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Waterfront Square

Whole life embodied carbon consideration

Prepared for Norman Place (Reading) LLP

making the **difference**

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Introduction

The project (Waterfront Square) has incorporated a life cycle thinking into the design progress and an early design stage full whole life carbon assessment is being carried out to inform the design decisions.

Aims of the Assessment

Whole life-cycle carbon emissions are the total greenhouse gas emissions arising from a development over its lifetime, from the emissions associated with raw material extraction, the manufacture and transport of building materials, to installation/construction, operation, maintenance, and eventual material disposal.

They capture a building's operational carbon emissions from both regulated and unregulated energy use, as well as its embodied carbon emissions. This includes emissions associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair, and replacement as well as dismantling, demolition and eventual material disposal.

A WLC assessment also includes an assessment of the potential carbon emissions 'benefits' from the reuse or recycling of components after the end of a building's useful life. It provides a true picture of a building's carbon impact on the environment.

Operational carbon emissions from electricity consumption will make up a declining proportion of a development's whole life carbon emissions as operational carbon targets become more stringent, and the national grid is further decarbonised.

To fully capture a development's carbon impact, a whole life-cycle approach is needed to capture its unregulated emissions (i.e., those associated with cooking and small appliances), its embodied emissions (i.e., those associated with raw material extraction, manufacture and transport of building materials, and construction) and emissions associated with maintenance and eventual material disposal.

Calculating and reducing WLC emissions offers a wealth of benefits including:

- Ensuring that a significant source of emissions from the built environment are accounted for, which is necessary in achieving a net zero-carbon city.
- Achieving resource efficiency and cost savings by encouraging the re-use of existing materials instead of new materials and the retrofit and retention of existing structures and fabric over new construction.
- Identifying the carbon benefits of using recycled material and the benefits of designing for future reuse and recycling to reduce waste and support the circular economy.
- Encouraging a 'fabric first' approach to building design thereby minimising mechanical plant and services in favour of natural ventilation.
- Considering operational and embodied emissions simultaneously to find the optimum solutions for the development over its lifetime.

- Identifying the impact of maintenance, repair and replacement over a building's life cycle which improves life-time resource efficiency and reduces life-cycle costs, contributing to the future proofing of asset value.
- Encouraging local sourcing of materials and short supply chains, with resulting carbon, social and economic benefits for the local economy.
- Encouraging durable construction and flexible design, both of which contribute to greater longevity, reduced obsolescence of buildings and avoiding carbon emissions associated with demolition and new construction.

Assessment Methodology

The assessment will follow the RICS and GLA's Whole Life-Cycle Carbon Assessments guidance and a nationally recognised assessment methodology, namely, BS EN 15978: 2011: (Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method).

Underpinning BS EN 15978 is the RICS Professional Statement: Whole Life Carbon assessment for the built environment (referred to as the RICS PS for the remainder of this document). The RICS PS serves as a guide to the practical implementation of the BS EN 15978 principles. It sets out technical details and calculation details and was used as the methodology for the assessment.

The whole life carbon assessment will cover all modules A, B, C and D as set out in BS EN 15978 and the RICS Professional Statement: whole life carbon assessment for the built environment (referred to as the RICS PS for the remainder of this document). The reference study period (i.e., the assumed building life expectancy) for the purposes of the assessment is 60 years. The categories are:

- Product Stages (module A1 to A3):** The carbon emissions generated at this stage arise from extracting the raw materials from the ground, their transport to a point of manufacture and then the primary energy used (and the associated carbon impacts that arise) from transforming the raw materials into construction products.
- Construction stage (module A4 to A5):** These carbon impacts arise from transporting the construction products to site, and their subsequent processing and assembly into the building, as well as the impacts from the temporary plant, site accommodation, and other temporary works.
- In-Use Stages (module B1 to B5):** This covers a wide range of sources from the embodied carbon emissions associated with the operation of the building, including the materials used during maintenance, replacement, and refurbishment.
- End of Life Stages (module C1 to C4):** The eventual deconstruction and disposal of the existing building at the end of its life takes account of the on-site activities of the demolition contractors. No

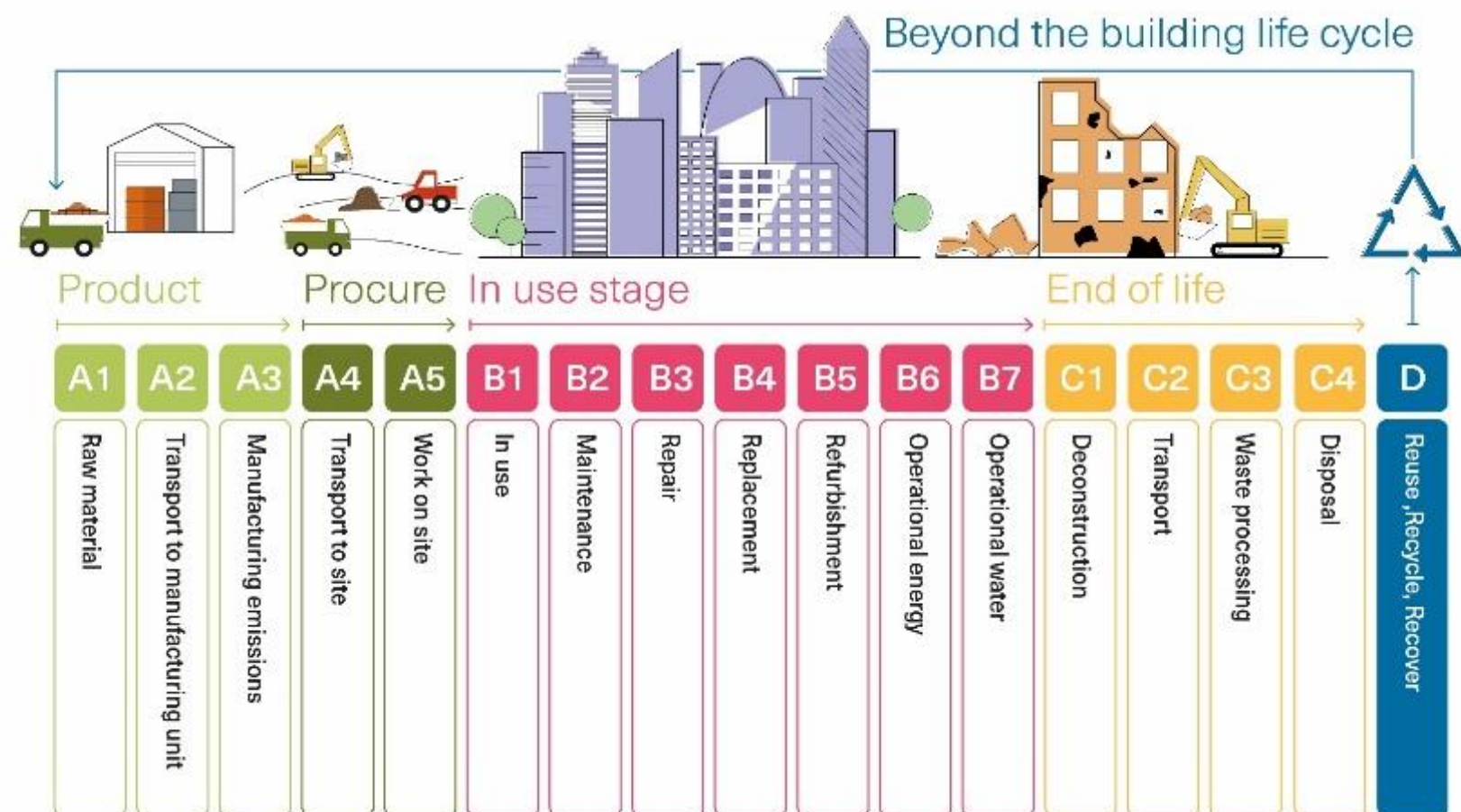


Figure 1: Life Cycle Modules as per BS EN 15978

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- 'credit' is taken for any future carbon benefit associated with the reuse or recycling of a material into new products.
- Benefits and loads beyond the system boundary (module D): Any potential benefit from the reuse, recovery and recycling potential of a building or a building product. This module has been included within the assessment scope of this study but excluded in the final results.

Assessment process

- The early design stage WLC assessment will use the following information:
- Design information at the given time, as supplied by the design team.
 - Default material baseline, as recommended by the RICS Professional Statement (PS).
 - Component life spans, as recommended by RICS PS.
- This will establish the project 'carbon baseline' allowing identification of areas with great carbon impacts. The main objectives being:
- To assess the current carbon footprint position.
 - To integrate whole Life-cycle carbon thinking into the project design and construction.
 - To identify whole Life-cycle carbon footprint reduction options of the project.
- The next step is to investigate options that the design could adopt during this stage to reduce life-cycle carbon and identify what future reductions could be targeted during further design and construction stages.

The diagram below indicates the assessment process and how it is integrated into the design process.

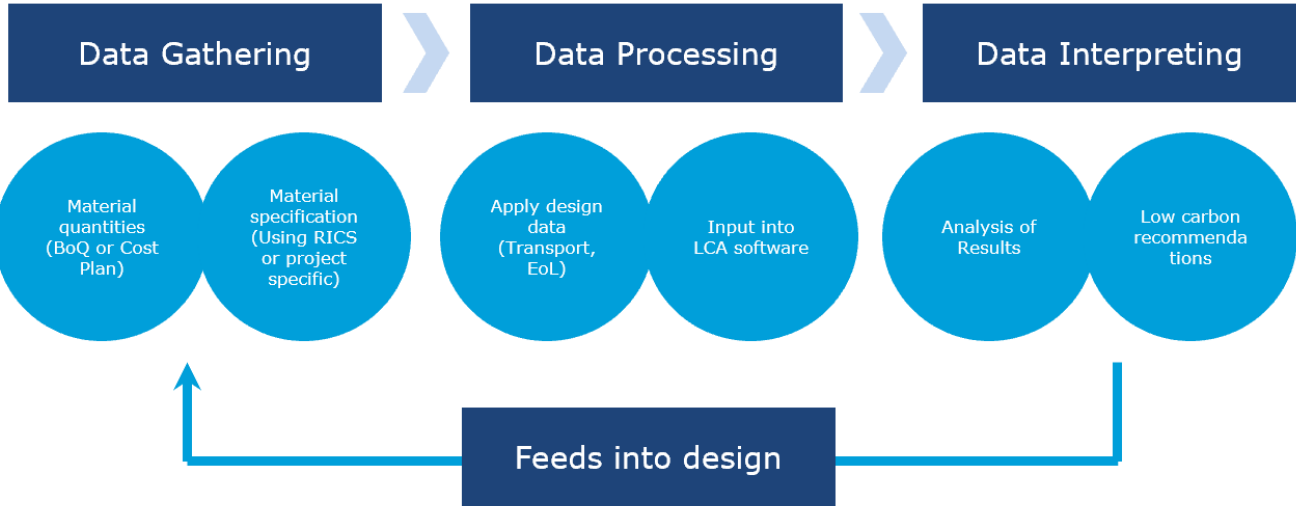


Figure 2: Assessment process

Assessment tool used:

OneClickLCA will be used for the assessment. It is an industry trusted tool that can be used to understand embodied and life-cycle carbon associated with a project.

The OneClickLCA platform collects Environmental Product Declarations (EPDS) from international markets and combines national and international EPD databases alongside several generic datasets developed by industry bodies for modules A1-A3. For the other modules, OneClick uses averaged out industry data for the predicted impacts.

Where the exact material specified does not have an EPD, then a best alternative has been used based on the library of EPDs and material information available.

Where local EPDs (or near matches) do not exist, OneClick has a function to 'localize' the material carbon footprint by adjusts automatically manufacturing electricity to the local electricity mix so that the results are more representative of the region.

Scope for the assessment

The project will be targeting relevant criteria under BREEAM and Home Quality Mark by assessing embodied carbon of key building elements, however, the project will expand beyond the assessment scopes and include all of the following building element and category.

The following key building elements were included in the assessment.

Building Element group	Building element
1. Substructure	1.1 Substructure
2.Superstructure	2.1 Frame
	2.2 Upper floors
	2.3 Roof
	2.4 Stairs
	2.5 External walls
	2.6 Windows and external doors
	2.7 Internal walls and partitions
	2.8 internal doors
3. Finishes*	3.1 Wall finishes
	3.2 Floor finishes
	3.3 Ceiling finishes
4. FEE*	4.1 Fittings, Furnishings & Equipment
5. MEP*	5. Building services
8. External works	8.1-8.8 Paving's, fixtures, drainage etc.

*Categories not required by BREEAM but included in the project assessment

Benchmarking

The Greater London Authority (GLA) has benchmarks for a few building types including office buildings. The benchmarks include all life-cycle modules apart from B1, B6 and B7 (operational energy and operational water) and module D. The benchmark values, as taken from the GLA's Whole Life-Cycle Carbon Assessments guidance, are displayed in Table 1-2.

Stage	GLA Benchmark (kg CO2e/m2 GIA)	GLA Aspirational Benchmark (kg CO2e/m2 GIA)
Carbon at completion (A1-A5)	850	500
Carbon Over life cycle (B-C exc. B6 & B7)	350	300

The development will also be compared against other assessments that the applicant has recently assessed to determine how the development compares to other similar schemes.

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It will provide an initial indication of the performance of the proposed project development against current industry average and identify specific high-emission components of the building.

The assessment report will also outline varying WLC reduction options actions to reduce WLC emissions and sets out measures that could be implemented throughout the design and construction stages of the development to ensure its environmental impact is limited. A project specific reduction target will be agreed with project team and this will be compared against throughout the design and construction stage to track the project performance.

