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BOUYGUES UK

Whole life carbon in construction projects

What it is and how we can lower it

Contents

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Introduction

Retrofit vs replacement

A proposal to demolish the flagship Marks & Spencer store on Oxford Street in London, and then construct a new building in its place, generated fierce debate throughout 2022. At the time of writing (Sep 2022), the final outcome of the review process is unknown – but it is the two sides of the argument that best illustrate the need for this white paper.

For those opposed to the scheme, there is both a heritage and environmental argument. The Art Deco-style building is nearly a century old (it was built in 1929). From a climate perspective, greenhouse gases were emitted to make the building's materials and components, assemble them into the finished structure, and operate the building for over 90 years.

An extensive retrofit of the existing structure still requires new materials and construction processes. Those against demolition argue the emissions that would result from retrofit are considerably less than those that would be 'lost' in the demolition material, and subsequently created by construction of a completely new building – estimated to be some 40,000 tonnes of carbon in total.

The age of the structure also factors into the arguments of those in favour of total redevelopment. Although the scheme contravenes the London Plan, they say the building is hard to retrofit and "has no capacity for further development". Furthermore, they say the "superior operational performance" of the new building would make up for the huge volume of upfront emissions.

While the existing building might have exceeded the typically assumed 60-year design life of a modern building, its maintenance will only become more expensive (financially and environmentally) over time. The new building, it is claimed, has been designed with a 120-year life in mind – double the standard assumption.

The climate emergency is not up for debate

Even though the scheme's architects say a whole life carbon assessment has been carried out, the voices in favour of the retrofit option are no less strong. The architectural merit of the site has its role to play in how vocally that argument is made.

At the same time, however, it is surprising how little consensus there is. Both sides of the debate are united in their desire to see the environmental impact of the site kept to a minimum. Yet they cannot agree about how to achieve that shared goal. In our view, that highlights two things.

1 The lack of clarity that surrounds how best to achieve a goal that nearly all of us share.

In a survey of construction industry professionals, nearly all respondents' said sustainability is 'very important' or 'quite important' to them. Broadly speaking, everyone is aware of the importance of tackling the climate emergency, and of reducing the greenhouse gas emissions that construction projects are responsible for.

Knowledge alone, however, is not enough. Real transformation comes from action, and we are more likely to act when the path in front of us is clear and easy to follow. A lack of clarity over what 'good' looks like, or what type of assessments we should be commissioning and taking note of confuses the picture. It makes the path harder to follow.

2 The immaturity of carbon assessment within the construction industry.

Disputing the 'correct' approach to projects – whether they are new-build or refurbishment – makes it harder for people to trust assessments when they are done. In turn, that slows the wider adoption of carbon emissions assessments in our industry.

There is a risk of a vicious circle that further slows our progress when what we really need is a greater uptake of such assessments. The industry needs more experience and knowledge, to speed the ease and frequency with which action is taken.

Embodied carbon. Whole life carbon. Net zero carbon

Media coverage of the Oxford Street debate mentions both embodied carbon and whole life carbon. Although both terms have gained in prominence in recent years, the knowledge and understanding surrounding the terms still varies wildly.

The assessment of carbon emissions was made part of the London Plan. That increased literacy – if not clarity – around the subject in that part of the country. Elsewhere, a focus on operational carbon remains prevalent, while embodied carbon is still relatively unknown.

In contrast to operational carbon, there is a lack of regulation and enforceable standards around embodied carbon. That is a significant contributor to the uncertainty and hard-to-follow path. For those who want to address the embodied carbon in their buildings, where do you start?

This white paper addresses embodied carbon and whole life carbon. It looks at what you can do to start taking action and make a positive difference in this area of building design and performance. What do assessments look like? When should you do them? What targets might you aim for?

This is a document about taking the steps to normalise whole life carbon assessment. It is not a detailed examination of how to achieve net zero carbon in the process. A separate Darren Evans white paper looks at net zero carbon in more detail. It specifically addresses operational carbon from a net zero perspective, and touches on where embodied carbon fits into that picture.

The difference construction is making

The potential to make a positive impact in the fight against climate change is huge

42%

of the total carbon footprint of the UK is attributable to the built environment

22%

was from the operational and embodied carbon in buildings, showing the huge potential for us to make a difference

Understanding ‘embodied’ and ‘whole life’ carbon

What is embodied carbon?

There is no escaping that every building we construct has a carbon cost. Raw material extraction, product manufacturing, transport to factories and construction sites as well as assembly and construction all results in the emission of greenhouse gases before a building is even occupied.

While a building is in use, components must be maintained, repaired or replaced. These processes also emit greenhouse gases.

Once a building has served its purpose, it is often demolished. The act of demolition or deconstruction, and the processing of waste materials, is all part of the ‘life cycle’ – and contributes to emissions yet further.

You can view the life cycle at the level of individual products or components, or the level of the whole building (or ‘asset’). Whichever the case, the total emissions associated with all these stages/processes is the embodied carbon of the product/component or building/asset.

What is whole life carbon?

If embodied carbon accounts for emissions throughout a product or building’s life cycle, how can there be a different measure called ‘whole life’ carbon?

The difference is the operational carbon; the emissions associated with energy and water use to heat and power the building. Whole life carbon can therefore be defined as follows.

Whole life carbon = **Operational carbon** + **Embodied carbon**

This is an unambiguous definition. It includes everything associated with a building’s life. At Darren Evans, we therefore prefer to assess projects in terms of whole life rather than embodied carbon.

As we’ll see later, the reporting of embodied carbon can be subject to different definitions, which only serves to add to the confusion within the construction industry.

The 'greenest' building

There is a lot of focus on greenhouse gas emissions and carbon dioxide emissions specifically. Most emissions are carbon dioxide, so the contribution that other gases make is usually adjusted to a 'CO_2 equivalent', to simplify reporting.

Emissions are not the only impact, however. It should be borne in mind that natural resources and raw materials are finite. Their extraction has an impact on the communities local to where they are sourced. Biodiversity loss is exacerbated by exploring new regions for raw materials, and by the growth of urban areas as the number of new buildings increases.

This white paper is focused on emissions. When we talk about the life cycle impacts of products and whole buildings, these wider issues should not be forgotten.

Uncomfortable as it may be for the construction industry to admit, the only building that has zero environmental impact is the one that does not get built. The issue of embodied carbon isn't about emissions alone. Underpinning it is issues of efficiency, of responsible sourcing and responsible specification.

Tackling embodied carbon and whole life carbon starts with questions. Is a building needed? If so, does it need to be constructed from raw materials? Can the need be met by adapting an asset that already exists (and for which the carbon cost has therefore already been counted)?

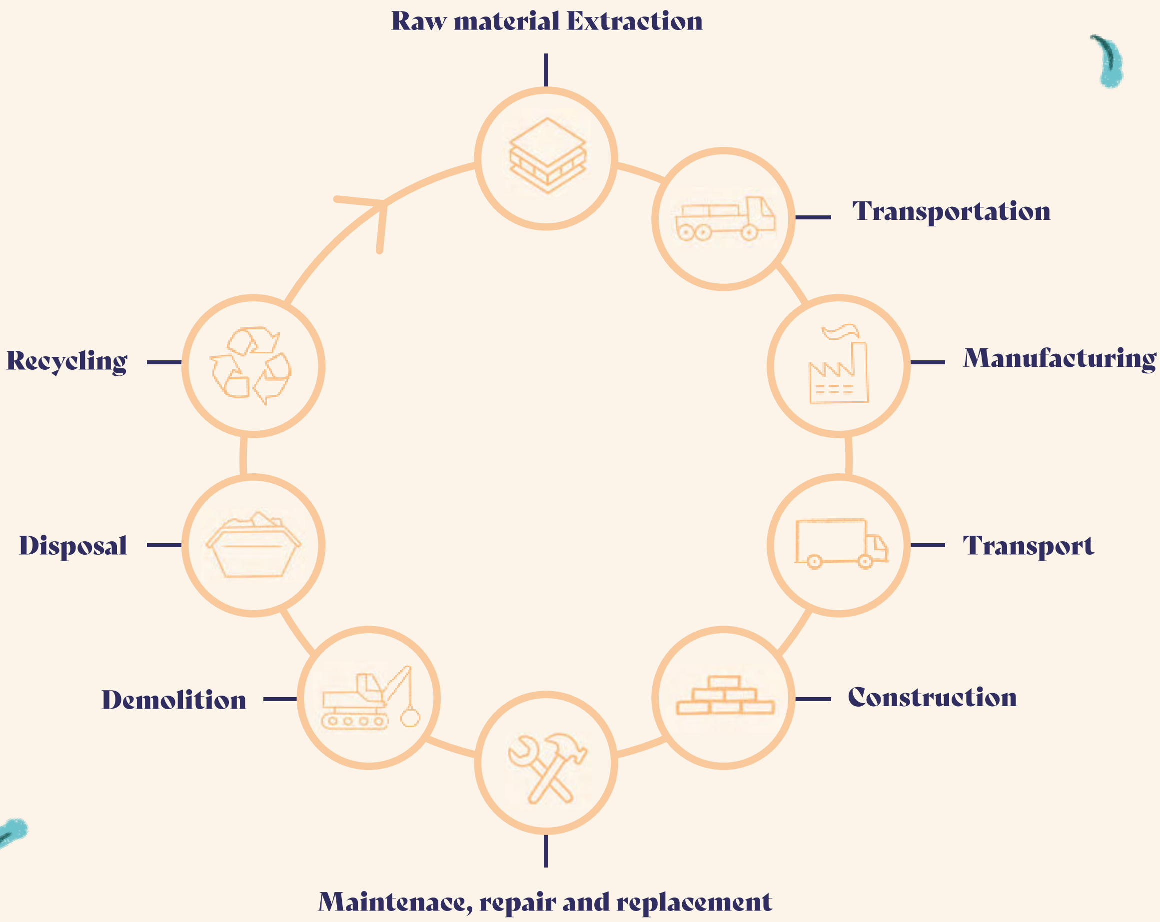
As we've seen with the debate over retrofitting Marks & Spencer on Oxford Street, there are not necessarily easy answers to these questions. Why is that the case?

Assessing life cycle carbon

Above we talked about the different phases of a building's life. The measuring and reporting of carbon emissions across these different phases is done with a life cycle assessment, or LCA.

At the product level, manufacturers follow the procedure set out in BS EN 15804:2012 + A2:2019 Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products. They issue environmental product declarations (EPDs) for the products they produce, which should be independently verified by a third party.

A life cycle assessment is carried out across multiple stages, each of which is broken down into a series of modules.



Product stage:

- A1 - Raw material extraction and supply
- A2 - Transport to manufacturing plant
- A3 - Manufacturing and fabrication

Use stage:

- B1 - Use
- B2 - Maintenance
- B3 - Repair
- B4 - Replacement
- B5 - Refurbishment
- B6 - Operational energy use
- B7 - Operational water use

B6 and B7 are operational carbon and tend to be more relevant to the complete building rather than an individual product.

Construction process stage:

- A4 - Transport to project site
- A5 - Construction and installation process

Together, these first two stages cover everything up to the practical completion of the building ('cradle to practical completion'). You may also see these stages referred to as 'upfront carbon'.

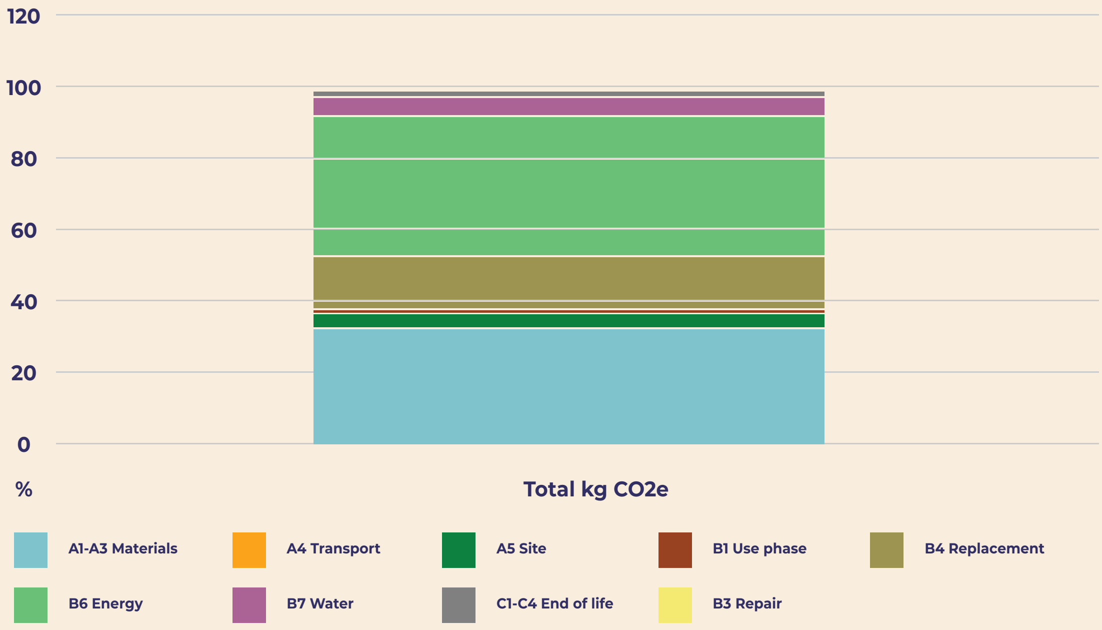
End of life stage:

- C1 - Destruction and demolition
- C2 - Transport to disposal facility
- C3 - Waste processing for reuse, recovery, or recycling
- C4 - Disposal

Taken together, modules A, B and C assess 'cradle to grave'.

As defined by the London Energy Transformation Initiative (LETI), embodied carbon is all the above modules, minus B6 and B7. Whole life carbon is all the above modules including B6 and B7.

Life-cycle impacts by stage as stacked columns



Is module D part of whole life carbon?

LCA includes a final module D, called 'benefits and loads beyond the system boundary'. It deals with the potential for reuse, recovery, or recycling. Where the life of a product can be extended, the potential future benefits of that product can be accounted for.

Module D is typically considered to be the 'circular economy module', or 'cradle to cradle'. If a product can be removed at the end of a building's life and recycled, then it leads to substantial savings in the manufacturing of product from virgin materials. If it can be reused, which is the ultimate goal, then there are no emissions.

The construction industry supply chain remains heavily geared towards the linear economy. Changing that is something that must be tackled to address the issues of resource availability and efficiency we discussed earlier. For now, however, cradle to cradle assessments remain relatively rare.

The products and processes associated with the circular economy are simply not mature. There is the example of a project where a brick facade was taken down and the mortar removed from each individual brick to allow them to be reused. That is expensive in terms of time and money, or simply not feasible for most construction projects.

Several sites have begun to use demolition material as part of the site preparation for the next building, thereby avoiding transport away form site and subsequent waste processing. Technically, this falls under module D. However, it is also downcycling (the value of the material is lower than it was before) and so doesn't contribute to broader circular economy goals.

The correct accounting for module D within LCA is therefore subject to debate. The work carried out by LETI has come to be seen as an industry benchmark. Their definition of whole life carbon does not include module D, because multiple scenarios can be produced. However, others in the construction industry do include it in the definition of whole life carbon.

Avoiding the Oxford Street debates of the future

The picture may not always be as clear as we'd like when it comes to embodied carbon and whole life carbon. Simply, though, reducing the amount of carbon for which our buildings are responsible is essential to help achieve a more efficient use of resources and reach net zero targets.

As decarbonisation of the energy grid continues, and the operational emissions of our building stock become net zero (see our net zero carbon white paper for more detail about this), the only carbon left to address will be the carbon embodied in the fabric of our buildings. We need to reduce it.

If we don't, then the buildings constructed today will, in a century's time, be subject to the same debates as the Marks & Spencer building – long after the target date of 2050 for net zero emissions.

The definition of whole life carbon is straightforward, even if the inclusion of module D of LCA is subject to some debate. The important thing is that whole life carbon includes everything in the life cycle. With that in mind we can start to take action, as the next section of this white paper discusses.

Making the changes to reduce whole life carbon

Wholesale change is impossible overnight

Several themes have emerged in this white paper so far. One is a lack of clarity around whole life carbon and how it is assessed. Another is that the construction industry and its supply chains struggle to embrace change, especially in trying to move towards a circular economy.

Together, these issues make it harder for individuals to identify a clear path for taking action. Clients don't know what to ask for. Designers and specifiers struggle to identify an obvious first step where they can make a difference. Even when someone – client or designer – does make a step, it's easy to encounter a roadblock soon after that stalls further progress.

It's important to acknowledge, then, that the entire construction industry is not going to change how it operates overnight. The good news is that immediate small changes can quickly start to make big impacts.

The power of individual change

On an individual level, choosing to address whole life carbon and engage with the assessment process on a live project is an important first step.

The next step is to then acknowledge the impossibility of reducing the environmental impact of every single product and component on that one project. Attempting too much change in one go is overwhelming, and potentially counterproductive.

Instead, it is a process of learning through action; of understanding what works and what doesn't and applying the lessons from one project to the next.

The construction industry has embarked on that journey with operational carbon. There are still challenges to overcome, not least in reducing performance gaps on site. Generally speaking, though, it can be said that we've learnt how to reduce the operational energy demand of our built environment.

Now, as an industry, we need to go through that same process with embodied carbon, so that we can deliver low whole life carbon projects consistently. The principal difference is the urgency of the climate emergency, which means we need to go on this particular journey faster than we might otherwise have done.

Making big step changes at the project level

The good news is that our first steps along this new path have the power to deliver substantial reductions in embodied carbon. And once we learn how to make a big step change like that, it's impossible to unlearn it – meaning the lesson is carried over onto future projects.

In operational carbon terms, a building's performance is affected by its occupants. An 'efficient' building can be operated relatively inefficiently, and vice versa.

Embodied carbon is not subject to the same potential variation. It can't be affected by occupant behaviour. Whether the embodied carbon is lower or not is entirely down to the design and specification decisions that are made.

Looking at all the different life cycle stages where carbon can be accounted for, it might feel daunting to wonder how you'll address each one. However, there is a clear and obvious starting point.

About 50% of all embodied carbon is accounted for in modules A1 to A3. The extraction of raw materials and the manufacture of construction products is responsible for most of the embodied carbon. Big step changes therefore come from selecting different materials.

Start with the structure

Establishing the embodied carbon of a product is fundamentally simple. Multiply the amount of the material being used by its embodied carbon per m3 and you have the total for that product. Do that for all the products in a building and you have the building's total embodied carbon.

(Add the predicted operational carbon for the building's intended life and you have the building's whole life carbon.)

Reducing embodied carbon therefore means using materials with a lower embodied carbon where possible. Where its unavoidable to use materials with a higher embodied carbon, then they should be used as efficiently as possible.

Ultimately, efficient use of materials is important regardless of embodied carbon content, as it also leads to cost savings. Designs should seek to use less-complex forms; in particular, reducing the amount of material that needs to go into foundations and structural frames is the ultimate aim.

Where that can be achieved at the same time as moving away from materials that have high upfront carbon, then a project will see substantial embodied carbon reductions.

For low-rise structures in particular, bio-sourced solutions are feasible and offer lower embodied carbon. Timber frame structures, and insulations such as wood fibre or hemp, are good examples. Bio-sourced materials sequester carbon – that is, they draw carbon from the atmosphere as they grow – and they store that carbon for as long as they are used in the building.

Materials such as steel and concrete have very high embodied carbon. Both industries have long-term plans to achieve net zero, and they will continue to be part of our built environment. In the short term at least, though, low embodied carbon design means keeping their use to a minimum. In a building with a 60-year or more lifespan, the sequestered carbon of bio-sourced products has a measurable positive effect on whole life carbon.

Engaging with the others

These first steps in lowering embodied carbon might be born from individual values and decision-making. But it must soon become more collaborative.

Specifying different materials, for example, means engaging with different manufacturers and supply chain partners. It means obtaining different information, to better understand product performance and compare environmental impact. It means understanding where products can be sourced from so that contractors don't try to substitute more 'usual' products back into the specification.

The calculation of embodied carbon might be straightforward in theory, but requires information that you might not typically ask for. Understanding the volume of concrete in a design, say, requires engagement with the structural engineer. Not only to get accurate information, but first to communicate the goal of lowering whole life carbon through more efficient design.

Through this engagement and collaboration, the whole industry can begin to move away from an approach of 'that's how we've always done it'. We all need to work together to create a common culture that prioritises low carbon design and construction, and achieve that by sharing data and learning from one another.

Through this process, your personal decision to think about more than 'just' operational carbon starts to have a ripple effect. You learn from others who are a little further along the road, and you start to inspire those who have only just found the path to start taking action.

Meeting a target

This section of the white paper has shown that you can choose to start making a difference and making that choice can have a surprisingly big impact.

Conversely, your decision to start looking at the issue of embodied and whole life carbon might not have been a choice. Maybe it was a target imposed by the client, or a local planning requirement. Despite the potential pressure accompanying a formal requirement, everything we have said so far remains true: you stand to make a substantial difference even by taking the first steps.

How do you measure the impact of your new choices, and demonstrate the difference you are making compared to 'business as usual'? That is where a whole life carbon assessment comes in, and the next section looks at the process in more detail.

Photo: Bouygues UK, Project: The Stratford

Assessing whole life carbon in construction projects

Proposed Document Z

In 2021, a group of industry experts published their proposal for 'Proposed Document Z' – an addition to the existing Building Regulations that would require whole life carbon emissions to be assessed and reported. Furthermore, it would set a requirement for 'carbon intensity', with the aim of achieving more efficient resource use.

The document is a proof of concept, designed to show that embodied carbon could be integrated into the existing regulatory framework and help to accelerate the action that has already started in this area. Legislation is frequently cited as a key driver in shifting attitudes and behaviour.

The proposal would not immediately set limits on carbon. In that sense, it is very much in line with what we discussed in the previous section of this white paper: start with measuring, assessing and reporting, to encourage action. Once action is commonplace, specific targets are easier to implement.

Currently, embodied carbon is not a feature of Building Regulations. Taking voluntary action to reduce embodied carbon is effectively penalised on many projects, as it tends to cost more to do compared to not taking such action.

Regulated whole life carbon targets, and their phased introduction as suggested by Proposed Document Z, would make sustainable design and construction consistent across the built environment.

Whole life carbon assessment targets

Until such a time as whole life carbon becomes part of national building regulations, anyone looking to benchmark a project must select from a limited range of voluntary schemes.

Our net zero white paper looks at whole-building schemes that include embodied carbon as part of meeting a definition of 'whole life net zero'. In this white paper, we are looking only at schemes that actually assess embodied carbon, which can then be used to produce a figure for whole life carbon – whether the ultimate aim is net zero or not.

The two main embodied carbon targets in use in the UK construction industry are:

- RIBA Climate Challenge 2030; and
- LETI Design Targets.

A **document produced by LETI**, working with other groups including RIBA, acknowledges that "a key issue the industry faces is the lack of consistent measurement, leading to mis-aligned benchmarks, project targets and claims".

Despite initial differences in the scope of reporting, a lot of work has gone into aligning the two targets. Part of that work has included the creation of a rating system (similar to that used for energy performance certificates (EPCs) or home appliances) to aid comparison. Both targets also assess buildings by type (office, residential, retail, education).

Nevertheless, some difference remains, with LETI's targets relating to the building at design stage, and RIBA's when a project has been constructed.

'Carbon Heroes'

Assessing buildings by type also forms the basis of the benchmarking scheme, **Carbon Heroes**, operated by the One Click LCA software (which the Darren Evans team use to carry out whole life carbon assessments). Carbon Heroes does not specify embodied carbon targets but allows users to see how a project performs relative to similar buildings.

This approach is like that behind the creation of Proposed Document Z. It aims to create a deeper pool of information that the industry can draw on to understand what 'good' looks like, building on voluntary initiatives like the UK's Built Environment Carbon Database (BECD). A consensus can then be reached on how we all work together to achieve the shared goal of a lower carbon-built environment.

How whole life carbon is measured

A familiar letter rating system, ranging from A++ to G, allows for a consistent industry approach. Simple comparisons can be made between buildings. It is also more straightforward to set targets and encourage conversations about how to achieve those targets.

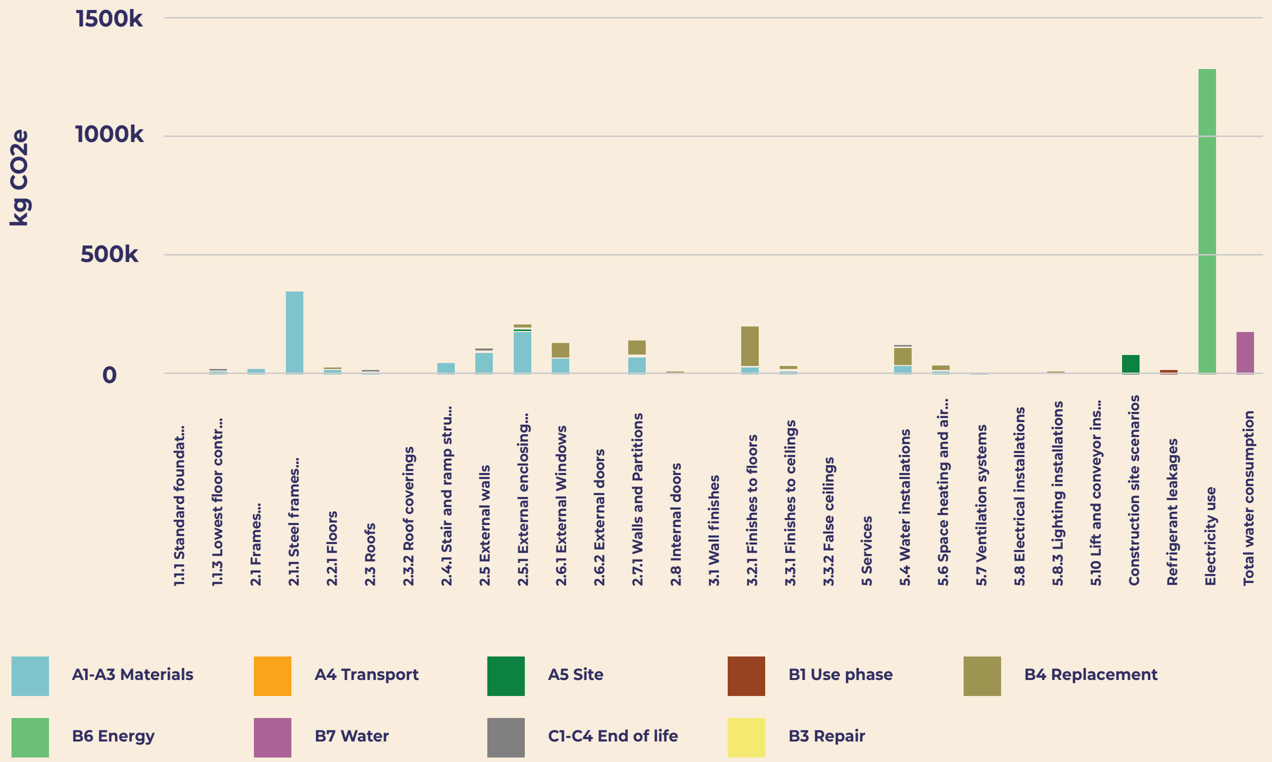
The figures that underpin those ratings, however, are based on the amount of carbon per square metre of usable floor area ($kgCO_2e/m2$). This is where the detail of assessments is found.

Basing the result on usable floor area encourages efficient design. An atrium is a good illustration of why this works. The materials used to construct a highly glazed atrium will most likely be carbon intensive, for the gain of relatively little usable floor area. There is nothing to stop your building design featuring an atrium, but it will likely require some trade-off elsewhere in the specification.

As we've seen in this document, however, things are rarely this clear-cut. Atria can offer building performance advantages, such as by providing daylight to areas of the building that would otherwise struggle to receive it. This can save on artificial lighting use, which is part of the operational carbon emissions.

This is why a whole life carbon approach is preferred, rather than looking at operational or embodied carbon in isolation. To what extent will that reduced artificial lighting use offset additional embodied carbon? It's impossible to say for a hypothetical project. For real projects, the answer will differ every time.

Total kg CO2e (Total kg CO2e) grouped by RICS category breakdown



Using buildings for longer

Is operational carbon or embodied carbon responsible for more emissions? Yet again, there is debate on this issue, and different people within our industry argue for different answers depending on how the issue is approached.

We are once more faced with a lack of clarity about how best to take action to reach a common goal. Those arguing that operational or embodied carbon is responsible for more emissions are doing so because they want to see emissions reduced overall. But the conflicting views leave decision makers uncertain about where to start.

The lack of maturity in the assessment process does not help here. We simply don't have enough historical data to help build a clear picture. The industry needs more whole life carbon assessments to be done, more often, so that we can start to see trends and identify what approaches work best in the majority of situations. The answer will always be slightly different for every building, but establishing best practice is critical.

Another element to this is the design life of buildings. The longer a building is used for, the less that embodied carbon 'matters' in the overall scheme. A 60-year design life is the standard assumption, while 50 years is used in the EU. There are also examples of requirements for 100-year assessments. In the introduction to this document, we described how the proposed replacement M&S building used a 120-year design life for its assessment.

Going from a 60-year to a 100-year design life means a two-thirds increase in the total operational carbon. From an LCA perspective, modules B1 to B5 take on greater prominence. Building services must be maintained more often, and components replaced. In the building fabric, the assessment assumes windows being replaced once or maybe even twice more over the extended lifespan.

Designing and constructing buildings so they can be used for longer is important in terms of using resources more efficiently. But if you say a building's design life is 120 years, will it be used for that long? The relative importance of the different modules changes with increased design life, and it's therefore important to be aware of the implication of that when making early decisions.

Photo: Bouygues UK

When should whole life carbon assessments be carried out?

Like all forms of mandatory and voluntary assessments, the best time to start looking at whole life carbon is in the early stage of projects. As more local planning authorities follow the lead of the Greater London Authority and start to adopt carbon targets as part of planning policy and approvals, early-stage assessments will become increasingly common.

The key to meeting targets is then following up with further assessments as the project progresses.

When detailed design and specification decisions haven't been made, generic materials are likely to be assumed as a placeholder. If these assumptions aren't updated (or accurate data added, where no assumption was included) as decisions are made, the original assessment becomes increasingly inaccurate.

A whole life carbon calculation that hasn't been refined doesn't contribute to the industry's efforts to achieve 'best practise'. And for individual projects, it could even mean being found in breach of planning approvals.

Another advantage of early assessment is that it gives designers and specifiers time to assess what information is available to inform decisions about products. EPDs are not ubiquitous, so information can be hard to find.

In some product sectors, even where manufacturers offer EPDs, the level of reporting in different ones may not be the same. Some EPDs report product impacts across all modules; others across only a limited selection. It makes fair comparisons even more difficult.

An early assessment could highlight where life cycle information is particularly needed and encourage the specification of products whose manufacturers offer that information. Maturing the whole life carbon assessment market also means creating the conditions in which manufacturers are encouraged to carry out fuller and more transparent reporting of environmental impacts.

In-depth analysis isn't yet normal, and that brings its own risks as the process does mature. Some projects want to show low assessments in order to win bids and tenders. The potential for misusing or omitting information is therefore high.

In the short term, therefore, more accurate assessment is likely to result in higher carbon emissions on projects. Seeking to cover everything and use exhaustive figures will paint a much clearer picture of where carbon emissions currently are. The increased accuracy will make it possible to demonstrate the full extent of the savings being made, as well as knowing that the savings being calculated are accurate as well.

Photo: Bouygues UK, Project: Postmark

Case study:
Darren Evans and Bouygues UK

Whole life carbon at Wornington Green, North Kensington

When phase 2b of the regeneration of the Wornington Green Estate in North Kensington completes in 2024, its residents will live in housing that has been the subject of one of the most accurate whole life carbon assessments undertaken for a project of its size and complexity.

Contractor Bouygues UK engaged Darren Evans to work with them collaboratively on assessing the whole life carbon of the 230 homes, comprising high-rise blocks and low-rise town houses. Darren Evans was brought on board to review the environmental impact data gathered by Bouygues UK and produce draft assessments for review.

The internal technical team at Bouygues UK already had several years of experience carrying out whole life carbon assessments. However, challenging themselves to make the whole life carbon assessment for Wornington Green as accurate as possible meant engaging with additional expertise. Working together, the two parties helped to develop each other's knowledge and find areas for improvement within the whole life carbon assessment process.

"Our carbon reduction plan for the project is to forecast, and try to measure, the carbon reductions we can make. But where do we start from? We had to understand what we wanted to do and why we wanted to do it, establishing a baseline as well as benchmarks, and then obtain the evidence that we'd achieved it," says Romain Richli, Chief Climate Officer at Bouygues UK.

"This wasn't the first time we'd undertaken whole life carbon assessments, having spent two years developing our internal expertise. However, if we only ever do these exercises alone then we won't know where we're risking falling foul of our own incorrect assumptions. We therefore decided to bring in outside help."

Darren Evans produced an initial draft assessment, and the Bouygues UK technical team carried out an internal high-level review, interrogating the results based on orders of magnitude and shares of scopes and categories. They returned queries to Darren Evans, who produced a revised draft. Again, Bouygues UK reviewed it, this time in more detail, covering components, products and materials.

Brandon Wipperfurth, Senior Sustainability and Energy Consultant at Darren Evans, describes what made this project so unique: “It was the scale of it. This was a big development, and big developments are extremely complicated. This is one of the first high rise projects I know of that’s been done accurately. Bouygues UK are really at the forefront of this, and you can tell by how they gave us really specific detail, and how they didn’t want to miss anything out.”

The importance of collaboration to whole life carbon assessment

“As an industry, we need to get better at measuring and assessing whole life carbon,” says Romain. “We’re all in the climate emergency together, so we must collaborate. Darren Evans shared our mindset. Our intention wasn’t simply to outsource a service and obtain a deliverable, it was to engage in a partnership to share our respective experiences and learn from each other.

“For some time we learnt by ourselves, as Bouygues UK have very strong internal technical capabilities. But at some point, there is a need to look out there and find levers to propel this knowledge further. Working with Darren Evans on this project has been a real success of collaboration.”

The benefits of collaboration were also felt by the Darren Evans team.

“I’ve very much learnt from Romain and his team on this project. We brought things to their attention as well,” says Brandon. “Bouygues UK really care about this, so the back and forth between us was really good.”

Romain describes how the industry needs to have something of a reality check. “The more detail we get into, the more likely we’ll actually have higher carbon emissions on projects – because we’ve sought to cover everything. It’s likely that our projects will look higher than others, and potentially higher for the coming year, while the whole industry is still learning. But that’s because we have exhaustive figures.

“We’re all learning, so it’s not the time to be making shortcuts. Only by being exhaustive and doing these analyses properly can we understand, learn and gain the complete expertise. Otherwise, claims are often made on very weak grounds. Only with that expertise can we then demonstrate the full extent of the savings we’re making.”

Where can whole life carbon assessments be made more accurate?

At the moment, whole life carbon assessments are not yet audited properly – which is what makes the collaboration between Bouygues UK and Darren Evans so unique.

“The robustness of assessment will come when the wider industry understands what needs to go into an assessment to make it as complete as possible,” Brandon says. “For a project like Wornington Green, hours and hours of time have to be put in to getting the assessment right. Until legislation requires it, not everybody will be able, or willing, to put similar effort in.”

M&E was the biggest area of shared learning on this project. “It’s an area of LCA not fully mastered,” says Romain, "so there are only a few EPDs available and generic carbon values are often used. Some of that generic data is five or ten years old, so it's not accurate."

Another issue is that the design of M&E is rarely complete before projects start on site, or sometimes even later on. Lengths of pipes and cables, for example, have not been fully designed or specified, so it's difficult to establish an accurate quantity of material that will be used. Some of them, though, are heavy carbon contributors.

Installations feature circuit boards, which are lightweight components and easy to miss, but which have significant carbon implications due to the heavy metals used in their make-up. For Romain, accounting for all of this is to be seen as a positive challenge.

"We are engineers," he explains, "and we're not satisfied with partial answers. That's why we have set ourselves the goal of going beyond high-level figures and understanding what they are really made of in order to draw conclusions."

Photo: Bouygues UK, Project: The Stratford

Conclusion

Tackling operational and embodied carbon together, in the form of whole life carbon, is essential. If we do it, and do it well, we stand to enjoy the benefits of a genuinely sustainable built environment that will serve us well beyond 2050's net zero carbon target.

However, the climate emergency means this is a journey we need to take quickly. Faced with that sort of urgency, it can be easy to feel as though we must do everything, right now, and perfectly.

That is impossible.

Chasing perfection actually inhibits progress. Striving to find the 'perfect' target to aim for, or to write the 'perfect' specification that minimises carbon, consumes time and energy. It can take so long to reach the desired goal that you fail to take action – and then learn from that action – in the meantime.

And when someone thinks they have come up with a 'perfect' solution, it is touted as the only way to do something. The efforts of others, elsewhere, risk being undermined.

Carbon reductions in the built environment are not a competition. The climate emergency is the thing we are all 'competing' against. As we have said repeatedly in this document: lower carbon is a goal we all share. Words are not always backed up by actions, however.

And action is what we need now. Without it, we cannot achieve the immediate aim of carbon reductions.

However, we also need to be conscious of the consequences of addressing that priority. In the majority of cases, delivering better performing and lower carbon buildings requires more material upfront – in the form of more insulation, or triple glazed windows, for example. More material equates to more carbon, so we have to understand how knowingly emitting more carbon now will benefit society in the future.

The concept of Carbon Payback Periods (CPPs) means that emitting one tonne of carbon (or equivalent in other greenhouse gases) now to save one tonne of carbon 'later' is not enough. The carbon emitted now will be in the atmosphere longer and therefore have a greater long-term impact on the warming of the planet.

If we commit to emitting a tonne of carbon today, it has to be with the knowledge that it will save two tonnes of carbon, or more, in the future. Only through the use of whole life carbon assessment and CPP together can we make sure that a proposed building's long-term carbon benefit exceeds the initial carbon investment.

Learning from one another is how we succeed. Understanding what it looks like to make progress on this issue is how we succeed. That's why we have written this white paper – to show where we at Darren Evans are on our journey, and to hopefully inspire you to continue taking steps on your own path.

By implementing practical changes in building design and specification, and then evaluating the impact of those changes, it's possible to continually aim for better than what you have done before.

Whole life carbon assessments are the tool to help you take those practical steps, contribute to the bank of industry knowledge that is so badly needed, and inspire those around you to make their own paths.

About Darren Evans

The expert team at Darren Evans can support you in achieving your low carbon goals by carrying out whole life carbon assessments. We'll look at the embodied carbon in your projects, as well as assessing their operational carbon.

At the same time, we can produce SAP assessments and SBEM calculations to help you demonstrate regulatory compliance. And we can help you with other voluntary certification schemes, such as Passivhaus or BREEAM.

View the full range of our services or contact us to discuss your sustainability goals.

As part of offering our whole life carbon and net zero carbon consultancy services, Darren Evans has committed to work only on net zero carbon projects by 2026.

To find out more about how Darren Evans can support your project, start a conversation with us.

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