Written evidence submitted by:

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Studio Bark is an award winning architectural practice focussing on inspiring and innovative ecological design. Studio Bark are inventors of the U-Build modular construction system, a self-build kit-based approach to timber building designed for the circular economy.

This submission is made primarily in response to the following points on which the committee is seeking evidence:

- How can materials be employed to reduce the carbon impact of new buildings, including efficient heating and cooling, and which materials are most effective at reducing embodied carbon?
- What role can nature-based materials can play in achieving the Government's net zero ambition?
- What methods account for embodied carbon in buildings and how can this be consistently applied across the sector?

0.0 Executive Summary

0.1 Embodied carbon should be regulated to create a level playing field and ensure that we are looking comprehensively at the carbon impact of the built environment.

0.2 Biogenic natural materials in-combination with circular design thinking can deliver significant reductions in embodied and whole life carbon impacts.

0.3 Alternative and unconventional construction approaches, such as "no-concrete foundations" can significantly reduce a building's embodied carbon.

0.4 Those who design and/or construct buildings should be required to calculate and report embodied carbon at both design and construction stages to mitigate a gap between design-intent, and as-built emissions. Requirements should be proportionate, with a more rigorous approach for larger impact projects.

1.0 Definitions

- Biogenic Carbon - Carbon trapped from the atmosphere through biological processes such as tree growth.
- Circularity - process considering the potential for recovery, reuse and recycling of items following circular economy principles.
- Embodied Carbon - Green House Gas emissions of materials as a consequence of construction, maintenance and decommissioning of buildings.

2.0 Evidence

2.1 This evidence is submitted based upon the professional experience of Studio Bark in regard to natural materials, whole life carbon and circularity.

2.2 This submission makes reference to a design stage whole life carbon study undertaken by Studio Bark for a new-build home entitled 'Quarry House'. The committee may wish to refer to this for one example of how whole life carbon studies can be used to assess options at the pre-planning design stage. Link to report: https://doc.cheshireeast.gov.uk/NorthgatePublicDocs/08259285.pdf

2.3 The Quarry House study uses the RICS modular reporting method for whole life carbon. This method provides a straight-forward and comprehensive approach to the consideration of whole life carbon impacts and is widely recognised as a go-to methodology across the industry based on the relevant British Standard BS EN 15978.

2.4 The above study illustrates that significant savings can be made in whole life carbon terms when combining biogenic materials with a circular approach based on design for reuse. Comparing a pre-fabricated modular timber approach to a more conventional masonry build, we found that the embodied carbon impact of the timber construction was just 20% or approximately one fifth of the carbon impact, as if the same building were constructed using masonry.

2.5 The biogenic or carbon sequestering characteristic of timber is significant in terms of whole life carbon assessment as carbon locked away for the lifetime of a building defers its global warming potential until it is eventually released. However, the embedding of circular design thinking and design for reuse is needed to mitigate against the potential that biogenic carbon is simply re-released into the atmosphere when the building reaches end of life.

2.6 Foundations and other structural elements typically account for a large slice of total embodied carbon emissions for a building. This is primarily due to the large amounts of cement and steel typically used in these elements. The Quarry House example demonstrates that it is possible to use alternatives that completely eliminate concrete and cement from the substructure, bringing massive savings in embodied carbon terms. Further detail may be found on pages 28-29 of the Design and Access Statement (pages 68-69 of the document which has been divided into two pdfs): https://doc.cheshireeast.gov.uk/NorthgatePublicDocs/08255233.pdf

2.7 While the embodied carbon of elements such as building fabric can be reduced through relatively straight forward material/construction choices, MEP (mechanical, electrical, plumbing) represents a significant on-going challenge in embodied carbon terms. Equipment typically has short life spans and is manufactured from a complex composition of carbon-intensive materials; metals, plastics, rare earth metals etc.

3.0 Recommendations

3.1 Embodied carbon should be regulated with capped limits which are in-line with our national commitments and become more ambitious as the economy decarbonises. Reporting requirements should take a proportionate approach, being more stringent and onerous for larger scale projects which are likely to have a far higher carbon impact.

3.2 Embodied carbon should be considered and calculated from the earliest stages of design, and updated as the project progresses through the RIBA stages. The fact that there might be a lot of unknowns at the early stages is not a reason not to make a start - in fact the opposite as it is through the mass calculations and reporting across projects that we as an industry will develop the much needed foresight to anticipate these early stage implications.

3.3 Further guidance and procedures are needed regarding the level of detail that is suitable for embodied carbon calculations at different stages of a project. In the early stages the design may be broad brush and little may be known about the final specifications. At what point in a project embodied carbon should be calculated for MEP, fixtures and fittings or landscaping/external works, for example is unclear. Where assumptions by those undertaking whole life-cycle carbon assessments are made at an elemental level (e.g. wall construction) there needs to be an agreed approach for transparency, interrogation, and understanding. Absence of this structure for managing this differential in level of detail from one calculation to the next, risks making meaningful comparison difficult.

3.4 Measures need to be considered in order to avoid a ‘performance gap’ in embodied and whole life carbon terms. Designers have been struggling with the ‘performance gap’ between the designed operational energy demand of buildings, and their actual in-use energy demand. Whilst the industry is increasing its ability to design this out via Passivhaus and Design for Performance methodologies, we simply cannot afford the implications of a similar gap for embodied carbon emissions.There is massive potential for the assumptions and factors used in design-stage calculations to vary significantly from what actually happens during construction and beyond. In order to mitigate this risk, construction stage reporting and cross checking of the material quantities and impacts, via their Environmental Product Declarations,is needed.

3.5 The implications for procurement also need to be addressed. Entering into a ‘performance based’ contract with the Contractor is one method to ensure the needed level of attention is instilled, with the payment of the Contractor dependant upon the out-turn embodied carbon calculation for the project. This has co-benefits of creating a culture of caring about material stewardship on site to minimise site damage, waste, and poor workmanship that can lead to condemned construction works.

3.6 Quality assurance and auditing is another issue that the committee should consider particularly while the industry upskills in regard to embodied carbon accounting. This process should be supportive rather than punitive to begin with. This could be a state-run checking service modelled along the lines of building control. This could be something that design teams opt into in order to sense check calculations. An optional element should be combined with mandatory random spot checks on larger projects (similar to tax audits) to ward against incorrect reporting, be it unintentional or otherwise. The pioneering NABERS Design for Performance methodology utilises a similar cross-checking of the calculations by a third-party to maintain the highest standard of calculations.With reference to the Quarry House example, Studio Bark sought the view of a carbon expert from the IStructE who commented favourably on the design and general approach to considering whole life carbon. However, short of employing a additional expert consultant, there is currently no straightforward way to get a third-party sense check or audit on whole life carbon calculations.

3.7 Circularity in design is key to ensuring that biogenic carbon remains sequestered over the longer term and is prevented for as long as possible from being re-released into the atmosphere. Construction is acknowledged as being a very suitable use for timber products as it offers the longest life for storage from re-release, in comparison to palettes, for example. Economic and regulatory measures are needed to encourage circular thinking, disassembly, reuse and discourage and reduce disposal of materials. This might include requirements to demonstrate a level of circular thinking within the planning process, such as the pioneering policy within the GLA’s new London Plan,or a review of landfill taxes and regulations for example.

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