Greengage

Brighter strategies
for greener projects

Client: Comer Homes

Project: North London Business Park

Report: Stage 2 WLCA Report

QUALITY ASSURANCE

Issue/Revision:	Draft	Final
Date:	January 2024	February 2024
Comments:	Draft for Comment	Final Issue
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File Reference:	551510cp02Feb24FV01_WLCA.docx	551510cp02Feb24FV01_WLCA.docx

CONTENTS

Tables

Figures

1.0 EXECUTIVE SUMMARY

Greengage has been appointed by Comer Homes (the “Applicant”) to conduct a Whole Life-Cycle Carbon Assessment (WLC) that follows the EN 15978 calculation methodology and further aligns by the guidelines set out in RICS Professional Statement UK - Whole Life Carbon Assessment for the Built Environment[1].

The assessment has been conducted at RIBA Stage 2 to inform the Applicant, the design team and the Greater London Authority (GLA) on the benchmark WLC performance for the new proposed educational development located at North London Business Park, within the Borough of Barnet.

This WLC report was produced in response to the policies and aspirations of the GLA (Policy SI 2) and the Barnet London Borough Council and will be submitted as part of the full planning application for the Proposed Development.

1.1 CARBON REDUCTION STRATEGIES

Energy Strategy

An energy strategy has been produced for the Proposed Development as a key mechanism for reducing WLC of the development. In addition to a passive design approach, a strategy has been proposed that features highly efficient heat pumps to deliver heating and hot water throughout the development. In addition to heat pumps working at greater efficiency than gas boilers, the heat pumps can take advantage of the projected decarbonisation of the national grid.

Circular Economy

The Proposed Development has taken care to consider Circular Economy in its design. The Circular Economy Statement, submitted as part of the planning application, details the strategy for recovery of materials in line with the circular economy model, with its findings incorporated into the WLC modelling.

Estimated Whole Life-Cycle Carbon Emissions

Table 1.1 below displays the results from the Proposed Development's assessment using SAP 10.2 carbon factors, with Table 1.2 and Figure 1.1 showing the breakdown by lifecycle module.

Table 1.1 Summary of total WLC emissions, using SAP 10.2 carbon factors

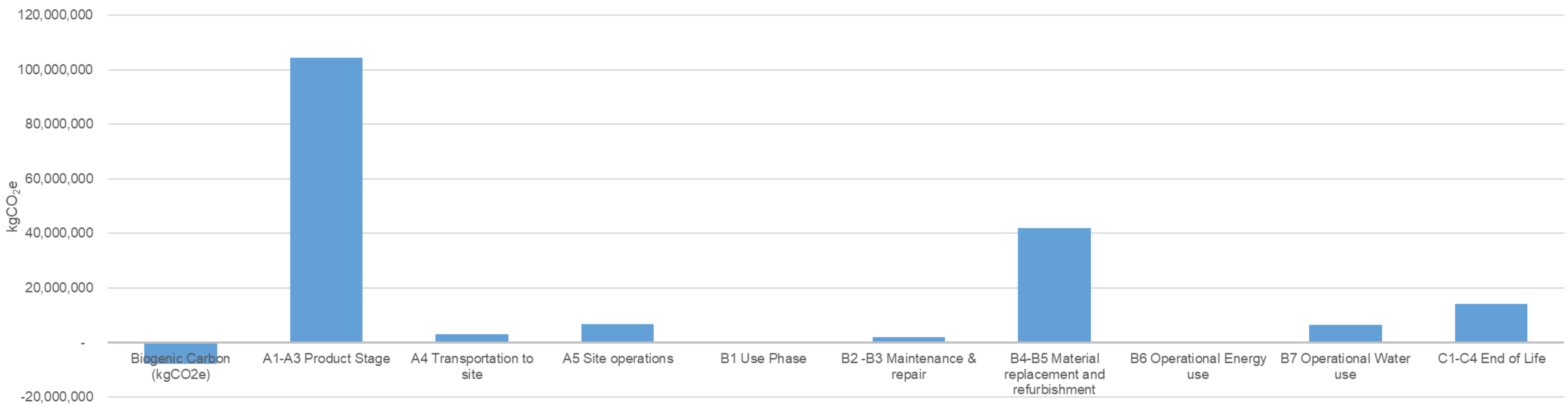
	Proposed Development	
	Carbon at PC (A1-A5 excl. sequestration) ($kgCO_2e$)	Life-Cycle Carbon (A-C incl. sequestration, excl. B6-B7) ($kgCO_2e$)
0.1-0.2 Demolition	473,946	502,387
0.3-0.5 Facilitation works	-	-
1 Substructure	26,575,286	27,456,156
2.1-2.4 Superstructure	41,378,523	44,365,145
2.5-2.6 Superstructure	13,117,651	21,091,016
2.7-2.8 Superstructure	12,945,819	18,498,486
3 Finishes	7,949,453	23,506,706
4 Fittings, furnishings & equipment (FF&E)	645,239	4,174,829
5 Services (MEP)	10,271,802	23,647,271
6 Prefabricated buildings and building units	-	-
7 Work to existing building	-	-
8 External works	847,212	1,075,834
TOTAL – $kgCO_2e$	**114,204,930**	**164,317,828**
TOTAL – $kgCO_2e/m^2$	**747**	**1,074**

Table 1.2 Summary of Proposed Development's total WLC emissions per module grouping

	Sequestered (or biogenic carbon)	Module A1-A3 Product stage	Module A4 Transportation to Site	Module A5 Site operations	Module B1 Use phase	Module B2-B3 Maintenance & repair	Module B4-B5 Replacement & refurbishment	Module B6 Operational energy use	Module B7 Operational water use	Module C1-C4	Module D External impacts (not included in totals)
Proposed Development $kgCO_{2e}$	-7,874,492	104,467,764	3,023,025	6,714,142	-	1,947,578	41,969,269	304,514*	6,607,986	14,070,543	-36,787,678

*Missing from School assessment

Figure 1.1 WLC results for the Proposed Development showing life cycle emissions at each Life Cycle Module.



2.0 INTRODUCTION

Greengage has been appointed by Comer Homes to undertake a Whole Life-Cycle Carbon (WLC) Assessment of North London Business Park, within the Borough of Barnet.

This assessment is aligned to the planning application submission (RIBA Stage 2) and has been carried out in line with guidance provided by the GLA in the London Plan Whole Life-Cycle Carbon Assessments Guidance, March 2022 and the RICS Professional Statement on Whole Life Carbon.

This report has been produced to support a hybrid planning submission comprising:

- A detailed element (Phase 1) comprising up to 461 residential units in five blocks reaching 9 storeys, the provision of a 5-form entry secondary school, a gymnasium, a multi-use sports pitch and associated changing facilities and improvements to open space and transport infrastructure, including improvements to the access from Brunswick Park Road; and
- An outline element (Phases 2-5) comprising up to 1,967 additional residential units in buildings ranging from three to twelve storeys, up to 7,148m^2 of non-residential floor space (use Class E) and 20,250m^2 of open space. Associated site preparation/enabling work, transport infrastructure and junction work, landscaping and car parking.

This assessment aims to assess the WLC for the proposed residential and educational buildings, defined as 'those carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal.' Embodied carbon emissions have been accounted for, relating to raw extraction, manufacture and transport of material, construction emissions, maintenance, repair, replacement, demolition and end of life disposal. Operational carbon emissions have also been accounted for as part of this assessment, including both regulated and unregulated energy use.

3.0 BACKGROUND

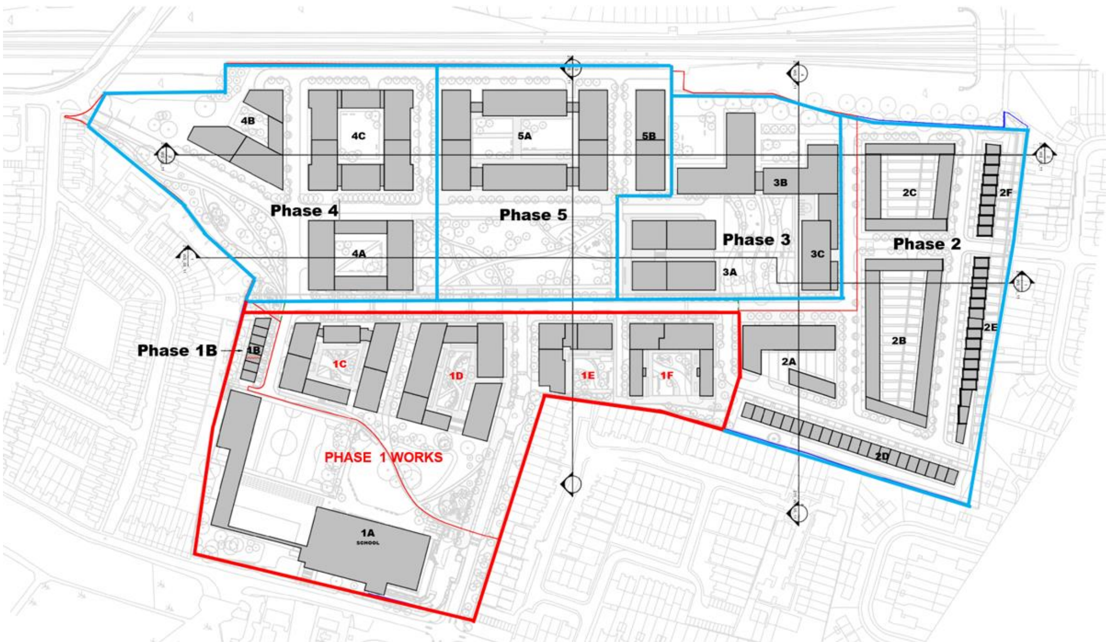
3.1 CONTEXT AND DESCRIPTION OF THE PROPOSED DEVELOPMENT

The site is located in Brunswick Park in the east of the London Borough of Barnet. The site measures c.17 hectares of brownfield site, which is predominantly undeveloped across grasslands, a lake and unplanned vegetation cover.

Existing structures on site include a large office building, a parking structure and the St Andrew the Apostle School on a temporary basis. The site is bound by the East coast mainline railway, with connection to Central London.

The proposed development consists of a mixed-use residential development of 2,412 dwellings plus a 5 Form of Entry secondary school (1,050 pupils) at the existing North London Business Park site in the LBB. There is no strategic commercial use planned for the site. Phases are shown in Figure 3.1.

Figure 3.1 Visualisation of the Proposed Development (Source: Plus Architecture)



The Detail Planning Area (Phase 1) is proposed to accommodate 461 new residential units, with a mixture of houses, duplexes, and apartments. The Detail Planning Area (Phase 1) will also include the 5th Form of Entry secondary school, which will replace the existing temporary school building on site accommodating the St Andrew the Apostle School.

All associated site works, landscaped areas (including Brunswick Lakeside Park), transport infrastructure and car parking required to support the delivery of the Detail Planning Area (Phase 1) is included in the Detail Planning Application.

The Outline Planning Area (Phases 2-5) is proposed to accommodate the balance of the 2,412 residential units proposed for the site. The Outline Planning Area (Phases 2-5) will also accommodate a small number of non-residential uses.

These ancillary uses are intended to compliment and support the planned residential community on the site and include Café/Retail Use, Community Use and Incubator Office Use.

The design framework for all associated site works, landscaped areas (including New Brunswick Park), transport infrastructure and car parking required to support the delivery of the Outline Planning Area (Phases 2-5) is described in Plus Architecture's Parameter Plans and Design Principles Document, which accompanied the Outline Planning Area (Phases 2 to 5).

3.2 BACKGROUND TO WHOLE LIFE-CYCLE CARBON ASSESSMENTS

The carbon emitted as a result of proposals for developments can be roughly divided into two overarching categories: the 'upfront' carbon embedded in products, materials, their transportation, and their construction (also referred to as the 'embodied' carbon) and the 'operational' carbon associated with the in-use energy consumption of the building once constructed.

Carbon emissions from operational use of buildings has been the subject of regulation for some time and has historically been the primary focus of reducing the impact of built environment projects. More recently, this focus has been expanded to also include carbon emissions associated with the building materials themselves and the carbon emitted through the construction of buildings, as well as their ongoing maintenance, refurbishment, and demolition.

The embodied carbon of a building can comprise a substantial portion of the overall carbon footprint of buildings, new or refurbished. Importantly, by 2050, ~40% of CO_2 emissions associated with the operation and construction of buildings will be from embodied carbon. As buildings become more energy efficient, and their operational carbon reduces, embodied carbon becomes significantly more important.

To acquire an overall understanding of a built project's total carbon impact, it is necessary to assess both the anticipated operational and embodied emissions over the whole life of the asset. This is often referred as 'Whole Life-Cycle Carbon' or Life Cycle Assessment (LCA).

A WLC approach identifies the overall best combined opportunities for reducing lifetime emissions and helps to avoid any unintended consequences of focusing on operational emissions alone.

Circular Economy

The construction and operation of the built environment consumes 60% of all materials in the UK. At the end of life, materials are often diverted from landfill, but in reality, downcycled, reducing their value.

There is growing industry consensus that the way we design, build, operate and dispose of our buildings and associated facilities needs a major overhaul to reduce waste and increase efficiency. There is an incredible breadth of opportunity that this shift in approach will create across the entire supply chain.

Designing for longevity and adaptability and maximising the use of recycled and renewable materials could reduce greenhouse gas emissions while increasing innovation opportunities and economic growth. Replacing finite and fossil-based materials with responsibly managed renewable materials can decrease carbon emissions whilst reducing dependency on finite resources.

By considering the carbon emissions of a development from a whole life perspective, design decisions can be made to not only minimise embodied carbon in construction, but it can assist to produce a development which reduces resource consumption throughout its use, extending life cycles of products, maximising re-use of building components and ensuring that all components are considered as a 'product resource', rather than 'product waste'.

3.3 SUPPORTING DOCUMENTATION

To support this assessment, Greengage has reviewed the following documents produced in support of the planning application:

- CouchperryWikes - Energy Assessment;
- Plus Architecture - Design and Access Statement; and
- Peter Bushnell - Elemental Cost Plan.

4.0 POLICY, REGULATIONS AND GUIDANCE

4.1 POLICY DRIVERS

This section sets out current policy drivers and strategies developed by national governments, and a range of organisations throughout the world, in order to set out a blueprint for action.

National Policy

Climate Change Act 2008 (2050 Target Amendment)[2]

On 26th November 2008, the UK Government published the Climate Change Act 2008, the world's first long-term legally binding framework to mitigate against climate change. Within the original framework, the Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad from the 60% target to 80% by 2050. This was amended in 2019 to a revised target of a 100% reduction in carbon emissions by 2050, over the 1990 baseline emissions levels, known at the net-zero target.

Regional Policy

Greater London Authority, London Plan, 2021[3]

The London Mayor and Secretary of State formally approved the London Plan for publication and adoption in March 2021, which will run from 2021 to 2041, providing a longer- term view of London's development to inform decision making.

Within the London Plan, Policy SI2 'Minimising greenhouse gas emissions' requires major developments to be net zero-carbon. It also requires referable developments to calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Local Policy

Barnet Council Local Plan 2012

Whilst the Local Plan, does not detail requirements relating to Whole Life Carbon directly, many policies discuss sustainable design and construction relating to its methodology, including:

Policy CS13 Ensuring the efficient use of natural resources

"We will seek to minimise Barnet's contribution to climate change and ensure that through the efficient use of natural resources the borough develops in a way which respects environmental limits and improves quality of life."

Policy CS14 Dealing with our waste

This policy intends to encourage waste management through "promoting waste prevention, re-use, recycling, composting and resource efficiency over landfill."

Policy DM04 Environmental considerations for development

Expecting all development to be energy efficient and aim to reduce wasted heat or power, reducing carbon emissions in line with the London Plan.

1.2 TECHNICAL GUIDANCE

RICS Professional Statement UK – Whole Life Carbon Assessment for The Built Environment

The RICS Professional Statement: Whole Life Carbon Assessment (WLC) for the Build Environment, released in 2017, seeks to standardise WLC assessment and enhance consistency in outputs by:

"Providing specific practical guidance for the interpretation and implementation of the methodology in EN 15978 in carbon calculations. This is to achieve coherent and comparable results that can be used to benchmark the whole life carbon performance of built assets. The specific objectives of this professional statement are to:

a. *provide a consistent and transparent whole life carbon assessment implementation plan and reporting structure for built projects in line with EN 15978;*
b. *enable coherence in the outputs of whole life carbon assessments to improve the comparability and usability of results;*
c. *make whole life carbon assessments more 'mainstream' by enhancing their accessibility and therefore encourage greater engagement and uptake by the built environment sector;*
d. *increase the reliability of whole life carbon assessment by providing a solid source of reference for the industry;*
e. *promote long-term thinking past project practical completion, concerning the maintenance, durability and adaptability of building components and the project as a whole; and*
f. *promote circular economic principles by encouraging future repurposing of building components, as well as of the project as a whole, through quantify."*

The Greater London Authority have adopted the RICS WLC methodology in their guidance methodology for Whole Life Carbon assessment of referable planning applications.

London Plan Guidance - Whole Life Carbon Assessments March 2022[4]

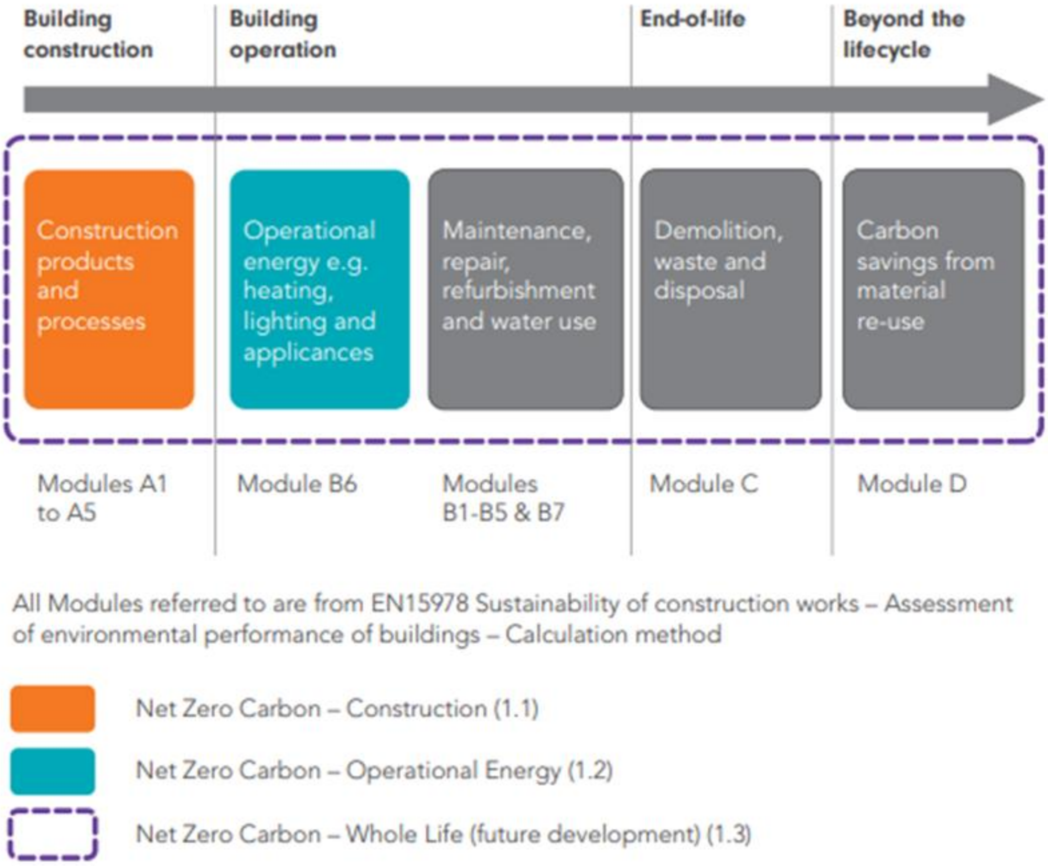
In March 2022 the GLA released guidance on the methodology to be followed and implemented for undertaking WLC assessments. The guidance also includes a set of WLC benchmarks for different building types against which developments should be compared.

UK Green Building Council (UKGBC) - Net Zero Carbon Buildings: A Framework Definition[5]

In response to the UK Government legislation to achieve net zero carbon by 2050, the UKGBC has developed a Framework Definition that includes operational and embodied carbon emissions, see Figure

4.1. It is worth noting that the UKGBC approach has not set out a methodology for the appraisal of WLC, which is still being developed.

Figure 4.1 UKGBC Advancing Net Zero framework approach



Low Energy Transformation Initiative (LETI) – Climate Emergency Design Guide[6]

LETI is a network of over 1,000 built environment professionals working together to put the UK on the path to a zero-carbon future. The voluntary group is made up of developers, engineers, housing associations, architects, planners, academics, sustainability professionals, contractors and facilities managers, with support and input provided by the GLA and London boroughs.

LETI has been established to support the transition of the capital's built environment to net zero carbon, providing guidance that can be applied to the rest to the UK.

The Climate Emergency Design Guide covers five key areas: operational energy, embodied carbon, the future of heat, demand response and data disclosure. The methodology includes setting the requirements of four key building archetypes (small scale residential, medium/large scale residential, commercial offices, and schools).

Low Energy Transformation Initiative (LETI) – Embodied Carbon Primer[7]

The LETI Embodied Carbon Primer offers supplementary guidance to the Climate Emergency Design Guide and is intended to provide designers including architects, engineers, interior designers and urban designers with easy-to-follow best practice and toolkits for reducing embodied carbon in buildings.

Low Energy Transformation Initiative (LETI) - Embodied Carbon Target Alignment[8]

This document has been produced to provide alignment in embodied carbon measurement and comparisons.

This paper summarises the following key points:

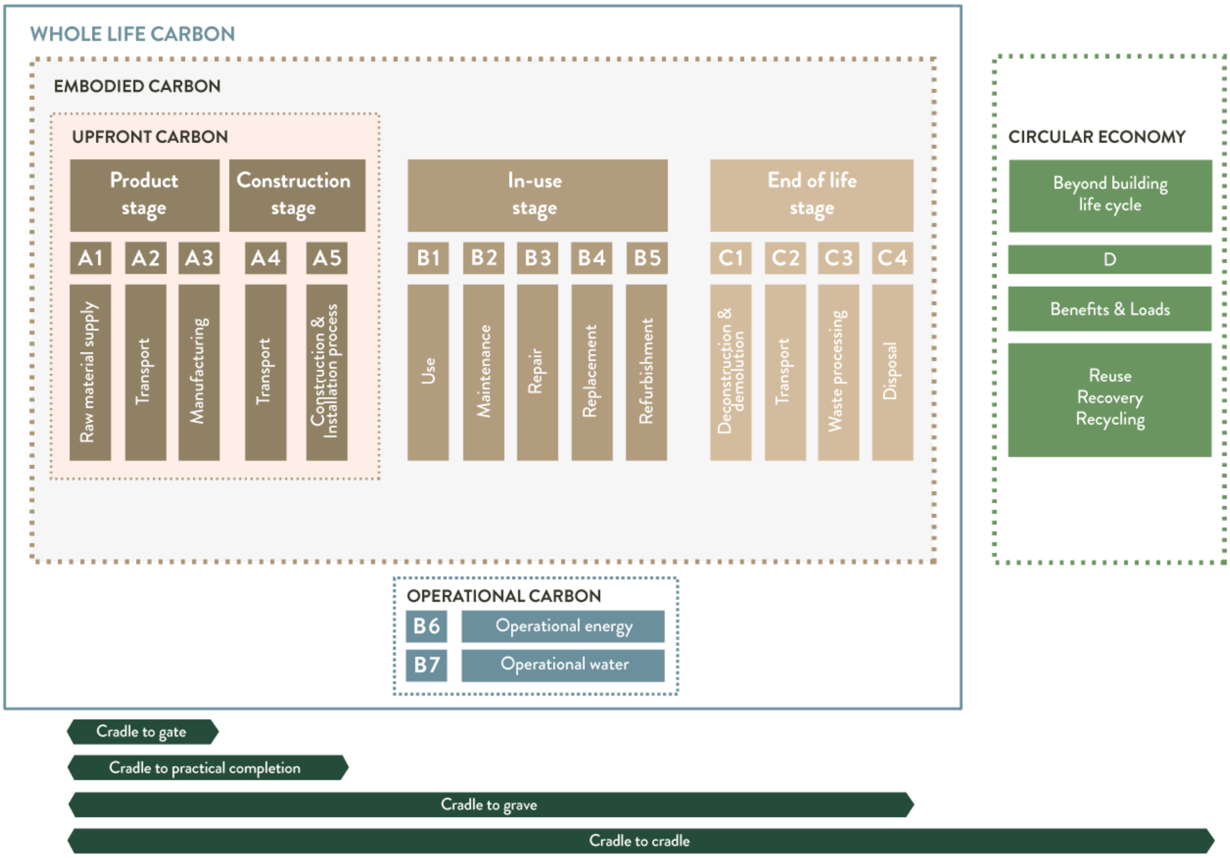
- The industry must push for embodied carbon reporting on all projects;
- A rating system should be introduced to allow quick comparison of ambition across various typologies and portfolios;
- Total embodied carbon targets have been introduced;
- Targets for retail have been developed;
- LETI and RIBA now have consistent embodied carbon targets;
- Data disclosure and breakdowns are key to ensuring reporting is valid and comparable; and
- There are two scopes that should be reported against: Upfront Carbon (modules A1-5, excluding sequestration), and total Embodied Carbon (A1-5, B1-5, C1-4, including sequestration).

5.0 METHODOLOGY

5.1 BOUNDARIES

The WLC model has included all life cycle stages detailed within the EN 15978 cradle-to-grave system boundary approach, as outlined below in Figure 5.1.

Figure 5.1 EN 15978 System Boundaries



An overview of the system boundaries is described below:

Product Stage

One Click LCA's extensive database of building materials was used to calculate the WLC emissions of the Site because this allowed for the selection of materials that are representative of the materials itemised in the provided Cost Plan.

The Cost Plan has been used to provide an itemised list of materials and quantities, and in accordance with RICS guidance, generic environmental profiles have been allocated to materials where product details have not been specifically stated within the cost plan and specifications.

As per the RICS guidance the reference study period (RSP) is 60 years, which aligns with the operational design life of 60 years. The functional unit for the assessment is $kgCO_2e/m^2$ GIA.

Demolition

RICS guidance acknowledges that *"Demolition works are often decoupled from new construction projects, hence the responsibility for any emissions arising from demolition is not necessarily solely attributable to the new build project"*.

As stated within the guidance *"New build projects assessed are considered to commence their development on a cleared, flat Site for consistency purposes."* Accordingly, this is the approach taken for this assessment. However, London Plan Guidance WLCA requires pre-construction demolition to be considered. As such, the default figure of 50kgCO_2e/m^2 (GIA) has been applied to the full extent of the existing Site, where applicable.

Construction Stage

Construction activities have been assumed based on geographic location of the project and building area to calculate electricity, fuel, waste and transportation impacts of the development's construction. This is calculated using an algorithm within the One Click software.

Use Stage

Operational energy demands (B6) have been based on the Energy Assessment which was produced to demonstrate compliance with GLA planning policy, based upon Building Regulations Part L 2021 modelling.

It is noted that Part L modelling does not accurately represent a building's energy performance because it focuses solely on the carbon produced through the use of the building' services (heating, hot water ventilation and air conditioning) and lighting, known as regulated emissions. However, figures for any carbon emissions emitted from using appliances such as cooking and plug in appliances, known as unregulated emissions, were calculated separately.

Nevertheless, unregulated emissions depend greatly on occupant behaviour, therefore it is anticipated that the in-use emissions will change and are likely to increase once the development is in full occupation.

End-of-Life Stage

Emissions from deconstruction are calculated within the One Click software based on the known parameters of the building and its location, as well as details sourced from the Circular Economy Statement.

5.2 ASSESSMENT SCOPE

The assessment has been undertaken in accordance with the GLA guidance for undertaking WLC Assessments, which recommends the breakdown of building elements as set out in the RICS Professional Statement on Whole Life Cycle Carbon Assessment. As a result, the building model was broken down into the constituent element groups listed below, using schedules, plans, elevations and sections before conducting the LCA modelling.

- Demolition;
- Facilitating works;
- Substructure;
- Superstructure (frame, upper floors, roof, stairs and ramps, external walls, windows and external doors, internal walls and partitions, internal doors);
- Finishes;
- Fittings, furnishings and equipment;
- Building services;
- Prefabricated buildings and building units;
- Work to existing building; and
- External works (hard and soft landscaping, fencing, fixtures, drainage, services).

The guidelines of BS 15978:2011 and the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment have been followed in conducting the LCA and reporting the results. All EPDs used have been produced in line with the requirements of BS EN 15804:2012.

Additionally, as per the requirements, the assessment has taken place analysing the lifecycle stages described in Figure 5.1.

Operational carbon emissions have been calculated in alignment with Part L assessments undertaken for the development as part of the Energy Strategy for planning. This accounts for carbon emissions related to both regulated and unregulated energy uses (in line with Part L definitions), over the 60-year study period.

5.3 ASSESSMENT SOFTWARE

In accordance with the RICS guidance, One Click LCA has been used to model the LCA impacts of building materials for the development. One Click LCA is an online Building Life-Cycle Assessment software; it is an industry-leading platform developed by Helsinki based developer, Bionova.

Within One Click LCA materials are represented by Environmental Product Declarations (EPDs). EPDs are produced by manufacturers, which quantify the carbon emissions of a material or component.

Materials are allocated to, where possible, the exact EPD match or the closest representing material available. In allocating all building materials and elements within the building to a relevant EPD, One Click LCA calculates estimated total life-cycle carbon emissions for the development.

It should be noted that the LCA tool has a limited database of materials (albeit with regular updates). In the scenario where a specified material is not included, the most similar material in terms of its composition would be selected instead.

5.4 DATA SOURCES

The following data sources were used to construct the LCA model for the Proposed Development:

- One Click LCA material/components database;
- A project cost plan supplied by the project Quantity Surveyor was used to determine material build ups and material quantities; and
- The remaining elements' quantities and build ups were extracted from plans, elevations and sections and approved by relevant members of the design team, including the Quantity Surveyor. This allowed for an accurate representation of the building materials' environmental impact.

A more detailed list of data used per building element is included further in this report (see Table 6.1).

Where information has not been provided or is unavailable, the assumptions taken from the RICS professional statement guidance were adopted, as displayed in Appendix A. Overall, in line with EN 15804, a minimum of 95% of the capital cost allocated to each building category has been accounted for within the modelling.

5.5 CARBON EMISSIONS FACTORS

In line with the GLA guidance, the WLC emissions of the development have been analysed against SAP 10.2 carbon factors providing a point-in-time assessment.

The SAP 10.2 emission factors have been used for those materials manufactured within the UK aligning with the GLA's Energy Assessment Guidance. Where sourced from outside of the UK, local energy grid data has been used.

6.0 MODELLING INPUTS

This section summarises the inputs used to assess the WLC of the Proposed Development.

Operational Carbon Assessment

Operational carbon emissions are estimated as part of CouchperryWilkes' Energy Strategy, submitted in support of the planning application.

The assessment of operational carbon emissions has been based on Part L of the building regulations methodology and CIBSE TM54 modelling, as a sum of the regulated and unregulated carbon emissions.

The calculation of such emissions was based upon SBEM calculations in line with the Part L2A methodology.

Embodied Carbon and End-of-Life Assessment

The building elements assessed within this report align with the RICS Professional Statement: Whole Life Carbon assessment for the built environment and can be found within Table 6.1 below.

Table 6.1 Data used to assess the embodied carbon of the Proposed Development

Building element group	Building element (NRM level 2)	Basis for information
Demolition	0.1 Toxic/hazardous/ contaminated material treatment	Has not been accounted for at this stage of the development.
	0.2 Major demolition works	The GLA default figure of $50kgCO_2e/m^2$ (GIA) has been applied to the full extent of the existing Site, based upon the GIA of the existing structures, and reported within the GLA Template. Furthermore, the One Click LCA default figure of $3.4kgCO_2e/m^2$ (GIA) has been applied to account for the end-of-life deconstruction impact.
0 Facilitating works	0.3 & 0.5 Temporary/enabling works	Has not been accounted for at this stage of the development.
	0.4 Specialist groundworks	Has not been accounted for at this stage of the development.
1 Substructure	1.1 Substructure	The specification and material quantities were sourced from information provided by the design team as well as design plans.

Building element group	Building element (NRM level 2)	Basis for information
2 Superstructure	2.1 Frame	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	2.2 Upper floors incl. balconies	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	2.3 Roof	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	2.4 Stairs and ramps	The specification and material quantities were sourced from information provided by the design team as well as design plans.
2 Superstructure	2.5 External walls	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	2.6 Windows and external doors	The specification and material quantities were sourced from information provided by the design team as well as design plans.
2 Superstructure	2.7 Internal walls and partitions	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	2.8 Internal doors	The specification and material quantities were sourced from information provided by the design team as well as design plans.
3 Finishes	3.1 Wall finishes	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	3.2 Floor finishes	
	3.3 Ceiling finishes	
4 Fittings, furnishing and equipment (FF&E)	4.1 Fittings, furnishings & equipment incl. building related and non-building related	The specification and material quantities were sourced from information provided by the design team as well as design plans.
5 Building services / MEP	5.1-5.14 Services incl. building-related and nonbuilding-related	The specification and material quantities were sourced from information provided by the design team as well as design plans.

Building element group	Building element (NRM level 2)	Basis for information
6 Prefabricated Buildings and Building Units	6.1 Prefabricated buildings and building units	Has not been accounted for at this stage of the development.
7 Work to Existing Building	7.1 Minor demolition and alteration works	Has not been accounted for at this stage of the development.
8 External works	8.1 Site preparation works	The specification and material quantities were sourced from information provided by the design team as well as design plans.
	8.2 Roads, paths, paving and surfacing	
	8.3 Soft landscaping, planting and irrigation systems	
	8.4 Fencing, railings and walls	
	8.5 External fixtures	
	8.6 External drainage	
	8.7 External services	
	8.8 Minor building works and ancillary buildings	

Table 6.2 below highlights the life cycle modules utilised in assessing the building's life cycle impacts, alongside details on the source for such modules within the LCA conducted for this report.

Table 6.2 Comments on the data source used in each Life Cycle Module included in the assessment

Module	Description	Data Source
A1-A3 Construction Materials	Raw material supply (A1) includes emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed. Loss of raw material and energy are also taken into account. Transport impacts (A2) include exhaust emissions resulting from the transport of all raw materials from suppliers to the manufacturer’s production plant as well as impacts of production of fuels. Production impacts (A3) cover the manufacturing of the production materials and fuels used by machines, as	Utilised EPDs within the One Click software which align with the products specified (where known) or the most applicable similar product. The sources list can be found in Appendix A.

Module	Description	Data Source
	well as handling of waste formed in the production processes at the manufacturer's production plants until end-of-waste state.	
A4 Transportation to Site	A4 includes exhaust emissions resulting from the transport of building products from manufacturer's production plant to building Site, as well as the environmental impacts of production of the used fuel.	Transport distances were estimated based on typical average transport distances based on material type and project location, in line with the RICS defaults.
A5 Construction/ installation process	A5 covers the exhaust emissions resulting from using energy during the Site operations, the environmental impacts of production processes of fuel and energy and water as well as handling of waste until the end-of-waste state.	At this stage of design, the average construction site impacts were estimated based upon the updated RICS estimation for 2022 of 10,973kgCO_2e per £1 million project value. Demolition emissions have been estimated based upon the GLA default figure of 50kgCO_2e/m^2 (GIA).
B1-B5 Maintenance and material replacement	The environmental impacts of maintenance and material replacements (B1-B5) include environmental impacts from replacing building products after they reach the end of their service life. The emissions cover impacts from raw material supply, transportation and production of the replaced new material as well as the impacts from manufacturing the replaced material and handling of waste until the end-of-waste state.	The design team is yet to create a maintenance schedule for the Proposed Development due to the early stage of the design process. As such, figures for Maintenance (B2) have been estimated at 10kgCO_2e/m^2 (GIA) or 1% A1-A5 emissions, depending on assessment. Furthermore, figures for Repair (B3) have been estimated at 25% of the B2 emissions in line with the RICS PS (item 3.5.3.3). Updated figures will be submitted at post completion once a schedule has been produced. Replacement (B4) and Refurbishment (B5) account for the technical service life of the building components, calculated using One Click LCA.
B6 Energy use	The considered use phase energy consumption (B6) impacts include exhaust emissions from any building level energy production as well as the	Energy consumption was calculated within the SBEM and CIBSE TM54 calculations and the Energy assessment. These were input into One

Module	Description	Data Source
	environmental impacts of production processes of fuel and externally produced energy. Energy transmission losses are also considered.	Click under the SAP 10.2 energy embodied carbon factor.
B7 Water use	The considered use phase water consumption (B7) impacts include the environmental impacts of production processes of fresh water and the impacts from wastewater treatment.	Water consumption was calculated based upon the figures provided by the BSRIA 'Rules of Thumb (5th edition) Table 22.
C1-C4 Deconstruction	The impacts of deconstruction include impacts for processing recyclable construction waste flows for recycling (C3) until the end-of-waste stage or the impacts of pre-processing and landfilling for waste streams that cannot be recycled (C4) based on type of material. Additionally, deconstruction impacts include emissions caused by waste energy recovery.	The end-of-life deconstruction/demolition (C1) impact has been calculated based upon the RICS default figure of 3.4kgCO_2e/m^2 (GIA). The remaining end-of-life Transport (C2), waste processing (C3) and disposal (C4) impacts have been estimated based upon best practice end-of-life assumptions, or re-use and recovery practices agreed with the design team and factored into the design. RICS 3.5.3.4 assumes a default C4 emissions rate figure of 0.013kgCO_2e/kg waste, resulting from any landfill or incineration.
D External impacts/end-of life benefits	External benefits for re-used or recycled material types include the positive impact of replacing virgin-based material with recycled material and the benefits of the energy which can be recovered from the materials.	End-of-Life impacts have incorporated the anticipated scenarios agreed with the design team. Where these have yet to be agreed, One Click LCA's default end of life scenarios have been utilised. See Appendix C for more detail.

6.2 ASSUMPTIONS & LIMITATIONS

The WLCA was completed for the planning submission using the cost plan available at the time of analysis. However, as exact products or specifications have not been finalised, generic materials were specified, and default transport distances and service life of products were used in accordance with the RICS guidance where specific information is not currently known (see Appendix B for further details).

This use of generic information can be reviewed and the allowances in the design of the model can be refined as the detailed design develops.

7.0 RESULTS

7.1 EMBODIED CARBON ASSESSMENT

Table 7.1 shows how the total embodied carbon emissions of the Proposed Development compare against various GLA benchmarks for the predominant building use (Residential).

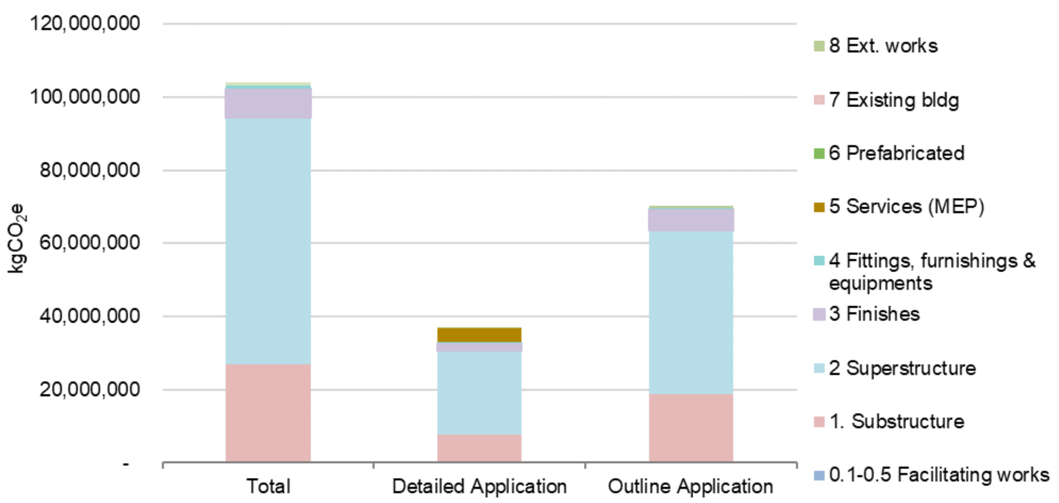
Table 7.1 Embodied carbon result in comparison with GLA's benchmarks for Residential

	Outline Development	Detailed Development	GLA WLC Benchmark	GLA Aspirational WLC Benchmark
Modules A1-A5 (excl. sequestration)	711 $kgCO_2e/m^2$	824 $kgCO_2e/m^2$	850 $kgCO_2e/m^2$	500 $kgCO_2e/m^2$
Modules B-C (excl. B6 & B7)	353 $kgCO_2e/m^2$	441 $kgCO_2e/m^2$	350 $kgCO_2e/m^2$	300 $kgCO_2e/m^2$
Modules A-C (incl. sequestration, excl. B6 & B7)	1,025 $kgCO_2e/m^2$	1,185 $kgCO_2e/m^2$	1,200 $kgCO_2e/m^2$	800 $kgCO_2e/m^2$

Through the WLC assessment, it can be demonstrated that the outline and detailed assessments achieve a 711$kgCO_2e/m^2$ & 824 $kgCO_2e/m^2$ (A1-A5) and 353$kgCO_2e/m^2$ & 441 $kgCO_2e/m^2$ (B-C (excluding B6 & B7)) carbon emission figure respectively, achieving the GLA benchmarks for A1-A5, but exceeding those for B-C (excluding B6 & B7).

Figure 7.1 below shows the overall carbon breakdown up to practical completion, demonstrating the contribution of the main building elements for modules A1-A3 (product stage), A4 (transport) and A5 (site operations), excluding sequestration.

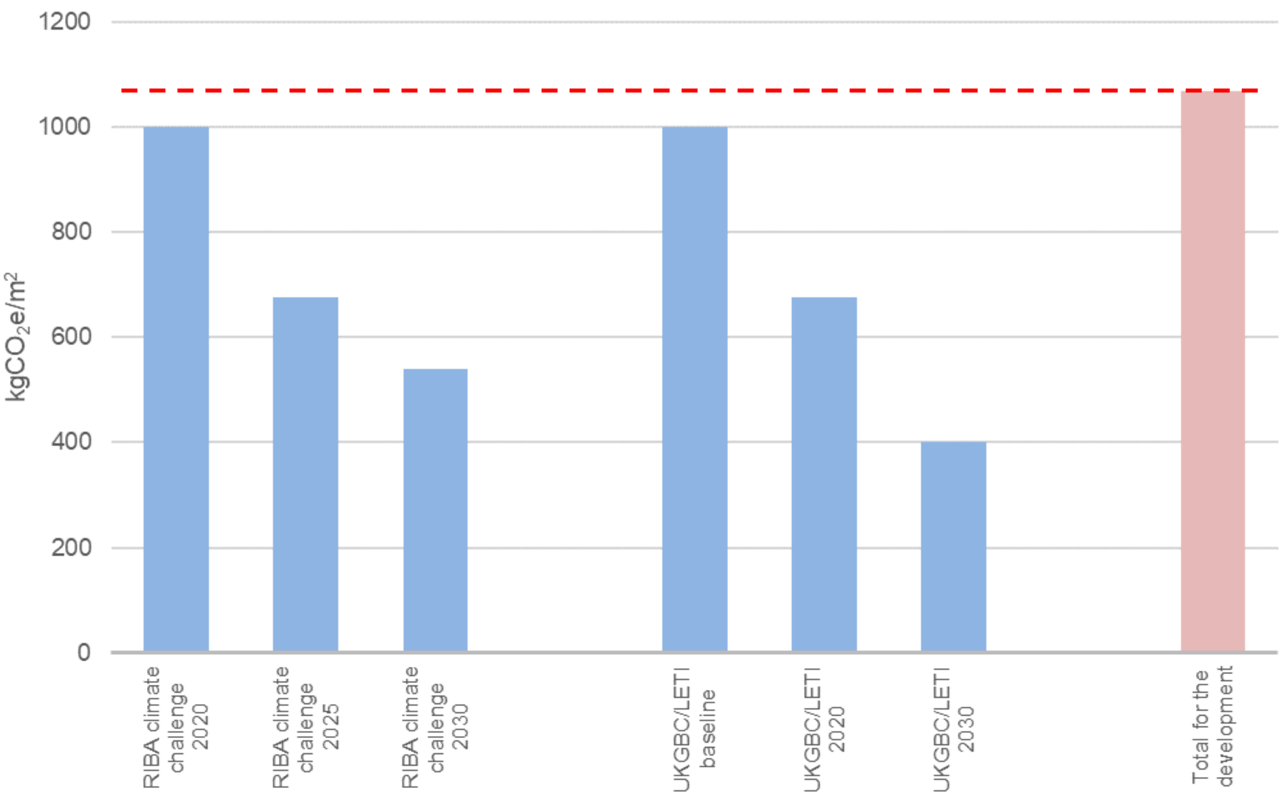
Figure 7.1 Estimated embodied carbon of the Proposed Development, broken down by main building elements (Modules A1-5 excluding sequestration).



Nevertheless, Figure 7.1 demonstrates that across each of the models, the greatest source of carbon is from the superstructure of each building. Further improvements have been explored in Section 8.0.

A further benchmark comparison exercise was made to include other industry targets, such as those produced by RIBA and LETI. Results are summarised in Figure 7.2 below.

Figure 7.2 Comparison of the Proposed Development's results (A-C excluding B6 & B7 and impacts from external works) with industry benchmarks.



7.2 ACTIONS TAKEN TO REDUCE WLC EMISSIONS

Re-use and Recovery

The Circular Economy Statement details the strategy for recovery of materials in line with the circular economy model. The benefits of recovered materials have been accounted for in this assessment, using One Click LCA benchmarks and assumptions due to uncertainty in the quantity of replacement materials. A more detailed analysis is recommended at a further stage when more accurate data is available.

7.3 PROPOSED DEVELOPMENT (OUTLINE): ESTIMATED WLC EMISSIONS.

Table 7.2 One Click LCA output, evidencing WLC emissions for all modules, utilising SAP 10.2 Carbon factors for operational energy use

													C3 Waste processing	C4 Waste Disposal	D External impacts (not included in totals)	TOTAL $kgCO_2e$
0.1-0.2 Demolition	-	-	-	74,207	-	-	-	-	-	-	-	-	-	-	-	-
0.3-0.5 Facilitating works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Substructure	-	17,323,116	690,903	820,140	-	-	-	9,532	-	-	-	424,943	192,240	186	-6,165,473	-
2.1-2.4 Superstructure	-43,582	23,553,140	754,033	1,239,169	-	260,424	65,106	999,290	-	-	-	443,325	256,698	-59,618	-7,295,031	-43,582
2.5-2.6 Superstructure	-783,478	8,699,811	40,395	799,101	-	299,488	74,872	4,577,325	-	-	-	94,257	1,262,618	317,035	-853,280	-783,478
2.7-2.8 Superstructure	-1,569,425	9,107,497	158,495	322,884	-	65,106	16,277	3,453,182	-	-	-	184,894	1,623,158	334,006	-1,265,753	-1,569,425
3 Finishes	-955,535	4,950,953	48,082	811,375	-	156,254	39,064	9,552,597	-	-	-	139,135	1,995,873	296,348	-1,387,566	-955,535
4 Fittings, furnishings and equipment (FF&E)	-29,590	213,375	680	10,690	-	13,021	3,255	1,383,956	-	-	-	43,284	33,625	-	-240,389	-29,590
5 Building Services (MEP)	-1,457	6,593,074	13,251	58,296	-	260,424	65,106	8,152,693	-	5,378,821	-	47,860	75,548	2,869	-4,874,321	-1,457
6 Prefabricated buildings and building units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Work to existing building	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 External works	-894,969	523,637	70,367	7,792	-	26,042	6,511	-	-	-	-	8,766	1,002,431	107	-97,496	-894,969
TOTAL $kgCO_2e$	-4,278,036	70,964,603	1,776,206	4,143,653	-	1,080,760	270,190	28,128,575	-	5,378,821	-	1,386,463	6,442,190	890,933	-22,179,308	-4,278,036
TOTAL $kgCO_2e/m^2$	-39.6	656.6	16.4	38.3	-	10.0	2.5	260.3	-	49.8	-	12.8	59.6	8.2	-205.2	-39.6

Figure 7.3 WLC emissions broken down into modules

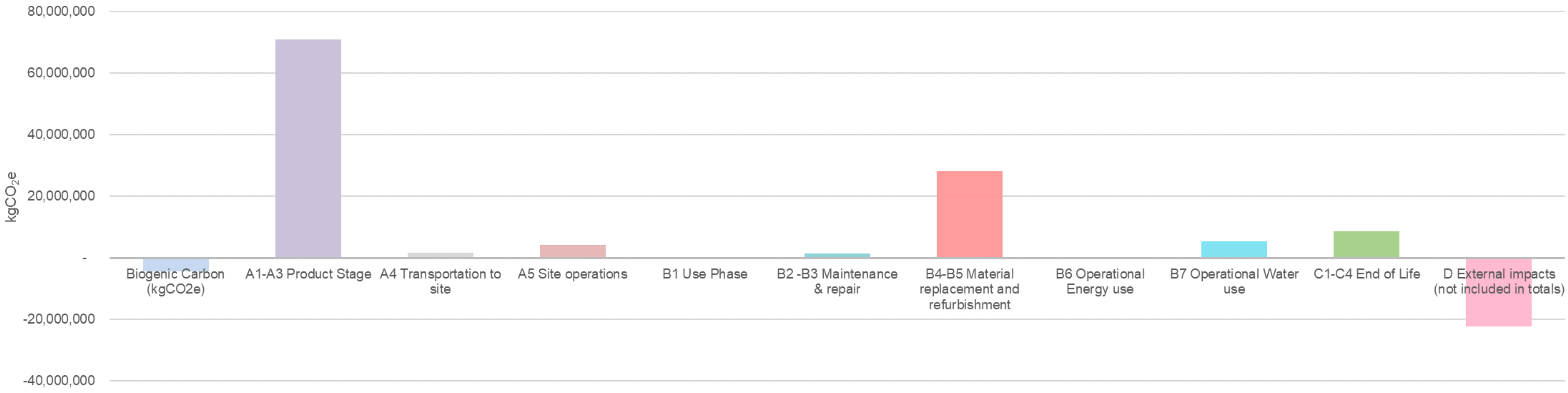


Figure 7.4 WLC emissions broken down into elements (Excludes B6 and B7, including sequestration)

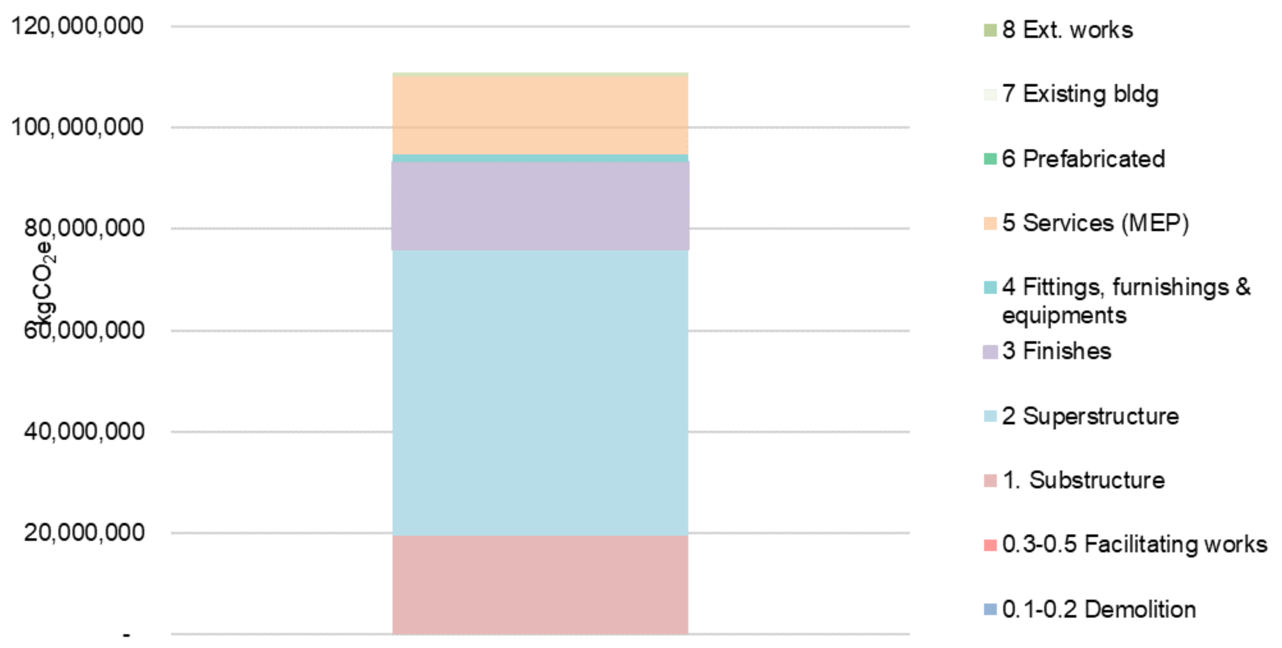
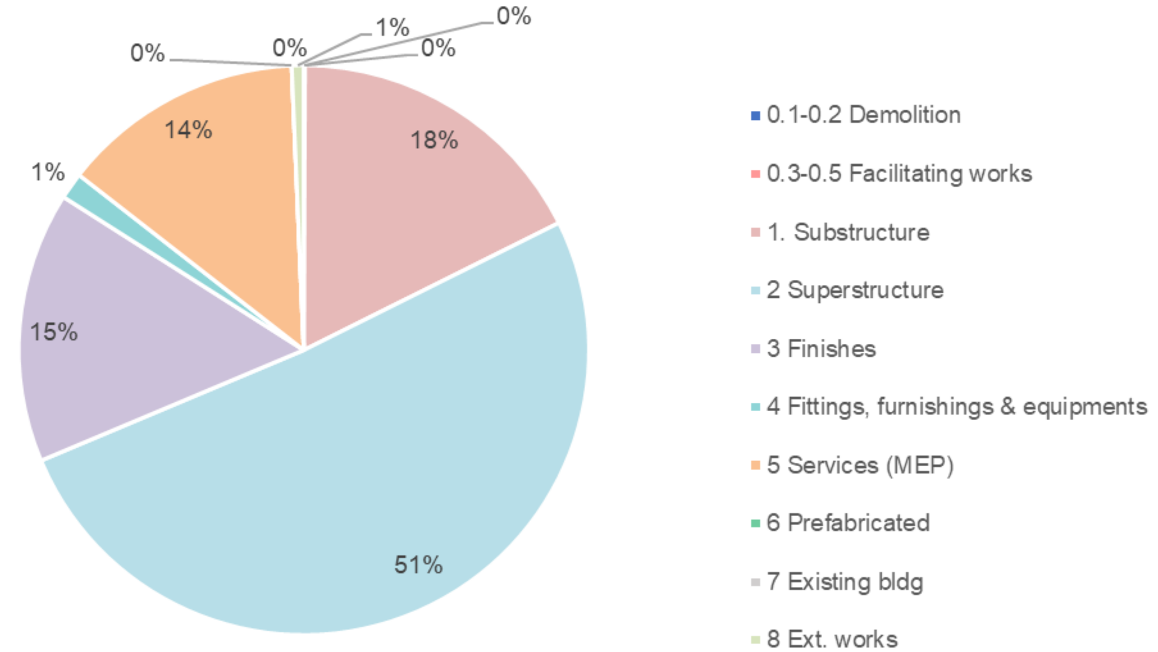


Figure 7.5 WLC emissions broken down into elements (%) (Excludes B6 and B7, including sequestration)



7.4 PROPOSED DEVELOPMENT (DETAILED): ESTIMATED WLC EMISSIONS.

Table 7.3 One Click LCA output, evidencing WLC emissions for all modules, utilising SAP 10.2 Carbon factors for operational energy use

													C3 Waste processing	C4 Waste Disposal	D External impacts (not included in totals)	TOTAL kgCO2e
0.1-0.2 Demolition	-	-	-	74,207	-	-	-	-	-	-	28,441	-	-	-	-	-
0.3-0.5 Facilitating works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Substructure	-	6,956,906	341,287	442,933	-	-	-	14,803	-	-	-	180,273	58,838	55	-2,374,662	-
2.1-2.4 Superstructure	-13,034	14,395,404	701,585	735,192	-	116,696	29,174	564,606	-	-	-	255,894	131,450	-19,807	-6,907,583	-13,034
2.5-2.6 Superstructure	-264,841	3,175,995	32,862	369,487	-	129,603	32,401	1,657,439	-	-	-	34,529	434,851	107,267	-343,507	-264,841
2.7-2.8 Superstructure	-559,693	3,159,044	63,086	134,813	-	29,174	7,293	1,211,797	-	-	-	64,088	579,897	112,912	-451,309	-559,693
3 Finishes	-323,183	1,779,679	30,765	328,600	-	66,256	16,564	3,749,767	-	-	-	48,747	675,187	100,178	-754,719	-323,183
4 Fittings, furnishings and equipment (FF&E)	-2,231,354	381,270	24,920	14,304	-	4,402	1,101	2,045,056	-	-	-	16,860	2,233,393	12,582	-1,181,527	-2,231,354
5 Building Services (MEP)	-624	3,472,902	28,125	106,154	-	110,427	27,607	4,582,536	304,514	1,229,165	-	24,286	27,065	1,129	-2,562,106	-624
6 Prefabricated buildings and building units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Work to existing building	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 External works	-203,728	181,961	24,189	39,267	-	20,744	5,186	14,690	-	-	-	2,967	239,838	39	-32,956	-203,728
TOTAL $kgCO_2e$	-3,596,456	33,503,161	1,246,819	2,244,957	-	477,303	119,326	13,840,694	304,514	1,229,165	28,441	627,644	4,380,517	314,355	-14,608,370	-3,596,456
TOTAL $kgCO_2e/m^2$	-80.1	746.1	27.8	50.0	-	10.6	2.7	308.2	6.8	27.4	0.6	14.0	97.6	7.0	-325.3	-80.1

Figure 7.6 WLC emissions broken down into modules

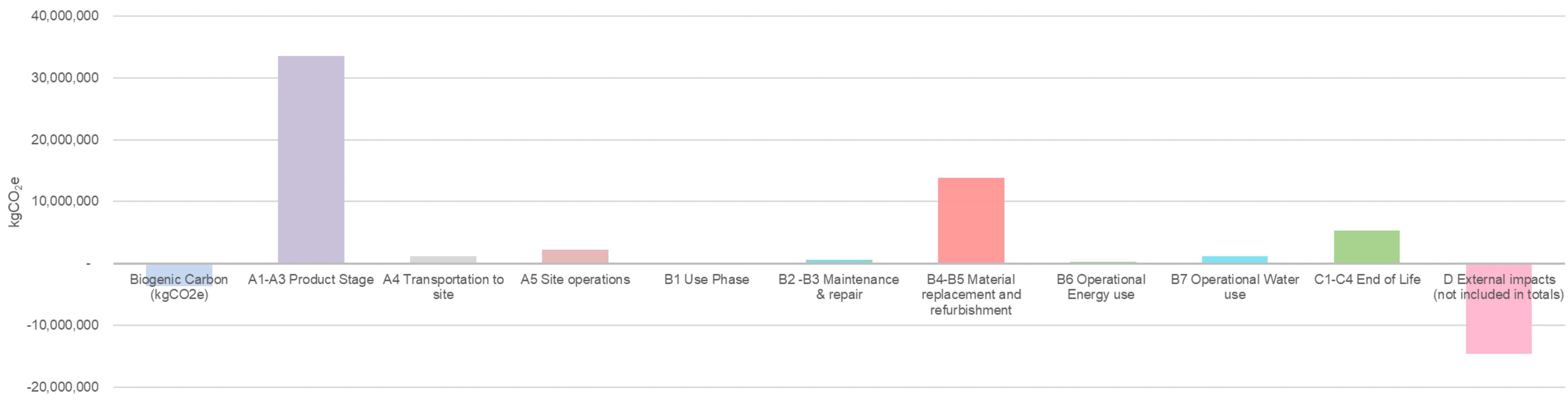


Figure 7.7 WLC emissions broken down into elements (Excludes B6 and B7, including sequestration)

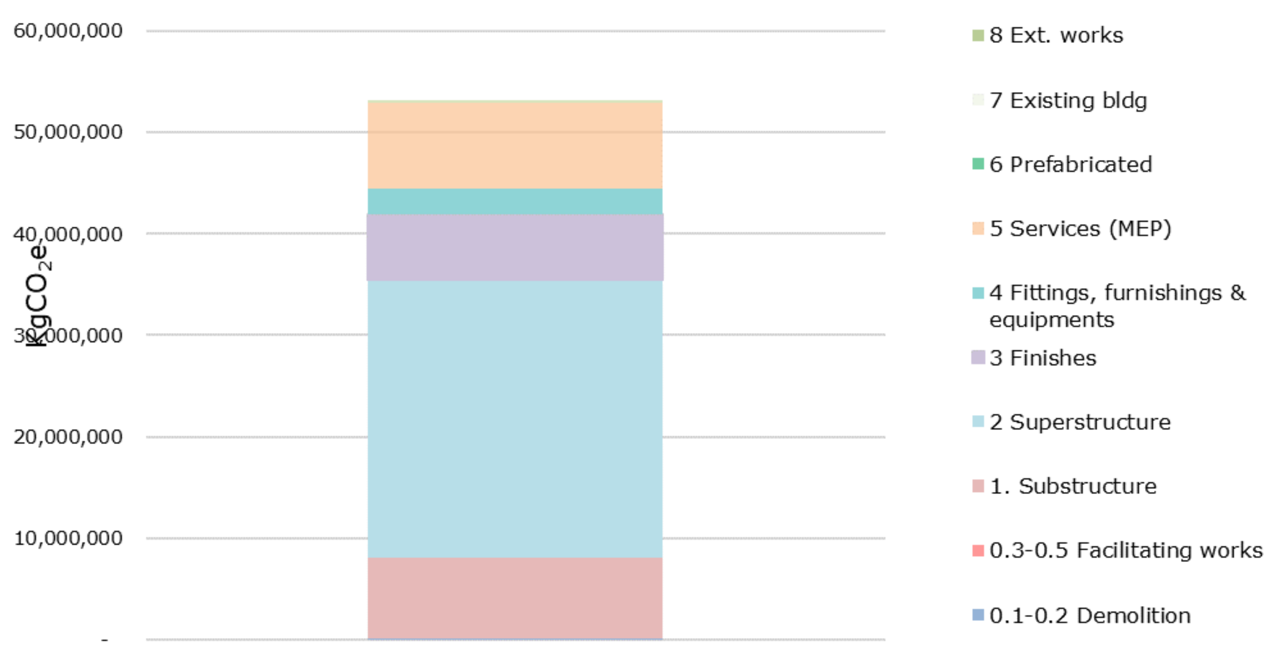
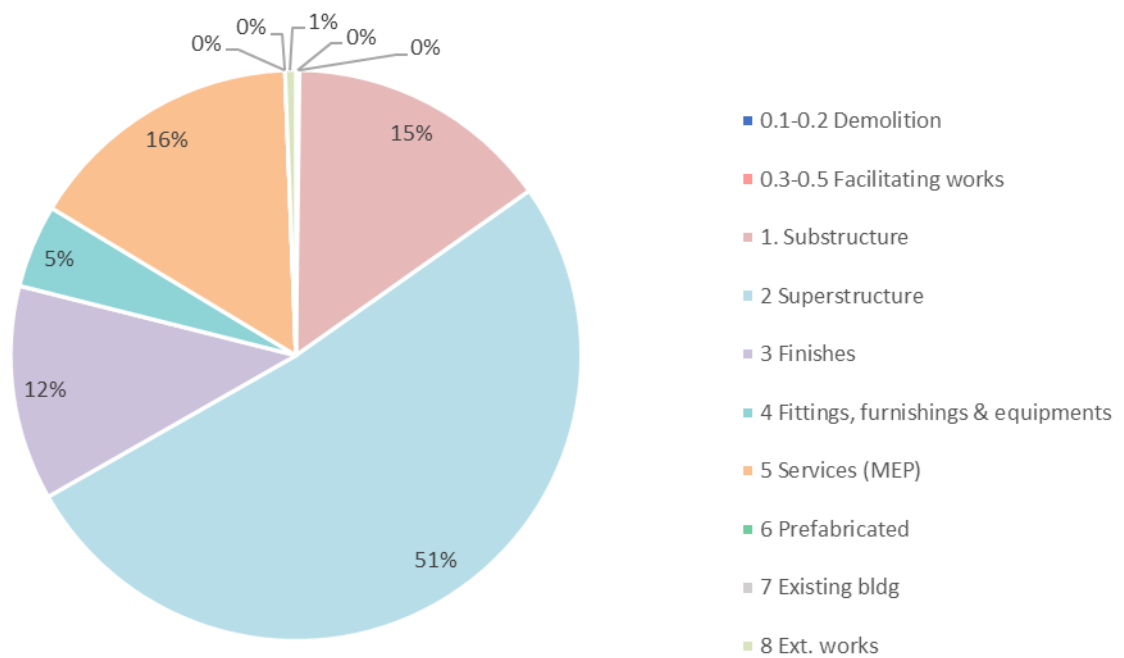


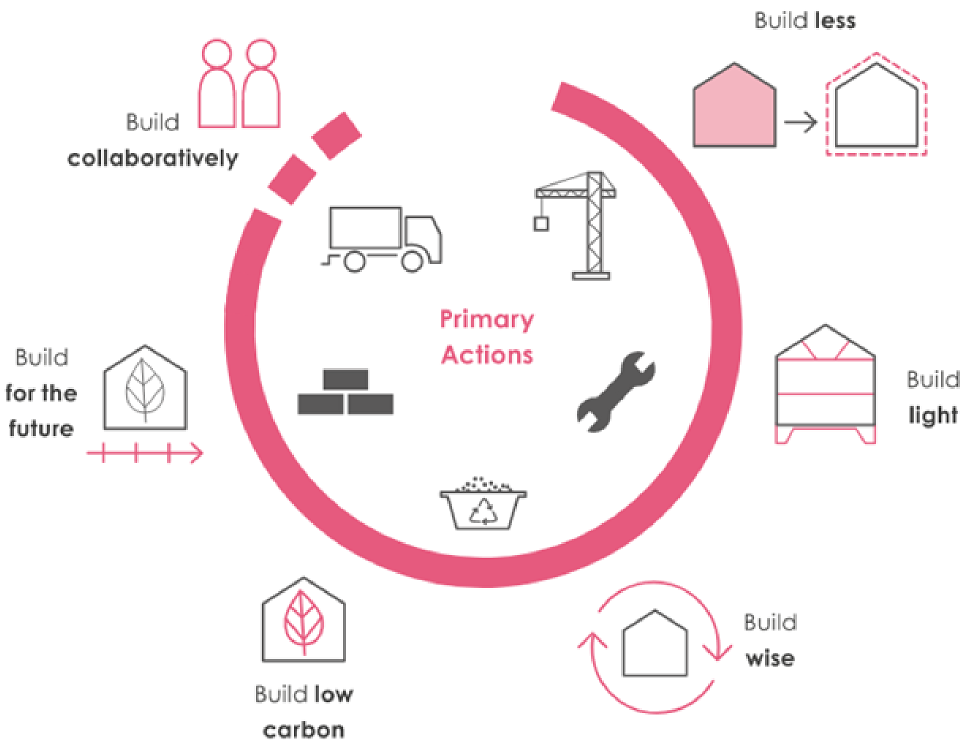
Figure 7.8 WLC emissions broken down into elements (%) (Excludes B6 and B7, including sequestration)



8.0 OPPORTUNITIES FOR REDUCING WLC

Greengage produced a summary of observations compiled through the review of the design information provided and the completion of the WLC assessment. In developing these observations, best practice guidance within the LETI Embodied Carbon Primer has been followed, see Figure 8.1 below.

Figure 8.1 Embodied Carbon reduction actions from LETI embodied carbon primer



It should be noted that these carbon reduction material suggestions have been considered in reference to carbon embodiment only, and other influencing factors, such as fire safety, cost implications and viability must be taken into account and assessed by suitably qualified team members before adoption in the design.

In general, for the specification of materials for the development, it is encouraged to choose suppliers with established procedures for selection of Environmental Product Declarations (EPDs) and make a clear specification of products and manufacturers during the following stages.

8.1 BRICKS

In respect to brick the following observations are made:

- Local reclaimed brick should be sourced wherever possible;

- Consider blockwork with high recycled content. An unfired brick system with much lower embodied carbon may be suitable for internal non-load bearing walls, such as Kenoteq (which can be load bearing as well), which makes bricks from 90% recycled content;
- Explore the use of bricks made from recycled building material, such as StoneCycling, which utilises 91kg of waste per m^2 brickwork;
- Consideration should be given for the use a mortar which is softer than the brick. Hard concrete mortars cannot be removed easily from brickwork, resulting in damaged and broken bricks. Whereas soft mortars (lime) are easier to remove and the brick can therefore be reused;
- Reuse damaged bricks within aggregates; and
- Consideration should be given for a mortar mix that is low in embodied carbon but strong enough for the purpose, whilst allowing the brick to be easily reclaimed.

8.2 CONCRETE

In respect to concrete the following observations are made:

- Using concrete as a finish can reduce the need for other materials. In addition, exposed areas of concrete can optimise the thermal mass performance. Thermal mass, with adequate ventilation, can be used to control daytime peak temperatures of a space and therefore reduce or minimise the need for air-conditioning. The areas where this can be done would need to be carefully considered. The durability of concrete also offers further savings through a reduction in the need for maintenance and repair (compared to a painted finish for example);
- The concrete's environmental impact can be further reduced by increasing the percentage of ground granulated blast furnace slag (GGBS) or pulverised fuel ash (PFA);
- Whilst aggregate only accounts for a minor proportion of the overall embodied carbon content of concrete, where feasible recycled aggregates should be sourced if located within a 15km delivery distance;
- Construction and demolition (C&D) waste and waste glass can be recycled within aggregates to reduce the use of virgin materials and reduce the amount of reusable materials sent to landfill;
- A significant reduction in embodied carbon could be achieved by using voided biaxial slabs, or slimming off the excess. For example, reducing a floor slab from 200mm to 190mm;
- Adopting standardised detailing would enable formwork to be re-used multiple times and would allow for repetition of reinforcement;
- Design for Manufacture and Assembly (DfMA). For example, pre-cast hollow core planks can be used elsewhere at the end-of-life if the screed is broken, allowing future change of use;
- Design for future flexibility, for example by over designing such as considering a structural grid that would support a variety of uses would enable the buildings to be adapted for future uses, reducing the need for complete demolition; and

- Another consideration factor is the transportation of concrete. If in-situ concrete could be sourced from a nearby concrete plant (i.e. 10-25 km away), this could further reduce the carbon impact of the concrete.

8.3 GLASS AND FACADES

In respect to glass the following observations are made:

- In accordance with the Overheating Assessment, the solar gain performance of the glazing should be considered under a climate change scenario to ensure a balance between the retention of heat and the ability to provide a thermally comfortable environment during the lifespan of the buildings;
- Typically, timber framing is the best option in respect to embodied carbon. It has a longer life span than polyvinyl chloride (PVC) and a better thermal performance than steel or aluminium. Aluminium cladding of timber frames can reduce maintenance and increase the expected life span of the product. However, consideration should be given to the ease of maintenance, weight and durability;
- The adoption of standard sizes for the glazing can support the re-use of the product at the end-of-life stage;
- Options should be considered for the use of aluminium with higher recycled content to reduce the use of virgin materials and the associated embodied carbon emissions. Polyester Powder Coating (PPC) aluminium should also be sought in lieu of Anodised Aluminium due to the reduced embodied carbon content;
- The curtain walling and windows are carbon intensive material and require high levels of maintenance. Considering timber framed or combi curtain walling and windows will reduce their impact; and
- Select low carbon panel product, such as Rockpanel or Steico, for insulation to reduce the carbon impact of the façade further.

8.4 STEEL

In respect to steel the following observations are made:

- Always consider the recycled content of steel elements within the specification;
- Internal partitioning contributes a significant proportion of the embodied carbon emissions, which can be attributed to the metal framing system. The replacement of this system with a timber stud system or concrete blocks with high recycled content can significantly reduce carbon emissions;
- Procure steel that is manufactured from an electric arc furnace rather than a blast furnace and incorporate recycled materials;
- Explore the procurement of re-used from a suitable supplier that meets the relevant steel condition and safety standards; and

- Steel products should be specified with an EPD as there are plenty available and this can significantly reduce the environmental impact.

8.5 TRANSPORTATION AND PROCUREMENT

The following observations are made:

- The RICS recommended transport distances have been adopted. Consideration should be given to the use of locally sourced material suppliers and material products with a certified Environmental Product Declaration (EPD); and
- Recycled aggregates should only be considered within the design when they are locally available, otherwise transportation impacts exceed the intended benefits. The use of recycled aggregates within a project also enables credits to be awarded under BREEAM.

8.6 FURTHER CONSIDERATIONS

The façade and roof are under constant wear from the environment, can lead to frequent repairs and maintenance. By using durable materials, this not only reduces the cost and frequency of refurbishment but also reduces the use of material replacement and its associated carbon footprint.

Improvement could be expected in ceilings and raised floors by specifying reused and recycled materials:

- Considering reclaimed raised access floor;
- Considering raised access floor made from Calcium Sulphate or other recycled materials;
- Considering metal ceiling units with high recycled steel content, rather than aluminium; or
- Opting for exposed services and a higher ceiling height in lieu of installing a suspended ceiling altogether.

Trialling the use of innovative low carbon materials, such as cement-free concrete, on noncritical areas, such as temporary works before attempting to use them more widely on permanent works.

Consideration of off-site fabrication, modularisation and standard sizes to reduce building complexity and embodied energy use in production.

Limitations and exclusions are present in some elements within the analysis, in particular building services, fixtures and fittings, unregulated energy demand and decarbonisation. Therefore, the embodied carbon emissions and proposed observations may change if the WLC model was to be modelled with more detailed information.

Furthermore, a clearer understanding on the quantities, material types and product suppliers will also influence the embodied carbon emission performance and observations made, especially in suppliers with an EPD are chosen. This is typical and expected within WLC assessments as the assessment is considered to be an ongoing and iterative process, refined and enhanced as project information becomes available through the development process.

In respect to building services, the following observations could be considered if they become included within the LCA model:

- Optimise the provision of building services and size by adopting load reduction measures, carrying out detailed load assessments, and carefully considering the requirements for flexibility and back-up. Alongside the completion of operational energy modelling; and
- In accordance with the proposed energy strategy specify equipment that has:
  - Low refrigerant GWP and leakage;
  - High thermal efficiency;
  - Long lifetime;
  - Light weight;
  - Materials with low embodied carbon;
  - Materials that can be demounted, disassembled and reused; and
  - Products with EPDs.

9.0 CONCLUSIONS

This assessment completed at RIBA Stage 2, informs Comer Homes 'the Applicant', the design team and the GLA on the benchmark WLC performance for the Proposed Development. The report has summarised the WLC assessment undertaken for the development at North London Business Park, in line with the GLA guidance and RICS Professional Statement on Whole Life Cycle Carbon Assessment.

The Proposed Development is currently achieving the GLA WLC benchmark, with figures of 711kgCO_2e/m^2 & 824kgCO_2e/m^2 (A1-A5) for the outline and detailed assessments respectively compared to the ≤850kgCO_2e/m^2 benchmark.

On the other hand, 353kgCO_2e/m^2 & 441kgCO_2e/m^2 (B-C excluding B6 & B7) has been achieved for the outline and detailed assessments respectively, thereby exceeding the GLA WLC benchmark of ≤350kgCO_2e/m^2.

In addition, there remains considerable opportunity to enhance the WLC assessment and improve its accuracy, as the design develops.

The most intensive carbon emitters have been identified to highlight the products that have the most significant contribution to the overall emissions. Suggestions have also been provided to reduce the carbon intensity of these products.

To effectively address WLC throughout the continuation of the design process, it will be important to implement the following next steps:

- It is recommended that the design team adopt a strategy for reducing the carbon emissions over this WLC model baseline through the technical design phase (RIBA Stage 4) with the intention of producing future models as the design and construction develops to confirm a reduction in 'as-designed' and 'as-constructed' WLC emissions over the baseline;
- Products and manufacturers with EPDs should be specified during RIBA Stage 4 and the material's carbon footprint data considered during procurement;
- The proportion of Portland Cement replacement in concrete products should be at least 25% to represent the results in this report. Increased quantities should be explored following an assessment of the suitability of the product for the application considered; and
- Publicly disclose and report to the RICS embodied carbon database.

Table 9.1 below summarises actions that should be undertaken as the scheme achieves planning approval and moves into the detailed design stages.

Table 9.1 WLC actions to undertake after planning approval

Action	Time	Effect on WLC
Update the WLCA model with further project information relating to building services, finishes and FF&E.	Early RIBA Stage 4	WLC will increase

Action	Time	Effect on WLC
Review design options to assess impact on WLC, with a view to developing a strategy to deliver an improvement over the baseline embodied carbon emissions.	Mid RIBA Stage 4	WLC could decrease
Undertake final 'as-designed' WLCA to represent final design.	End of RIBA Stage 4	Neutral change in WLC or possible decrease
Undertake 'as-constructed' WLCA to represent final as-built development.	End of RIBA Stage 5	Neutral change in WLC or possible decrease

- END -

APPENDIX A RICS PROJECT ID MATRIX

Table A.1 RICS Project ID Matrix

RICS Reporting Requirements	LCA Assessor Response	
Date of Assessment	12th January 2024	
Verified By	Cameron Parker	
Project Type	New-build	
Assessment Objective	A detailed element (Phase 1) comprising up to 461 residential units in five blocks reaching 9 storeys, the provision of a 5-form entry secondary school, a gymnasium, a multi-use sports pitch and associated changing facilities and improvements to open space and transport infrastructure, including improvements to the access from Brunswick Park Road; and An outline element (Phases 2-5) comprising up to 1,967 additional residential units in buildings ranging from three to twelve storeys, up to 7,148m2 of non-residential floor space (use Class E) and 20,250m2 of open space. Associated site preparation/enabling work, transport infrastructure and junction work, landscaping and car parking.	
Project Location	North London Business Park, London, N11 1GN	
Date of Project Completion	n/a	
Property Type	Residential, Educational & Class E	
Size	152,978m^2 (GIA)	n/a m^2 (NIA)
Project Design Life	60-years	
Assessment Scope	RICS/GLA etc.	
Assessment Stage	Stage 2	
Data Sources	One Click LCA; and EPDs, all EU databases included comply with the EN 15804 standard and North American databases comply with the ISO 14040/44 standard.	
Assumptions and Scenarios	The model is based on the latest information received from the Design Team and the RICS default specifications for the main building materials when lack of detailed information. As outlined within Table 6.1, emissions for B2 Maintenance have been calculated based upon the highest figure of either 1% A1-A5 emissions or 10kgCO_2e/m^2 GIA.	

RICS Reporting Requirements	LCA Assessor Response
	B3 Repair Emissions have been calculated as 25% of the total B2 emissions.

APPENDIX B ASSUMPTIONS FROM RICS PROFESSIONAL GUIDANCE

	Material	Details	Specification
1.	Concrete	Piling	C32/40 20% cement replacement [1]
		Substructure	C32/40 20% cement replacement [1]
		Superstructure	C32/40 20% cement replacement [1]
		Generic concrete	C16/20 0% cement replacement [1]
2.	Steel	Reinforcement bars	97% Recycled Content [2]
		Structural steel sections	20% Recycled Content [3]
		Studwork/Support frames	Galvanised steel, 15% Recycled Content [4]
3.	Blockwork	Precast concrete blocks	Lightweight blocks for building envelope
			Dense blocks for other uses
4.	Timber	Manufactured structural timber CLT, Glulam, etc.	100% FSC/PEFC [5]
		Formwork	Plywood
		Studwork/Framing/Flooring	Softwood
5.	Aluminium	Cladding panels	Aluminium sheet, 35% Recycled Content [6]
		Glazing frames	Aluminium extrusions, 35% Recycled Content [6]
6.	Plasterboard	Partitioning/Ceilings	Min. 60% Recycled Content [7]
7.	Insulation	To floors, roofs & external walls	PIR

Material specification assumption for 'baseline building' as per RICS Professional Statement.

Transport scenario	km by road*	km by sea**
Locally manufactured e.g. concrete, aggregate, earth	50 [1]	-
Nationally manufactured e.g. plasterboard, blockwork, insulation	300 [1]	-
European manufactured e.g. CLT, façade modules, carpet	1,500 [2]	-
Globally manufactured e.g. specialist stone cladding	200 [3]	10,000 [3]

Material transport assumption for 'baseline building' as per RICS Professional Statement.

Building part	Building elements/components	Expected lifespan
Roof	Roof coverings	30 years
Superstructure	Internal partitioning and dry lining	30 years
Finishes	Wall finishes: Render/Paint	30/10 years respectively
	Floor finishes Raised Access Floor (RAF)/Finish layers	30/10 years respectively
	Ceiling finishes Substrate/Paint	20/10 years respectively
FF&E	Loose furniture and fittings	10 years
Services/MEP	Heat source, e.g. boilers, calorifiers	20 years
	Space heating and air treatment	20 years
	Ductwork	20 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installations and controls	15 years
	Water and disposal installations	25 years
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
Facade	Opaque modular cladding e.g. rain screens, timber panels	30 years
	Glazed cladding/Curtain walling	35 years
	Windows and external doors	30 years

Material life span assumption for 'baseline building' as per RICS Professional Statement.

APPENDIX C END OF-LIFE SCENARIOS

Material group	End-of-life scenario	Materials included	C3-C4 waste, processing and landfilling	D Recycling benefits
Mineral building materials	Recycling for ground works	Concrete*, Cement*, Bricks, Porcelain, Plaster, Clay products, Stone, Ceramics, Asphalt	C3: Construction waste preparation for recycling	Recycling benefit from replacing the primary gravel
Metals	Metal preparation and recycling**	Aluminium, Steel, Stainless steel, Galvanized steel, Copper coated, Copper uncoated, Brass, Zinc	C3: Metal waste preparation	Recycling benefits for replacing virgin metal
Biobased materials with heating value	Incineration and energy recovery	Wood, Wood products	C3: Construction waste incineration for energy recovery	Recovered energy
Other materials with heating value	Incineration and energy recovery	Plastics	C3: Construction waste incineration for energy recovery	Recovered energy
Other materials that can be landfilled in construction waste Site	Disposal / landfilling of inert material	Coatings, Synthetic materials, Panels and boards***, Insulating materials***, Glass, Window and façade components***	Disposal of inert construction waste	

* Taking into account concrete carbonation.

** Recycling potential can only be reported for metals with shares of primary manufacturing, i.e. if a product is made of recycled material, it no longer has recycling potential. 5% of losses is assumed for recycling (the remaining 95% are recycled).

*** When not included to above groups.

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