Whole Life Carbon Assessment

Britannia Street Car Park

January 2025

ensphere

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This document has been prepared and checked in accordance with Ensphere Group Ltd.'s Quality Management System.

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Report Outline

Contents

Executive Summary

This Whole Life Carbon ("WLC") Assessment considers the carbon emissions resulting from the construction and use of the proposed development at Britannia Street Car Park, London, WC1X 9BP.

The proposals are for the redevelopment of an existing brownfield site for Purpose-Built Student Accommodation in addition to community floorspace.

Consideration has primarily been given to the planning policy and other relevant standards and guidance prior to specifying the assessment object.

All stages of the project have then been considered, from raw material extraction, product manufacturing, transport, and installation on site through to the operation, maintenance, and eventual material disposal.

Best available data has been used, with the acknowledgement that this assessment has been undertaken at a relatively early stage of design.

Specialist software has been used with emissions calculated using the One Click LCA software, utilising the RICS and GLA compliant LCA calculation tool.

The assessment has reviewed whole life carbon emissions over a 60-year period, in line with the recommended RICS approach. This identified total WLC emissions of circa 9,308,918 $kgCO_2e$ (~2,013 $kgCO_2e/m^2$) under a non-decarbonised scenario. Embodied carbon emissions have been estimated at ~616 $kgCO_2e/m^2$ (below the 850 $kgCO_2e/m^2$ threshold given by GLA for residential developments).

The key lifecycle stages responsible for these emissions are [A1-A3] materials emissions (2,380,234 kg CO_2e), [B4] material replacement (952,059 $kgCO_2e$), and the [B6] operational energy use (5,287,391 kg CO_2e).

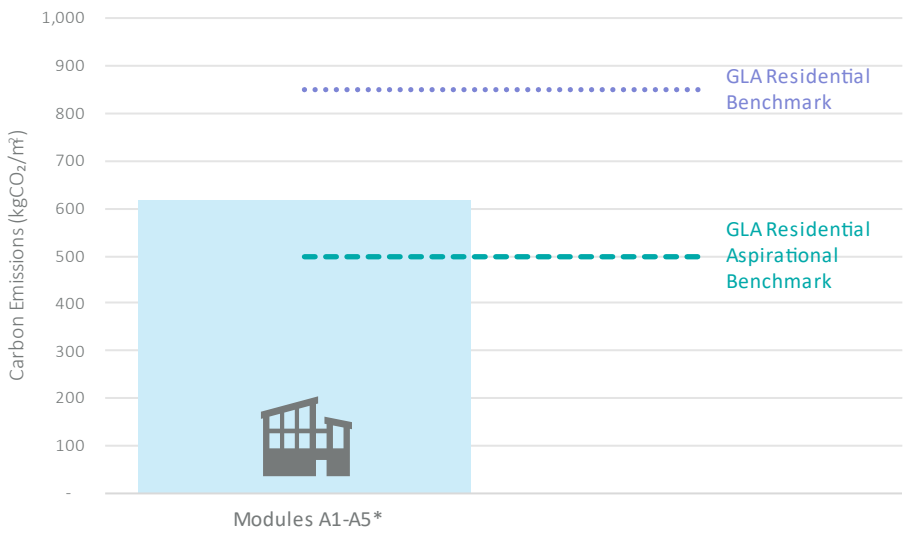

Figure ES.1– Project Embodied Carbon to Practical Completion relative to GLA Benchmarks (*excl. sequestered carbon)

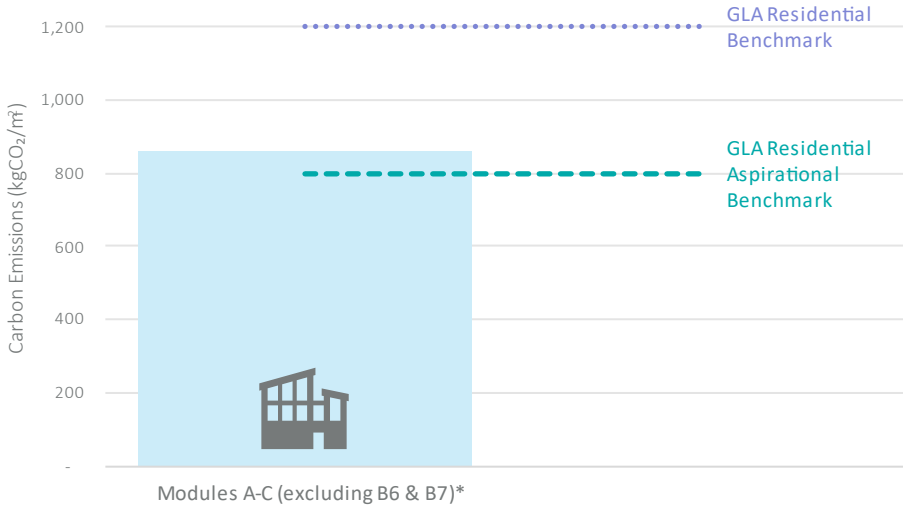

Figure ES.2– Project Embodied Carbon over the Life Cycle Relative to GLA Benchmarks (*incl. sequestered carbon)

1. Introduction

Ensphere Group Ltd was commissioned by Curlew Developments London Limited to undertake a Whole Lifecycle Carbon Assessment for a proposed development at Britannia Street Car Park, London, WC1X 9BP.

Site and Surroundings

The application site (the 'Site'), which is 0.1 hectares in size, is located in the Kings Cross Ward of the London Borough of Camden, bounded by Britannia Street to the north; the three storey 'Help Musicians Building' and six storey Derby Lodge buildings to the east; Wicklow Street to the south; and by London Underground railway lines (in a cutting) to the west. The Thames Link railway line also runs in a shallow tunnel beneath the western half of the Site.

The Site comprises undeveloped hardstanding in use as a public car park and includes a ventilation shaft linked to the Thames Link railway tunnel running below the Site.

The area surrounding the Site was historically industrial and residential in nature with the Site itself having previously been occupied by a 3-storey warehouse. While the area generally retains its historic built from, forming part of the Kings Cross St Pancras Conservation Area, over time the areas industrial uses have been replaced by office, creative and additional residential uses (including student accommodation). Building heights in the area generally range from two to six storeys, while the consented redevelopment of the nearby Royal National Throat, Nose and Ear Hospital (located to the south-west of the Site) permits the delivery of building up to 13 storeys tall.

The Site benefits from a high PTAL rating of 6b ('Excellent'), Kings Cross and St Pancras Railway and Underground Stations are located within 370 metres / 7-minute walk from the Site. There are also a number of bus stops within close proximity, with bus stops located at Grays Inn Road and Kings Cross Road.

Given the Sites proximity to various Universities including Central Saint Martins, Aga Khan University Institute, University of London & UCL within short walking and cycling distance of the Site, and its location within the 'Knowledge Quarter', the Site is an ideal location for students.

Proposed Development

The proposals are for the redevelopment of an existing brownfield site for Purpose-Built Student Accommodation in addition to community floorspace. Drawings showing the proposals and red line boundary of the Site are provided in Appendix A.

Report Objective

To assess the carbon emissions resulting from the construction and use of the building over its entire life, to improve understanding, consistent measurement and enable comparability of results, benchmarking and target setting to achieve carbon reductions.

Figure 1.1 – Map Showing the Location of the Proposed Development

2. Assessment Importance and Framework

Climate Change Context

Climate change, primarily caused by heightened greenhouse gas emissions from human activity, poses serious risk to human and natural systems around the world. In 2011-2020, global surface temperature reached 1.1 °C above 1850-1900[1]. There is 'very high confidence' that with every future increment in global warming, the risk and severity of impacts will magnify, heightening related losses and damages[1]. Stabilising global warming below 1.5 °C above pre-industrial levels will minimise impact to the Earth system and reduces the likelihood of surpassing irreversible thresholds, which will have benefits for ecosystems and society, and will help in achieving many aspects of the Sustainable Development Goals (SDGs)[2].

Causes of Climate Change

The higher the amounts of greenhouse gases in the atmosphere, the warmer the Earth becomes as the Sun's energy becomes trapped. Recent climate change is happening largely as a result of this warming; within smaller contributions from natural influences, such as variations in solar and volcanic activity. The IPCC reports with very high confidence that the increases in CO_2 (47%) and CH_4 (156%) concentrations since 1750 far surpass the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years, with increases in N_2O (23%) similar[3]. Global net anthropogenic greenhouse gas emissions include CO_2 from fossil fuel combustion and industrial processes, net CO_2 from land use, land-use change and forestry, as well as non-CO_2 emissions including CH_4; N_2O; and fluorinated gases[3].

Climate Change and the Built Environment

The share of emissions that can be attributed to urban areas have been rising over the last decade. These urban greenhouse gas emissions have complex drivers which include population size, income, state of urbanisation and urban form[3].

Typically, the climate change impacts of a building, when viewed in isolation, will not materially affect the climate. This is due to the relatively large scale of the principal receptor (the atmosphere) compared to the relatively minor potential harm that might be associated with the site and activities under consideration. However, it is acknowledged that when viewed cumulatively, with consideration given to activities by all buildings at a global level, buildings are together significant contributors to carbon emissions and climate change.

In terms of the UK carbon footprint, the built environment is estimated to currently be responsible for over 25% of total UK greenhouse gas emissions (buildings and infrastructure)[4]. Around 20% of built environment emissions are linked to the embodied carbon from the construction and refurbishment of buildings.

As operational emissions from buildings decrease, primarily due to rapid decarbonisation of the electricity grid, it is predicted that by 2035 embodied carbon will form over half of built environment emissions.

Whole Lifecycle Carbon Approach

Whole life carbon ("WLC") emissions are the carbon emissions resulting from materials, construction and use of a building over its entire life, including its demolition and disposal. A whole life carbon approach identifies the overall best combined opportunities for reducing lifetime emissions and helps to avoid unintended consequences of focusing on operational emissions alone.

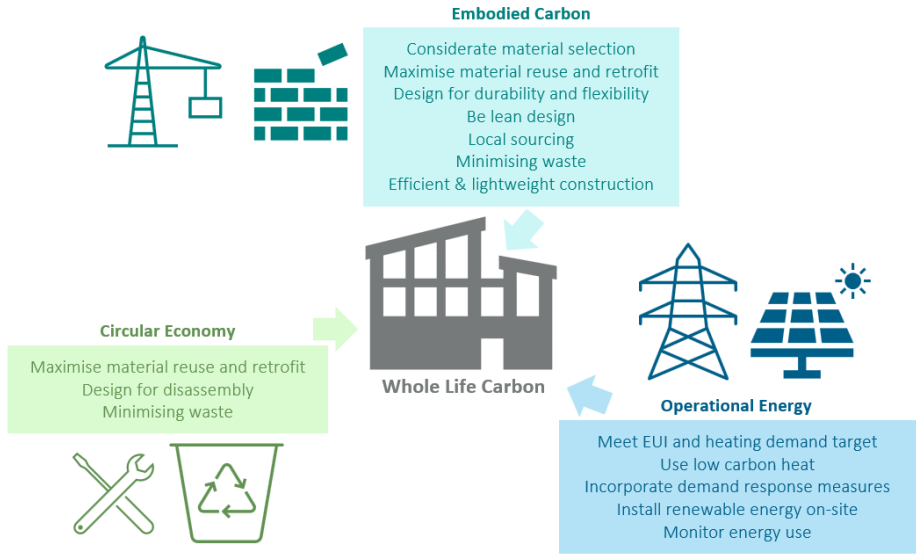

Figure 2.1 – Whole Lifecycle Carbon Principles

1 IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland

2 IPCC, 2018: Global Warming of 1.5°C.- An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, et al.)]

3 IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland

4 UK Green Building Council, 2021: Net Zero Whole Life Carbon Roadmap - A Pathway to Net Zero for the UK Built Environment

Relevant Standards & Guidance

The framework for appraising the environmental impacts of the built environment is provided by BS EN 15978:2011, a European Standard now adopted at a national level. The Standard specifies the calculation method, based on Life Cycle Assessment (LCA) and other quantified environmental information, to assess the environmental performance of a building. It also gives the means for the reporting and communication of the outcome of the assessment.

The standard gives:

- The description of the object of the assessment.
- The system boundary that applies at the building level.
- The procedure to be used at the inventory analysis.
- The list of indicators and procedures for the calculations of these indicators.
- The requirements for presentation of the results in reporting and communication.
- The requirements for the data necessary for the calculation.

In response to the challenge of ensuring consistency with the application of BS EN 15978, further work has been undertaken by organisations including the Royal Institute of Chartered Surveyors (RICS) and the Building Research Establishment (BRE), with the following references also being pertinent to this assessment:

- RICS Professional Statement – Whole Life Carbon Assessment for the Built Environment 1st Edition (RICS; ISBN 978 1 78321 208 8, November 2017), which has been recently updated to the RICS Professional Standard - Whole Life Carbon Assessment for the Built Environment 2nd Edition (RICS; ISBN 978 1 78321 503 4; August 2024) which became effective on the 1st July 2024.
- BRE Global Methodology for the Environmental Assessment of Buildings Using EN 15978:2011 (Building Research Establishment; ref PN 326 Rev 0.0; January 2018).

This assessment primarily follows the GLA London Plan Guidance for Whole Life-Cycle Carbon Assessments (March 2022). It is noted that at the time of the assessment, whilst the RICS Professional Statement – Whole Life Carbon Assessment for the Built Environment 1st Edition has been superseded by the 2nd Edition, the GLA WLC guidance document (including benchmarks) and template are underpinned by first edition methodology. The GLA have therefore released a statement to say that referable applications should provide assessment in accordance with their guidance, i.e. the 1st Edition of the RICS PS. This approach has been followed for this Whole Life Carbon Assessment, although some references are made to the 2nd Edition methodology where considered relevant.

Consideration has also been given to the guidance and targets set by Low Energy Transformation Initiative (LETI) and their joint work on carbon alignment with the organisations above.

Defining Carbon Emissions

The Net Zero Carbon Framework[5] outlines a whole life carbon definition for achieving net zero carbon emissions in buildings. This scope is widely used and considered one of the most representative of associated carbon. The definition is split into a two-parts:

> Net zero carbon – construction: "When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy".
>
> Net zero carbon – operational energy: "When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset".

A modular structure is followed for carbon reporting through breaking down the built asset's life cycle into stages and modules. The building and infrastructure life cycle stages and information modules are presented on the following page, which has been replicated from RICS PS Version 2 (itself adapted from EN 15978, EN 17472 and EN 15643, with additions to illustrate biogenic carbon).

The boundaries of these stages are all clearly defined to ensure consistency of approach and comparison between the whole life results for different projects, and the process of reporting.

This depicts that the upfront carbon relates to modules A0-A5, which covers all impacts up to the completion of the project but excludes any sequestered biogenic carbon within the materials used for construction (reported separately). Embodied carbon is in turn defined as all material impacts, i.e. modules A0–A5, B1–B5 and C1–C4. Modules B6 and B7 are operational carbon, and user activities are covered under module B8. Whole life carbon therefore covers modules A, B and C which is the system boundary, with module D included in a full assessment and reported separately.

[5] https://ukgbc.org/wp-content/uploads/2019/04/Net-Zero-Carbon-Buildings-A-framework-definition.pdf

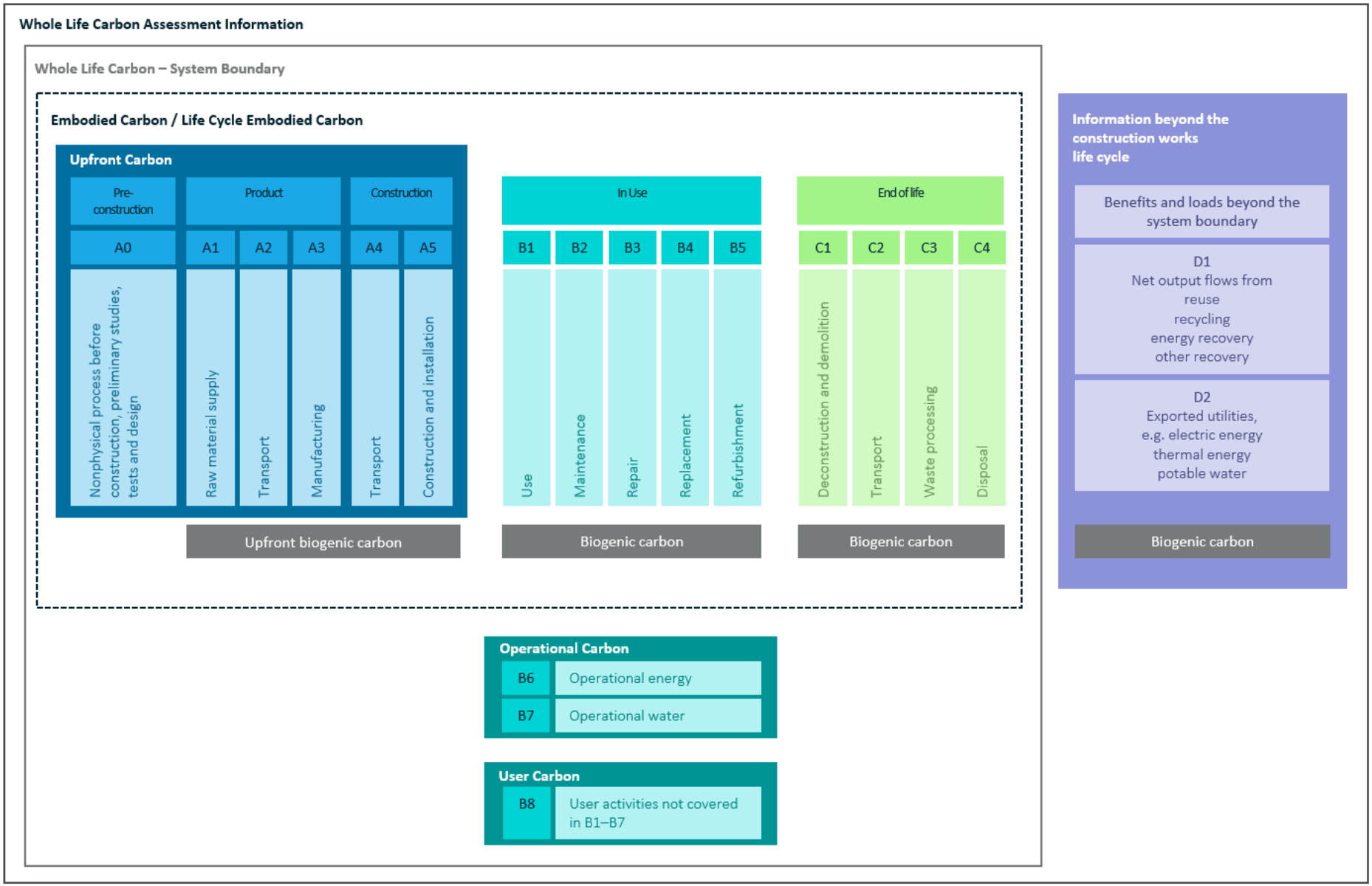

Figure 2.2 – Whole Life Carbon Stages (Reproduced from BS EN 15978:2011 stages and the RICS PS Version 2 graphic)

3. Planning Context

Minimising carbon emissions and waste are referenced throughout planning policy, with consideration given to relevant local policies and guidance, as per summarised in this section.

Figure 3.1 – Tiers of Key Relevant Planning Policy

National Context

National Planning Policy Framework (2023)

The National Planning Policy Framework (NPPF) was updated in December 2023. Paragraph 7 of the revised NPPF include reference to the following:

> *"The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs."*

Minimising emissions and waste are listed as part of the "environmental objective" in relation to achieving sustainable development.

London Context

London Plan (2021)

The London Plan is the overall strategic plan for London, it sets out an integrated economic, environmental, transport and social framework for development of London over the next 20-25 years. The London Plan is part of the Development Plan and covers a range of planning issues. The presented policies provide a vision for how London should sustainably grow and develop in the future. Policies considered pertinent to this report are presented below:

- Policy SI 2 (Minimising greenhouse gas emissions) – Major development should be net zero-carbon and minimise emissions in accordance with the following energy hierarchy: be lean, be clean, be green, be seen. A minimum on site reduction of 35% beyond Building Regulations will be required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Any short fall with the zero-carbon target should be addressed through a carbon offset payment. Development referable to the GLA should also calculate whole life-cycle carbon emissions.
- Policy SI 5 (Water infrastructure) – Development proposals should be achieving mains water consumption of 105 litres or less per head per day; and achieve at least the BREEAM excellent standard for the 'Wat 01' water category. Smart metering, water saving, and recycling measures should also be incorporated.
- Policy SI 7 (Reducing waste and supporting the circular economy) – Referable applications should promote circular economy outcomes and aim to be net zero-waste.

London Plan Guidance – Whole Life-Cycle Carbon Assessments (2022)

The guidance document explains how to prepare a WLC assessment which should accompany all referable planning applications in line with the London Plan Policy SI 2. The guidance follows BS EN 15978 using the RICS Professional Statement (1st Edition) as the methodology for assessment.

North London Waste Plan (Adopted 2022)

The North London Waste Plan (NLWP) has been prepared jointly by the seven North London Boroughs of Barnet, Camden, Enfield, Hackney, Haringey, Islington and Waltham Forest. The NLWP's purposes is to ensure there will be adequate provision of suitable land and to provide policies for waste development.

Local Context

Camden Local Plan (July 2017)

The Local Plan sets out the planning policies, site allocations and land designations Borough-wide and is the central document in the Borough's Development Plan.

The following policies are considered relevant to this report:

- Policy D1 (Design) – includes a requirement for development to be sustainable with regards to design and construction.
- Policy CC1 (Climate Change Mitigation) – promotes zero carbon development, consideration of the Energy Hierarchy (encouraging connection to District Energy Networks), reduced reliance on transport by car and resource efficiency. All new residential development will be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy). The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation, unless it can be demonstrated that such provision is not feasible.
- Policy CC2 (Adapting to Climate Change) – requires development to seek to protect existing green space, use of SUDS, incorporating biodiverse roofs, consideration of overheating risks, encourages the use of the Home Quality Mark and Passivhaus Standards along with BREEAM "excellent" for non-domestic and refurbishment developments >500sqm and/or five or more dwellings.
- Policy CC3 (Water and flooding) – The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible. Residential developments will be expected to meet the requirement of 110 litres per person per day (including 5 litres for external water use).
- Policy CC5 (Waste) – developments need to include facilities for the storage and collection of waste and recycling, in line with Council waste targets.

Camden Planning Guidance – Energy Efficiency & Adaptation (January 2021)

This document was adopted on 15 January 2021 following statutory consultation and replaces the Energy efficiency and adaptations CPG (March 2019), which replaced the CPG3 Sustainability (July 2015).

This guidance provides information on key energy and resource issues within the borough and supports Local Plan Policies CC1 Climate change mitigation and CC2 Adapting to climate change.

- Includes requirements concerning credits under certain BREEAM categories (60% energy, 60% water and 40% materials); and reference to a 20% carbon reduction target using renewables.
- Where developments are likely to be at risk of overheating applicants will be required to complete dynamic thermal modelling to demonstrate that any risk to overheating has been mitigated.
- The document also has a section on reuse and optimising resource efficiency, stating that a Condition and Feasibility Study should be undertaken to understand the reuse potential of the existing building for any development proposing substantial demolition. Taking into account the condition of the existing building and feasibility of re-use, the refit, refurbish, substantial refurbishment and extension, reclaim and recycle hierarchy should be used to explore all potential options of an existing site.

4. Assessment Approach and Key Actions Taken to Minimise Emissions

Approach to Assessment

Given there are no existing buildings on site, options for retaining existing buildings and structures did not need to be explored for this project as no demolition is proposed. Existing site materials comprise undeveloped hardstanding and a ventilation shaft.

Whilst the opportunities to reuse materials from the existing site are therefore minimal, the design team have collaborated ideas since the early stages of design development to maximise whole life carbon emission reduction potential.

This early stage of assessment will help to determine an initial carbon impacts baseline and identify carbon reduction potential at a time where the capacity to influence decisions is high, as per illustrated on the figure below.

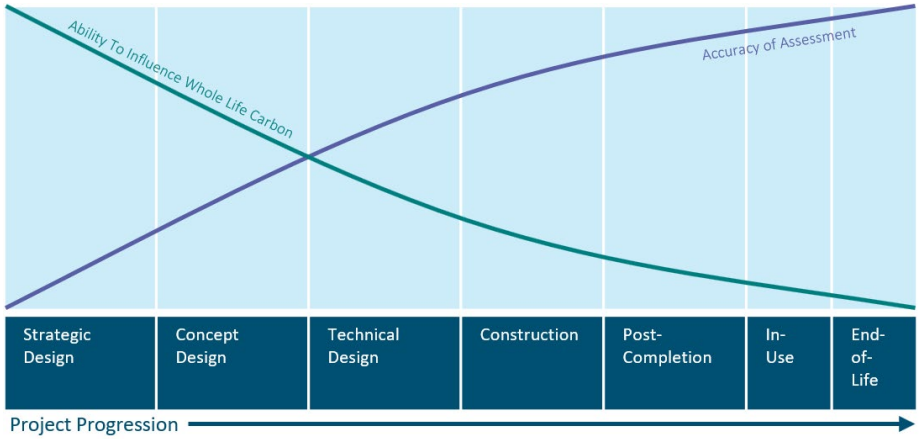

Figure 4.1 – The Ability to Influence Whole Life Carbon and the Accuracy of Assessment as the Project Progresses (Figure Adapted from RICS PS Version 2 Graphic)

Various workshops have taken place to discuss whole life carbon and circular economy principles in order to embed this in the design from the early stages, whilst also balancing this with other requirements including the operational energy performance. The Applicant is committed to sustainable development and recognises the interrelationships between sustainable design and the minimisation of emissions throughout the development's lifecycle.

The holistic approach to design and the need to optimise the relationship between operational and embodied carbon, whilst also being considerate of circular economy principles, are portrayed in the following figure.

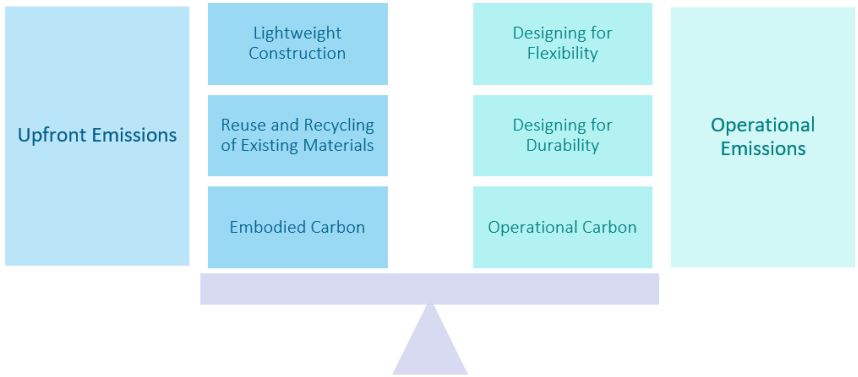

Figure 4.2 – Representation of the Need for Optimisation of the Relationship Between Operational and Embodied Carbon

Design Evolution and Material Specification Requirements

For this development, the design is cantilevered to maximise use of the site area whilst catering for the constraints relating to the Thames Link railway tunnel running below the Site. This posed various limitations in terms of structural and design options, with a lightweight frame needed over the tunnel location. Nevertheless, structural simplification and optimisation to reduce material loads has been the aim of the current design, driven by the optimisation of the site.

As the design progresses and materials are specified, reclaimed products and those with a higher recycled content will be sought where available, with preference given to materials that can also be sourced locally. Current targets include aiming for 50% reclaimed steel across structural frame and using 25% GGBS (or other cement replacement alternatives). Elements will be chosen based on the long-term needs, maintenance requirements and durability. A preference will be given to more resilient material products with longer lifespans to reduce the need for replacement. To reduce the need to repair and replace materials, suitable resilience and protection measures will also be adopted, particularly for parts of the building vulnerable to damage due to high usage or where elements are exposed and therefore at risk of degradation due to environmental factors. This will include measures such as kickplates on doors, hard-wearing and easily washable floor finishes as well as wall protection in areas of high pedestrian traffic in key circulation areas. Please refer to the Circular Economy Statement submitted with the application for more details on the design approach for the development.

5. Specification of the Object of Assessment and Scope

The following section outlines the parameters by which the Whole Life Carbon Assessment has been undertaken. Specification of the boundaries is necessary to ensure consistency of approach and comparison.

Spatial Boundaries

A Whole Life Carbon Assessment should consider all building components and works relating to the project, including any external works within the site boundary. The site boundary needs to be in line with the definition and intended use of the built asset, including all contiguous land that is associated with the project and that supports its operations.

For this Whole Life Carbon Assessment, the spatial boundary is consistent with the red-line site boundary presented in support of the planning application. This is shown in the figure below as well as Appendix A, with detailed drawings submitted separately as part of the application.

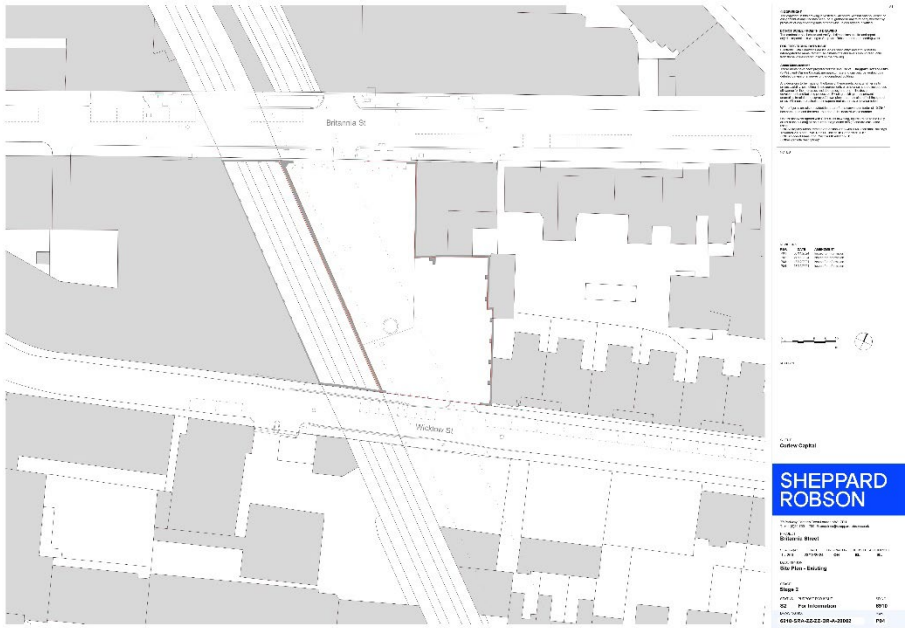

Figure 5.1 – Site Red Line Boundary (Produced by Sheppard Robson)

Building Physical Characteristics

This section outlines the building parts, elements, and components to be included in the Whole Life Carbon Assessment. The physical characteristics are as described in architect drawings and include:

- A student accommodation building (totalling circa 4,625 m^2 GIA).
- Amenity and landscaping areas (both internal and external at roof level).

Pre-Construction Demolition

In line with the GLA approach, any carbon emissions associated with pre-construction demolition have been accounted as part of the proposed development's lifetime carbon emissions. The assumption of 50kgCO_2e/m^2 for the existing areas being demolished can be assumed as per the GLA guidance in the absence of project specific information.

Given there are no existing buildings on site, emissions associated with pre-construction demolition are assumed to be negligible.

Reference Study Period

The Reference Study Period (RSP) to be used for the Whole Life-Cycle Carbon Assessment is defined by the RICS PS as being dependent on the nature of the development. The RICS PS compliant RSP for both domestic and non-domestic projects is 60 years. The reason for using fixed RSPs for the purposes of assessment is to simply enable comparability between WLC for different projects, rather than prescribe a limit on the life expectancy of a project.

Life Cycle Stages Scope

Given this is a new build project, and in line with the RICS approach and GLA Guidance, the assessment assesses all life cycle stages for the building and/or infrastructure elements within the project site boundary (defined in the above section). This includes all construction works as well as any demolition required for building the asset, and external works within the site boundary.

As a change of use is not planned in the RSP, predicted impacts from replacement cycles of elements that reach their end of life during the RSP are reported in module B4.

Certain potential sources of carbon (e.g., user activities in Module B8) have been excluded from the scope of this Whole Life Carbon Assessment as these emissions are only expanded upon in RICS PS Version 2 methodology where they can be optionally reported; however, such emissions might be picked up through other assessment (organisational carbon foot printing).

Units of Measurement

The units of measurement are reported in $kgCO_2$ equivalent ("$kgCO_2e$"). This is standard unit for measuring carbon footprints and expresses the impact of each different greenhouse gas in terms of the amount of CO_2 that would be required to create the same amount of warming. It therefore allows for the simultaneous assessment of multiple greenhouse gases.

Future Decarbonisation Projections

The energy sector is a major carbon emitter and will need to continue to decarbonise over time to be consistent with national policy targets.

To enable consistency in the calculation of life cycle carbon impacts, EN15978 suggests that current practices shall apply to any future projections and does not allow for decarbonisation in the calculations. This is as the data surrounding the decarbonisation of the electricity grid is not reliable to use for accurately estimating embodied carbon emissions. This is in line with the GLA methodology, as the data surrounding the decarbonisation of the electricity grid is not reliable to use for accurately estimating embodied carbon emissions.

It is noted that this differs to the RICS PS approach which recognises the importance of considering grid decarbonisation as an additional part of the WLC assessment over the asset's life cycle. Nevertheless, for consistency reasons, the GLA methodology has been followed for this assessment. SAP10.2 carbon conversion factors have been used in this assessment to align with the energy strategy of the development and GLA guidance.

6. Assessment Methodology and Data Sources

The Whole Life Carbon Assessment was calculated using the One Click LCA software, utilising the RICS 1st Edition supported LCA calculation tool.

Data detailing the measurements of building elements were taken from the "Order of Cost Estimate - Stage 2" produced by 100 Acre London Limited for the scheme. These measurements of building elements were inserted into One Click LCA, providing the appropriate material quantities for the assessment. This process was assisted by architectural drawings, material assumption schedules, as well as the IES VE 2024 model which was used to calculate quantities for materials not given in the Cost Plan, such as doors and internal walls. Information on MEP items was also provided from WSP. This should therefore represent at least 95% of each building element category, relative to the details available at this stage.

Building materials were then attached to the appropriate building elements based on available information in the documentation provided. It should be noted that the availability of construction data and material options in the One Click LCA tool limit the selection of possible material specifications therefore closest matching Environment Product Declarations (EPDs) were selected where appropriate. Most technical specifications for products were not available at this stage and therefore generic data, representative of standard, market average specifications have been used where no specific material details are available.

The following table summarises the key sources of information and out of scope modules.

Table 6.1 – Model Primary Data Sources Summary

Module	Lifecycle Stage	Key Data Source(s)
Pre-construction	A0: Pre-Construction	GLA Assumption
Product	A1: Raw Material Supply	Cost Plan, MEP specification details, architect drawings, material schedule and IES VE model. One Click LCA database
	A2: Transport	One Click LCA database
	A3: Manufacturing	One Click LCA database
Construction	A4: Transport to Building Site	One Click LCA database
	A5: Construction and Installation	One Click LCA database
In Use	B1: Use	MEP specification details and TM65
	B2: Maintenance	One Click LCA (GLA Assumption)
	B3: Repair	One Click LCA (GLA Assumption)
	B4: Replacement	One Click LCA (RICS Assumption)
	B5: Refurbishment	N/A
	B6: Operational Energy Use	TM54
	B7: Operational Water Use	London Planning Policy Water Use Requirements
End of Life	C1: Deconstruction and Demolition	One Click LCA (RICS Assumption)
	C2: Transport	One Click LCA (RICS Assumption)
	C3: Waste Processing	One Click LCA (RICS Assumption)
	C4: Disposal	One Click LCA (RICS Assumption)
Benefits & Loads Beyond the System Boundary	D: Reuse / Recovery / Recycling	One Click LCA (RICS Assumption)

As per the RICS PS, to ensure baseline consistency, certain default specifications and recycled content assumptions for main building materials based on UK average industry standard practice were employed where detailed information was not available. The following table summarises the building materials assumptions.

Table 6.2 – One Click LCA Building Materials Specified

RICS Category	Resource	Quantity (kg)
1.1.1.Standard foundations	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	147,168
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	318,888
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	15,330
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615	26,780
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	442,526
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	30,692

1.1.3.Lowest floor construction	Resilient and vibration-damping underlay, Lnw = 28 dB, 5 mm, 5.6 kg/m2, Minigran (POLYMAXITALIA S.r.l.)	3,000
	Insulating vapour control layer and air barrier, 0.148 kg/m2, Protect VC Foil Ultra (Building Product Design Ltd)	130
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	510,000
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	440,000
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	23,496
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	20,680
	Stone wool insulation panels, L=0.037 W/mK, R=2.63 m2k/W, 100 mm, 3.3 kg/m2, 33 kg/m3, Lambda=0.037 W/(m.K), FLEXI 1200x600x100 (ROCKWOOL, UK plant)	3,003
	Precast concrete ground beam, 2400 kg/m3 (British Precast)	72,000
2.1.1.Steel frames	Galvanized steel stud framing profiles per m2 (air gap included), UD and CD profiles included, wing width: 6 mm, flange width:50 mm, steel thicnkess:0.6 mm (23 gauge), 450 mm spacing, 2.4 kg/m2 (One Click LCA)	5,400
	Structural steel profiles, generic, 20% recycled content, I, H, U, L, and T sections, S235, S275 and S355	39,000
	Structural steel profiles, generic, 20% recycled content, I, H, U, L, and T sections, S235, S275 and S355	32,000
	Structural steel profiles, generic, 20% recycled content, I, H, U, L, and T sections, S235, S275 and S355	51,000
	Steel hollow sections (CFRHS, CFCHS, HFRHS, HFCHS), 7850 kg/m3 (Norstal Steel Structure S.R.L.)	9,000
2.1.4.Concrete frames	Formwork concrete elements for floor slabs, 127 kg/m2, Gamme PREDALLE BA RECTOR BAS CARBONE de 50 mm d`épaisseur (RECTOR LESAGE SAS)	1,186,434
	Integrated formwork precast concrete wall, excluding the filling concrete, 200 mm, 245.9 kg/m2, C40/50, XA2 CEM I (SPURGIN LEONHART)	52,000
	Integrated formwork precast concrete wall, excluding the filling concrete, 200 mm, 245.9 kg/m2, C40/50, XA2 CEM I (SPURGIN LEONHART)	836,060
	Integrated formwork precast concrete wall, excluding the filling concrete, 200 mm, 245.9 kg/m2, C40/50, XA2 CEM I (SPURGIN LEONHART)	230,000
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	43,200
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	806,400
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	297,600
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	57,600
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	1,120,800
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	3,000
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	61,000
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	37,000
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	3,840
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	79,000
2.2.1.Floors	Galvanized profiled steel decking, for composite floor slabs/decks, 1.2 mm sheet thickness, 15.11 kg/m2, ComFlor® 80+ 1.20mm (Tata Steel Europe, Tata Steel International (2021))	40,000
	Stone wool insulation panels, L=0.037 W/mK, R=2.63 m2k/W, 100 mm, 3.3 kg/m2, 33 kg/m3, Lambda=0.037 W/(m.K), FLEXI 1200x600x100 (ROCKWOOL, UK plant)	6,900
	Stone wool insulation panels, L=0.037 W/mK, R=2.63 m2k/W, 100 mm, 3.3 kg/m2, 33 kg/m3, Lambda=0.037 W/(m.K), FLEXI 1200x600x100 (ROCKWOOL, UK plant)	8,712
	XPS insulation board, 0.033 W/mK, 31 kg/m3, Floorboard Standard, Laminating Board, Upstand Board (Polyfoam XPS Ltd (2021))	5,000
2.3.2.Roof coverings	Multi layer waterproofing system with flexible sheets for roofing, mechanically fastened, European average, 3.8 (top) + 3.0 (bottom) mm, 4.9 (top) + 3.7 (bottom) kg/m2 (BMI Group, IKO, Imperbel, Perwez, Soprema, Imperalum, Danosa, Derivados Asfálticos Normalizados, Technonicol, Axter, Binné & Sohn,	7,000

	KG, Georg Börner Chemisches Werk für Dach- und Bautenschutz, C. Hasse & Sohn Inh. E. Rädecke, Mogat-Werke Adolf Böving, Paul Bauder, Copernit, General Membrane, Imper Italia, Index, Matco, Polyglass, Valli Zabban, Katepal, Isola (2021))	
	Cement screed, EN15804+A2, ref. year 2022	196,080
	Vapour control layer for roof, ceiling and wall systems, 0.15 mm, 1715 g/m2, AirGuard® Air & Vapour Control Layer 5816X (DuPont de Nemours)	140
	Plywood board, 490.6 kg/m3, EN15804+A2, ref. year 2021	8,000
	Drainage layer for green roofs from pozzolona and conifer bark, biogenic CO2 not subtracted (for CML), 971 kg/m3, Couche de drainage SOPRALITHE Z (SOPREMA SAS)	16,000
	Green roof system, biogenic CO2 not subtracted (for CML), 21.54 kg/m2, Procédé de végétalisation des toitures Vertige classique. (VERTIGE INTERNATIONAL)	8,000
	Stone wool building panel for façade cladding, roof detailing soffits and fascias, 3050x1250 mm, Durable ProtectPlus (ROCKPANEL)	54
	Stone wool insulation for ETICS and flat roofs, R=1 m2K/W, L=0.044 W/mK, 44 mm, 0.97 kg/m2, 22 kg/m3, Lambda=0.044 W/(m.K) (Rockwool)	4,700
	Geotextile from polypropylene, 300 g/m2 (MDEGD)	110
2.3.6.Roof features	Lightweight concrete block, with expanded clay aggregate, generic, 650 kg/m3 (40.6 lbs/ft3), 18 kg/block (39.7 lbs/block), 0.5x0.3x0.185 mm (0.019x0.012x0.007 in)	21,000
	Aluminium sheet, generic, 0% recycled content, average European aluminium manufacturing technology (One Click LCA)	792
	Aluminium die-cast parts, 2700 kg/m3, EN15804+A1, ref. year 2018	3
	Aluminium wire rod for electrical applications, Aluminium Wire rod - series 6000 (TRIMET France)	16
	Red brick, average production, UK, 215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3 (Brick Development Association (BDA) Ltd (2019))	21,000
	Gypsum plaster, 1100 kg/m3 (Bundesverband der Gipsindustrie)	530
	Galvanized steel railing for supporting partitions or plasterboard, 0.415 kg/m, Fourrure F47, Fourrure F45, Fourrure MOB, Fourrure CD 60, Fourrure F60 OMEGA, Fourrure FL55, Entretoise F47. (KNAUF)	0
	Steel sheet hot dip galvanized, 2-20 mm, 7840 kg/m3, EN15804+A1, ref. year 2018	127
	Plasterboard hatch door, for attic access, with aluminium frame, 13.14 kg/m2, Trappe de visite en cadre aluminium - plaque de plâtre (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	39
	Masonry mortar/facing wall mortar/mortar with special properties, 1500 kg/m3, EPD coverage: >1500 kg/m3 (IWM)	390
	Masonry mortar/facing wall mortar/mortar with special properties, 1500 kg/m3, EPD coverage: >1500 kg/m3 (IWM)	130
	Flush metal enclosure with door, 23.1 kg/unit, 401449 + 401459 Ref door : 401441/401451, 401442/401452 , 401443/401453, 401447/401457, 401448 401458, 401449/401459 (LEGRAND)	2
	Precast concrete paver, 60 mm, 135.78 kg/m2 (CENTRE D`ETUDES ET DE RECHERCHES DE L`INDUSTRIE DU BÉTON)	48
	Corrugated plastic pipes, 0.138 kg/m, FFKuS-EM-F-105 co2ntrol (Fränkische Rohrwerke Gebr. Kirchner GmbH & Co.)	10
	Polyethylene vapour barrier membrane, 0.15 mm, 0.14 kg/m2 (One Click LCA)	23
	EPDM waterproofing membrane, 1.5 mm, 1.95 kg/m2 (One Click LCA)	310
	Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)	1,700
	Gas pipe protection channel from stainless steel, largeur 90 mm, 1.4kg/m, Goulotte de protection en acier inox pour conduite de gaz se situant à une hauteur inférieure à 2m (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	35
	Stone wool insulation panels, unfaced, generic, L = 0.037 W/mK, R = 2.70 m2K/W (15 ft2°Fh/BTU), 150 kg/m3 (9.36 lbs/ft3) (applicable for densities: 100-150 kg/m3 (6.24-9.36 lbs/ft3)), Lambda=0.037 W/(m.K)	3,600
	Automatic air vent, 0.63kg, Purgeur d´air (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	1
2.4.1.Stair and ramp structures	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	67,000
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	2,805
	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	138
2.5.1.External enclosing walls above ground level	Aluminium rainscreen cladding for façade, 7.953 kg/m2, Vantage® MF Mechanical Fix Rainscreen System (BTS Facades & Fabrications)	10,000
	Solar shading and facade system, 36.83 kg/m, Infiniti (Maple Façades Ltd.)	31,000

	Single skin wall from bricks, including mortar, with Mortar 1:4 cement:sand mix (Using CEM I cement)	310,000
	Concrete masonry unit (CMU), 250 mm x 587 mm x 190 mm, 3 Mpa, 650 kg/m3, Leca® Sulblock (Leca International)	21,000
	Medium-density fibreboard (MDF), 650 kg/m3 (Norbord)	1,500
	Glass wool insulation for external wall structures, unfaced, L=0.033 W/mK, R=3 m2K/W, 100 mm, 2.52 kg/m2, 25.2 kg/m3, Lambda=0.033 W/(m.K), Trestenderplate 33 (Knauf Insulation)	7,600
	Gypsum plaster, 1100 kg/m3 (Bundesverband der Gipsindustrie)	9,900
	Galvanized steel stud framing profiles per m2 (air gap included), UD and CD profiles included, wing width: 6 mm, flange width:50 mm, steel thicnkess:0.6 mm (23 gauge), 600 mm spacing, 1.6 kg/m2 (One Click LCA)	4,800
	Hot-dip galvanized perforated steel panels for buildings and data centers, 17.3 kg/m2 (Maple Façades Ltd.)	2,900
	Mortar, 2000 kg/m3, EN15804+A2, ref. year 2021	2,520
	Low alkali micro concrete, Renderoc LA60 (Fosroc)	5,376
	Gypsum plaster board, regular, 10% recycled gypsum, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)	1,900
	Gypsum plasterboard, fire and sound resistant, 12.5 mm, 11.1 kg/m2, L=0.25 W/mK, Fire resistance class: A2-s1,d0, Lambda=0.25 W/(m.K), Gyproc SoundBloc (Saint-Gobain Construction Products t/a British Gypsum)	33,000
	Stone wool (mineral wool) insulation, unfaced, L = 0.031 W/mK, R = 1 m2K/W, 31mm, 1.86 kg/m2, 60 kg/m3, (Range: 51-65kg/m3), 50% slag content (One Click LCA)	310
2.6.1.External Windows	Aluminium curtain walling, 2700 kg/m3 (GAA)	160
	Aluminium frame window double-glazed, operable(tilt and turn), 0% recycled aluminium, 1.48 m x 2.18 m, 25.3 kg/m2 (One Click LCA)	10,000
2.6.2.External doors	Aluminium frame sliding patio door, double-glazed, 40% recycled aluminium, 3 m x 2.18 m, 43.77 kg/m2 (One Click LCA)	980
	Aluminium entrance door, 26.5 kg/m2 (One Click LCA)	900
2.6.Windows and external doors	Door lock, European average (ARGE)	200
2.7.1.Walls and Partitions	Glass wool insulation panels, unfaced, generic, L = 0.031 W/mK, R = 3.23 m2K/W (18 ft2°Fh/BTU), 25 kg/m3 (1.56 lbs/ft3), (applicable for densities: 0-25 kg/m3 (0-1.56 lbs/ft3)), Lambda=0.031 W/(m.K)	14,000
	Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)	91,000
	Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)	91,000
	Structural steel profiles, generic, 20% recycled content, I, H, U, L, and T sections, S235, S275 and S355	16,753
2.7.2.Balustrades and handrails	PVC railings, for external use, H = 1 m, 8.12 kg/m, Garde corps en PVC [usage extérieur] (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	690
2.8.Internal doors	Wooden internal door excluding frame, unglazed, 0.762mx1.981m, 7.75 kg/m2 (JELD-WEN)	3,600
3.1.Wall finishes	Emulsion matt paint for interior use, 0.174 kg/m2, 1.39 kg/l, Diamond Matt (Dulux Trade)	1,400
	Emulsion matt paint for interior use, 0.174 kg/m2, 1.39 kg/l, Diamond Matt (Dulux Trade)	710
3.2.Floor finishes	Self-levelling screed for commercial and domestic building floors, 1 mm, 2.23 kg/m2, Gyvlon® XTR, XTR SP, XTR FD E2C (Anhydritec)	4,100
	Tufted carpet tile with nylon 6.6 pile material, 1.8 kg/m2, maximum surface pile weight 400 g/m2 (One Click LCA)	190
	Self-levelling screed, 1 mm, 2.16 kg/m2, Gyvlon® ECO, ECO SP, ECO FD E2C (Anhydritec)	2,500
	Foam backed vinyl (PVC) flooring rolls and planks, 2.64 kg/m2, L = 0.25 W/mK, Acoustic attenuation = 13 dB, Lambda=0.25 W/(m.K), Gerflor SA : Taralay Premium confort Taraldal Tarastep Taralay sécurité confort Taralay element confort Forbo Flooring Systems : Sarlon marche complète Complete step Primeo modal Vinyl pro dalles Sarlon quartz Sarlon sparkling Sarlon tech 17dB Sarlon 17dB (KALEI)	2,800
	Luxury vinyl flooring tile, 5 mm, 8 kg/m2, wear layer: 0.5 mm (One Click LCA)	1,600
	Ceramic tiles, glazed, for floor application, 10 mm, 27.263 kg/m2, 2200 kg/m3	7,300
3.3.Ceiling finishes	Emulsion matt paint for interior use, 0.174 kg/m2, 1.39 kg/l, Diamond Matt (Dulux Trade)	360
3.Internal finishes	Moulded torus/ogee shaped profile from medium density fiberboard (MDF), 4.4x144x18 mm, 1.944 kg/m, Skirting Torus/Ogee Profile (Staircraft Group Ltd)	9,400
4.Fittings, furnishings and equipment	Lockers, 41 kg/unit, MonoBlocTM & CLK (Bisley)	246
	Wooden desk and drawer units, 73.4 kg/unit (Bisley)	73
	Stainless steel bicycle rack, 1.3 kg/unit, Ratelier à vélo - DONNEE ENVIRONNEMENTALE PAR DEFAUT (MINISTERE DE L'ENVIRONNEMENT, DE	57

	L'ENERGIE ET DE LA MER - MINISTERE DU LOGEMENT ET DE L´HABITAT DURABLE)	
	Student desk with plywood worktop and steel legs, W: 700 mm, L: 500 mm, 13 kg/unit (One Click LCA)	1,573
	Student chair from plywood and steel, 14 kg/unit (One Click LCA)	1,694
	Wooden bed frames, 1240x1950 mm, 72.4 kg/unit (Bisley)	8,800
	Kitchen cabinet, H: 900 mm, D: 600 mm, W: 600 mm, 44 kg/unit (One Click LCA)	10,648
5.1.Sanitary installations	Kitchen mixer, 1.65 kg/unit (GROHE AG)	200
	Washbasin mixer tap, 0.98-1.33 kg/unit, Nautic (Villeroy & Boch Gustavsberg AB, Sweden)	124
	Ceramic toilet set, 26.93 kg/unit (Ideal Standard International)	3,300
	Ceramic bathroom washbasin, 16.7 kg/unit, 850 × 460 × 150 mm (One Click LCA)	2,100
	Ceramic shower tray, 33.3 kg/unit, 900 × 900 × 80 mm (One Click LCA)	4,100
	Sink from polyester resin reinforced with fiberglass, 5.77 kg/unit, Evier en matériau de synthèse [Long. 860 mm Larg. 500 mm Haut. 185 mm] (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	700
5.10.Lift and conveyor installations/systems	Passenger elevator car , electrical controls, counter weight, drive and motor of traction (cable) type, 630 kg (8 persons) load capacity, 1.0 m/s speed, 1587.7 kg/unit (USE ONLY WITH Elevator hoistway) (One Click LCA)	4,800
	Elevator hoistway with floor door per floor, traction (cable) type, 251.36 kg/unit (USE ONLY WITH Passenger elevator car) (One Click LCA)	750
	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% fly ash content in cement (300 kg/m3; 18.7 lbs/ft3 total cement) (One Click LCA)	291,000
	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	291,000
	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615 (One Click LCA)	12,125
5.4.Water installations	Drinking water supply piping network, per m2 GIFA (residential buildings)	1,200
	Sewage water drainage piping network, per m2 GIFA (residential buildings)	850
	Irrigation system, 1.42 kg/unit, Tête d`arrosage pour système d`arrosage (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	3
5.6.2.Local heating	Outdoor unit for air/air heat pump, P=33.6 kW, 207 kg/unit (One Click LCA)	1,656
5.6.Space heating and Airconditioning	Air handling unit, with heat recovery through plate heat exchanger, 10 000 m3/h (5885.8 ft3/min), 1256 kg/unit (2769 lbs/unit)	1,500
	Ventilation ducting, per m linear, D: 63 mm (2.48 in)	1,300
	District heat distribution center, per 1kW	1,400
	Heat distribution piping network, per m2 heated area, all building types	860
5.8.3.Lighting installations	Fluorescent lamp, T5-14W, 0.05 kg/unit, EN15804+A1, ref. year 2018	1
	Emergency evacuation lighting, 0.604 kg/unit, 0 The environmenal data is representative of the following products : <cat.number list> (LEGRAND)	70
	Fluorescent lamp, T8-18W, 0.07 kg/unit, EN15804+A1, ref. year 2018	42
	Indoor luminescent ceiling light, linear, P=20W, Encastrés intérieurs linéaires pour éclairage tertiaire (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	2,600
	LED lighting, P = 40W, Réglette LED (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	170
	Indoor pendant lights, painted black (1 side), 1000 dia, 2,54 kg/unit, Ulu Half Paint, black (1 side) (David Trubridge Limited (2020))	47
5.8.5.Local electricity generation systems	Photovoltaic monocrystalline panel, per m2, 14.5 kg/m2, 224 Wp (One Click LCA)	1,160
5.8.Electrical installations	Electricity distribution system, cabling and central, for all building types, per m2 GFA	18,315
5.Services	Pendent fire sprinkler for residential buildings, K-factor: 4.9, max working pressure: 12 bar (175 psi), thread size: 1/2 in (12.7 mm) NPT, 90 g/unit, 3.2% Recycled material (One Click LCA)	11
8.2.1.Roads, paths and pavings	Facing bricks, clay pavers and brick slips, 900-2500 kg/m3 (Bauen mit Backstein Zweischalige Wand Marketing)	15,810
	Sand, compacted dry density, 1682 kg/m3	7,821
	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	24,800
8.External Works	Aluminium traffic signs, 13.30 kg/m2 (Euroskilt AS)	266

7. Product Stage [A1-A3]

The product stage deals with the carbon emissions attributable to the cradle to gate processes: Raw Material Extraction & Supply [A1], Transport to Manufacturing Plant [A2] and Manufacturing & Fabrication [A3]

The processes covered by [A1–A3] frequently occur in several steps, where components are manufactured and then transported to a further fabrication plant for assembly into a system; and all of these interim steps need to be taken into account.

The calculation for the carbon emissions associated with the product stage [A1-A3] requires the assignment of suitable embodied carbon factors to the given elemental material quantities, as follows:

[A1-A3] = Material Quantity x Material Embodied Carbon Factor

Environmental information for a product is defined in its EPD, stored in the One Click LCA database. Based on the selected EPDs and associated quantities, as per the methodology described in the previous section, the product stage emissions have been estimated.

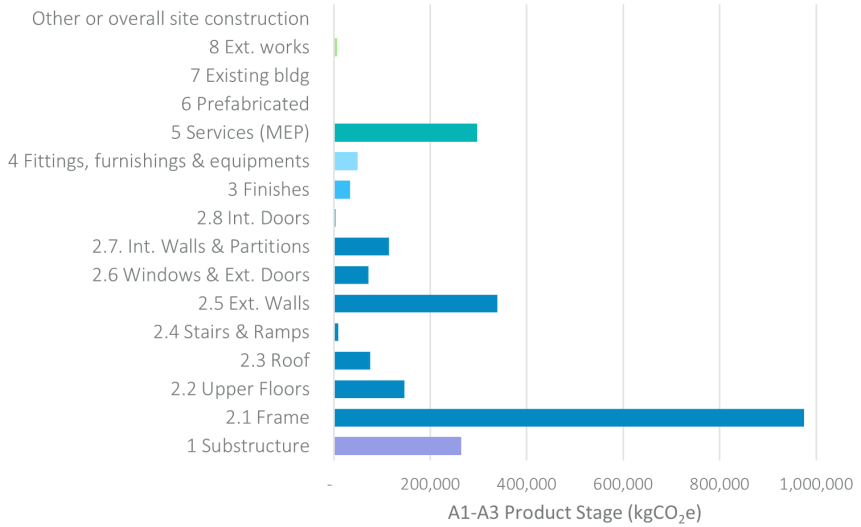

Figure 7.1 – A1-A3 Product Stage Breakdown of Emissions

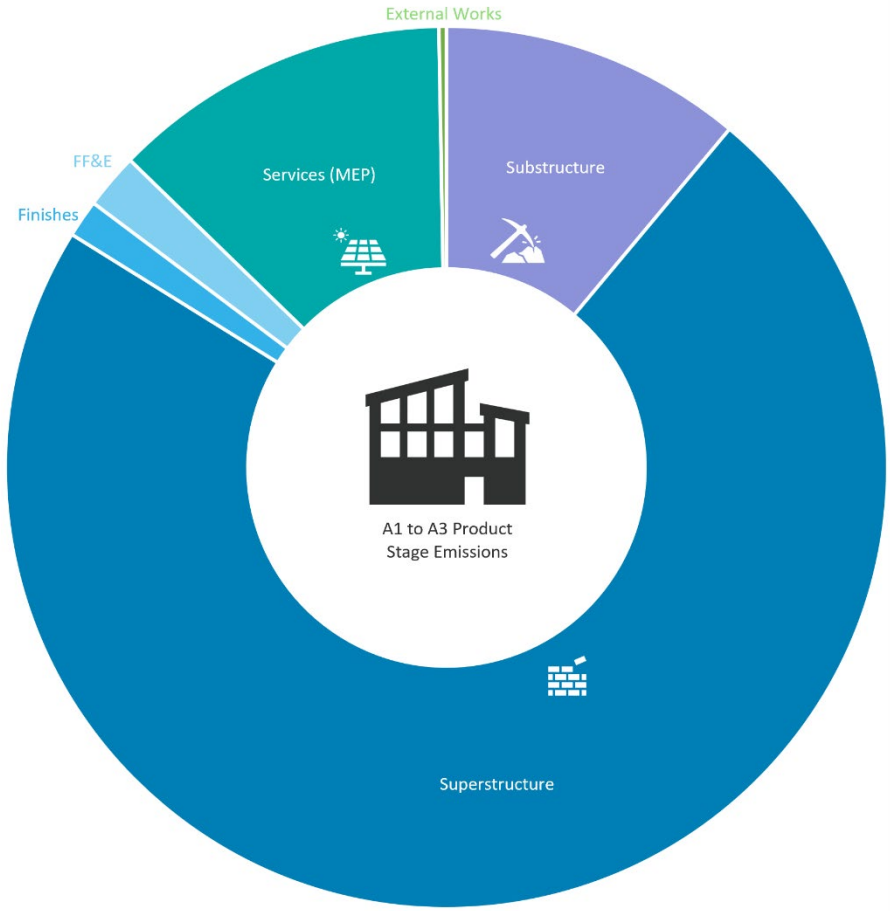

Figure 7.2 – A1-A3 Product Stage Emissions Across Building Elements (excl. sequestration)

8. Construction Process Stage [A4-A5]

Modules A4 and A5 respectively capture the emissions associated with the transportation of the materials and components from the factory gate to the project site, and their assembly into a building.

Transport Emissions [A4]

Transport emissions must include all stages of the journey of the products following their departure from the final manufacturing plant to the project site, taking into account any interim stops at storage depots / and / or distribution centres. The scope of A4 does not include transport impacts from construction workers, which are covered under A5.

Transport emissions are calculated as follows:

[A4] = Material/Product Mass (A) x Transport Distance (B) x [Carbon Conversion Factor Outward (C1) + (Empty Running Factor x Carbon Conversion Factor Return (C2))]

For the purposes of this Whole Life Carbon Assessment, the One Click LCA parameters for default values have been set to the RICS method and the following emissions have been calculated in relation to the selected materials.

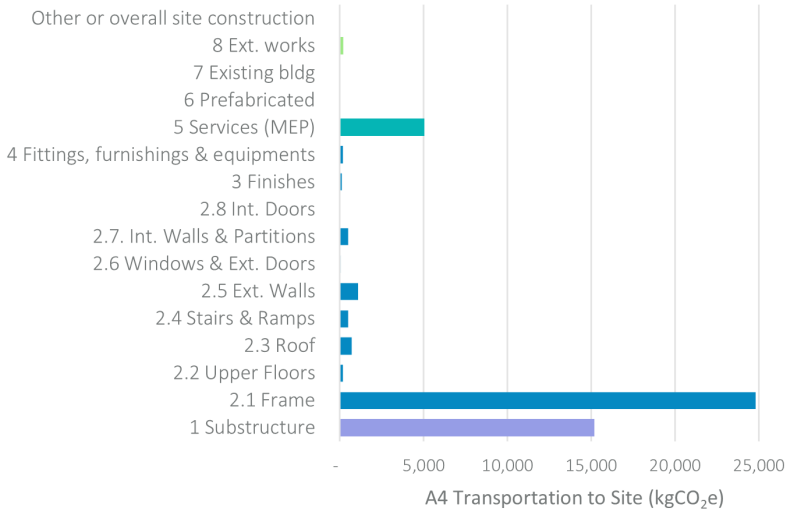

Figure 8.1 - Transport [A4] Emissions ($kgCO_2e$)

Construction – Installation Process Emissions [A5]

The carbon emissions arising from any on- or off-site construction-related activities must be considered in module A5. This includes any energy consumption for site accommodation, plant use and the impacts associated with any waste generated through the construction process, its treatment and disposal.

Emissions at this stage include any impacts from construction activities and installation processes on-site, including temporary works, energy consumption for site accommodation and use of plant, machinery and equipment.

The RICS PS permits the use of an average figure of 1,400$kgCO_2e$/£100K of project value for building construction site emissions, in the absence of more specific information. For the purposes of this WLC assessment, the "Order of Cost Estimate - Stage 2" produced by 100 Acre London Limited for the scheme has been used for the construction cost estimate.

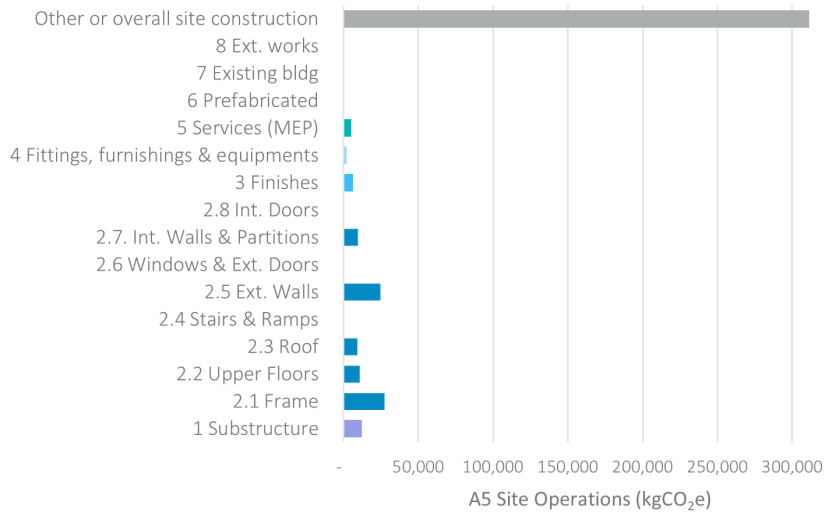

Figure 8.2 - Construction – Installation Process Emissions [A5] Emissions ($kgCO_2e$)

9. In-Use Stage [B1-B6]

The in-use stage captures the carbon emissions associated with the operation of the built asset over its entire life cycle, from practical completion to the end of its service life. This includes any emissions relating to operational energy and water use, user activities as well as any embodied carbon impacts associated with maintenance, repair, replacement, and refurbishment of building components.

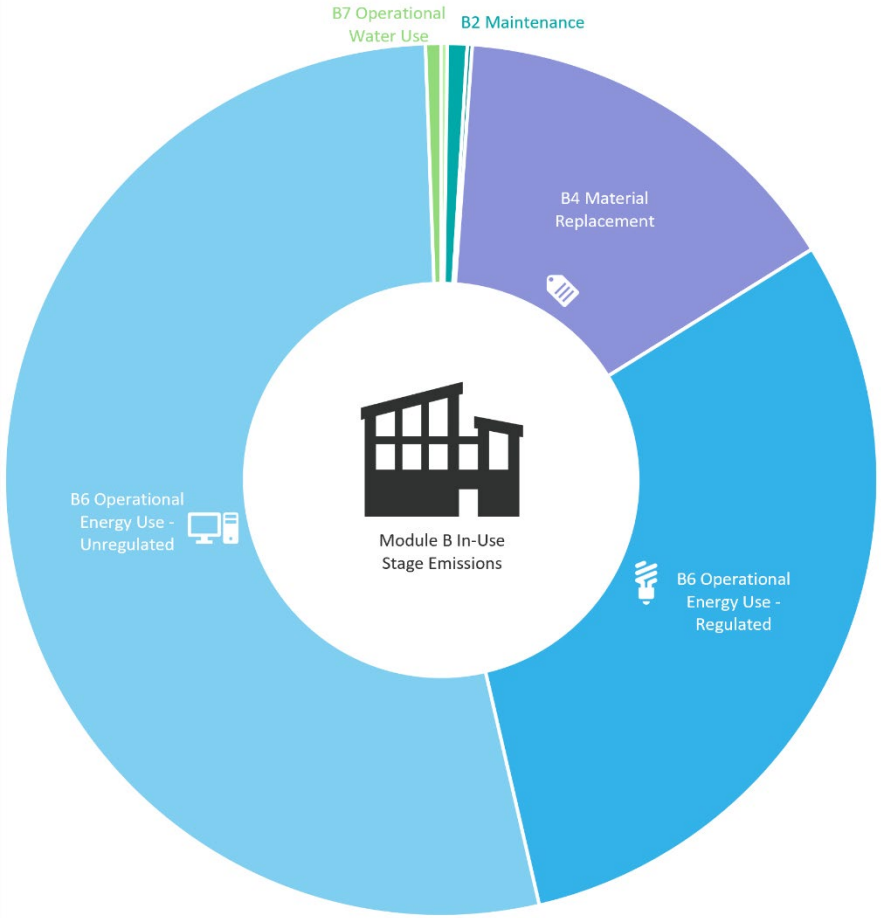

Figure 9.1 – Module B Proportional Breakdown of Emissions

In-Use Impacts[B1]

The in-use module [B1] captures the emissions arising during the life of a building from its components; including any emissions arising from refrigerants, insulation blowing agents and paints; as well as accounting for the carbonation process in items containing exposed concrete and / or lime. These are effectively the non-energy-related carbon removals or emissions. It is considered using two sub-modules to account for emissions and removals from materials and fugitive emissions of refrigerants.

Material Emissions and Removals

Cementitious materials, such as concrete, cement and mortar, absorb carbon dioxide when exposed to air. This process is the chemical reversal of the cement production process calcination phase. The amount of carbon dioxide absorbed depends on exposure of the material, duration of the exposure as well as the initial amount of cement. The figures associated with the carbonisation have not been generated through the OneClick LCA software and therefore this has not been estimated in the absence of accurate benchmarks. Carbon absorption potential by green roofs and facades should also be considered, although the absorption potential for areas <1,000m^2 is generally considered negligible. It should be noted that removals associated with vegetation are not persistent and will be lost unless the project is set up in such a way to preserve vegetation at its eventual demolition. Vegetation carbon withdrawals have therefore not been modelled.

Fugitive Emissions (refrigerants)

For the refrigerants, leakage from the ASHPs were estimated using TM65 methodology as part of the emissions arising during the operation of the building. Assumptions from the MEP consultant regarding the type and number of ASHPs being installed as part of the development were applied. These were then used within the model to estimate the refrigerant charge.

B1.2 = Refrigerant Charge x Refrigerant GWP x Annual Leakage Rate x RSP

The refrigerant used was R1234yf based on the potential ASHPs that will be specified, with an annual leakage rate of 4% and end of life leakage rate of 2% using the TM65 methodology for 'Type 2' ASHP system.

Maintenance [B2]

The [B2] module accounts for the carbon emissions arising from any activities relating to the maintenance processes, including cleaning, and any products used. It also includes any emissions from the energy and water use associated with these activities.

The GLA WLC guidance suggests that for module B2 emissions in the UK, where project specific information is not available, a total figure of 10 kgCO_2e/m^2 gross internal area (GIA) may be used to cover all building

element categories, or 1% of modules A1-A5, whichever is greater. This approach has been adopted to estimate emissions from maintenance in this assessment.

Repair [B3]

Module [B3] is intended to take account of the carbon emissions arising from all activities that relate to repair processes and any products used. Typically, this would require data from facilities management / maintenance strategy reports, façade access and maintenance strategy, life cycle cost reports, O&M manuals, and professional guidance.

As per the B2 module, given the lack of accurate data at this stage for repair scenarios, the GLA WLC guidance methodology has been used which assumes UK repair impacts are equivalent to circa 25% of B2 maintenance impacts for the relevant items, except for MEP, where 10% of A1–A3 impacts should be assumed. For this assessment, the One Click LCA default repair scenario has been applied.

Material replacement and refurbishment [B4-B5]

Carbon emissions associated with the anticipated replacement of building components, including any emissions from the replacement process are captured under module [B4]. All emissions arising from the production, transportation to site and installation of the replacement items must be included. This extends to cover any losses during these processes as well as the carbon associated with component removal and end of life treatment.

Details for service life are automatically entered into the One Click LCA software for each of the selected building materials since it is typically quantified in the product's EPD. These service life timeframes have been amended in line with the RICS PS indicative component lifespans for the UK, where different, in the absence of more specific data. It is assumed that items are being replaced on a like-for-like basis and full replacement (100%) of the items is assumed once the specified lifespan is reached. These emissions are accounted for in the B4 part of the lifecycle.

Module [B5] must take into account any carbon emissions associated with any building components used in a refurbishment, including any emissions from refurbishment activities. All emissions arising from the production, transport to site and installation of the components used must be included. The calculation of refurbishment should account for any material additions and variations, instead of like-for-like as in replacement. As no refurbishment is planned for the building, it has been assumed that no change of use will occur during the service life of the project.

Operational Energy Use [B6]

The operational carbon emissions arising from the energy use of building-integrated systems as projected and/or measured throughout the life cycle of the project would be reported under module [B6]. Operational impacts include all asset-related operational energy use, regulated and unregulated, as described in EN15978-1. For buildings, operational impacts must include all operational energy used in the building, including heating, hot water, cooling, ventilation, lighting, cooking, equipment and lifts, broken down separately by fuel type and energy end use. The inclusion of any energy use related to external works (e.g. car park lighting) is optional.

A CIBSE Technical Memorandum 54 (TM54) assessment has been undertaken to provide an estimate of operational energy consumption. The aim of this assessment was to identify and quantify the factors associated with operational energy use within the building, helping to bridge the performance gap between the regulated energy use from Part L compliance and actual operational energy use. As CIBSE TM54 accounts for unregulated energy uses which are usually discounted by Part L energy modelling, one total figure for energy demand has been calculated. This has been split into regulated and unregulated for the purposes or this WLC report.

The results of the analysis conducted by Ensphere Group Ltd have estimated an overall energy demand for development to be 665 MWh/yr, using the SAP 10.2 carbon conversion factors. This is broken down into ~253 MWh/yr from regulated sources, ~413 MWh/yr from unregulated energy and -17 MWh/yr displaced energy from renewables. This equates to ~5,287.4 tonnes CO_2e over a 60-year time period.

Operational Water Use [B7]

All carbon emissions related to water supply and wastewater treatment, over the life cycle of the building (excluding water use during maintenance, repair, replacement, and refurbishment that are reported elsewhere), must be reported under module [B7].

For the student accommodation, the maximum daily total water demand was assumed to equal 105 litres / person / day in line with policy requirements for residential development. This should be understood as upper limits (i.e., worst case scenario) as the proposed reduced flow / flush systems should limit daily usage. Proposed occupancy numbers have been taken from the latest Accommodation Schedule which indicates 121 units and thus an equivalent number of students.

Thames Water Utilities Ltd specific emissions relating to clean tap water and wastewater were selected in the One Click LCA tool, with values taken from the Thames Water Combined Report 2019/20. Based on a daily water consumption of ~4,637,325 litres for the proposed development, emissions associated with operational water usage are estimated to be 36.6 tonnes CO_2e over the 60-year period.

10. End-of-Life Stage [C1 to C4]

The end-of-life stage commences when the built asset has reached the end of its life and will no longer be used. For the purposes of this whole life carbon assessment, this is assumed to occur at the end of the reference study period of the building. The reference study period is used for consistency and comparability of results, irrespective of other factors which might determine the lifespan of the building (e.g., lease period).

Module C impacts must be included for all components and materials that make up an asset at the end of the RSP, whether the asset continues to provide functionality or not. Any emissions arising from decommissioning, stripping out, disassembly, deconstruction and demolition operations as well as from transport, processing and disposal of materials at the end of life of the project must also be accounted for in module C.

As stated in the RICS PS, decarbonisation could have a significant impact on the calculation of Modules C and D. This is primarily because the RSPs is 60 which could take end-of-life considerations into the 2080s and beyond, a point at which many governments and industries have committed to being net zero. Processes such as energy from waste cannot be decarbonised except through the use of carbon capture, which will require a significant additional input of energy that will affect efficiency. For biogenic carbon, permanent capture cannot be modelled. The transfer of biogenic carbon with reuse or recycling to the next product system also cannot be decarbonised. Therefore, only modules C1 and C2 can be decarbonised.

Deconstruction and demolition impacts [C1]

The carbon emissions arising from any on or off-site deconstruction and demolition activities, including any energy consumption for site accommodation and plant use, must be considered in C1. According to the RICS PS, an average rate of 3.4 kgCO2e/m2 GIA (rate from monitored demolition case studies in central London) based on aggregated data should be used in the absence of more specific information.

Transport impacts [C2]

Any carbon emissions associated with the transportation of deconstruction and demolition arisings to the appropriate disposal site, including any interim stations, must be captured within module C2. These emissions have automatically been calculated in the One Click LCA tool used.

Waste processing for reuse, recycling or other recovery [C3]

When materials and/or components are intended to be reused, recycled or recovered after the RSP of the asset, any impacts associated with their preparation for reuse, waste treatment and recovery prior to reaching the end-of-waste state must be included in module C3. Data for C3 from the relevant EPDs was used in this assessment.

Disposal impacts [C4]

For elements not expected to be recovered and repurposed but intended for final disposal either in landfill or incineration, an allowance for the emissions arising from their disposal must be included in module C4. Data for C4 from the relevant EPDs was used in this assessment.

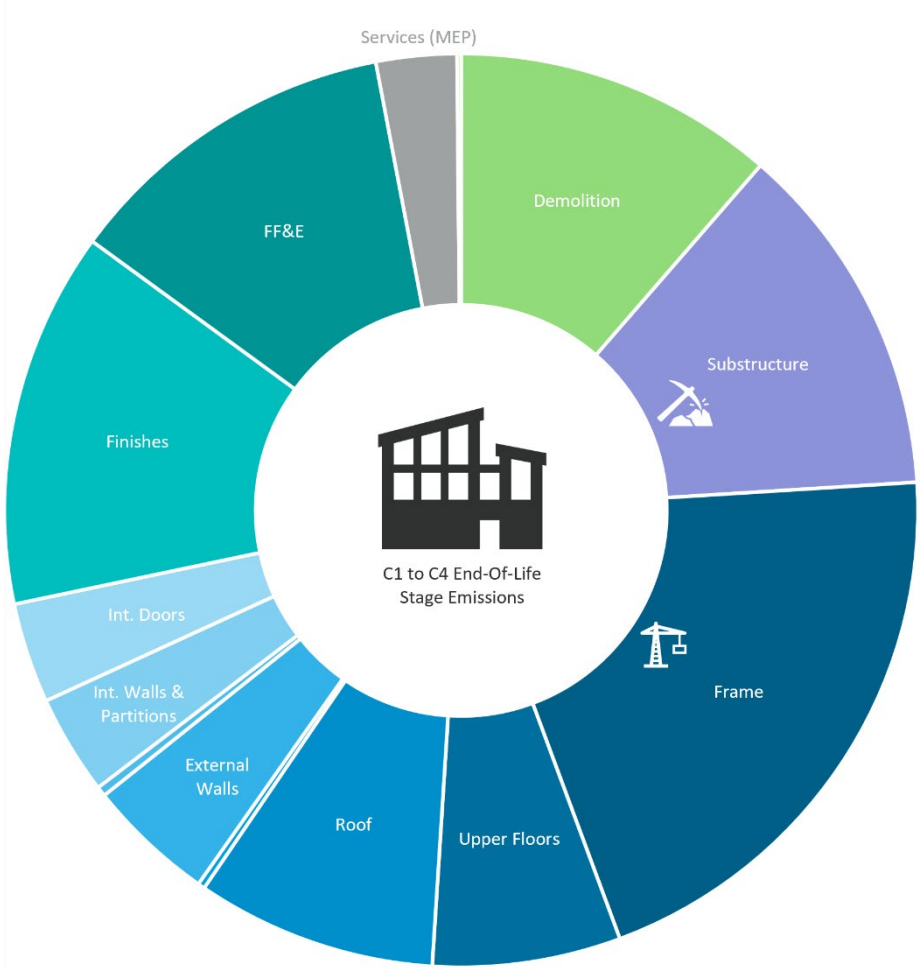

Figure 10.1 – C1-C4 End-of-Life Stage Emissions Across Building Elements

11. Whole Life Carbon Assessment Results

The following presents the project Whole Life Carbon Assessment according to RICS methodology and EN 15978. This includes the reporting of module D (benefits and loads beyond the system boundary) which have not been included in the total results as it mainly occurs beyond the RSP and outside the system boundary of the project being assessed.

Table 10.1 – Whole Life Carbon Assessment Results ($kgCO_2e$)

Category	Biogenic Carbon	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total	D
Pre-Construction												15,725				15,725	
Substructure	-	263,890	15,177	12,269			-						10,149	7,129	191	308,806	-54,013
Frame	-	973,979	24,783	27,228			-						25,811	2,298		1,054,100	-423,476
Upper Floors	0	146,031	220	10,847			-						1,597	512	7,098	166,305	-92,334
Roof	-2,175	74,684	745	9,134			-	61,829	-				924	3,028	7,798	155,968	-10,586
Stairs & Ramps	0	9,621	535	411			-						309	30		10,905	-2,447
Ext. Walls	-2,255	338,612	1,112	24,370			-	89,866	-				3,680	2,519	46	457,951	-277,006
Windows & Ext. Doors	0	71,709	61	114			-	72,250	-				469	6	6	144,614	-5,144
Int. Walls & Partitions	0	114,437	524	9,722			-	72,077	-				4,679	165	38	201,643	-31,373
Int. Doors	-4,854	3,013	18	-			-	3,084	-				14	4,891	2	6,168	0
Finishes	0	32,770	131	6,257			-	52,463	-				101	10,002	8,312	110,036	-9,113
FF&E	-16,207	48,451	214	1,952			-	242,200	-				90	16,444	12	293,156	-294
Services (MEP)	-43	296,512	5,031	4,939	14,558		-	358,291	-	5,287,391	36,588		3,515	388	43	6,007,213	-168,963
Prefabricated																-	
Existing bldg																-	
Ext. works	0	6,525	181	390			-						129	71		7,296	-2,456
Other or overall site construction				311,220		46,250	11,563									369,033	
Total	-25,535	2,380,234	48,733	418,854	14,558	46,250	11,563	952,059	-	5,287,391	36,588	15,725	51,468	47,483	23,546	9,308,918	-107,7205

12. Future Opportunities and Recommendations

The following comprises a series of recommendations to assist with further reducing the carbon emissions associated with the proposed development. The Whole Life-Cycle Carbon Assessment has identified the following key areas as being the most significant contributors to emissions:

[A1-A3] Product Stage

These were assessed to represent 2,380,234 $kgCO_2e$, equating to roughly 26% of the total. These emissions are largely associated with the material choices associated with the substructure, superstructure, and external works; where decisions are also influenced by factors such as structural performance, cost and aesthetics.

There may be scope to investigate alternatives with a lower carbon footprint; however, given the nature of the proposed development, the potential for significant reductions may be limited. Nevertheless, it is recommended that material options be revisited as the detail of the design development to review the potential extent of savings.

[B4-5] Material Replacement and Refurbishment

Material replacement and refurbishment emissions were assessed at 952,059 $kgCO_2e$, roughly 10% of the total.

These emissions are associated with the estimated lifespans associated with the selected materials and it may be feasible to identify more resilient materials products with longer lifespans. As these will be sought throughout the development's lifetime, when accounting for the expected decarbonisation of manufacturing processes, it is expected that these emissions will be less significant relative to the upfront emissions.

[B6] Operational Energy Use

Operational energy use emissions were assessed at 5,287,391 $kgCO_2e$ (regulated and unregulated); representing circa 57% of the total.

Operational energy use is expected to contribute significantly to emissions over the buildings predicted lifetime, this figure may not however fully account for future grid decarbonisation in the UK over the next 60 years as it is based on current (SAP10.2) carbon conversion factors and will likely steadily reduce over time.

Offsetting

Acknowledging that it is not always feasible to completely eradicate WLC emissions through design decisions, consideration could be given to the potential for offsetting the impacts through abatement measures elsewhere and / or contributions to facilitate such abatements (e.g., green tariff electricity).

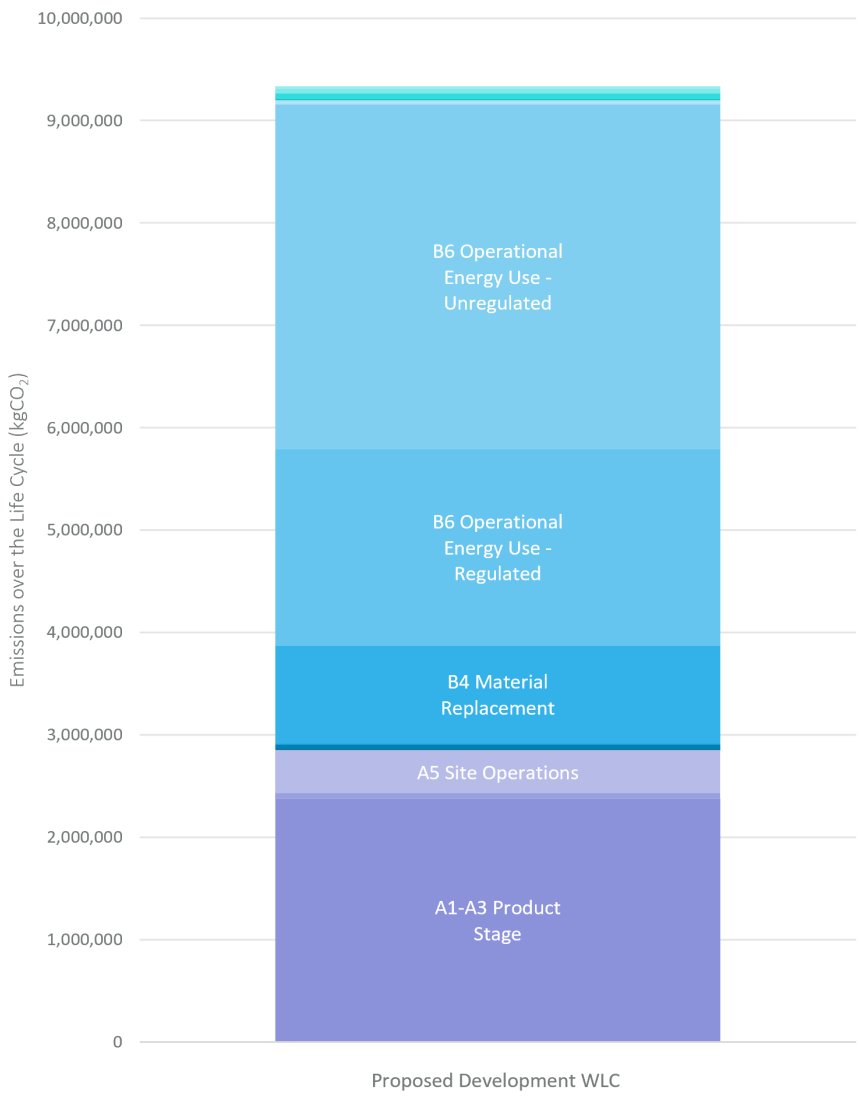

Figure 12.1 – Modelled WLC Emission Split for RICS Reporting Modules

13. Summary

This Whole Life Carbon ("WLC") Assessment considers the carbon emissions resulting from the construction and use of the proposed development at Britannia Street Car Park, London, WC1X 9BP.

Consideration has been given to the RICS Professional Statement – Whole Life Carbon Assessment for the Built Environment 1st Edition (November 2017) and GLA WLC Assessment Guidance prior to specifying the assessment object.

All stages of the project have then been considered, from raw material extraction, product manufacturing, transport, and installation on site through to the operation, maintenance, and eventual material disposal.

Best available data has been used, with the acknowledgement that this assessment has been undertaken at a relatively early stage of design, pre-contractor involvement.

Specialist software has been used with emissions calculated using the One Click LCA software, utilising the RICS compliant LCA calculation tool.

The assessment has reviewed whole life carbon emissions over a 60-year period, in line with the recommended RICS approach. This identified total WLC emissions of circa 9,308,918 $kgCO_2e$ (~2,013 $kgCO_2e/m^2$) under the non-decarbonised scenario. Embodied carbon emissions have been estimated at ~616 $kgCO_2e/m^2$ (below the 850 kgCO2e/m2 threshold given by GLA for residential developments).

The key lifecycle stages responsible for these emissions are [A1-A3] materials emissions (2,380,234 kg CO_2e), [B4] material replacement (952,059 $kgCO_2e$), and the [B6] operational energy use (5,287,391 kg CO_2e).

Module A1-A3 emissions are largely associated with the material choices associated with the substructure, superstructure, and external works; where decisions are also influenced by factors such as structural performance, cost and aesthetics. There may be scope to investigate alternatives with a lower carbon footprint; however, given the nature of the proposed development, the potential for significant reductions may be limited. Nevertheless, it is recommended that material options be considered when deciding specific sourcing and the associated supply chain to review the potential extent of savings.

Material replacement emissions were assessed to be over 15% of the total under both decarbonised and non-decarbonised scenarios. These emissions are associated with the estimated lifespans associated with the selected materials and it may be feasible to identify more resilient materials products with longer lifespans.

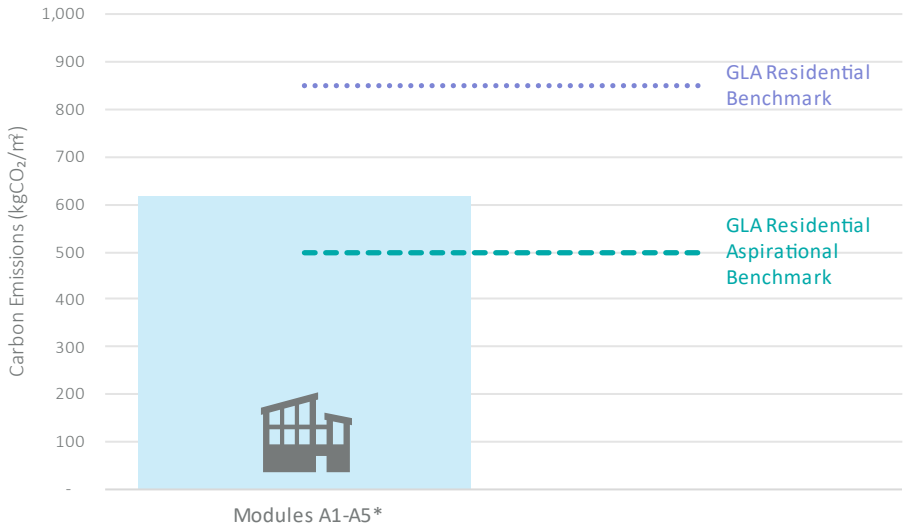

Figure 13.1 – Project Embodied Carbon to Practical Completion relative to GLA Benchmarks (*excl. sequestered carbon)

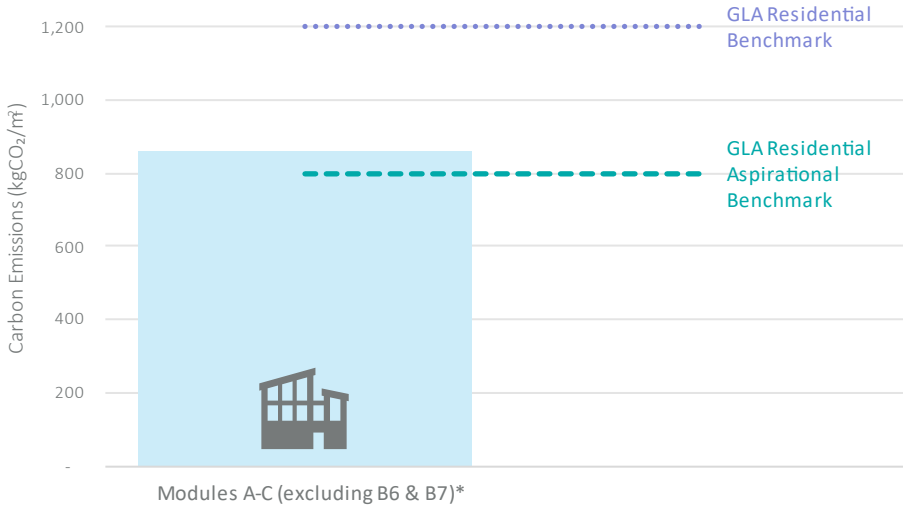

Figure 13.2 – Project Embodied Carbon over the Life Cycle Relative to GLA Benchmarks (*incl. sequestered carbon)

Appendices

A. Proposed Site Plan

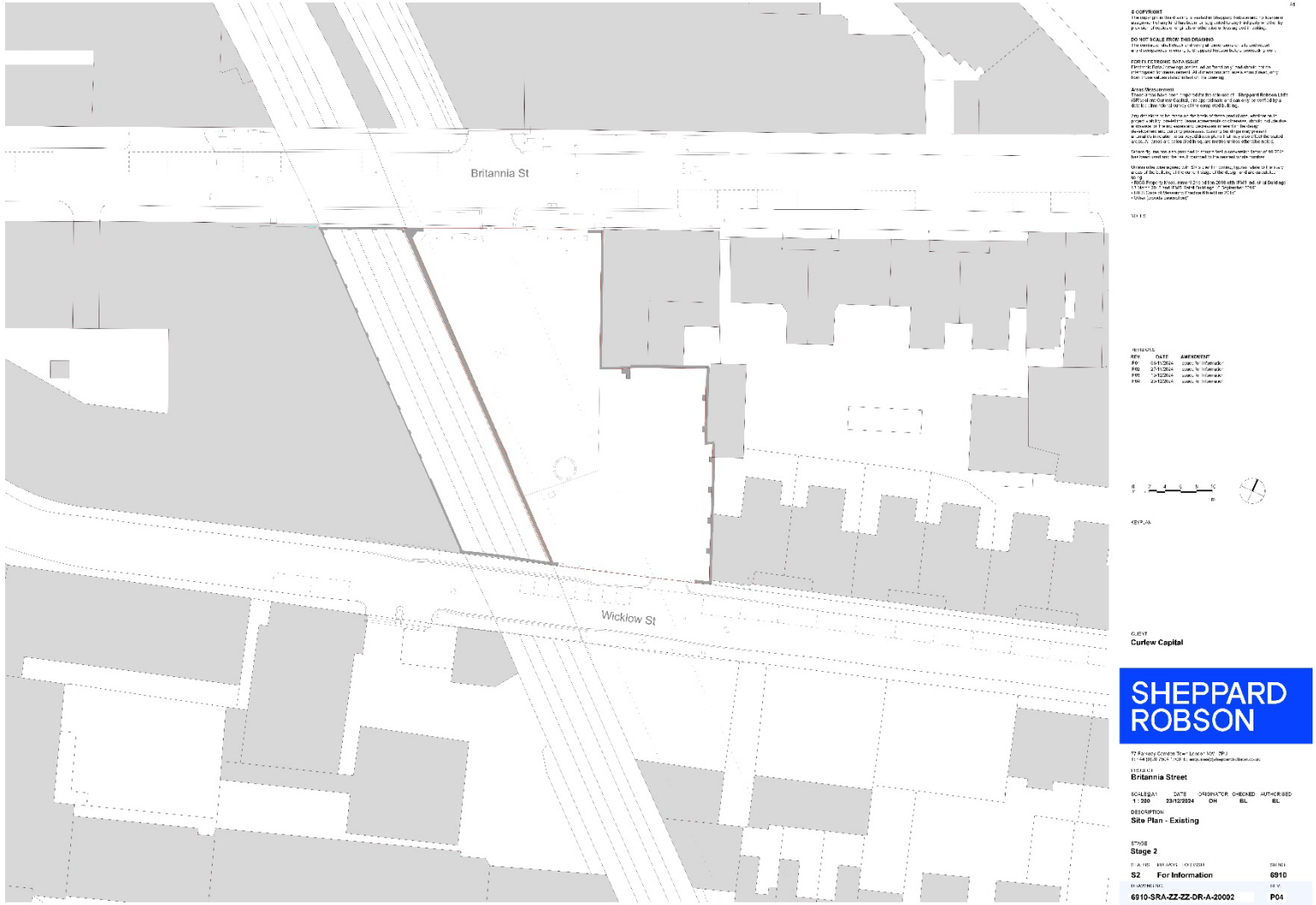

Figure Appendix A.1 – Proposed Site Plan (Provided by Sheppard Robson)

B. Key Local Planning Policy Requirements

London Planning Policy Framework

Table Appendix B.1 – London Plan (2021)

Policy Reference	Details
Policy SI 2 Minimising greenhouse gas emissions	A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy: 1) be lean: use less energy and manage demand during operation 2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly 3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site 4) be seen: monitor, verify and report on energy performance. B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy. C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: 1) through a cash in lieu contribution to the borough's carbon offset fund, or 2) off-site provided that an alternative proposal is identified and delivery is certain. D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually. E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions. F. Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.
Policy SI 5 Water infrastructure [extract]	[…] A. Development proposals should: 1) through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption) 2) achieve at least the BREEAM excellent standard for the 'Wat 01' water category or equivalent (commercial development) 3) incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.
Policy SI 7 Reducing waste and supporting the circular economy	A. Resource conservation, waste reduction, increases in material reuse and recycling, and reductions in waste going for disposal will be achieved by the Mayor, waste planning authorities and industry working in collaboration to: 1) promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible 2) encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products 3) ensure that there is zero biodegradable or recyclable waste to landfill by 2026 4) meet or exceed the municipal waste recycling target of 65 per cent by 2030 5) meet or exceed the targets for each of the following waste and material streams: 6) construction and demolition – 95 per cent reuse/recycling/recovery 7) excavation – 95 per cent beneficial use 8) design developments with adequate, flexible, and easily accessible storage space and collection systems that support, as a minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food. B. Referable applications should promote circular economy outcomes and aim to be net zero-waste. A Circular Economy Statement should be submitted, to demonstrate: 1) how all materials arising from demolition and remediation works will be re-used and/or recycled 2) how the proposal's design and construction will reduce material demands and enable building materials, components and products to be disassembled and re-used at the end of their useful life 3) opportunities for managing as much waste as possible on site 4) adequate and easily accessible storage space and collection systems to support recycling and re-use 5) how much waste the proposal is expected to generate, and how and where the waste will be managed in accordance with the waste hierarchy 6) how performance will be monitored and reported. C. Development Plans that apply circular economy principles and set local lower thresholds for the application of Circular Economy Statements for development proposals are supported.

Local Policy

Table Appendix B.2 – Camden Local Plan (July 2017)

Policy Reference	Details
Policy D1 Design [extract]	The Council will seek to secure high quality design in development. The Council will require that development: […] a. respects local context and character; b. preserves or enhances the historic environment and heritage assets in accordance with Policy D2 Heritage; c. is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation; d. is of sustainable and durable construction and adaptable to different activities and land uses; e. comprises details and materials that are of high quality and complement the local character; f. integrates well with the surrounding streets and open spaces, improving movement through the site and wider area with direct, accessible and easily recognisable routes and contributes positively to the street frontage; g. is inclusive and accessible for all; h. promotes health; i. is secure and designed to minimise crime and antisocial behaviour; j. responds to natural features and preserves gardens and other open space; k. incorporates high quality landscape design (including public art, where appropriate) and maximises opportunities for greening for example through planting of trees and other soft landscaping, l. incorporates outdoor amenity space; m. preserves strategic and local views; n. for housing, provides a high standard of accommodation; and o. carefully integrates building services equipment.is of sustainable and durable construction and adaptable to different activities and land uses; […]
Policy CC1 Climate Change Mitigation	The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. We will: a. Promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy; b. Require all major development to demonstrate how London Plan targets for carbon dioxide have been met; c. Ensure that the location of the development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks; d. Support and encourage sensitive energy efficiency improvements to existing buildings; e. Require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and f. Expect all developments to optimise resource efficiency. For decentralised energy networks, we will promote decentralised energy by: g. Working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them; h. Protecting existing decentralised energy networks (e.g. at Gower Street Bloomsbury, Kings Cross, Gospel Oak, and Somers Town) and safeguarding potential network routes; and i. Requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network. To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.
Policy CC2 Adapting to Climate Change	The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as: a. The protection of existing green spaces and promoting new appropriate green infrastructure; b. Not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Sustainable Drainage Systems; c. Incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and d. Measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy. Any development involving 5 or more residential units of 500sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement. Sustainable Design and Construction Measures The Council will promote and measure sustainable design and construction by: e. Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation; f. Encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;

	g. Encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and h. Expecting non-domestic developments of 500sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new developments from 2019.
Policy CC3 Water and flooding	The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible. We will require development to: a. incorporate water efficiency measures; b. avoid harm to the water environment and improve water quality; c. consider the impact of development in areas at risk of flooding (including drainage); d. incorporate flood resilient measures in areas prone to flooding; e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and f. not locate vulnerable development in flood-prone areas. Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable. The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore
Policy CC5 Waste	The Council will seek to make Camden a low waste borough. We will: a. aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031; b. deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan; c. safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and d. make sure that developments include facilities for the storage and collection of waste and recycling.

C. LCA Details

One Click LCA

One Click LCA is specialised software developed by Bionova Ltd, that provides the means to generate quick and accurate building level Lifecycle Assessments using designs imported from tools such as Revit, IFC (BIM), Excel, IESVE, energy models (gbXML).

Further, it provides access to one of the largest LCA database's currently available with Environmental Product Declarations (EPD) from manufacturers as well as generic materials.

Environmental Product Declarations (EPD)

An environmental product declaration or EPD is a document which is used to quantifiably demonstrate the environmental performance of a product.

The European Standard for the generation of environmental product declarations for construction products is EN 15804 and was published by the CEN Technical Committee for the sustainability of construction works (CEN TC350 in 2012.)

EPD are generated based on data obtained through Life Cycle Assessment (LCA), with the LCA being performed using a peer-reviewed Product Category Rules (PCR) document in line with EN 15804, ISO 14025, and other related intranational standard.

EN15804:2012 & Life cycle assessment scope and system boundaries

EN 15804:2012 + A1:2013 'Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products' is a European standard that provides core product category rules (PCR) for Type III environmental declarations for any construction product and construction service. The core PCR defines the parameters to be declared and the way in which they are collated and reported, describing which stages of a product's life cycle are considered in the PED and which processes are to be included in the life cycle stages. Further information can be found on the European Committee for Standardisation's website.

Further detailed explanation of the life cycle stage and analysis score of the EN 15804 standard are as follows:

- 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 considered. 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 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.
- 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.
- 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 replacing new material as well as the impacts from manufacturing the replacing material as well as handling of waste until the end-of-waste state.
- B6 Energy use - The considered use phase energy consumption (B6) impacts include exhaust emissions from any building level energy production as well as the environmental impacts of production processes of fuel and externally produced energy. Energy transmission losses are also considered.
- 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.
- 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.
- D External impacts/end-of-life benefits - The external benefits include emission benefits from recycling recyclable building waste. Benefits for re-used or recycled material types include positive impact of replacing virgin-based material with recycled material and benefits for materials that can be recovered for energy cover positive impact for replacing other energy streams based on average impacts of energy production.

D. General Notes

The report is based on information available at the time of the writing and discussions with the client during any project meetings. Where any data supplied by the client or from other sources have been used it has been assumed that the information is correct. No responsibility can be accepted by Ensphere Group Ltd for inaccuracies in the data supplied by any other party.

The accuracy of the figures reported in this assessment is therefore commensurate with the data supplied. Some benchmark assumptions from the One Click LCA interface regarding quantity of materials and equipment were utilised in the absence of specific information for the assessed building. The emission estimates for the materials used are also dependent on the accuracy of the data sources in the One Click LCA software in terms of the EPDs selected, as well as the availability of product and manufacturer options.

The review of standards and other requirements does not constitute a detailed review. Its purpose is as a guide to provide the context for the development and to determine the likely requirements of assessment.

No site visits have been carried out, unless otherwise specified.

This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in guidance may necessitate a re-interpretation of the report in whole or in part after its original submission.

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