Written evidence submitted by Price & Myers LLP

1 Introduction

The issue of embodied carbon and the impact of building materials on the environment has been known about for a long time, but the industry has only woken up to it in the past couple of years. Within the structural engineering sector, progress is currently being led by groups of individuals within some of the leading design firms and volunteer groups, backed up by professional institutions. This is already having an impact but will only get so far without backing from the government in the form of legislation.

As one of the country's leading structural design practices, there is an additional motive for Price & Myers to address this issue – in that we believe we have the knowledge and ability to produce excellent low carbon designs but can struggle to do so within the confines of a purely competitive industry. There are currently serious issues with lack of understanding of embodied carbon and of transparency in carbon assessments. These must be overcome to ensure a level playing field and to remove the risk of 'greenwashing' poor designs with creative accounting and ineffective offsetting. The current balance between the low cost of materials and the high cost of design also needs to be addressed to incentivise the key decision makers (clients and contractors) to reduce their material usage. This would need to be in the form of carbon taxes or embodied carbon limits embedded into the planning system.

Price & Myers has taken this issue seriously and have been one of the leading contributors to the industry's current efforts to self-govern. In conjunction with the University of Cambridge we have developed PANDA (1), a unique embodied carbon assessment tool funded by Innovate UK that is currently being used to reduce embodied carbon across all our designs. We will develop this tool further in future and are thinking of ways to make it economically accessible to the wider industry to help drive change. Our responses to the relevant questions are given in the following paragraphs.

2 Responses to Questions

2.1 To what extent have the Climate Change Committee's recommendations on decarbonising the structural fabric of new homes been met?

We are now beginning to see an interest from clients in the decarbonisation of structural fabric as many clients begin to aim for Net-Zero Whole Life Carbon. However, there is still a lack of knowledge about the true implications of this aim to the building fabric – with reducing operational carbon still seen as the main way of ensuring a building is considered sustainable. We have also often found that carbon offsetting is seen as the first solution to this goal, as opposed to a true engagement with embodied carbon reduction through efficient and intelligent design. We note that most of our clients who are currently taking this seriously are doing so because it fits in with their corporate strategy, rather than because of any government interventions or incentives. A clear set of rules are needed to ensure more wider adoption.

2.2 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?

No single material is best placed to reduce embodied carbon and the solution is using materials as efficiently as possible and using them to their individual strengths. A lot of material selection in modern construction is done without much thought, based on standard details and methods that may not always be appropriate for the task, which is why a robust process to properly assess embodied carbon is required. There is also a hesitancy to try new methods, due to lack of experience in the design or construction team, time pressures and issues around insuring 'non-standard' methods of construction. One example of these would be rubble footings, which can often be substituted for mass or reinforced concrete but are rarely used in practice.

Any design should require a multi-disciplinary assessment to determine the influence of the structure on the heating and cooling load. Concrete is often favoured for certain types of building as the 'thermal mass' it achieves is perceived to reduce overall energy consumption, adding significantly to the embodied carbon in the frame. Less attention appears to be given to the fact that grid decarbonisation is rapidly occurring, and that tangible emissions that occur during construction (now) are much worse environmentally that potential emissions in the future.

2.3 What role can nature-based materials can play in achieving the Government's net zero ambition?

Nature-based materials are essential in achieving net-zero carbon, provided they are used sensibly and sustainably. Production of steel and concrete is incredibly carbon-intensive at the moment, and whilst there are new technologies under development there is nothing that is likely to become commercially available at sufficient scale in the required urgent timeframe. The only solution therefore is to minimise the use of these materials in favour of natural materials produced in as low carbon a way as possible. If this is to occur, then a greater awareness and understanding of the sourcing and supply chains of these materials is required, and legislation needs to rapidly adapt to enable the use of them. This includes urgently addressing the current issues around the fire design of timber structures, with Government-backed testing being prioritised to enable wider use of these methods.

There is also a concern about timber supplies and whether there is sufficient sustainable timber to cover the industry's requirements. Greater understanding of the use of sequestration of carbon in calculations is therefore essential to avoid the over-use of timber products – which should be used as sparingly as all other resources. Major investment in UK forestry is required, as growing construction grade timber takes 30-40 years. More research into faster growing alternatives – such as bamboo – would be beneficial.

2.4 What role can the planning system, permitted development and building regulations play in delivering a sustainable built environment? How can these policies incentivise developers to use low carbon materials and sustainable design?

The industry is working hard to overcome the technical challenges of low-carbon design but needs the regulations and legislation governing our designs to work in a complementary manner. Current planning regulations take little or no account of the sustainable use of materials and this needs to be addressed urgently, with mandatory calculation of embodied carbon using a standardised national dataset and increasingly stringent targets for different building typologies. In addition to this, there are numerous examples where current regulations actually constrain the ability of designers to reduce embodied carbon. Some examples are given below:

- Current restrictions on use in timber in construction, following the backlash after the fire in the (concrete-framed) Grenfell tower are compromising the widespread adoption of mass-timber construction in the UK.

Whilst safety should never be compromised, the current guidance can preclude designs which can be proven to be safe.

- Restrictions on the height of buildings (such as the 30m limit in the New London Plan) can be highly counter-productive and are often compounded by other guidance that requires minimum internal floor-ceiling heights (such as BCO for offices). Restricting the overall height in this way encourages the use of slimmer flooring systems, which are inherently higher in materials and embodied carbon. We agree that limits are necessary, but a limit on the number of storeys would be more appropriate, with economics (such as cladding and energy bills) creating a natural limit on the actual height that will be desired by the client and architect. As an example, on a scheme we are looking at for a new office building (constrained by the London Plan externally and the BCO clear height guidance internally) we are looking at having to potentially double the amount of embodied carbon in the frame, when a modest increase in allowable height (<5%) would provide us with the space we need. This can be frustrating as the client is keen to ensure the sustainability of the structure, but also needs to create a building that is economically viable.
- Several studies have also shown the current loading codes to be highly conservative and not fit for purpose in modern buildings, particularly given the significant (50%) safety factors that are then added to them.
- The final point would be that our research has found that the construction of basements is responsible for a hugely significant proportion of the embodied carbon in new-build structures. Most of this is down to the 'wasted' material required to form basements in enclosed sites where open excavations are not possible. Putting much stricter limits on basement construction would assist with this, as would investigating making it easier for available land outside a site to be used temporarily to allow open excavations (such as pavements where appropriate). Relaxing constraints on building heights to allow more space above ground (where construction can be much less carbon intensive) would also reduce the need for basements for plant and other back-of-house areas.

2.5 What methods account for embodied carbon in buildings and how can this be consistently applied across the sector?

This is a huge issue, but figures within the industry (ourselves included) have been working hard over the past 18 months to try and solve this. Part of the problem at the moment is a lack of any consistent industry-wide process, meaning consultants are essentially free to use the figures as needed, often claiming significant embodied carbon savings that could be contested. We see the following steps as essential to this process:

- The standardisation of embodied carbon figures for bulk materials around a centralised, freely available dataset (such as the inventory of carbon and energy (2)). This would require the resourcing to ensure it covers all necessary materials.
- The requirement for all proprietary product manufacturers to produce an environmental performance declaration (EPD) for their products as part of any certification processes. This will ensure that everything can easily be accounted for. These would then need to be accessible through a similar centralised national database.
- Limits on the use of 'low-carbon' replacement materials to align with industry averages. For example, in the current market recycled steel content makes up around a third of all current usage, so specifying more than this in any instance is essentially false accounting and will not help to bring overall usage down. The same applies to GGBS, which is a waste product from the steel industry used to replace cement. These figures should form part of any centralised database of figures, based on academic-led research.
- A standardised rating system (such as the SCORS system (3) proposed by the IStructE) to give all designs a clear assessment against others. Over a realistic period of time this should be used to start to set limits on the embodied carbon in all construction
- Mandating the calculation of embodied carbon, based on standardised figures, as part of the planning process for all buildings, regardless of size and scale.

2.6 Should the embodied carbon impact of alternative building materials take into account the carbon cost of manufacture and delivery to site, enabling customers to assess the relative impact of imported versus domestically sourced materials?

Yes, this is essential. The current carbon calculation system does include an allowance for transportation (module A4) so this is usually done in a typical assessment, however the impact of transportation is often misunderstood – with the assumption that concrete and steel are affected by it much more than they are in reality. The materials that are most affected are low carbon, low density products (such as engineered timber) that often travel large distances to the UK. It is also important to accept that in many cases materials can probably be brought into South-Eastern England from the continent as easily (in terms of distance and vehicle emissions) as from other parts of the UK, so the concept of domestic vs imported is not always helpful.

2.7 How well is green infrastructure being incorporated into building design and developments to achieve climate resilience and other benefits?

We are seeing a drive for improved green infrastructure from planning authorities. This needs to become more central to the design from the outset, instead of an afterthought. Care should be taken to avoid unnecessarily increasing embodied carbon when providing green infrastructure on top of buildings, but a better balance is certainly possible.

2.8 How should we take into account the use of materials to minimise carbon footprint, such as use of water harvesting from the roof, grey water circulation, porous surfaces for hardstanding, energy generation systems such as solar panels?

Water conservation is obviously essential. There is a difficulty however in using embodied carbon as a metric for this, as whilst there are emissions associated with the provision of water supply and treatment these are very small per unit of water due to the economies of scale involved. It is likely that even a moderate increase in embodied carbon of a structure to capture rainwater & the energy used to run the pumps and filters will ever be recovered over the lifetime of the structure. Therefore, we would require a means of addressing this, through a system that addresses that the benefits of saving water are not necessarily equivalent to saving carbon.

2.9 How should re-use and refurbishment of buildings be balanced with new developments? What can the Government do to incentivise more repair, maintenance and retrofit of existing buildings?

Reuse of existing structures should always be considered as the first option. It is clear though that a full and balanced assessment needs to be carried out to ensure that this is the best option in terms of embodied carbon for the following reasons:

- Older buildings may require much more work to achieve modern operational requirements. A full assessment of the embodied carbon needed to achieve this should be weighed against a rebuild option.
- The building may require extensive repair or remediation. The work required to achieve this should be weighed against its new anticipated lifespan and against a rebuild option.

Essentially this all comes down to a complete, whole-life assessment of the viable options and making decisions based on these. There is also a lot more work that could be done on introducing material passports and enforcing circularity of materials into building designs. This would enable buildings to be more easily disassembled and the components directly reused on other projects with minimal carbon impact.

Insurance companies are again an issue, as the reuse of substructure elements, such as foundations, is often prevented through the lack of the ability to ensure the design/scheme as opposed to any technical reason. The final point would be a change in the VAT system to incentivise reuse of buildings and/or materials in favour of new build.

3 Contact Details

This document has been written on behalf of Price & Myers LLP. For any questions or follow-up information, please refer to our website or contact one of the following members of staff:

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4 References

1. https://www.pricemyers.com/news/price--myers-launch-embodied-carbon-software-panda-52
2. https://circularecology.com/
3. https://www.istructe.org/IStructE/media/Public/TSE-Archive/2020/Setting-carbon-targets-an-introduction-to-the-proposed-SCORS-rating-scheme.pdf

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