Embodied Carbon

Definition

Embodied Carbon emissions are the GHG emissions and removals associated with materials and construction processes throughout the whole life cycle of an asset (Modules A1-A5, B1-B5, C1-C4). (LETI/WLCN 2021)

Life cycle embodied carbon emissions

This diagram is structured by the BS EN 15978 life cycle stages, which in turn define the reporting metrics. The circular form and proposal to integrate a pre-design period at the start emphasises the opportunities available to reduce the upfront carbon emissions associated with Life Cycle Stages A1-A5.

Hierarchy for Embodied Carbon Reduction

Build less

- Challenge the client brief for spatial efficiency
- Re-use and renovate existing instead of new build, where possible
- Carry out audit of materials on site for Circular Economy purposes

Build light

- Review structural loadings, utilisation and spans
- Reduce material quantities before relying on specification
- Consider whole life aspects – replacements and maintenance

Build wise

- Know where your carbon is; incl. 'big ticket' items and repeating 'small ticket' items.
- Explore standard modules, test Design for Manufacture and Assembly (DfMA) options and material efficiency.

Build low carbon

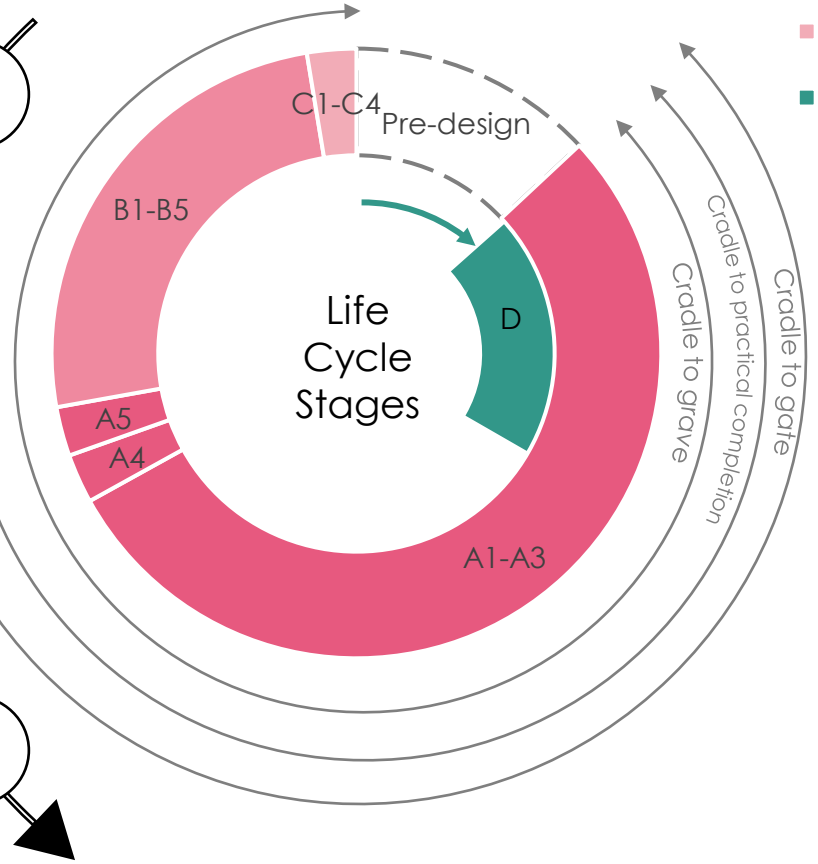
- Specify low-carbon, renewable, bio based, re-used or recycled materials from responsible sources
- Be aware of uncertainty/variability in data

Build for the future

- Design for durability, flexibility and adaptability
- Design for disassembly and circular economy at end of life

Build collaboratively

- Measurement, verification and disclosure
- Share knowledge



Key

Pre-design period
Encompassing Embodied Carbon Reduction strategies nos. 1-6 to reduce upfront carbon emissions in Life Cycle Stages A1-A5.

A1-A5 – Upfront carbon emissions in product and construction
A1-A3 Raw material supply/ Transport/ Manufacturing
A4-A5 Transport/ Construction & installation processes

B1-B5 – In use carbon emissions
B1-B5 Use/ Maintenance/ Repair/ Replacement/ Refurbishment

C1-C4 – End of life carbon emissions
C1-C2 Deconstruction & demolition/ Transport
C3-C4 Waste processing/ Disposal

D – Beyond building life boundary
Reuse, Recovery, Recycling (reported separately but Circular Economy principles can be used to reduce upfront carbon).

Elemental Reduction Strategies

In typical order of highest to lowest

Structure
- Compare options at an early stage. Lighter super structure, saves on sub-structure. Timber allows sequestration when boundaries A-C are included.
- Review loadings and rationalize or reduce structural grids.
- Consider basement omission or test ground conditions.

Façade and roof
- Compare options at an early stage.
- Note, it is often the hidden parts of the build up that have the most effect so include all framing elements in the assessment.
- Consider the effect of replacement cycles.

Mechanical, Electrical and Plumbing (MEP)
- Interrogate comfort metrics.
- Avoid over-provision of plant. Typically, fewer and simpler systems are preferable. Reduce duct-runs.
- Natural ventilation can reduce upfront carbon, maintenance burden and energy use.
- Specify refrigerants with low GWP and ensure leakage is considered in the analysis.
- Design for easy access through finishes, recycling and deconstruction as MEP is regularly replaced.

Finishes, furniture and fittings
- Eliminate materials where possible and utilise self finishing surfaces with low maintenance.
- Ensure replacement cycles are considered, especially on loose items and high foot fall areas.
- Replacement cycles should be reduced where possible.

SIGNPOST *Whole Life Carbon One Pager and Embodied Carbon Primer*

Guidance
This summary document should be read with the LETI Embodied Carbon Primer, BS EN 15978: 2011, BS EN 15804: 2019,CIBSE TM65:2021, RICS Professional Statement and GLA WLC guidance. An embodied carbon analysis must include at least 95% of all elements within the cost plan for the project. When carried out during the design stages, the data can be used to make design decisions. It is best practice to include the embodied carbon analysis in tender information and track the as built information against this during construction. An analysis should also be carried out post-completion based on as built products.

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