Infrastructure Sustainability Council

IS Impact Notes

Low Embodied Carbon Materials

Overview

This IS Impact Note outlines the role of the infrastructure industry in reducing the embodied carbon emissions of construction materials. It describes how the IS Rating Scheme drives embodied emissions reductions at a project level via sustainable procurement, options assessment, innovation, and at a materials level via Environmental Product Declarations (EPDs) and Third-party product certifications.

The embodied carbon of materials equates to the greenhouse gas (GHG) emissions that occur during the resource extraction, transportation of resources to manufacturer, manufacturing, and transportation to construction site of materials.

What is the issue?

The greenhouse gas emissions associated with infrastructure development and delivery are significant. Usually, efforts to tackle carbon emissions have been focused on asset operations. However, as the management of operational energy becomes a business-as-usual practice and net-zero strategies are implemented, the attention towards the embodied carbon emissions of materials has increased. For example, in Australia, embodied carbon emissions of materials represent an estimated 5% to 10% of the total annual greenhouse gas emissions.

Opportunities to tackle embodied carbon emissions exist across multiple stages of an infrastructure asset's development, from project planning to design and ultimately operations. All related stakeholders including material manufacturers and suppliers, investors, designers, contractors, asset owners, and government authorities have a role to take action to reduce embodied carbon emissions and ensure the infrastructure industry is on the right path towards a net-zero future. A focus on tackling materials' embodied carbon emissions in infrastructure also supports the transition to a circular economy.

How can you deliver impact?

Taking positive action

The Infrastructure Sustainability Council sees materials' embodied carbon as a key issue in the decarbonisation pathway of the infrastructure industry. ISC members can make a significant difference by actively using the IS Rating Tool to drive the use of low carbon materials (see table below) and by:

1. Adopting Science Based Targets for addressing the emissions of main construction materials.
2. Trialing low embodied carbon and carbon positive materials.
3. Setting policies for low carbon and carbon positive materials in tendering processes.
4. Removing organisational policy and operational barriers to maximising use of low carbon materials.
5. Collaborating with suppliers and industry partners to create opportunities and remove barriers for low carbon material use.
6. Requiring offsets where materials are not carbon neutral.

Driving outcomes with the IS Rating Scheme

Relevant IS v1.2 and IS v2.1 Credits

The IS Rating Scheme drives the reduction of materials' embodied carbon emissions in multiple ways. As of FY2021, it has led to a 55% avoidance of lifecycle materials GHG emissions (see ISC 2021 Impact Report). IS Rating Tool credits (see table below) provide specific guidance and key indicators that inform and significantly reward change. These credits focus on sustainable procurement, options assessment, materials use and reduction, resource efficiency and smart design, innovation, and energy efficiency.

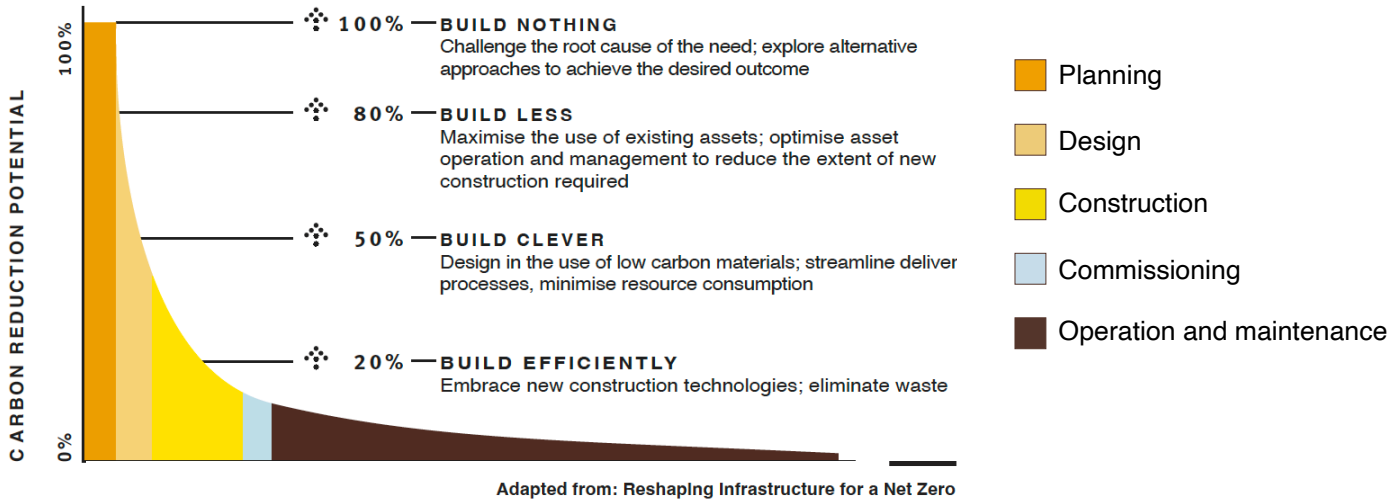
IS Rating Tool – focus area	Relevant IS v1.2 Credits	Relevant IS v2.1 Credits	Key points to note (details in the IS Technical Manuals)
Sustainable procurement	• **Pro-1** Commitment to Sustainable Procurement • **Pro-2** Identification of Suppliers • **Pro-3** Supplier Evaluation and Contract Award • **Pro-4** Managing Supplier Performance	• **Spr-1** Sustainable Procurement Strategy • **Spr-2** Supplier Assessment and Selection • **Spr-3** Contract and Supplier Management	IS v1.2 and IS v2.1 credits reward: • The implementation of a sustainable procurement strategy where low carbon aspects are considered, including: > Specification of low carbon products > Specification of products with EPDs or third-party sustainability labels. > Sourcing local materials > Suppliers required to demonstrate fuel efficiency related to transportation. > Low carbon KPIs and incentives reflected in supplier contracts.
Options assessment		• **Ecn-1** Options Assessment and Significant Decisions	IS v2.1 Ecn-1 credit rewards: • Inclusion of sustainability factors in options assessment. Whole of Life costing including social cost of carbon.

IS Rating Tool – focus area	Relevant IS v1.2 Credits	Relevant IS v2.1 Credits	Key points to note (details in the IS Technical Manuals)
Materials use and Resource efficiency	• **Mat-1** Materials lifecycle impact measurement and reduction • **Mat-2** Environmentally labelled products and supply chains	• **Rso-1** Resource strategy development • **Rso-6** Material life cycle impact measurement and management • **Rso-7** Sustainability Labelled Products and Supply Chains	IS v1.2 and IS v2.1 credits reward: • Use of the IS Materials Calculator (or equivalent) for the modelling and monitoring of materials' lifecycle impacts and demonstrating reductions. • Identification of design options that embed opportunities for minimising resource consumption and use of low impact materials. • Identification of significant circular economy opportunities, materials with third party sustainability credentials, and materials and resource use opportunities that meet regulatory approval requirements relevant to the project or asset.
Innovation	• **Inn-1** Innovation strategies and technologies	• **Inn-1** Innovation	IS v1.2 and IS v2.1 Innovation credits reward: • Innovations related to embodied carbon of materials including specific Innovation Challenges • Third-party certification of carbon neutrality for the final infrastructure asset
Energy and Carbon		• **Ene-3** Offsetting	IS v2.1 Ene-3 credit rewards: • The offsetting of residual emissions from the project's construction (including embodied carbon in materials).

The impact of Planning and Design

There is a significant opportunity to prioritise net-zero emissions via strategic planning and sustainable design. Relevant actions regarding the embodied carbon of materials include having proactive communications with the market and suppliers regarding resource efficiency targets and strategies considering circular economy, lean design, and resource use reduction opportunities.

Carbon reduction potential of strategic infrastructure choices



Adapted from: Reshaping Infrastructure for a Net Zero Emissions Future (2020)

Assurance of embodied carbon claims: EPDs and Third-Party Product Certifications

When accounting for the lifecycle impact of infrastructure, organisations require reliable data to make informed decisions related to the materials they use. EPDs and third-party product certifications allow decision-makers to identify low carbon materials, ensure accurate measurements of the materials' lifecycle, reduce the environmental footprint of their assets, and drive competitive advantage.

EPDs are verified and registered documents that communicate transparent and comparable information about the lifecycle environmental impact of products.

Third-party product certifications are awarded to businesses and organisations that have credibly achieved carbon neutrality. For example, Climate Active in Australia and Toitū in Aotearoa New Zealand

Future of assurance – EPDs digitalisation

The digitalisation of EPDs will increase their transparency, accessibility, and affordability. It will allow the quick incorporation of data from EPD users and providers into rating schemes such as IS. It will ensure the continuous improvement of the EPDs' quality and allow EPD use under different scenarios (geographic, jurisdiction, or industry). In the infrastructure sector, EPD digitalisation will enable a more streamlined and reliable process when comparing the environmental performance of different products and materials across the same category, including their carbon footprint.

Sustainable procurement actions for impact

Procurement is a significant opportunity to reduce the environmental and social impact of materials on a project. Outlined below is a set of actions, strongly rewarded in the Sustainable Procurement categories of the IS Rating Tools, to promote the use of low carbon materials in a project or an asset.

Action 1: Set a carbon budget per material

Setting an absolute carbon budget allows projects to understand and improve their performance and limit GHG emissions from infrastructure developments. Projects and assets should implement credible and rigorous carbon budgets to meet the 1.5ºC goal of the Paris Agreement. These budgets can be set for the GHG emissions associated with materials, in addition to other construction and operational emissions. Carbon budgets can be incorporated in the sustainable procurement policy and strategy (rewarded in IS v2.1 Spr-1, IS v1.2 Pro-1).

The Science Based Targets Initiative (SBTi) allows the establishment of a cost-effective and long-term decarbonisation strategy. The SBTi Sectoral Decarbonisation Approach (SDA) is useful in the infrastructure industry as it presents a methodology to set science-based emissions intensity targets for materials including aluminium, cement, and steel (all in development). This allows projects to establish outcome-based targets on the carbon intensity of key construction materials equal to or below sectoral emissions intensity.

Action 2: Establish a sustainable procurement process including carbon targets

Sustainable procurement processes should include the incorporation of science-based targets on the carbon intensity of materials (rewarded in IS v2.1 Spr-3, IS v1.2 Pro-3). Supplier performance can then be assessed by setting weightings for materials that achieve these targets. If the targets were not achieved, suppliers can be required to offset the difference between their proposed target and the project or asset's determined targets.

In effect, projects can incorporate in their procurement process the prioritisation of suppliers and products publicly committed to net zero, establish partnerships, support early engagement with contractors to investigate and assess low carbon alternatives, and provide feedback to suppliers on their sustainability performance (rewarded in IS v2.1 Spr-2, IS v1.2 Pro-4).

Action 3: Require suppliers' assurance of low embodied carbon materials

Projects and assets should seek assurance from suppliers on their materials' footprint and environmental information. This can be delivered by requiring suppliers to provide EPDs and independent product certifications on their materials, as well as offset certificates where required (rewarded in IS v2.1 Spr-2, IS v1.2 Pro-4).

This approach enables suppliers and manufacturers to effectively communicate their environmental credentials.

Case studies

Case study 1: Bayswater Level Crossing Removal Project

The Victorian Government's Level Crossing Removal Project involves the removal of 85 level crossings in Melbourne by 2025, one of which is the Bayswater Level Crossing Removal.

The project's target was to reduce the carbon intensity related to lifecycle impacts of materials by 30%. The project achieved its target through smart design, minimising materials used and selecting more sustainable materials. Some of the initiatives implemented during the planning and delivery of the project included:

- Drain design re-development and raising of bridge levels, led to savings of 8,903 m3 of concrete and 3,400 tonnes of asphalt.
- Use of 20 to 30% of recycled asphalt in asphalt products.
- 25% of supplementary cementitious materials average for structural concrete, including retaining walls, piling, soil nails.
- 30 - 40% of supplementary cementitious materials average for non-structural concrete including kerbs, shared user paths and gutters.

For more information, please refer to the Bayswater Level Crossing Removal Project Sustainability Report (2017).

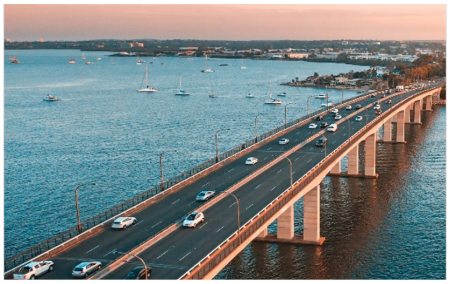
Case study 2: John Holland Group: Low carbon concrete trials

John Holland CPB Contractors Joint Venture (JHCPB) conducted a series of low carbon concrete trials within structural and non-structural works in both temporary and permanent areas of the Rozelle Interchange Project (RIC). The RIC is the fifth and final stage of the WestConnex tunnelling Program which is the largest road Infrastructure project in Australia.

The project has applied a bespoke low-carbon concrete to replace up to 70% cement content, using 8%-15% crushed glass sand as fines replacement. It includes 4-6kg/ m3 of 100% recycled macro polypropylene fibres in lieu of steel mesh. Results from the Low Carbon Concrete trials showed:

- A satisfactory performance of the implemented custom concrete mix over 12,000 m3 across multiple areas, including increased durability, early strength gains and good workability.
- Initial diversion of 140 tonnes of glass sand and 570kg of plastic fibres from landfill for a total reduction of approximately 127 tCO2e emissions.

There are a series of key lessons learned from this trial. For more information, please refer to the ISC 2021 Impact Report.



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