

RIDGE

HIGH STREET UXBRIDGE
WHOLE LIFE CARBON ASSESSMENT
31/10/2024



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1. EXECUTIVE SUMMARY

Ridge and Partners LLP have been appointed by DNA Uxbridge Ltd. to complete a Whole Life Carbon (WLC) Study for the 148-154 Uxbridge High Street development. The assessment has been completed in support of the Detailed Planning Application, in line with the London Plan 2021, as well as the GLA Whole Life-Cycle Carbon Assessments (WLCCA) guidance document (March 2022).

This report summarises the results of the WLCCA undertaken before the end of Concept Design stage (RIBA Stage 2) and is written to accompany the 'GLA Whole Life Carbon Assessment Template', which sets out the Whole Life Carbon emissions estimated for the Proposed Development, declaring assumptions and methods utilised for the assessment.

The model is to be updated using the actual WLC carbon emissions figures at post-construction at RIBA Stage 6 (prior to handover), where further modelling will be carried out as per the GLA requirements. In addition to embodied carbon calculations, the model and subsequent report has also utilised the Energy Assessment for the development to report on the operational carbon impacts.

The aim of this assessment is to assess the WLC impact for the Proposed Development, defined as 'those carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal.' This assessment captures the operational carbon emissions for the Proposed Development from both regulated and unregulated energy use, as well as its embodied carbon emissions, i.e. those associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair, and replacement as well as dismantling, demolition, and eventual material disposal.

Brief Description of the Development

"Demolition of the existing buildings and comprehensive redevelopment of the site to provide a mixed-use development comprising hotel (Class C1), co-living (Class Sui Generis) and replacement commercial floorspace (Class E) alongside public realm improvements, including a new pocket park, basement parking and associated infrastructure."

Scope of the Assessment

The WLCA conducted conforms with BS EN 15978 and 'RICS Professional Statement and guidance, Whole life carbon assessment for the built environment' 1st edition (November 2017). The WLC model used to inform this assessment has been formulated to demonstrate the improvements that can be achieved in terms of embodied carbon and the proposed strategies to be implemented in the next stages of design.

The assessment has been completed using the OneClick LCA online software, compliant with both ISO 14044 and EN 15978 and is aligned with the RICS Professional Statement 'Whole Life Carbon Assessment for the Built Environment' 1st edition (November 2017) for service life of materials and transport distances, with at least 95% of the costs allocated to materials included in the model. This report should be read in conjunction with the updated GLA Whole Life Carbon Assessment template.

Benchmarks

The embodied carbon results of the Uxbridge High Street Development have been compared with the WLC 'Residential' benchmark, considered the most relevant building typology in relation to the building types available for the GLA WLC benchmark comparisons. The GLA's WLC benchmarks figure for residential developments is 850 kg CO₂e/m² for Modules A1-A5 (excluding sequestered carbon), 350 kg CO₂e/m² for Modules B-C (excl. B6 & B7) and 1200 kg CO₂e/m² for Modules A-C (excl. B6 & B7, including sequestered carbon).

The proposed scheme was shown to demonstrate an embodied carbon performance (modules A-C) of **939 kgCO₂e/m²**, falling within the < 1200 kgCO₂e/m² WLC benchmark range, and falling short of the aspirational benchmark of < 800 kgCO₂e/m² by 139 kgCO₂e/m².

Opportunities to Reduce Whole Life-Cycle Carbon Emissions

High level strategic opportunities were explored during a workshop with the project team, which has fed into the development of the following actions taken to reduce the whole life carbon emissions, in addition to the formulation of additional measures, which will be considered to further reduce the WLC emissions at a later stage.

The design team will continually review the benefits of the options explored, considering cost management, practicality, benefits to the whole life carbon at each stage of assessment.

Key action scenarios

Embodied carbon has been a key element when assessing different substructure, superstructure, and hard landscaping options for the project. The measures undertaken to minimise embodied carbon have included:

- Use of 50% GGBS cement replacement for substructure elements, such as the piles, pile caps and capping beam.
- Use of 30% GGBS in the upper floor slabs and 50% GGBS in the walls and columns.
- Optimised superstructure design, through the selection of post-tensioned concrete for elements, such as the upper floors slabs, walls and columns, results in considerable reduction in the building weight and translates to a significant carbon saving when compared to reinforced concrete.

ROLE	ORGANISATION
Client	DNA Uxbridge
Planning Consultant	Savills
Principal Designer / Architect	CGL Architects
Structural & Civil Engineer	EDGE Consultants
Cost Consultant	Cast Consultancy
M&E / Sustainability Consultant	Ridge & Partners
Landscape Architect	OUBE

Table 1 – Summary of the project team in workshop attendance

Post-Construction WLC

In accordance with the GLA's Whole Life-Cycle Carbon Assessment Guidance (March 2022), an additional WLCA will be completed at Post Construction Stage. The post construction WLC will require an update of the information provided at the planning submission stage (RIBA Stage 2/3) with the as built WLC carbon emission figures to be reported.

The WLC calculation results will be updated for all modules, and will be based on the actual materials, products and systems used for the construction of the Proposed Development. Further carbon reduction measures, such as the use of product specific Environmental Product Declarations (EPDs), site impacts and product transport distances will be explored, and details will be supplied by the site team at RIBA Stage 6 to ensure these impacts are accurately reflected in the scheme and the revised WLCA.

2. INTRODUCTION

Ridge and Partners LLP have been appointed by DNA Uxbridge Ltd. to complete a Whole Life Carbon (WLC) Study for the 148-154 Uxbridge High Street development. The assessment has been completed in support of the Detailed Planning Application, in line with the London Plan 2021, as well as the GLA Whole Life-Cycle Carbon Assessments (WLCCA) guidance document (March 2022).

This report summarises the results of the WLCCA undertaken before the end of Concept Design stage (RIBA Stage 2) and is written to accompany the 'GLA Whole Life Carbon Assessment Template'. The model is to be updated using the actual WLC carbon emissions figures at post-construction at RIBA Stage 6 (prior to handover), where further modelling will be carried out as per the GLA requirements. In addition to embodied carbon calculations, the model and subsequent report has also utilised the Energy Assessment for the development to report on the operational carbon impacts.

The purpose of this assessment is to assess the WLC impact for the Proposed High Street Uxbridge Development, defined as 'those carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal.' This assessment captures the operational carbon emissions for the Proposed Development from both regulated and unregulated energy use, as well as its embodied carbon emissions, i.e. those associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair and replacement as well as dismantling, demolition and eventual material disposal.

3. RELEVANT POLICIES AND REGULATIONS

3.1. The London Plan

The London Plan is the statutory Spatial Development Strategy for Greater London prepared by the Mayor of London. The new London Plan, adopted March 2021, includes the following policy in relation to the Whole Life Carbon (WLC) Assessment:

Policy SI 2 - Minimising Greenhouse Gas 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."

4. PROJECT DESCRIPTION

4.1. Site Location and Existing Site Description

The site is located in Uxbridge at the junction of High Street, Belmont Road and Bakers Road and is an existing brown field site with previous Retail and Office uses. There is an existing development on the site which is to be demolished as part of the project.

The site is currently occupied by commercial buildings up to three storeys in height and is located the town centre of Uxbridge, north of Uxbridge Underground and bus station. The site is bounded by Belmont Road, which is a vehicular route through Uxbridge; Bakers Road, which leads to the Uxbridge bus and underground terminuses; High Street a pedestrianised boulevard; and Cocks Walk, a narrow pedestrian link between High Street and Bakers Road.

The existing building is primarily of retail use at ground floor. The primary frontage is to the High Street, with the most active retail stores. Along Belmont Road and Bakers Road much of the frontage is inactive due to back-of-house areas and vacant units.

The surrounding area is predominantly retail or commercial in nature, with some hotel and residential uses in buildings of up to seven-eight storeys in height.

4.2. Description of the Proposed Development

"Demolition of the existing buildings and comprehensive redevelopment of the site to provide a mixed-use development comprising hotel (Class C1), co-living (Class Sui Generis) and replacement commercial floorspace (Class E) alongside public realm improvements, including a new pocket park, basement parking and associated infrastructure."



Figure 1 – Satellite image of the Proposed Development – Source: DAS March 2024

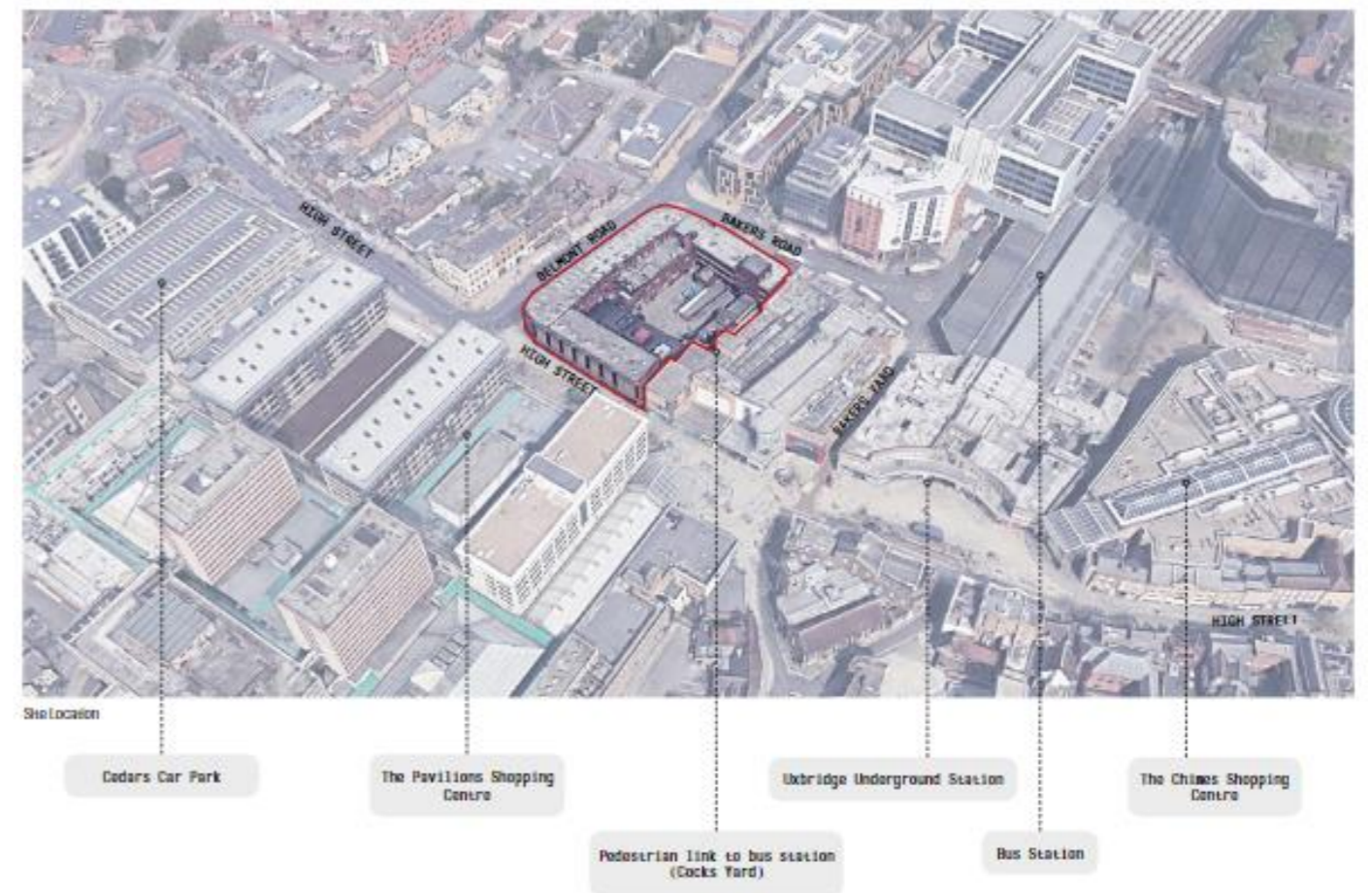


Figure 2 – Site Location High Street, Uxbridge – Source: DAS March 2024

5. WHOLE LIFE CARBON ASSESSMENT METHODOLOGY

5.1. Assessment scope and study period

There are various data sources that can be utilised to undertake Whole Life Carbon Assessments. This study has been prepared using a variety of these, as outlined in Table 2 below.

Cost Plan / Bill of Quantities Cast Consultancy have provided a Stage 2 Cost Plan which provides an indicative cost of all materials specified at this stage and ensures a minimum of 95% of the capital cost for the project for each building element has been accounted for within the assessment. The project quantities, approved by Cast Consultancy as part of the cost appraisal, have been provided for the substructure, superstructure, external landscaping, and service elements.

Design-Stage Drawings Design Stage drawings often specify manufacturer specific products installed and offer an opportunity to take exact measurements where required. The following RIBA Stage 4 drawings have been used to inform assumptions: Elevations, Site Plan, External Wall, Roof, Floor plans, Drainage Plans, Soft Landscaping Strategy.

Energy Strategy The Energy Statement document describes the energy strategy for the residential and non-domestic elements of the proposed development in accordance with the Greater London Authority (GLA) Guidance. The Sap 10 (domestic – i.e. co living) and TM54 (commercial – i.e. hotel / retail / amenity) calculations as part of the Assessment were used to calculate the regulated and unregulated operational energy.

Other Site impact assumptions have been made based on the Gross Internal Floor Area of the building, through Area Schedules provided by CGL. Refrigerant information and allowances for services at this stage have been provided by the Ridge & Partners MEP Team. Where not specified, good practice assumptions were used to determine product specifications as per the RICS Whole Life Methodology.

Table 2 - Data sources

In accordance with the RICS Professional Statement, this assessment has covered all building elements listed that are applicable to the project and are to be included in the finished area of the completed project:

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

The building elements have been reported according to the RICS NRM classification system level 2 sub-elements at minimum.

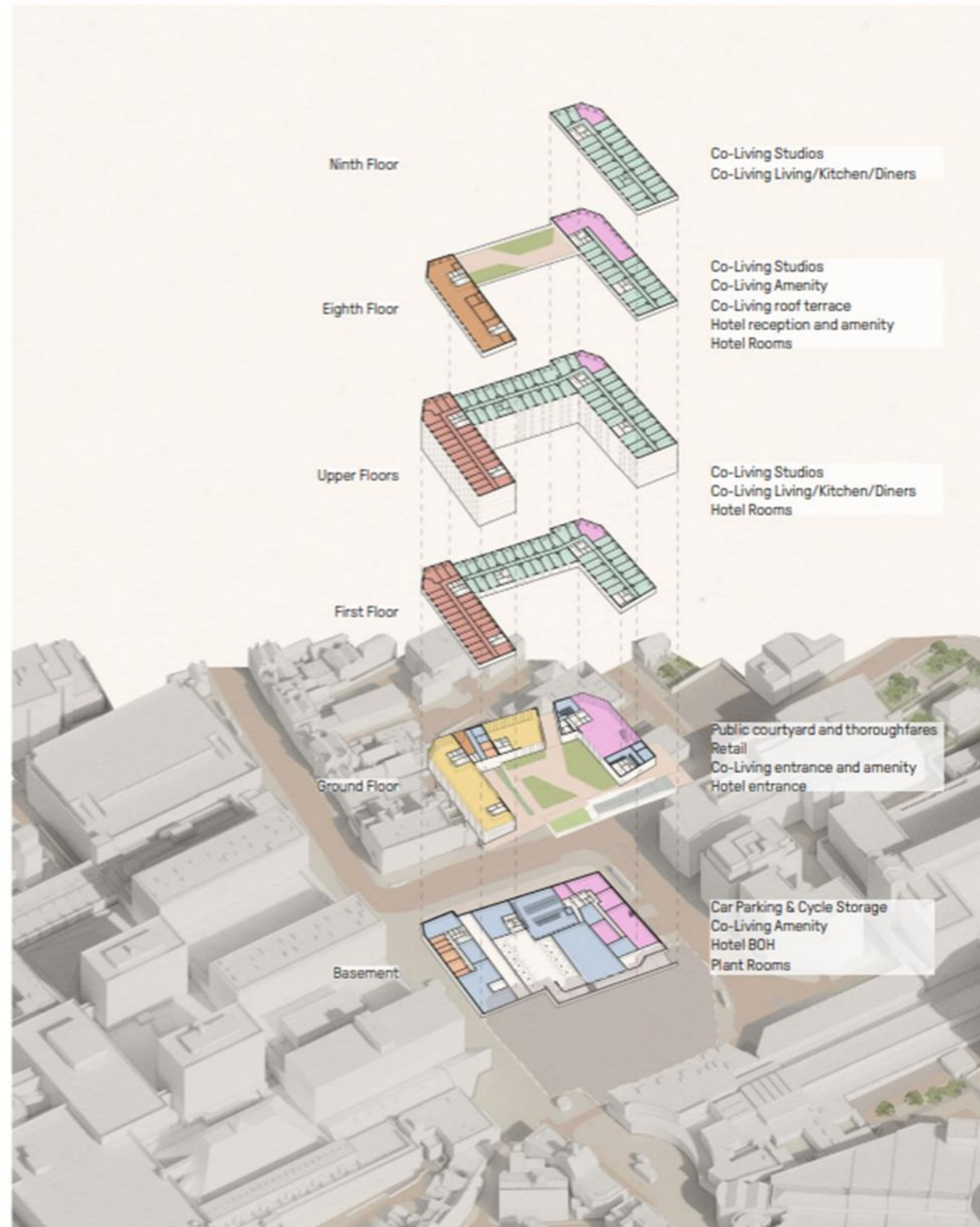


Figure 3 – Proposed Uses - High Street, Uxbridge – Source: DAS March 2024

Uses:

- Hotel lobby/ social space
- Retail
- Co-living amenity
- Co-living bedrooms
- Hotel BOH
- Ancillary/Plant

5.2. Software

The software used to carry out the modelling is OneClick LCA online software, which ensures alignment with the underlying standards and requirements, and includes a database of environmental impacts which is continuously updated. This database relies upon Environmental Product Declarations (EPD's), which are a mechanism for manufacturers to audit and declare the environmental burden of their products. EPD's are subject to detailed industry standards (e.g., ISO14025 standard), 3rd party verified and are only valid for a period of time before a re-evaluation is required.

The underlying principles of calculating whole life carbon emissions is based on the RICS Whole Life Carbon guidance (Ref: Whole life carbon assessment for the built environment 1st edition, Nov 2017).

5.3. Life Cycle Stages

The source of the carbon data for materials and products are presented in Section 5.1 of this report. The data covers all of the main life cycle module groups which equate to a WLC scope (A1-A5, B1-B5, B6-B7, C1-C) as defined on Figure 4 below.

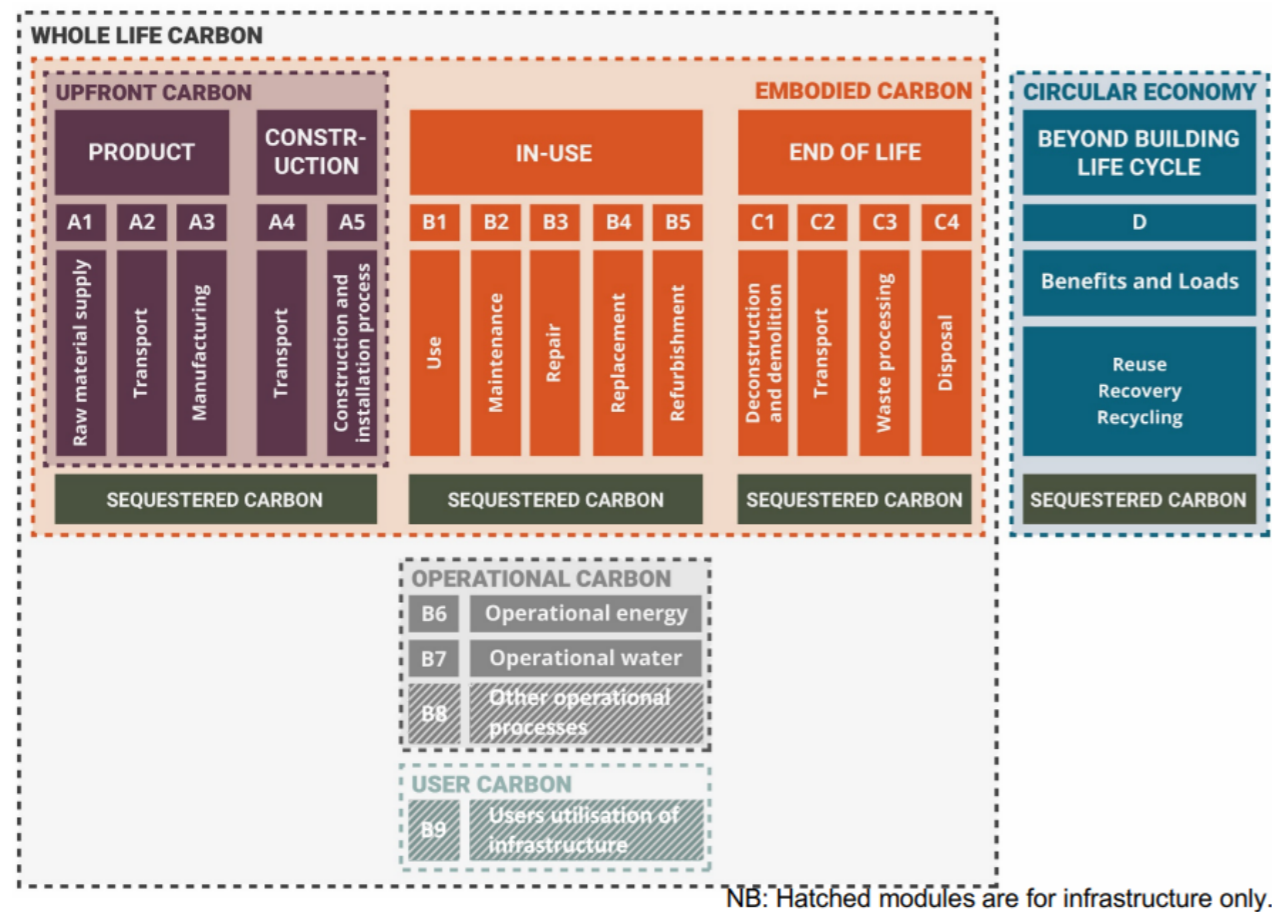


Figure 4 - Life-cycle stages - Source: WLCN Carbon Definitions for the Built Environment, Buildings and Infrastructure – Version 'A' - May 2021

To further supplement the information available provided by the design team outlined in Section 5.1 above, certain assumptions have been made. These are listed below in accordance with the Life Cycle Modules included in the assessment.

5.3.1. Modules A1-A3: Product Stage impacts

At this stage generic EPDs have been prioritised to reflect the current uncertain nature of the product specifications (as the design is not sufficiently developed to confirm exact products to be used), with assumed recycled contents aligning with RICS Whole Life Carbon Guidance (1st Edition, 2017). At the next stage, product specific EPDs should be sourced where possible to accurately report the carbon impact of key elements.

For concrete specifications, information provided by Cast Consultancy and EDGE for the likely strength and reinforcement have been used. At this stage of design, relative percentages of GGBS have been assumed for concrete building elements specified for the substructure and superstructure. For further details, please refer to Section 7 of this report.

Information provided by the design team has been used to account for finishes, sanitaryware, fittings and furnishings (FF&E) across the scheme. Non-fixed furnishings have been excluded from the assessment scope, in line with the approach taken in both LETI and RIBA's respective upfront and embodied carbon reporting methodology. At this stage, high level allowances for mechanical & electrical installation have been made based on information provided by the R&P MEP team and extrapolated across the whole design.

5.3.2. Module A4: Construction Transport Impacts

No specific product transport details have been included at this stage. Transport distances were estimated based on typical average transport distances based on material type and project location, provided by OneClick LCA, in accordance with the RICS Whole Life Carbon guidance (1st Edition, 2017).

A summary of the proposed transport distances for selected key materials, as per RICS methodology default figures applied within the OneClick LCA software is presented in Table 3.

TRANSPORT SCENARIO	DISTANCE KM BY ROAD	DISTANCE KM BY SEA
Locally manufactured e.g. concrete, aggregate, earth	50	-
Nationally manufactured e.g. plasterboard, blockwork, insulation	300	-
European manufactured e.g. CLT, façade modules, carpet	1,500	-
Globally manufactured e.g. specialist cladding	200	10,000

Table 3 - Data sources

5.3.3. Module A5: Construction Site Impacts

Construction Site Impacts have been included in line with assumed fuel usage and waste product values across the full construction period of the project as follows:

- Site Waste has been estimated at this stage of design as 11.1t per 100m² gross internal area based on BRE good practice site waste guidance.
- Due to lack of site-specific construction data at this stage, the climate zone average construction impact was used and sized based upon the scale of the development, provided by the OneClick LCA Software.
- Wastage allowances for each material specified have been assumed through default allowances (e.g., 4% for concrete, 15% for cladding panels) until specific records for site waste can be provided. The actual site waste data will supersede both the wastage allowances per material and the general site waste allowance in line with the BREEAM targets.

5.3.4. Module B1-B5: Use Stage – Maintenance & Material Replacement

Use (B1) includes the impact of refrigerant leakage, values for refrigerant charge were provided by the design team. RC132 has been included as the operational refrigerant types and annual / end-of life have been assumed as 2% and 4% respectively. This information has been provided by Ridge & Partners MEP team.

Module B2 (Maintenance) and Module B3 (Repair) is assumed at 10kgCO₂eq/m² and 2.5kgCO₂eq/m² GIFA respectively, in accordance with GLA Whole Life carbon assessment methodology (London Plan Guidance: Whole Life Carbon Assessments).

Module B4 (Replacement) over the 60-year study period, is defined by the expected lifespan of each building element. Material lifespans are presented as per the RICS methodology default figures, where available at this stage of design warranty periods for the replacement of major systems, such as services and plant have been applied. A detailed table of the bill of materials and the expected lifespan of each building element is included in 'GLA Whole Life Carbon Assessment Template'.

Module B5 (Refurbishment) relates to planned refurbishment only (i.e. where the initial construction accounts for a refurbishment as standard). Due to lack of available data and no currently planned refurbishment, no allowance for B5 has been included at this stage.

5.3.5. Module B6 & B7 Use Stage - Operational Energy & Water

The regulated energy emissions (B6a) presented have been provided by the Part L Energy Assessment undertaken for the Proposed Development to accompany the Planning Application. These reflect the estimated figures calculated as part of the CIBSE TM54 analysis for the Co-Living, Hotel and Retail space uses respectively.

The unregulated energy emissions (B6b) reported includes carbon emissions for non-building-related systems, such as ICT equipment, and from the operation of building-integrated systems, such as lifts. The energy use intensities (EUI) and annual consumption for the regulated and unregulated energy, in addition to the maximum water usage (B7) estimated for the scheme is presented within Table 4 below.

OPERATIONAL ENERGY		HOTEL & RETAIL	CO-LIVING
Regulated Energy (B6a)	EUI (kWh/m ² /year)	60.6	61.4
	Annual consumption (kWh)	433,379	895,081
Unregulated Energy (B6b)	EUI (kWh/m ² /year)	48.18	39.82
	Annual consumption (kWh)	344,482	580,890
Water	Annual water use (m ³)	14,391	12,264

Table 4 – Summary of energy (B6) and water use (B7) contributing to operational carbon emissions

It should be noted that the energy results are RIBA Stage 2 estimates and are therefore subject to update based on the modelling to be developed during Stage 3, once more specific information is available in accordance with the 'Be Seen' methodology of the GLA energy monitoring guidance.

Estimates of the anticipated operational water consumption (Module B7) for the Hotel and amenity spaces of the Co-Living designations of the scheme have been made using the BSRIA Rules of Thumb – guidelines for the building

services (5th edition). The water demand predictions for the units of the Co-Living proportion of the build have been calculated in line with the Building Regulations Part G 'Enhanced Consumption' recommendation of 105 litres of water per person per day and multiplied by the intended full occupancy. The water demand for the scheme has utilised a combined EPD for freshwater and wastewater.

Currently no other water usage has been included, as no indication has been provided to suggest additional water demand sources (i.e. irrigation systems, vehicle wash systems). The estimates for water consumption at this stage of design will be replaced by figures provided by the MEP consultant and landscape architect as they become available.

5.3.6. Module C1-C4: End of Life

Module C1 (Deconstruction / Demolition) has been included using an allowance for UK average demolition impacts relative to gross floor area, as provided by One Click LCA software, in accordance with the RICS methodology.

Modules C2-C4 (Waste Transportation, Waste Processing & Waste Disposal) are assumed based on end-of-life processing chains relative to each material, as provided by One Click LCA software. This aligns with industry good practice assumptions as per the RICS Whole Life Carbon guidance (1st Edition).

5.3.7. Module D: Benefits beyond the system

Default assumptions regarding the quantities of reusable and recyclable materials have been provided by the One Click LCA software. The submitted GLA WLC Template provides estimates of the percentages of reusable and recyclable materials.

5.4. Industry guidance and benchmarks

The GLA provides a set of WLC benchmarks for which the WLC assessment can be compared against, which do not include operational carbon emissions (B6-B7) and sequestration (Module D). These can therefore be considered as whole life-cycle embodied carbon benchmarks and are measured against the gross internal area (GIA).

The 'Residential' benchmarks assumed as the most appropriate comparison for the High Street Uxbridge development Hotel/Apartment build use types are captured in Table 5 below. The standard and aspirational benchmarks are based on a 40% reduction in WLC emissions on the first set of WLC benchmarks. This is aligned with the World GBC's target to achieve 40% reduction in WLC emissions by 2030.

MODULES	WLC BENCHMARK (KG CO ₂ E/M ² GIA)	WLC ASPIRATIONAL BENCHMARK (KG CO ₂ E/M ² GIA)
A1-A5 (excluding sequestration)	<850	<500
B-C (excluding B6 & B7)	<350	<300
A-C (excluding B6 & B7, including sequestration)	<1200	<800

Table 5 – GLA 'Residential' Benchmark Targets (GLA WLC Guidance – March 2022)

6. RESULTS AND BENCHMARK COMPARISON

The assessment has been undertaken in line with RICS Whole Life Carbon methodology, and at least 95% of the costs allocated to materials have been included in the model.


Based on the design stage information provided and outlined in Section 5 the total Whole Life-cycle Carbon emissions (embodied + operational) associated with the development were 23,943,147 kgCO₂e or 1,148 kgCO₂e/m² GIA based on a total GIA (including the basement & mezzanine) of 20,865 m². The operational carbon emissions, including operational energy and operational water loads, account for 18% in the whole life cycle carbon emissions for the development, and the embodied carbon emissions account of 82%.

Table 6 below demonstrates how these emissions were shared between different lifecycle stages.

LIFE-CYCLE MODULE	KG CO ₂ E	KGCO ₂ E/M ² GIA
Biogenic Carbon	-1,805,085	-87
Product Stage A1-A3	8,364,382	401
Transport to Site A4	1,387,170	66
Site Operations A5	940,339	45
In-Use B1-B5	8,206,224	393
Operational B6 & B7	4,354,243	209
End of Life C1-C4	2,495,873	120
Product Reuse D	-3,962,456	-190


Table 6 – Summary of High Street, Uxbridge WLC results

To put the current WLCA total reported above in context, **23,943** tCO₂e is equivalent to the following annual emissions based on the US EPA Calculator (April 24):

 **5,698** typical petrol-powered passenger vehicles' fuel emissions.

 **3,122** homes' energy emissions.

These emissions would also be equivalent to the equivalent carbon saved by:

 **6.3** wind turbines running for 1 year.

The proposed scheme was shown to demonstrate an embodied carbon performance (modules A-C) of **939 kgCO₂e/m²**, falling within the < 1200 kgCO₂e/m² WLC benchmark range, and exceeding the aspirational benchmark of < 800 kgCO₂e/m² by 139 kgCO₂e/m².

On the other hand, the embodied carbon value associated with In-Use and End-of-Life (modules B-C) was above the GLA benchmark range of < 350 kgCO₂e/m² with a reported current total of 513 kgCO₂e/m². Elements which require life-cycle replacement, such as the service equipment and finishes, have been estimated from high level assumptions available for these elements at RIBA Stage 2, and default replacement cycles have been allocated to the materials based on the RICS WLC methodology. The total may therefore be an overestimate at this stage of design. Nevertheless, any large increase to in-use emissions would result in a relatively smaller increase to the total A-C benchmark as the modules A1-A5 make up a greater proportion of WLC.

6.1. Embodied Carbon Analysis

Figure 5 below provides a breakdown of the cradle to grave embodied carbon (Modules A-C) by the main lifecycle modules over the 60-year study period.

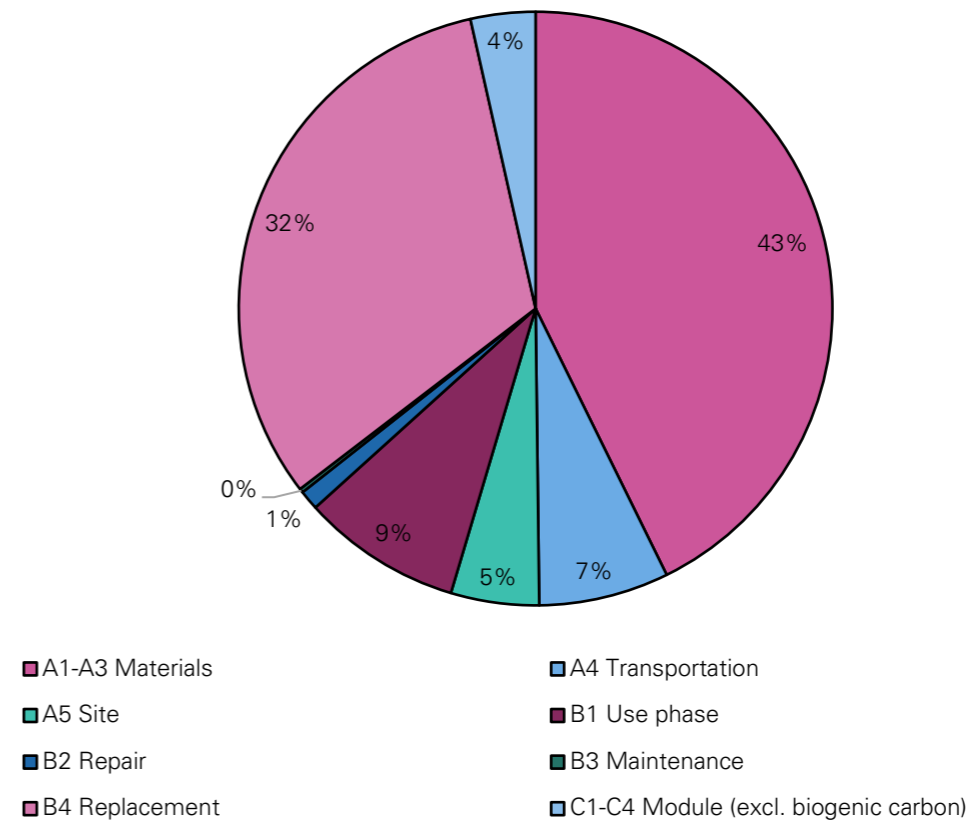


Figure 5 – Summary of upfront embodied carbon emissions in percentage broken down by lifecycle module.

The study demonstrates that the largest share of the embodied carbon emissions (43%) is attributed to the product stage life (Modules A1-A3) or raw material supply, transport, and manufacturing, also termed the cradle to gate stage. Priority will be given to reduce the embodied carbon, with material selection as well as a reduction in the mass and quantity will be the focus during the next stage of assessment.

Smaller proportions of the embodied carbon, approximately 12% of the total, result from the construction process stage, which refers to transportation of materials to site, and their assembly into the building (Modules A4-A5). Whilst this is a small contributor in comparison to other elements, it is still important to reduce transport emissions through focus on the local sourcing of materials and to reduce consumption of energy and water during construction where possible.

Combined, the upfront (A1-A5) embodied carbon up to practical completion contributes 10,692 tonnes of CO₂e, which proportionally makes up 80% of the embodied carbon total over the 60-year study period.

Figure 5 also demonstrates the significant recurring impacts associated with in-use life cycle emissions for replacement (module B4), which currently accounts for 32% of the emissions. As previously outlined, throughout the life cycle of a development, there will be carbon impacts arising from the replacement of materials and equipment. At this stage of design, the B4 replacement emissions included are based on assumptions from the RICS WLC methodology with relation to replacement cycles. However, during the remaining design and construction stages, where manufacturers can provide documentation showing their products are guaranteed for a longer period than specified, these assumptions can be amended to reduce B4 emissions.

Finally, 4% of the emissions have been generated by the End-of-Life (modules C1-C4), this accounts for emissions arising from decommissioning, disassembly, transportation to a waste processing facility and disposal of materials at the end of their lifecycle.

Figure 6 below shows the 10 most significant impacts across the scheme for Embodied Carbon (A1-A5, B1-B4, C1-C4). The graph also shows the division between the Upfront (A1-A5) carbon and the subsequent Embodied (B1-B4, C1-C4) emissions. The results show that the Building Services are the most significant embodied carbon impact of the scheme, largely due to the frequent rate of replacement of the mechanical & electrical systems expected over the 60-year study period, accounting for 28% of the total embodied carbon impact.

In contrast, although the upper floor slabs demonstrate the largest upfront carbon impact due to the carbon intensity of Ordinary Portland Cement within the concrete construction, the carbon associated with this element is locked up in construction and the contribution to the total embodied carbon is significantly lower (a very minor embodied carbon impact is reported for the end-of-life processes).

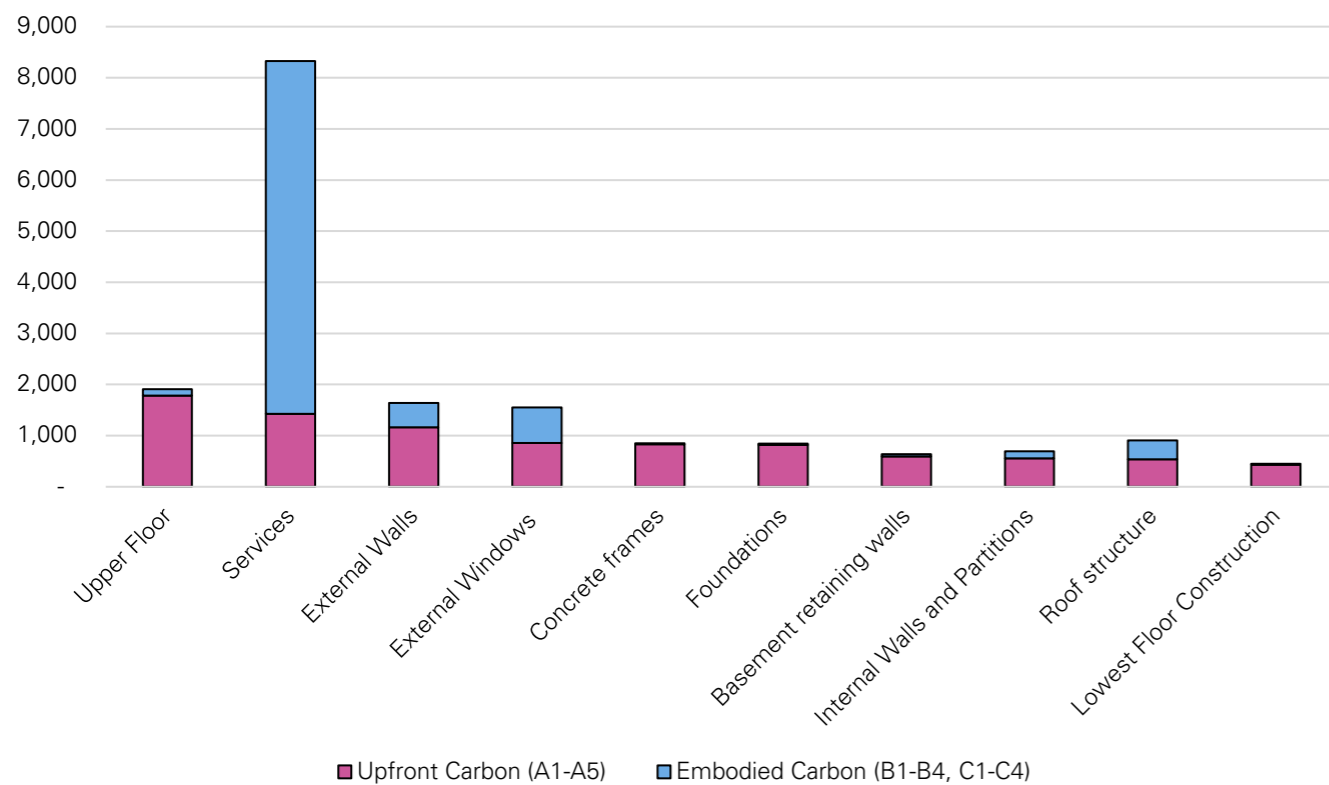


Figure 6 – Embodied Carbon by key elemental impacts.

7. ACTIONS TAKEN TO REDUCE WLC EMISSIONS

High level strategic opportunities to reduce the whole life carbon emissions were explored during design team workshops, which has fed into the development of the following actions taken, in addition to the formulation of additional measures explored in Section 8 of this report which will be considered to further reduce the WLC emissions at a later stage.

7.1.1. Low Carbon Materials

By specifying products with high contents of recycled material, the product life cycle emissions can be significantly reduced, compared to products procured with virgin material.

Concrete is one of the most carbon intensive materials used in construction, and this is largely attributable to the Portland Cement within the element, which has a very energy intensive production process. Long term, concrete manufacturers need to bring down the impacts associated with cement to help decarbonise construction, but in the short-term replacing cement with alternatives can help to achieve notable savings. Fly Ash and Ground Granulated Blast Furnace Slag (GGBS) are two examples of commercially available cement replacement products which are both by-products of heavy industry and therefore have lower attributed embodied carbon emissions.

There are various opportunities to reduce the impacts arising from the concrete elements of the proposed design including the substructure and concrete frame. As per the outcomes of the design team meetings, the use of 50% GGBS cement replacement for substructure elements, such as the piles, pile caps and capping beam has been specified and the use of 30% GGBS in the upper floor slabs and 50% GGBS in the walls and columns was established. This has led to notable savings within the design, typically foundations are a significant contributor to the upfront total due to the concrete construction, especially where cement replacement has not been considered. A piled solution, as proposed for the development, requires significant quantities of concrete and steel reinforcement, both carbon intensive materials.

7.1.2. Material Reduction

Optimising the superstructure design, through the selection of post-tensioned concrete for elements such as the upper floors slabs, walls, and columns, has resulted in a considerable reduction in the building weight through the decrease of slabs and piles volume. Opting for post-tensioned concrete over reinforced concrete has reduced the overall amount of concrete needed and subsequently the embodied emissions associated with this element.

Using concrete as a finish has been assumed for application to select floor areas of the Proposed Development, such as the plantroom space and the retail units, to reduce the specification of unnecessary finishing materials. Exposed areas of concrete can optimise the thermal mass performance and removes carbon from the atmosphere, making a direct contribution to carbon reduction and feeding into the regenerative design of the Proposed Development. In addition, the durability of concrete offers further potential savings through a reduction in maintenance and repair, when compared to finishes such as paint and tiles.

7.1.3. Energy Strategy

The energy strategy for the project has been a key driver for reducing the operational energy. An ‘all electric’ energy strategy has been proposed, which features the implementation of passive design measures, such as operable panels on the walls of the Co-Living areas, which reduce reliance on mechanical ventilation by maximising natural ventilation.

Optimised systems and efficiency measures are proposed, these include the prioritisation of a ‘fabric first approach’ to minimise the operational energy demand and reduce carbon, and highly efficient low carbon technologies, such as heat pumps to deliver heating, cooling, and hot water throughout the development.

7.1.4. Building in Layers

To accelerate the transition and embed Circular Economy (CE) principles within the Proposed Development, the 'building in layers' concept, as illustrated in Figure 7 has formed the foundations of the strategic approach for the WLCA. The superstructure of the building has been designed to have a long-life cycle so longevity, adaptability and flexibility will be prioritised. For example, the concrete frame is designed to exceed the 60-year lifetime when appropriately managed and maintained. Whereas for features that will need to be replaced over the lifetime of the building, for example the window frames, glass panels, metal fixtures, and steel sections have been designed for ease of maintenance, reuse, and recoverability,

Adopting this design approach that recognises these distinctions will ensure the structure and façade of a development will be built to be long lasting and adaptable, whilst individual components like the services, interior space and furnishings are designed in a way that supports reuse or recycling.

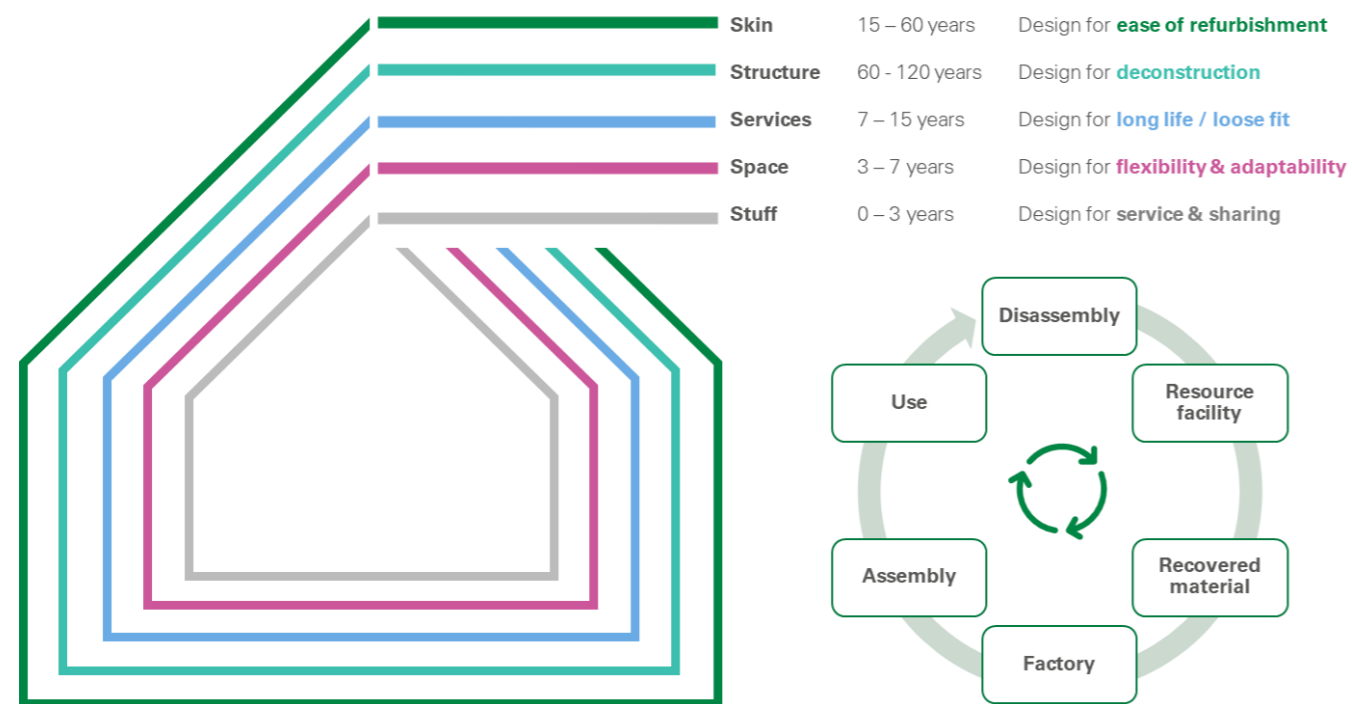


Figure 8 - Emissions per lifecycle stage (incl. sequestration).

7.1.5. Retain and Reuse

Retaining existing built structures for reuse and retrofit, in part or whole has been prioritised before considering substantial demolition. A Pre-Demolition Audit has been completed and is contained within the Circular Economy Statement. This indicates that besides from the possibility of retaining elements of the underground car park walls as discussed further below, there is limited opportunity to claim benefits from complete reuse due to the number and position of the columns and beams combined with the low soffit height.

Since the current buildings are coming to the end of their useful life and are deemed unsuitable to refurbishment for a development of this scale, most of the materials forming the existing structure will be recycled. The significant waste streams to undergo this process were identified as concrete and brick, which is proposed to be recycled into secondary aggregates, and steel (predominantly reinforcement) which is to be placed in scrap metal re-processing.

The substructure design of the Proposed Development has been optimised to take advantage of the existing basement retaining walls, translating to carbon savings associated with the mass of material specified as part of the new build basement design.

Opportunities to minimise WLC through low carbon material specifications such as cement replacements and low carbon reinforcement steel will be prioritised. Further opportunities will include sourcing products with EPD's with a lower carbon factor than the generic carbon factors selected at this stage for the WLCA.

8. OPPORTUNITIES FOR FURTHER REDUCING WLC EMISSIONS

8.1.1. Locally sourced low carbon materials

As shown in Section 6 of the report, the majority (43%) of the Embodied Carbon impact is attributed to the products and materials chosen. Another contributing lifecycle stage is from the transport of materials to site (7% of the total embodied carbon). Therefore, choosing low carbon and locally sourced materials is a key consideration.

At the next stage EPD's will be sought from manufacturers where possible to maximise accuracy of the modelling. Additionally, selecting products with EPD's will allow the design team to compare and select the lowest carbon products for the Proposed Development. The Developer Sustainable Construction Policy encourages consideration of a reduction of supply chain carbon in the specification and procurement of all building materials.

8.1.2. Reuse and Recovery

As discussed in Section 7 of this report, the client has provided a Pre-Demolition Audit at RIBA Stage 2, which identifies materials which can be reused or recovered to be used for the existing structures of the Proposed Development and the Circular Economy Statement details the strategy for recovery of materials in line with the circular economy model.

An allowance for the benefits of recovered materials been accounted for in the Whole Life Carbon Assessment and replace virgin material where applicable, however at this stage due to uncertainty in the quality & quantity of replacement materials this is an estimation. It is understood that this will be accounted for at a more detailed stage of design when more accurate data is available when the actual site works are undertaken, however as a minimum these will meet the London Plan Policy targets of 95% reuse/recycling/recovery of construction and demolition waste, and 95% beneficial use of generated excavation waste.

8.1.3. Designing for Durability

As demonstrated, the in-use life cycle emissions for replacement (Module B4) currently account for 32% of the embodied carbon total. Primarily, floor, wall and ceiling finishes have short replacement cycles (~10 years on average) and as such contribute highly to B4 emissions. Replacement emissions were also accumulated throughout the services category and reflected within the results as the highest elemental contributor to the embodied carbon of the Proposed Development reported at this stage (28%).

Without exact information or specifications provided, based on RICS methodology and dependent on the equipment, 15-20 years has been assumed. During the remaining design and construction stages, where the service design is further progressed and manufacturers can provide documentation showing their products are guaranteed for a longer period than specified, these assumptions can be amended to reduce B4 emissions. This will provide a much more accurate overview of the emissions associated of their systems, and their service life.

8.1.4. Functional Adaptability & Disassembly

A Functional Adaptability and Disassembly Study is being developed to ensure that any work to the development can respond to a required change of use or requirements and goes beyond maintenance and repairs whilst solving functional problems. It will also allow the building or parts of the building to be disassembled at the end of its life, or to be renovated rather than demolished, with individual components being used for other purposes.

The functional component of the study will consider feasibility, accessibility, versatility, adaptability, convertibility and expandability and the refurbishment potential. The ease of disassembly component will encompass accessibility, durability, exposed & reversible connections, layer interdependence and the avoidance of unnecessary toxic

treatments and finishes. Through undertaking this study, recommendations or solutions will be proposed which will be considered and factored into the design and reflected in the next stage of development.

9. POST CONSTRUCTION WLC ASSESSMENT

As per the GLA's Whole Life-Cycle Carbon Assessment Guidance (March 2022), a further WLCA should also be completed at Postconstruction Stage. The post-construction WLC will require an update of the information provided at the planning submission stage (RIBA Stage 2/3) and for the actual WLC carbon emission figures to be reported. The WLC calculation results will be updated for all modules, based on the actual materials, products and systems used for the construction of the Proposed Development. The updated results will be supported by the following listed evidence:

- Site energy (including fuel) use record.
- Contractor confirmation of as-built material quantities and specifications.
- Record of material delivery including distance travelled and transportation mode (including materials for temporary works).
- Waste transportation record including waste quantity, distance travelled, and transportation mode (including materials for temporary works) broken down into material categories used in the assessment.
- A list of product specific EPDs for the products that have been installed.

The data collected at this stage will provide an evidence base that could help inform future industry-wide benchmarks or performance ratings for building typologies. The post-construction results will need to be compared with the WLC emissions baseline reported at planning submission stage and with the WLC benchmarks. This will need to be accompanied by an explanation for the difference, including any design changes that may have impacted on the results.

APPENDIX A: WHOLE LIFE CARBON ASSESSMENT RESULTS SPREADSHEET

RESULT CATEGORY	BIOGENIC CARBON (KG CO2E)	A1-A3 PRODUCT STAGE	A4 TRANSPORTATION TO SITE	A5 SITE OPERATIONS	B1 USE PHASE	B2 MAINTENANCE	B3 REPAIR	B4 MATERIAL REPLACEMENT - MATERIALS	B5 MATERIAL REFURBISHMENT	B6 OPERATIONAL ENERGY USE - REGULATED	B6 OPERATIONAL ENERGY USE - UNREGULATED	B7 OPERATIONAL WATER USE	C1 DECONSTRUCTION / DEMOLITION	C2 WASTE TRANSPORTATION	C3 WASTE PROCESSING	C4 WASTE DISPOSAL	TOTAL KG CO2E	D EXTERNAL IMPACTS (NOT INCLUDED IN TOTALS)
0.2 Demolition	-	-	-	-	-	-	-	-	-	-	-	-	14864	-	-	-	14864	-
0.4 Groundworks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Substructure	0	1296233	465964	78291	-	-	0	-	-	-	-	-	-	82704	7345	-	1930537	-330307
2.1 Frame	0	657429	112872	58250	-	-	0	-	-	-	-	-	-	20431	1517	-	850499	-437851
2.2 Upper Floors	-521023	1496072	144976	144804	-	-	0	-	-	-	-	-	-	32106	611632	-	1908567	-501938
2.3 Roof	0	333308	165691	37924	-	10063	2516	107853	0	-	-	-	-	10755	236078	952	905140	-191145
2.4 Stairs & Ramps	0	47835	20876	0	-	844	211	5103	0	-	-	-	-	957	113	1	75940	-11837
2.5 Ext. Walls	-756	970589	119527	70323	-	18260	4565	440604	0	-	-	-	-	12287	6644	356	1642400	-228528
2.6 Windows & Ext. Doors	0	788048	29008	46215	-	17428	4357	672803	0	-	-	-	-	9487	193	1	1567540	-687550
2.7. Int. Walls & Partitions	-846	438688	72065	46716	-	7728	1932	114781	0	-	-	-	-	12262	1358	426	695110	-212543
2.8 Int. Doors	-28421	38917	7337	0	-	960	240	38383	0	-	-	-	-	297	28611	11	86334	-9200
3 Finishes	-646	246638	50098	41591	-	17532	4383	1115326	0	-	-	-	-	3671	98265	77	1576934	-143766
4 Fittings, furnishings & equipments	-313441	84370	14549	13723	-	5452	1363	367571	0	-	-	-	-	783	316050	4	490424	-187052
5 Services (MEP)	-302	1864589	131293	15811	1702913	129364	32341	3364622	0	2548014	1774883	31346	-	9107	31504	276	11635761	-1000109
8 Ext. works	-939649	101666	52915	4295	0	2009	502	14215	0	-	-	-	-	2439	942307	0	180700	-20630
Other or overall site construction	-	-	-	382395	-	-	-	-	-	-	-	-	-	-	-	-	382395	-
TOTAL kg CO2e	-1805085	8364382	1387170	940339	1702913	209640	52410	6241261	0	2548014	1774883	31346	14864	197287	2281617	2105	23943147	-3962455

*B2-3 emissions assumption included as per Greater London Authority WLC guidance recommended assumption of 10kg/m² for B2 and 2.5kg/m² for B3.