycled as a secondary aggregate, techniques to remove the cement paste can now greatly enhance its performance, allowing it to replace a far greater proportion of virgin materials. The cement paste itself can also be recycled, either as filler or potentially as new cement. National Highways is currently working with SigmaRoc and concrete recycling company Xeroc on a trial scheme that will take the concrete dug up during road renewals and recycle it in the mix for the new central reservation barriers.

Away from the high-stakes environment of a live construction site, under controlled factory conditions, the precast industry is perhaps the natural place to innovate with concrete mixes. Techrete's Russell certainly doesn't see the revised BS 8500 as the end of the road, but more a new beginning: "This is going to be a journey now for the next four or five years. People will develop their designs, make the mixes work harder, and just keep pushing."

"Any innovation also has a tendency to foster more innovation..."



Marshgate, UCL

The new cultural and academic buildings rising on the East Bank of the former Olympic Park offer a showcase of architectural precast concrete, and none more so than Stanton Williams' Marshgate building for University College London.

What appears to be a bush-hammered finish has in fact been achieved using precast concrete, its surface texture created using rubber moulds cast against quarried stone. The subtle changes as the building rises show the level of precision that architects now specify from precasters. "As you get closer, you notice there are three different textures as you go up the building and three slightly different pigment levels," says Derek Russell of precast supplier Techrete. The intended effect, Stanton Williams says, is of the building emerging from the riverbed.

The Art of Mixology | Case Study

Carbon-negative cement-free blocks

Last year, SigmaRoc company CCP Building Products partnered with Carbon8 to develop a carbon-negative concrete block.

The product is based on SigmaRoc's Greenbloc technology, which replaces all cement with SCMs (mainly GGBS), activated with a chemical admixture. This was then added Carbon8's Circabuild aggregates, which are processed waste materials that capture and store CO_2. "When we generated an EPD through One Click LCA, we ended up with a 115% carbon reduction," says Ian St. Hilaire of SigmaRoc. "The cement-free technology reduced carbon by 80% and the aggregate took off another 35%."

The Art of Mixology | Case Study

Seratech

This SCM, developed by researchers at Imperial College London, only needs to replace 35% of Portland cement to produce carbon-neutral concrete.

The fact that Seratech concrete is still cement-based means curing times and early strength gain are similar, making it suitable for precast applications. The company also claims that no adjustment to plant or machinery is needed. The Seratech process uses olivine – an abundant mineral comprising mainly magnesium silicate – and adds CO_2. This produces two compounds: a silica powder which is used as the SCM, and a magnesium carbonate by-product suitable for making bricks, which permanently store the CO_2.

Spotlight on Health and Safety:

Code of Practice for Safe Stressing

A new edition of the Code of Practice for Safe Stressing of Prestressed Concrete Products was developed by MPA Precast at the end of 2023 to communicate good practice in the management of health and safety when manufacturing prestressed concrete products.

Prepared in collaboration with the membership of MPA Precast and with the support of the Health and Safety Executive (HSE), the Code of Practice (CoP) applies to all companies with prestressing activity on their sites.

Stressing of prestressed concrete is acknowledged to be a potentially high-risk activity, involving the use of industrial prestressing equipment that uses hydraulic rams to stretch high-yield wires and strands with forces that can be more than 1500 tonnes. First published in 2014, this second edition brings together the many developments, not only in health and safety legislation, but also in good practice within the prestressing industry.

Colin Mew, Head of Health and Safety at MPA said: "It is anticipated the Code will become the primary reference document when introducing and operating prestressing production equipment, along with ongoing reviews of process, systems, risk assessment, safe system of work for maintenance and training.

"It is recommended that all manufacturers involved in prestressing operations perform a detailed review of their prestressing operations and consider the content of this Code, implement improvements to their relevant health and safety policies, procedures, and physical controls, where required. Adherence to the Code of practice will be monitored during the annual audits and significant findings and learning points reported at the MPA Precast & Masonry Health and Safety Steering Committee meetings."

The Code of Practice forms part of MPA Members' ongoing commitment to Vision Zero, an unrelenting drive to eliminate incidents related to the so called 'The Fatal 6'.

Asif Khalil, Head of Health and Safety at Ibstock PLC and Chair of the MPA Precast and Masonry Health and Safety Steering group said:

"MPA Precast is committed to achieving high standards through a universal approach to Health and Safety. The provision to employers, employees, and designers alike of clearly presented information about the systems of work employed is an essential element in achieving this.

As part of the continued collaboration between MPA and HSE, the HSE's endorsement says:

"HSE encourages and welcomes industry codes of practice such as this produced by MPA Precast, which receive careful consideration and input from key players within the industry who have the health, safety and welfare of those involved in prestressing work foremost in their mind.

"If a stressing bed system were to fail, serious injuries or fatalities are a possibility. If the work is planned in line with this code of practice guidelines, and carried out by competent operatives, using equipment properly maintained and inspected then many accidents can be prevented.

"It is only by the industry showing leadership, working in partnership, and taking ownership of the management of risk that improvements will be made, and we commend its use to all concerned."

This edition can be downloaded from the Safequarry website, with printed copies made available to MPA members, training organisations and the Health and Safety Executive.

All members of MPA Precast and MPA Masonry are committed to reducing harm and have signed up to the MPA Charter which includes the elimination of reportable incidents related to 'The Fatal 6'.

A Better Public Realm with Permeable Paving

by Chris Hodson, consultant to MPA Precast Paving

More than 25 years' use reveals that the problem-free performance of concrete block permeable paving far exceeds original expectations.

But, in addition, designers with a full understanding of the technology can now exploit its wider multifunctional potential as a nature-based SuDS technology to deliver tree-lined, quality places for people, alongside flood prevention.

Concrete block permeable paving (CBPP) shares the unique attributes of modular concrete paving generally. High-strength units are installed with granular material filled joints and laying course, enabling miniscule movement between blocks while retaining interlock. This creates a particularly durable, long-life surface over structural layers below. Decades of use internationally have demonstrated the suitability of concrete block paving for the most taxing applications.

A growing choice of shapes, styles, colours and finishes – including natural aggregates – add a richness, diversity, visual interest and human scale unavailable with formless materials like asphalt. With an extremely long lifespan, blocks can be taken up and re-used without processing for repairs, altered layouts or new schemes – saving carbon and meeting 'circular economy' criteria. Concrete block paving is slip-resistant, durable, strong and sustainable. It delivers fast, low-cost installation and replacement, using weather-independent, 'dry' construction. There are no curing, hot-work or noxious fume issues and only small plant and equipment is needed.

Concrete Block Permeable Paving

CBPP shares and enhances this technology, and is central to the 'nature-based' sustainable drainage systems (SuDS) increasingly demanded for developments. It simply combines self-drained, safe and attractive surfaces for a wide range of applications with attenuation, storage, pollution removal and conveyance of rainwater runoff. But there is far more to CBPP than drainage, heralding its far wider use on both new and retrofit schemes.

The difference with CBPP is the angular aggregate (not sand used for conventional block paving) used to fill joints and as a laying course. Pavement layers of voided material below accommodate water, whilst still providing structural performance. CBPP can also accept additional runoff from adjacent impermeable paving and roofs. It has proven to be a robust, resilient and adaptable technology for projects ranging from footpaths to container terminals.

By its very nature, it requires no additional land-take for water storage and no gulleys or related pipework. Both construction and whole-of-life costs are lower than for conventional paving and drainage, and it requires only limited maintenance, without clogging. It's important to remember that CBPP is unlike – and not to be confused with – permeable materials, which behave very differently and may be prone to clogging.

Multifunctional Benefits

But CBPP also offers multifunctional benefits too. Rainwater is removed straight off the surface and it can be laid level, avoids puddles and potholes, and provides attractive, safe surfaces for all. Its unique SuDS capabilities include source control and delivering a gradual flow of clean water near the surface – for amenity, open SuDS features, drainage systems or ground discharge.

Concrete block permeable paving has been proven to work in synergy with trees and can be used over standard tree pits, proprietary planters and 'Stockholm System' or other 'structural soil' installations. It allows irrigation and simple gas (oxygen/CO2) exchange essential to trees, enabling their shading, albedo reduction and biophilia benefits for our towns and cities. CBPP also helps meet NPPF requirements for long-term street tree maintenance, while avoiding tree root disruption to the surface.

Urban designers are increasingly taking a holistic approach to make the most of all the benefits of CBPP when creating new or regenerating existing places for people.

Innovative Regeneration

Apart from new-build, CBPP is also central to retrofitting SuDS for the reversal of the sealing-up and flooding of our towns and cities, in line with 'sponge city' principles. It is a sustainable alternative to regular replacement of failed impermeable surfaces, as well as for planned regeneration and upgrade projects. Various low-intervention techniques are already being used to replace worn-out paving and also deliver SuDS, green infrastructure, trees and 'healthy streets' requirements.

One exemplar of this approach is the regeneration of London's White Hart Lane, by muf architecture/art – a pilot designed using 'Healthy Streets' principles which aim to create: 'streets that feel pleasant, safe and attractive. Streets with seating, shade and greenery, and reduced dominance of vehicles by designing for slower vehicle speeds.' The project delivers these aspirations and was one of the first to use the 'Healthy Streets' indicator as a metric.

But it also applies innovative SuDS techniques introduced by design collaborators Robert Bray Associates. This approach utilises bioretention raingardens to collect and treat polluted road runoff, while extensive CBPP surfaces not only act as SuDS elements – attenuating and treating rainwater runoff – but also enable essential gas exchange and optimised water supply for trees. A focal point of the scheme is a new Pocket Park, enabled by relocation of a bus stop and removal of extensive asphalt paving, particularly around a mature but suffocated Plane tree. The adjacent road is now a CBPP-paved, adopted highway. At two points, 'Stockholm Solution' structural tree pits span the full width below the CBPP, connecting road-narrowing tree planters on each side.

Permeable Paving Overlays

In addition to excavated-profile CBPP, other techniques can be used in existing urban settings, minimising excavation and avoiding statutory service complications. One example is CBPP overlay – a deceptively simple but innovative approach – maximising re-use of the existing road-base and its embodied carbon. The CBPP surface zone simply replaces planed-off old asphalt or other road surface, applied over the original structural road base.

This approach is exemplified in another Robert Bray Associates design in London – Bridget Joyce Square, Australia Road. Here, a typical, adopted asphalt street and adjacent parking areas were transformed for community use, by CBPP overlay shared surfaces discharging to tree-planted raingarden basins. The basins provide water storage for SuDS to reduce overloading existing drains as well as for irrigation.

Latest Guidance

A new Edition 7 of Understanding Permeable Paving, published by MPA Precast Paving, gives a comprehensive review of all aspects of concrete block permeable paving and enables all those involved with the development process to rediscover this most versatile SuDS technique.

www.paving.org.uk

www.mpaprecast.org

At White Hart Lane, a Plane tree previously suffocated by asphalt has been liberated with concrete block permeable paving within a new Pocket Park, providing irrigation and gas exchange.

A typical adopted asphalt street and adjacent parking areas were transformed with concrete block permeable paving shared surfaces at Bridget Joyce Square.

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