BUILDOFFSITE
COLLABORATING FOR IMPACT

Can offsite make a concrete change with low carbon precast?

Chaired by: Nigel Fraser, Industry Advisor, **Buildoffsite**

This session addressed the following questions:

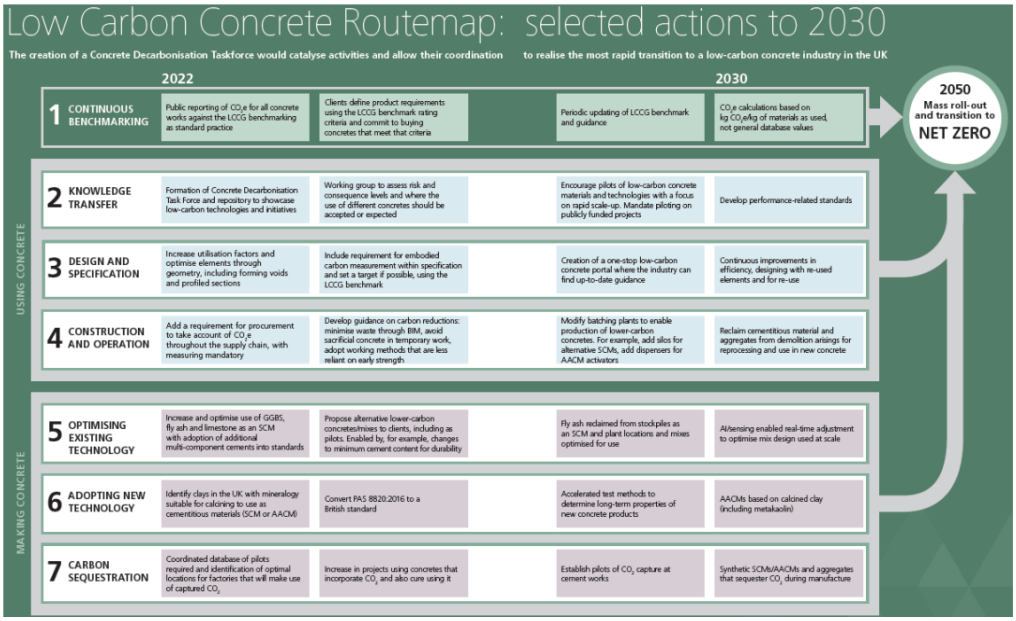
- Does Low Carbon Concrete deliver an industry roadmap for Net Zero concrete?
- How can Offsite and MMC accelerate the decarbonisation of concrete?
- Sustainable options for the precast sector.

We were privileged to hear from four informed speakers who covered the topic from their different perspectives:

- Andrew Mulholland, Managing Director, **Amcrete**
- Graeme Jones, Managing Director, **C-Probe Systems**
- Andrew Rolf, Technical Advisory Lead, **Mott MacDonald**
- Rosella Nicolin, Head of Sustainability – Europe, **Laing O'Rourke**

Session summary

Andrew kicked off by explaining how, in April 2022, the ICE supported the publication and launch of the Green construction board (GCB)'s Low carbon concrete route map. Eight workstreams have been identified, starting with the establishment of a task force and engagement with the Infrastructure Client Group. This is progressing towards the establishment of a new standard, BSI Flex 350: Low carbon concrete – Alternative binder systems - Code of practice. Andrew also explained how existing standards and codes could be applied to enable the use of alternative cementitious binders and how the Route map is already evolving.

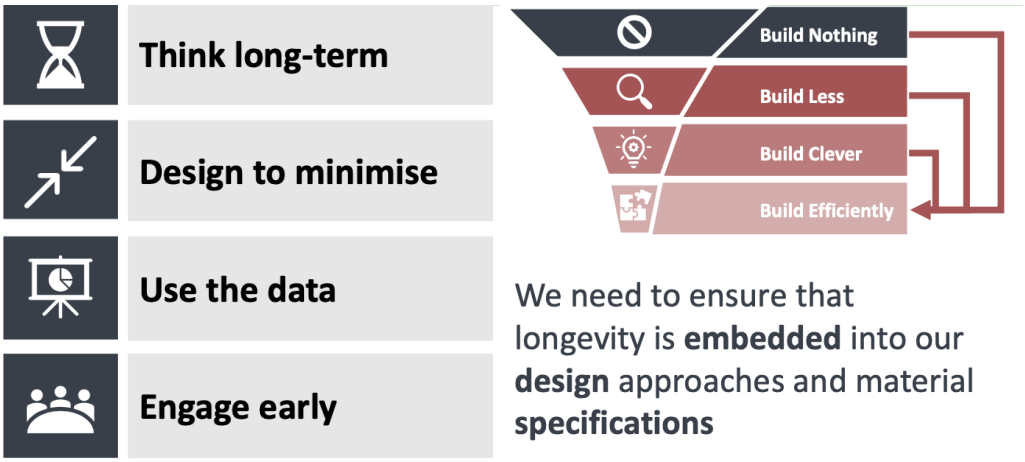


Graeme went on to explain the significance of corrosion in steel reinforced concrete and how this can be remedied, and even better, avoided through resilient designs. 70% of the damage to infrastructure is due to largely avoidable corrosion. Buildings and bridges are degrading, some to the point of catastrophic failure. Impressed current cathodic protection systems can avoid this. C-Probe have developed such a technology that also exploits a low carbon geopolymer cement along with an Internet of things-based system for control and monitoring ensuring ongoing futureproofing with structural healthcare. Several factors related to climate change (increased atmospheric CO2, more extreme weather events often with airborne chlorides and increased temperatures accelerating the rate of electrochemical reactions and the level of humidity in the air) are making the corrosion risk worse. We need to reconsider how we design for greater resilience given the technology exists to do so. Technology that has now been packaged as a “kit of parts” for installation into precast products to assure resilience.

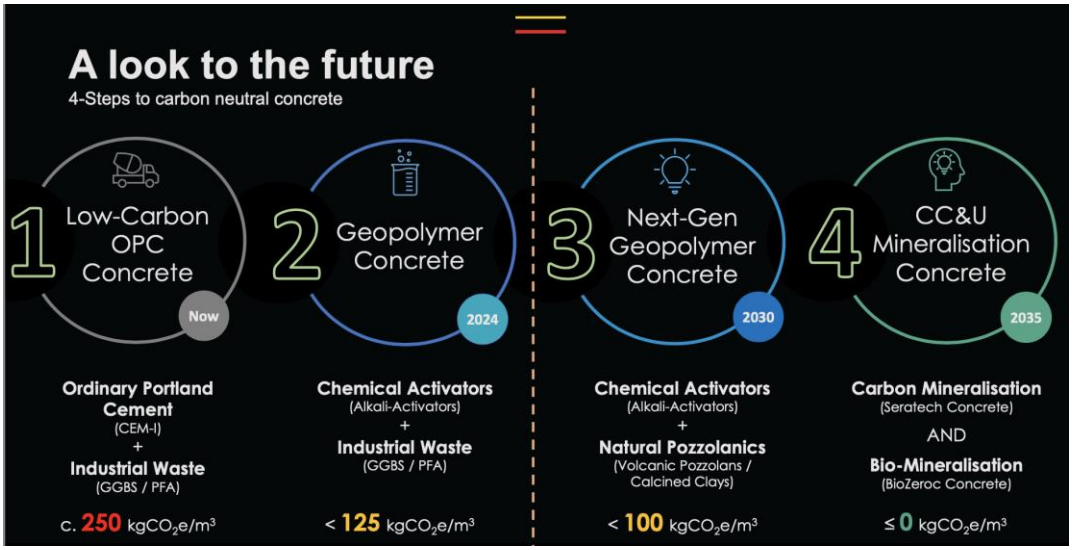
modular, plug & play anodes to protect new construction

and low carbon build with LoCem®concrete

Andrew Rolf highlighted why we need to think differently about embodied carbon and that this needs to start with design. The biggest impact for low-carbon design is when we are deciding what to build. “We need to get the brief right.” “Specification is incredibly important, both for materials and construction.” Designers are increasingly being instructed by clients to respond to the carbon challenge and designers need data from manufacturers. Carbon is now a key metric in decision making. We need to think holistically to optimise results. “How we plan and design our buildings will impact the ability to utilise offsite construction.” Early engagement is needed with manufacturers.



Rosella explained how Laing O’Rourke’s advanced delivery model combined with Centres of Excellence for manufacturing precast products is already delivering significant reductions in embodied and in-use carbon. Reductions in the amounts of materials required combined with research into the use of geopolymer, cement free concrete has been demonstrated to reduce embodied carbon by 62% and 85% respectively, with a route to reducing this further still.



BUILDOFFSITE
COLLABORATING FOR IMPACT

This is clearly an area with significant opportunities for carbon reduction, and in some applications, it is already happening. Suppliers can provide reliable carbon data for their products over the whole life, will be sought out. Leading players are already providing clients with opportunities to use low carbon concretes in the precast sector.

This session built upon guidance, *Achieving sustainable resilience in new precast concrete structures*, recently issued by BuildOffsite on designing more resilient structures in the face of climate change, available free to members (and for a modest fee for non-members).

Download their presentations.

Can one standard be created for cradle-to-grave to achieve net zero?

Chaired by: Ken Davie, Industry Advisor, **Buildoffsite**

Carbon reduction has historically been limited to existing structures but now the focus has shifted from operational carbon emissions to energy consumed at each lifecycle stage in the delivery of buildings and infrastructure. Under the main heading the speakers were challenged to consider:

- What is the best methodology for carbon emissions calculations across all life cycle stages?
- Are supply chain emissions a crucial factor for reducing overall emissions across all phases of a project?
- Can embodied and operational carbon be combined to emphasise the social cost of carbon?
- Are there good examples of carbon reduction and how carbon calculators have helped address key challenges?

Our guests who explained different perspectives on measurement of carbon emissions and debated these questions were:

- Dr Juan Ferris-Papi, Lecturer – Building Survey, **Salford University**
- Dr Jennifer Charlson, MMC Programme Manager, **Infrastructure Projects Authority**
- Ian Heptonstall, Director, **Supply Chain Sustainability School**
- Florian Hoyndorf, Head of Development Europe, **Cromwell Property Group**
- Rory Bergin, Partner, Sustainable Futures, **HTA Architects**

It was clear from the very beginning of this session that there is a plethora of guidance and several different standards, which must be incredibly confusing.

Guidance	Standards
RICS 'Whole life carbon assessment for the built environment' (2017, 2nd ed 2023)	**CEN/TC 350**. EN 15804+A2 Environmental Product Declarations (2019)
RIBA 'Whole life carbon assessment for Architects' (2019)	**Construction Leadership Council, Green Construction Board, ICE**. PAS 2080:2023 Carbon Management in Buildings and Infrastructure
CIBSE 'Climate Action Plan' (2019 and beyond); 'Steps to Net Zero carbon buildings (2019); etc.	(**Different authors**) Proposed BR Doc Z Whole life carbon of buildings
UKGBC 'Net Zero carbon network framework' (2019); 'Net Zero whole life carbon roadmap' (2021)	**BBP, BRE, The Carbon Trust, CIBSE, IStructE, LETI, RIBA, RICS, UKGBC**. UK Net Zero Carbon Building Standard (started in 2022)
LETI 'Climate Emergency Design Guide' (2020); other publications	
Supply Chain Sustainability School 'Whole life carbon guidance for off-site construction' (2023)	

Juan explained even these do not consider the influence of the circular economy relating to the benefits and loads beyond the system boundaries of current assessment methodologies. These include reuse, recycling, energy and other recovery and the potential for developments to export utilities (power, heat & water).

The introduction of Industry-Proposed Document Z for the carbon assessment of buildings will provide common ground for carbon assessments.

The University of Salford is running the Energy House Labs project laboratory testing an early 20th century two-bedroom terraced house inside an environmental chamber simulating various weather conditions. Buildoffsite is looking forward to organising a visit soon.

Current research includes:

- the monitoring of the modular construction Barratt Zed House, which has some innovative technology including overhead infrared panels, air powered showers, self-cleaning plaster, and heated skirting boards.
- Assessment of the A rated Bellway House Ehome2 timber frame future home, a Barratt/Saint Gobain collaboration with two different heating systems.

The University of Salford is also working on a Low Impact Materials study for future homes aimed at:

- Completing the gap in energy assessment (currently only covering operational).
- Covering assessment in other stages of the material life cycle (manufacturing, construction, end of life).
- Fulfilling current demand on embodied carbon assessment.
- Developing progressive action plan towards innovation and research.

A great deal of the focus on offsite and embodies carbon is on the residential sector but the same issues relate to the entire built environment.

Gen Zero is a major research project seeking to create a new generation prototype for secondary schools enabling offsite construction and meeting ultra-low carbon targets, part of a planned approach to standardisation.

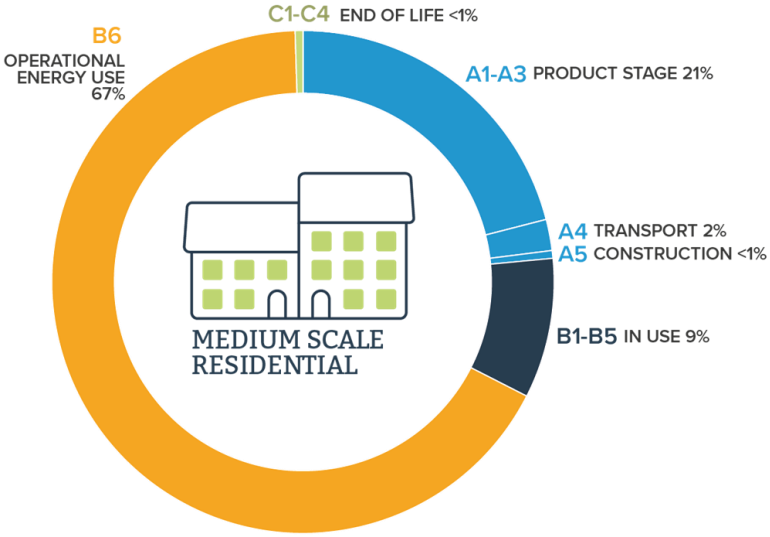
Dr Charlson provided an overview of the project based on a standard grid, which combines several types of pre-manufactured elements including volumetric modular (MMC Cat 1) and panelised systems (MMC Cat 2).

Large spaces will be a combination of cross laminated timber wall and roof panels with glulam beam roof structure.

Services are designed to be modular flexible and standardised from plantroom to classroom focussed on reducing waste and onsite installation duration whilst maximising flexibility.

The built environment needs to decarbonise but the question in many people's minds is – how can offsite help? The latest report from the Supply Chain Sustainability School shares possible and evidenced benefits, and examples of good practice. It discusses challenges around carbon measurement, suggests key actions and provides role-specific guidance to help maximise the carbon benefits of offsite construction.

Ian introduced this new report completed in collaboration with several of the Supply School partners. The chart below shows the percentage if carbon emissions for the life span of a medium scale residential development.



To understand where to focus our efforts to reduce emissions we need to know what we should be influencing. A copy of the report can be downloaded from the Supply Chain School website. Anyone not yet a member simply has to register with an email address.

A key part of the Cromwell Property Group environmental policy is the optimisation of building costs, downtime, and carbon emissions by:

- Reusing existing structures.
- Modernising M&E, insulation and building materials.
- Optimising design, construction, and operational processes.
- Applying technology for governance, process steering, monitoring, and data collection.

Florian explained the three steps in the Cromwell approach to achieving the above objectives and followed up with case studies for completed projects.

- Analyse brownfield and identify redevelopment potential
- Calculate carbon foot print and energy efficiency before and after
- Design new building with sustainable principles
- Set up an ESG plan for the users and neighbours

- Deconstruct only essential parts
- Decontaminate site
- Recycle, reuse and reassemble demolished building parts
- Redesign to perform (energy efficient with natural climatization)

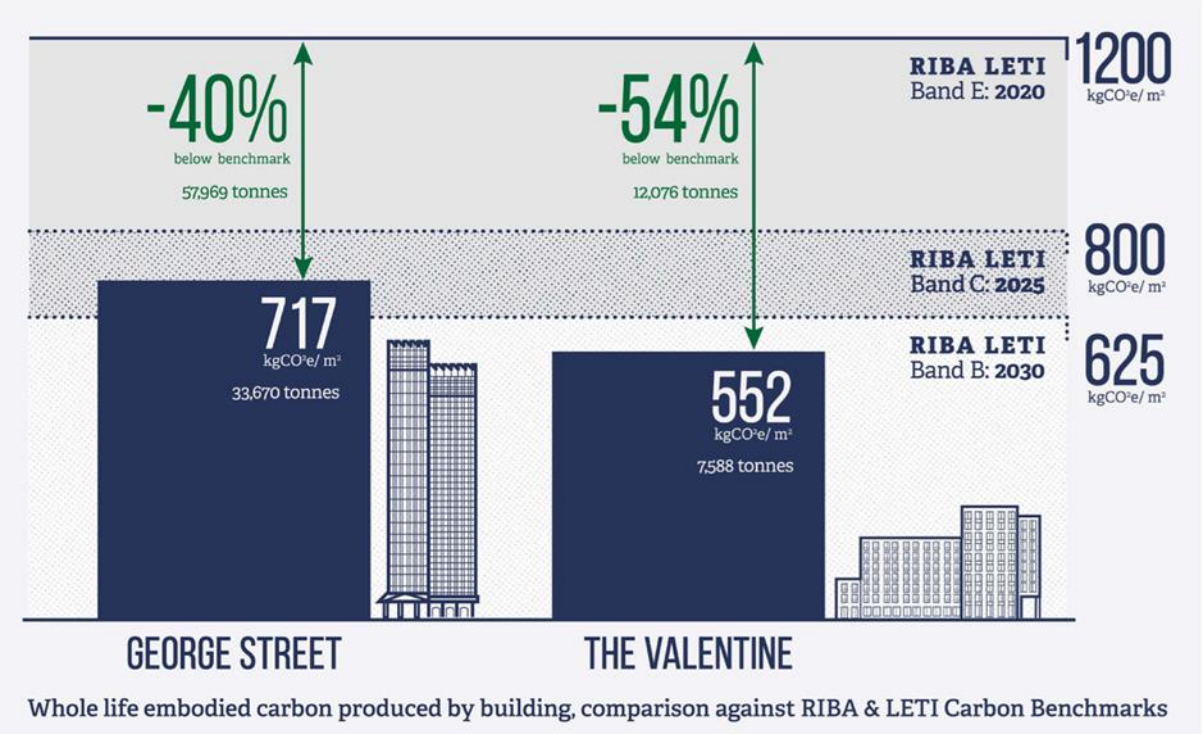
- Rebuild and develop air space on top with geo, bio based, recycled materials
- Integrate smart meters and technology to monitor consumption
- Connect to grid of renewable energy for production and consumption
- Manage and operate building with ESG parameters (waste, water, air quality)

HTA architects have a unique modular construction record with 7,000 schemes built to date in collaboration with several module manufacturers and more in the pipeline. One the projects, 10 Degrees, George Street in Croydon is the tallest modular building in the world with the future tallest volumetric building in the world currently “on the drawing board”.

Rory stressed several points about standardisation in the residential sector, many of them misconceptions. Standardisation is helpful for the housing industry because:

- Standardisation does not mean ‘everything looks the same.
- Efficiency comes from everyone knowing what the task is and from repetition.
- Factories are typically twice as efficient as construction sites (60% compared with 30%).
- Offsite (Cat 1) typically delivers twice as quickly.
- Factories can deliver four times the output compared to traditional construction.

Designing homes well does not mean starting from scratch every time; both building on past success and learning from failure help. Significant carbon savings are achievable by using offsite methods as can be seen from the metrics below from two independently checked projects.



Whole life embodied carbon produced by building, comparison against RIBA & LETI Carbon Benchmarks

The session concluded with some interesting questions posed by Ian Heptonstall for the other members of the panel. Although one standard for measuring the cradle-to-grave, or cradle-to-cradle carbon emissions and embodied carbon would be nice to have, it is not a practical possibility.

Download their presentations.