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Slattery embodied carbon benchmarking report

July 2023

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Counting the cost of carbon

Since releasing the first upfront embodied carbon benchmarking paper in May 2022, the property industry has moved at pace. Upfront embodied carbon is now central to the sustainability conversation. As we work towards national standards and benchmarks, Slattery will continue contributing data and knowledge so the industry can move further and faster together.

Key highlights

According to Slattery's most recent benchmarking data:

- Tertiary education, healthcare and education are the top three sectors with the highest global warming potential GWP/m2 of gross floor area. These building types construct both the base build and fitout
- 82-91% of the upfront embodied carbon in typical new builds come from the cold shell scope
- 77% of the total GWP of new commercial office buildings, on average, comes from the substructure, structure and external walls

The data confirms that extending the life of existing structures through retrofitting and reuse is the most effective strategy to minimise upfront embodied carbon and meet sustainability targets.

Introduction

Change starts with a decision to do things differently – and good decisions are based on trustworthy data. We can't tackle upfront embodied carbon without comparable, consistent and replicable benchmark data.

Slattery released the first upfront embodied carbon benchmarking paper in May 2022. Since then, Australia's property industry has moved at pace.

The NSW Government is funding the development of a world-leading framework to measure, benchmark and certify emissions from construction and building materials. Informed by industry expertise, including from Slattery, NABERS released a consultation paper in December 2022 and is now reflecting on feedback.

The Property Council of Australia and Green Building Council of Australia (GBCA) have developed a new suite of policy recommendations to inform the federal government's approach to upfront embodied carbon. The Every Building Counts report, released in April 2023, urges the federal government to adopt the NABERS framework, set new minimum reporting requirements within the National Construction Code, and create a national embodied carbon database for products and materials.

A growing number of developers and asset owners are also stepping up their pace of change, some of them Slattery clients. The GPT Group, for instance, is addressing upfront embodied carbon on all new developments.

National standards and benchmarks are absolutely mission critical. As the work to set those national standards and benchmarks accelerates, Slattery will continue to contribute data and knowledge so the industry can move further and faster together.

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Why upfront embodied carbon benchmarking matters

Australia has an ambitious target to reach net zero carbon emissions by 2050. We can't meet this target without addressing emissions in the built environment.

Embodied carbon – the greenhouse gas emissions generated during the manufacture, construction, maintenance and demolition of buildings – accounts for 35-45% of a standard building's life cycle carbon emissions. This means the decisions we make during design and construction are 'locked in' to a building's carbon footprint forever.

As rating tools and government regulations expand their focus to include embodied carbon, our understanding of upfront embodied carbon in buildings must expand too.

Image:
51 Flinders Lane,
Melbourne, VIC

Slattery embodied carbon methodology

To dive into the detail of how Slattery's Carbon Planning Service measures the upfront embodied carbon, read our methodology report **here!**

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The benchmarks

Slattery has updated the filters in the data to include only the cold shell building scope. This benchmarking approach is aligned with the NABERS Embodied Emissions Initiative proposed methodology (Option 1), currently in development, which excludes most finishes and services and sequestered carbon.

Cold shell covers the most carbon intensive elements of a new build, including substructure, upper floors, columns, and external walls and windows.

Across all sectors that Slattery benchmarks, the cold shell scope is responsible for 82-91% of the total building global warming potential.

The benchmarked projects encompass a range of design stages and represent developers with varying degrees of environmental sustainability intent. Values at the lower ranges of each sector generally indicate an effective application of upfront embodied carbon reduction principles.

The higher range values typically represent a “business as usual” approach to sustainable design.

Since the initial release of the first embodied carbon benchmarking paper, we have observed a shift towards lower GWP/m2 rates across most new build sectors. This is an early and positive sign that Australia’s property and construction industry is moving towards systemic upfront embodied carbon management.

Deep dive into commercial new builds

Australia’s commercial building sector is responsible for approximately 25% of electricity consumption and 10% of our national total carbon emissions (DCCEEW, 2023).

At Slattery, we are increasingly engaging with commercial clients that have made ambitious sustainability and net zero commitments across their developments.

To support our clients, we have investigated commercial upfront embodied carbon data in detail. Figure 2 demonstrates the average elemental breakdown of total GWP across our commercial new build benchmarking projects.

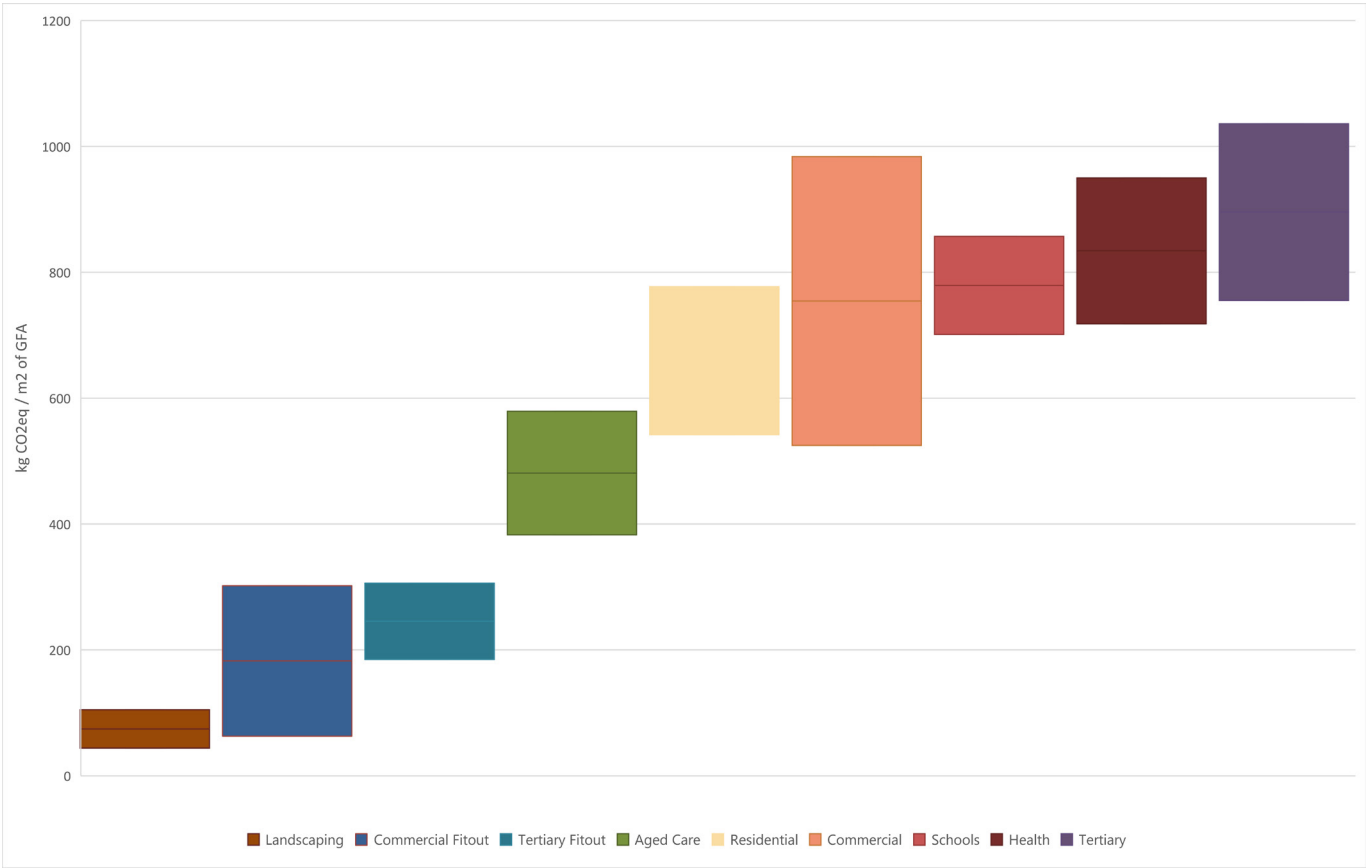

Figure 1. Benchmarking graph

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The substructure, columns, upper floors, external walls and internal walls constitute 77% of the average commercial building total GWP. There are substantial opportunities to achieve significant carbon reductions within these key elements by implementing various sustainable design strategies such as:

- Considering adaptive reuse of all or components of an existing structure
- Designing a more efficient or compact building form
- Reviewing the façade loadings on the structure
- Selecting durable materials with greater service life potential
- Specifying low carbon, reused or recycled materials.

Finishes are responsible for an average of 11% of total building GWP across our commercial benchmarked projects. Opportunities to reduce upfront embodied carbon emissions in floor, ceiling and wall finishes include the following:

- Use fewer finish materials (e.g., utilise structural materials as finishes, deliver office tenancies as cold shell to minimise wastage)
- Minimise quantities of carbon-intensive stone and ceramic tiling
- Avoid raised access floors
- Specify carbon neutral plasterboard, stud framing and carpet products.

Figure 2 displays the rates of GWP/m2 of GFA for each building element within our commercial benchmarked projects. Upper floors and internal walls, screens and partitions are the most carbon intensive elements, most commonly due to high quantities of reinforced concrete in suspended slabs and core walls.

The substructure GWP/m2 range is large across our commercial projects due to the high emissions resulting from bulk excavation and retaining wall structures in basements in some projects, and varying extents and depths of basements and associated piling. Projects which opt for podium carparking solutions have a substantially lower upfront embodied carbon contribution from the substructure, and typically reflect the lower end of the emissions range.

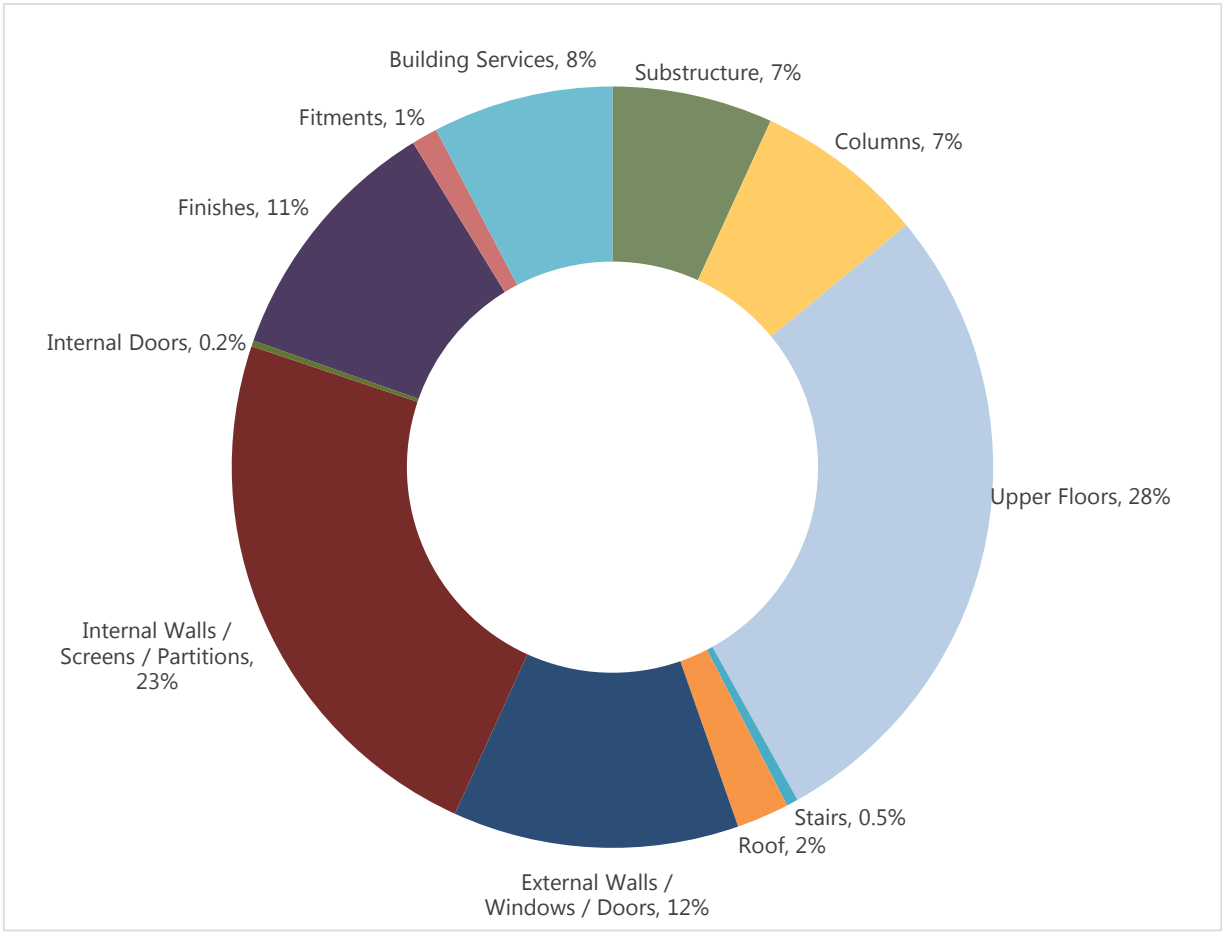

Figure 2. Average elemental percentage breakdown of GWP in Slattery commercial benchmarked projects

To review the methodology and the connection between these graphs, click here.

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Anticipating future carbon trends

The Australian Government has pledged to achieve net zero emissions by 2050. Efforts to decarbonise our building industry are critical to this ambition.

Construction activity in Australia generates a significant flow of materials, as old buildings are continuously demolished and replaced, and new buildings constructed to meet growing demand.

Construction consumes as much as 50% of the world's raw materials and generates a mountain of waste (BBC, 2021). Of Australia's 76 million tonnes of waste in 2021, 38% was construction materials (Australian Government, 2022).

As we decarbonise the grid and improve energy efficiency, our buildings will generate less carbon in operation. But as our building stock grows, embodied carbon will become the dominant source of building emissions.

Looking ahead, we expect a complete reimagining of the way we design, specify and construct buildings.

Multiple organisations and rating tools are working on projects to address the embodied carbon challenge, including the Green Building Council Australia's Green Star, Climate Active, NABERS and EPD Australasia.

Large-scale manufacturers of key building materials are also setting ambitious sustainability targets to remain innovative and competitive in a market geared towards sustainable procurement. For instance, Infrabuild, a major supplier of reinforcement steel, has ambitions to achieve carbon neutrality by 2030 (Infrabuild, 2020). Concrete suppliers, most notably Boral and Holcim, have released low carbon concrete blends (Boral, 2023; Holcim, 2023). BlueScope was the first company in Australia to publish an EPD and now has five for steel products (BlueScope 2023).

High embodied carbon materials may be eliminated from the supply chain by developers as carbon offsets become more expensive. The price of Australian carbon credit units has risen substantially and non-linearly from $18/tonne to $33/tonne in the last 24 months (Jarden, 2023). Purchasing carbon credits to offset large developments is an added cost that comes with significant risk on top of already surging materials costs and interest rate rises.

Smarter design and materials choices, dematerialisation and innovative construction methods, as well as pre-purchased carbon offsets will become critical to net zero strategies.

Designing buildings for eventual repurpose, rather than demolition or disassembly, could also be advantageous. This would deliver substantial embodied carbon savings and respond to the constantly changing nature of building function requirements. For this reason, we anticipate an increasing shift towards adaptive reuse.

More flexible structural grid layouts would, for instance, allow for the adaptation of a commercial office into a residential space, or the transformation of a multi-level carpark into a residential apartment or commercial office building. Implementing "long life, loose fit" approaches into building designs could extend the life of structures from 50 years to 100-plus years and significantly reduce the demand for raw, non-renewable materials (and associated energy use).

Addressing upfront embodied carbon emissions is an economy-wide challenge, requiring active engagement from every link in the value chain.

Developers and designers, regulators and rating systems, suppliers, financiers and professional services must all work together to challenge business-as-usual and to make low upfront embodied carbon buildings the rule, rather than exception. This ambition is achievable, but its success is underpinned by reliable and rigorous data. Slattery is proud to play our part in sharing data so together we can move at speed and scale.

> "Slattery is proud to play our part in sharing data so together we can move at speed and scale."

Definitions

Biogenic emissions: The release of greenhouse gases, such as carbon dioxide and methane, from natural biological processes, including plant growth, animal digestion, and decay of organic matter.

Carbon budget: The amount of carbon that can be emitted while still achieving a specific climate goal, such as limiting global warming to 1.5°C.

Carbon offsetting: The process of compensating for carbon emissions by funding projects that reduce or remove carbon from the atmosphere.

Carbon sequestration: The process of capturing and storing carbon from the atmosphere in vegetation, soils or geological formations.

Circular economy: An economic model that aims to minimise waste and resource consumption by sending products and materials around in a 'closed loop'.

Decarbonisation: The process of reducing or eliminating carbon emissions.

Embodied carbon emissions: The carbon emissions associated with the production, transportation and construction of building materials and products, including end of life demolition.

Environmental Product Declaration (EPD): A standardised document that provides transparent and comparable information about the environmental impact of a product, including carbon emissions over its entire life cycle.

Global Warming Potential (GWP): A measure of the warming effect of a greenhouse gas, relative to carbon dioxide, over a specified period of time, often used to compare the climate impact of different gases and emissions.

Life cycle assessment (LCA): A method used to quantify the environmental impact of a product or process from the raw materials stage to the end of its useful life, including disposal and recycling.

Upfront embodied carbon emissions: The amount of greenhouse gases emitted during the product manufacture and construction phase of a building, including the production of materials and transportation.

Whole-life carbon assessment: An assessment that considers the embodied carbon, operational carbon and end-of-life carbon of a building.

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Citation

O'Connor, J., Dean, T. and Mortensen, J., (2023), Carbon counts: Upfront Embodied Carbon Benchmarking, Slattery.

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Image:
New Days and Old Days, Titjikala, 2020
by Doris Thomas
Slattery Warrang (Sydney) Collection

About Slattery and Kaizen

Slattery is a property and construction advisory firm specialising in quantity surveying, cost management and early phase project advisory, with an outstanding history spanning more than 40 years.

We work hand-in-hand with governments, institutions and organisations as well as planners, developers, architects and design teams on a broad range of property and construction projects.

A commitment to excellence and innovation, and an ability to become an integral part of the project team, has earned Slattery the trust and respect of clients and project teams alike. Slattery adds value by taking control and ownership of the cost management process from the outset.

Slattery's Kaizen papers share knowledge, ideas and pertinent cost information related to our industry. Kaizen is the Japanese word for improvement, and a business philosophy that strives for continuous improvement in process. We produce papers across the sectors we work with, which are shared with our clients and made available on our website for all to view.

Explore our knowledge sharing further at www.slattery.com.au/thought-leadership

Slattery Carbon Planning

Slattery is proud to be the first quantity surveying firm in Australia to launch a carbon planning service.

Our service is available in conjunction with cost planning to assist our clients to address upfront embodied carbon on current and future developments, and to achieve their net zero and sustainability targets.

Read more about Slattery's carbon planning offering at www.slattery.com.au/carbon-planning

Our team is pleased to hold memberships to the following industry groups:

AIQS Australian Institute of Quantity Surveyors
MECLA
Green Building Council Australia

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