LOVE DESIGN STUDIO

August 2022

Uxbridge Road

Whole Life-Cycle Carbon Assessment

Contents

Section Zero

0 Executive Summary

Executive Summary

Whole Life-Cycle Carbon

This Whole Life-Cycle Carbon Assessment (WLCA) has been prepared on behalf of Infinite Partners (the applicant) as part of a planning application to the London Borough of Hillingdon (the Local Planning Authority).

The WLCA has been undertaken pursuant to Policy SI 2 of the London Plan (2021) and in accordance with London Plan Guidance on WLCA (March 2022). The report should be read in conjunction with the WLCA Template, contained within Appendix E.

The scheme set WLCA targets based on the aspirational targets of the GLA, and other best practice guidance, such as those included in LETI's Embodied Carbon Primer, the 40% reduction target set by the UKGBC and the RIBA 2030 climate challenge.

The total whole life-cycle carbon emissions using SAP10 carbon factors are estimated at 36,227tCO2e or 1,778kgCO2e / m2 over the buildings assumed lifespan of 60 years.

The results indicate that at this stage the scheme is outperforming the GLA aspirational targets and achieving some of the aspirational targets set by LETI and RIBA.

Embodied Carbon

The embodied carbon footprint of the scheme totals 11,812tCO2e over an assumed life span of 60 years.

This can be broken down as 580 kgCO2e/ m2.

Significant embodied carbon savings have been made in the early design stages through careful material specification and by designing to retain and refurbish the existing building on site, rather than demolishing and rebuilding. Once complete, the refurbished building accounts for around 40% of the GIA of the proposed development.

There is the potential for further savings to be made as the design progresses to the detailed design stage, which are expanded upon in the body of this report.

The largest contributing life-cycle stage factors to the overall embodied carbon footprint are A1-A3, which accounts for 54% of the total embodied carbon emissions.

The most contributing element of the building is the superstructure, which is accountable for approximately 45% of the schemes embodied carbon.

The results indicate that at this stage the scheme is outperforming the GLA aspirational WLCA targets.

Operational Carbon

The results of the TM54 Energy assessment indicate that the operational Carbon Footprint for the proposed scheme over an assumed life span of 60 years totals 24,415tCO2e.

This can be broken down as 1,198 kgCO2e/m2.

In accordance with GLA and LPA policy, the scheme has been carefully designed to reduce its carbon emissions in Operation.

The scheme adopted the principles of the energy hierarchy, Be Lean, Be Clean, Be Green to maximise on-site carbon reduction and then uses a carbon offset any remaining emissions. Please refer to the energy statement for further detail.

The most contributing elements to the operational carbon footprint are domestic hot water, fans and pumps and space heating.

Section One

1 Introduction

Introduction

This Whole Life-Cycle Carbon Assessment has been prepared on behalf of Infinite Partners (the applicant) as part of a planning application to the London Borough of Hillingdon (the Local Planning Authority).

The objective of this assessment is to estimate the total carbon emissions emanating from the development over its lifetime, including the emissions resulting from the materials used, the building's construction, the use of the building and its demolition and disposal.

Operational carbon emissions have been calculated for the proposed development including regulated and unregulated energy use. Embodied carbon emissions have also been assessed, which are the emissions generated over the course of the building material's lifespan, from cradle to gate. The assessment has been carried out in compliance with methodology contained in the London Plan Guidance - *Whole Life-Cycle Carbon Assessments* (March 2022). In compliance with the GLA guidance, the completed Whole Life-Cycle Carbon Assessment is contained in the appendices and should be read in conjunction with this report.

Figure 1: CGI of the proposed development

Site Description and Proposal

Figure 2 illustrates the proposed 1.40 acres site area for 27 Uxbridge Road. The site is bounded by Uxbridge Road to the north and Springfield Road to the west. The sites surrounding the proposal is a mixture of light industrial, residential and open spaces.

The site lies within the jurisdiction of the London Borough of Hillingdon, and is considered an application of Potential Strategic Importance (PSI). It will therefore be referred to the GLA Planning Authority,

Within the site currently stands a 60's 13 storey, including plant, hotel building comprising 170 keys, meeting rooms and gym.

The proposed scheme entails the Demolition of ground floor entrance, parking structure and north-east and south-west wings of the existing building, and refurbishment and extension of existing hotel to include additional accommodation at roof level and full height extension on the north elevation, together with walkways connecting to new buildings of between 6 and 8 storeys, to create additional hotel floor space (Use Class C1) and commercial floorspace (Use Class E(g)), along with ancillary facilities, parking and landscaping.

Figure 2: Site plan, with the proposed development site marked in Red.

Section Two

2

Policy & Methodology

Driving Guidance and Policy

Regional Policy

Regional Policy is governed by the London Plan (March 2021). Policy SI2 (f) of the London Plan mandates that development proposals, which are referable to the Mayor, should calculate the proposed scheme whole life cycle carbon emissions.

Local Policy

The Hillingdon Local Plan is the foundation for how planning is controlled in Hillingdon. The Local Plan is broken into two parts, with Part 1 focused on Strategic Policies and Part 2 comprising the Development Management Policies. The policies which regulate carbon emissions, and therefore relevant to this assessment, are the following:

- Policy EM1: Climate Change Adaptation and Mitigation
- Policy DMEI 1: Living Walls and Roofs and Onsite Vegetation
- Policy DMEI 2: Reducing Carbon Emissions
- Policy DMEI 3: Decentralised Energy

Assessment Guidance

The guidance for the methodology in this assessment is set out in the London Plan Guidance on Whole Life Cycle Carbon Assessments (March 2022). This document sets out the required scope of a GLA compliant assessment.

The underpinning methodology for the GLA Guidance Note is extracted from BS EN 15978:2011: Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method) and the subsequent RICS Professional Statement: Whole Life Carbon Assessment for the built environment. The BS15978 note sets out ways to assess a buildings environmental impact, while the RICS document provided an industry standard methodology to allow comparison and benchmarking of different projects.

This WLCA complies with the requirements of the London Plan Guidance Methodology Note.

Several organisations, such as LETI and UKGBC have produced their own documentation and guidance on minimising emissions, from both operational and embodied carbon sources. The LETI Embodied Carbon Primer is referenced as a good source of information within the London Plan Guidance.

Figure 3: Key policy and guidance documents used within this WLCA.

Methodology & Assumptions

Whole Life Cycle Assessment

This Whole Life-Cycle Carbon Assessment (WLCA) is comprised of the following section:

- Steps taken to reduce WLC carbon at the early design stages
- Total operational carbon emissions (regulated and unregulated) based on SAP10 carbon factors
- Embodied Carbon emissions
- Opportunities for further carbon reduction and end of life scenarios

The methodology for the assessment follows BS EN 15978, as interpreted by the RICS Professional Statement: Whole Life-Cycle Carbon assessment (2017), later amended by The London Plan Guidance on WLCA's (2022). The methodology set out by the London Plan Guidance document is almost identical to RICS guidance, save for the alterations explained in Box 1 of the London Plan Guidance document.

The London Plan Guidance document is the underpinning guidance used in the production of this report.

The assessment has been prepared on the assumption that the building will have a lifespan of 60 years, as per RICS guidance.

Embodied Assessment

Love Design Studio have utilised One Click LCA to calculated the embodied carbon associated with the proposed development, which is a policy compliant Life Cycle Assessment (LCA) tool in accordance with Appendix 1 of the GLA's guidance note.

One Click LCA calculates the embodied carbon of materials used by allocating them to a relevant Environmental Product Declaration (EPD). EPDs are produced by manufacturers of materials and incorporate the environmental impact, including carbon emissions over the materials life cycle.

In accordance with GLA guidance, EPDs utilised within this assessment should be produced in accordance with European Standard for the generation of EPD for construction products (EN15804), or certified by other EPD standards as established in table 3.3.1 of RICS Whole Life Cycle guidance (November 2017). The reference study period for the WLCA is 60 years, in coherence with paragraph 2.5.3 of GLA guidance.

The environmental impact of building materials will be reported across life-cycle modules A-D as set out in BS EN 15978. The RICS NRM Classification system has been used to specify the building elements that will be included within this WLCA, as follows:-

- Demolition (0.1, 0.2)
- Facilitating works (0.3 - 0.5)
- Substructure (1)
- Superstructure (2.1-2.8)
- Finishes (3.1-3.3)
- Fittings, Furnishes and equipment (4.1)
- Building Services (5.1 - 5.14)
- Prefabricated buildings and building units (6.1)
- Minor demolition and alteration works (7.1)
- External works (8.1-8.8)

Operational Assessment

As stipulated within GLA guidance, operational carbon emissions have been calculated based on a CIBSE TM54 Assessment. The figures may differ from the Energy Statement as teh GLA Guidance on ENergy Assessments does not stipulate the requirement for utilising CIBSE TM54.

For this WLCA assessment CIBSE TM54 analysis was carried out to calculator the estimated operational energy use for the proposed building for both regulated and unregulated energy.

Most recent GLA acknowledges that although the UK's electricity grid is decarbonising, the data presently available is not reliable to utilise when reviewing WLCA emissions. Therefore this assessment does not take into account grid decarbonisation.

Whole Life Cycle Carbon Inputs

The Operational Energy Use has been calculated using CIBSE TM54 Analysis in Dynamic Simulation Modelling (DSM) software. The model was based on frozen design drawings received from Haptic Architects in June, 2022.

Module B7, Operational Water Use, has been estimated utilising the BSRIA Rule of Thumb document, as per paragraph 2.5.15 of the GLA guidance note. In line with paragraph 3.2.6 of the RICS WLCA guidance (2017), information relating to the quantum of materials used has been extracted from the following sources:

- BIM Model - Provided by Haptic Architects (May 2022)
- Cost Plan - Provided by Stockdale LLP (June 2022)
- Structural Information via Email from Engineeria (June 2022)

The WLCA model constructed in One Click LCA achieved an 'A' rating within the RICS sense checker, which indicates that building elements and quantities included are in accordance with RICS guidance and estimations. This tool provides a high level sense check, to ensure nothing has been omitted from the assessment.

As per paragraph 2.6.3 of the GLA guidance, more than 95% of the capital cost allocated to each building element category has been accounted for within this WLCA. RICs WLCA guidance suggests that there are two aspects to WLCA benchmarking:

- 'Dynamic' benchmarking - which is where a WLCA is carried out at the early design stages to provide a baseline to compare the results of later assessment iterations, so as to monitor the carbon progress of the project
- 'Static' benchmarking - which is the collection and analysis of Whole Life Carbon results reviewed at the 'as built' stage

Therefore, a Static Benchmarking assessment should also be undertaken once a bill of materials and as built information is available.

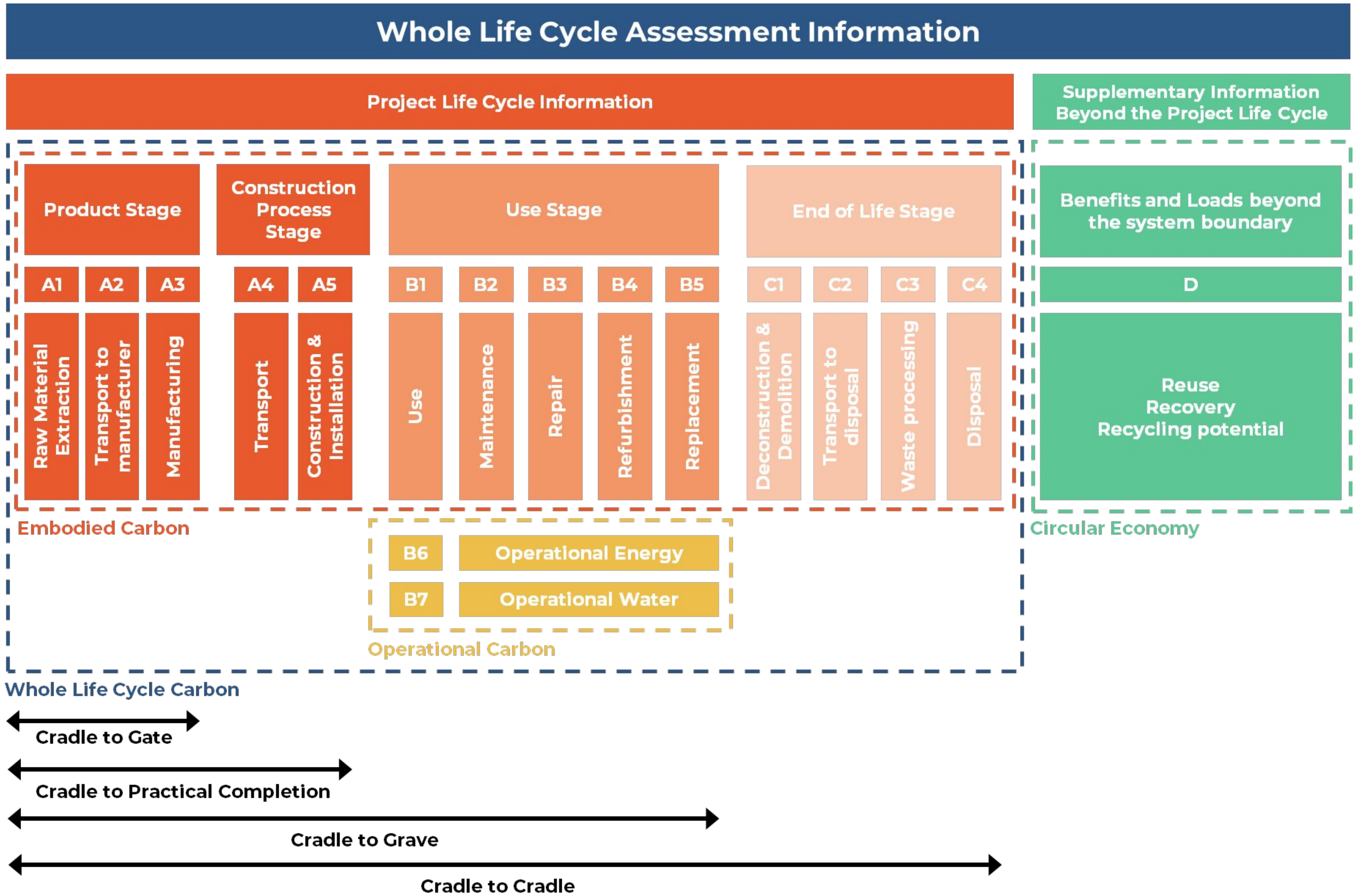


Figure 4: Modular information for the assessment as per EN 15978 including typical system boundaries.

Embodied Carbon Parameters

Table 1: Illustrating the origin of information enabling embodied carbon analysis to be undertaken in accordance with RICS NRM 2 components.

Building element Group	Building Element	Origin of information
0 Demolition and Facilitating Works	0.1 Toxic/ hazardous / contaminated material treatment	Site investigations reported no risk of contaminated land and therefore this element has been excluded from the assessment.
	0.2 Major demolition works	To ensure a circular scheme is delivered, no major demolition works are required, instead, the existing buildings will be refurbished and extended.
	0.3 and 0.5 Temporary enabling works	No temporary enabling works are envisioned at this stage.
	0.4 Specialist groundworks	No specialist groundworks were specified. All groundworks are accounted for in the substructure section.
1 Substructure	1.1 Substructure	Substructure specification was provided by structural and architectural drawings and reports, while precise quantities were extracted from the scheme cost plan.
2 Superstructure	2.1 Frame	Information regarding material quantities required for the frame was extracted from the cost plan.
	2.2 Upper floors including balconies	Cross section drawings of the likely floor and balcony arrangements were provided by the architect, and further information was made available, including information of formwork, in the cost plan.
	2.3 Roof	Details of the proposed roof structure was included in the cost plan. Some of the roof areas will be a 'green roof' which will be further specified as the design develops.
	2.4 Stairs and ramps	Information pertaining to stairs and ramps was extracted from the BIM model provided.
	2.5 External walls	The external wall build up was provided in drawings received from the architect, while material quantities from the cost plan.
	2.6 Windows and external doors	The total number of external doors was provided within the cost plan, while the number and area of windows was calculated using the BIM model.
	2.7 Internal walls and partitions	The proposed internal wall construction is provided in the cost plan, and extrapolated for the purposes of this assessment.
	2.8 Internal doors	The quantum of internal doors was made available in the cost plan.

Embodied Carbon Parameters

Table 1 (cont.): Illustrating the origin of information enabling embodied carbon analysis to be undertaken in accordance with RICS NRM 2 components.

Building element Group	Building Element	Origin of information
3 Finishes	3.1 Wall finishes	At this stage, wall finishes have not been finalised, however the cost plan indicates it is likely that the majority of walls will be finished with a coat of gypsum plaster and paint and therefore the appropriate quantity of plaster and paint has been included.
	3.2 Floor finishes	Floor finishes were provided within the cost plan.
	3.3 Ceiling finishes	Ceiling finishes have been provided within the cost plan.
4 Fittings, furnishings and equipment (FFE)	4.1 Fittings, furnishings and equipment, incl. Building related and non-building related	Information regarding FFE was limited, therefore assumptions have been made as to the likely inclusions within the hotel and incubator spaces.
5 Building Services / MEP	5.1 - 5.14 Services	The quantity of building services provided is based on information from the M&E consultant, and from generic EPDs produced by OneClickLCA based in GIA of the scheme..
6 Prefabricated buildings and building units	6.1 Prefabricated buildings and building units	There are no prefabricated elements within the scheme, therefore this has been excluded from the assessment.
7 Works to existing building	7.1 Minor demolition and alteration works	Works to the retained building are included within the cost plan and are therefore included in this report. The operational energy for the existing building has also been calculated and is included in the total whole life cycle figure.
8 External Works	8.1 - 8.8 External works	External works have been listed within the cost plan and included where possible.

GLA Benchmarks

In the most recent version of the GLA WLCA guidance note (March 2022) the benchmarks for which results of WLC assessments can be compared against, were updated. This update removed previous benchmark comparisons available under an 'apartment/ hotel category'.

This development is a mixed use scheme, comprised of industrial work space and hotel accommodation. Based on the GFA of different use types, hotel accommodation is the predominant use classification. Based on the updates to GLA guidance, benchmarking for 'Residential' buildings has been used, as this is the most comparable use type to hotels.

The two benchmarking targets provided represent a standard benchmark, representing an 'average' of multiple schemes, and an 'aspirational'. The aspirational target is a 40% reduction on the standard, in line with the RIBA 2030 challenge and World Green Building Council's Net Zero Targets, which suggest that a 40% reduction in embodied carbon emissions should be achieved by 2030.

The GLA does not currently refer to, or state any benchmarking guidance for operational carbon, therefore, this report uses Embodied Carbon Benchmarks only.

Modules	WLC Standard Benchmark kgCO2e/m2 GIA	WLC Aspirational Benchmark kgCO2e/m2 GIA
A1 - A5 (Excl. Sequestration)	<850	<500
B-C (Excluding B6& B7)	<350	<300
A- C (Excluding B6 & B7, including sequestration)	<1200	<800

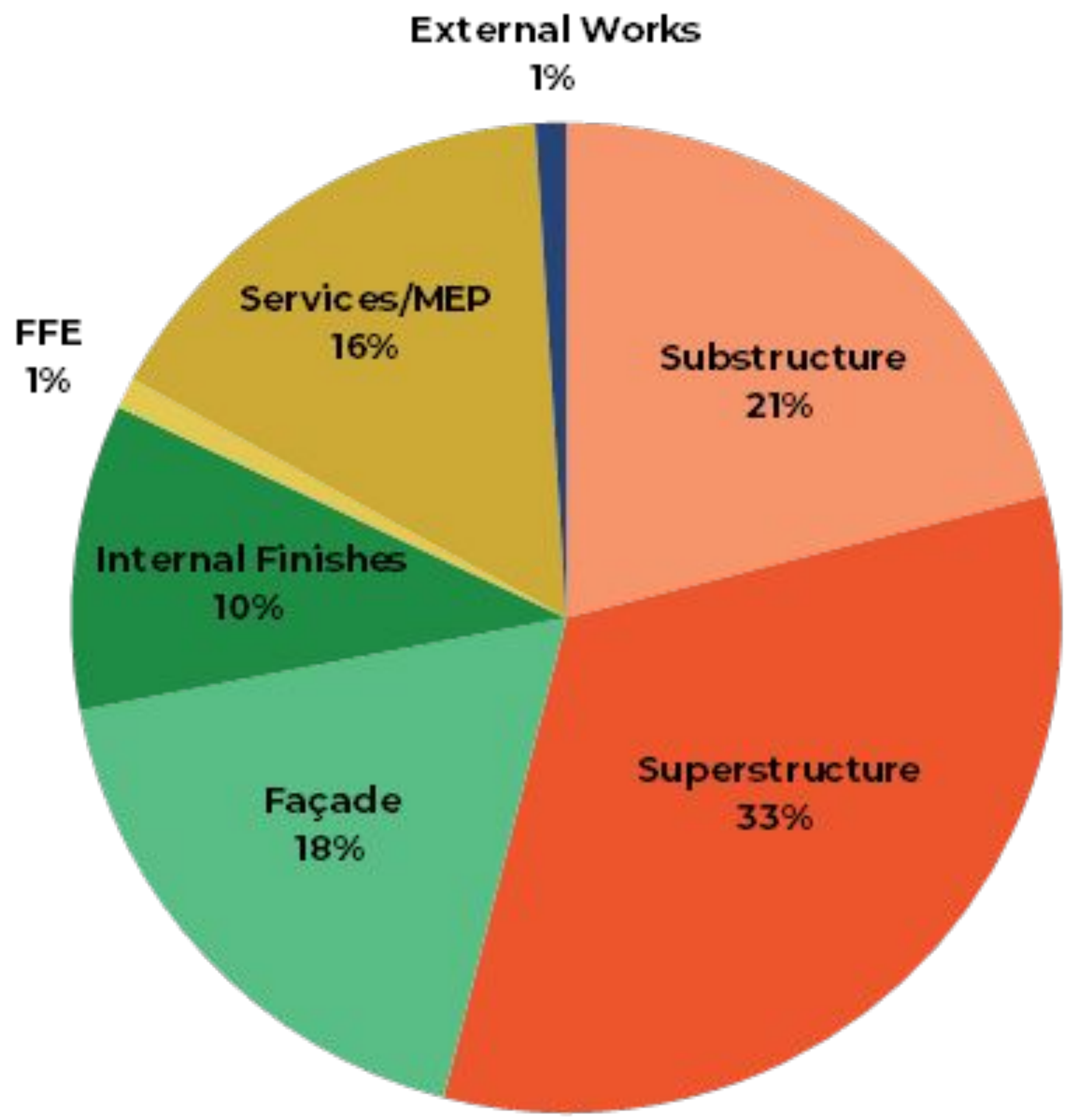


Figure 5 - Percentages of embodied carbon emissions by building element (A1-A3)

Operational Carbon Parameters

CIBSE TM54 modelling utilises a Dynamic Simulation Model (DSM) to calculate the space heating, cooling (if any) and fans & pumps power (plus space heating demand) whereas the remaining energy consumption figures are calculated using engineering calculations as stipulated within the CIBSE TM54 guidance.

The TM54 assessment for the proposed scheme assesses the refurbished and proposed building areas.

The Building fabric parameters used for the different areas are illustrated to the right.

The assessment of operational carbon emissions is compliant with paragraph 2.5.14 of the GLA WLCA guidance.

The existing hotel block already has a fully functioning, relatively modern (circa. 2015), HVAC system in the form of; a refrigerant pipework network connected to bedroom comfort conditioning units in the ceiling void, providing space heating and cooling; these are connected via rooftop outdoor condensers. An Air Handling Unit (AHU) supplies fresh air to each individual hotel room. DHW to the existing hotel building is currently supplied by a mix of gas boilers and heat pumps.

All the rooftop units will look to be repositioned to the higher part of the roof rather than fully replaced. The decision for repositioning is to align with the aims of the scheme to avoid the unnecessary increase of embodied carbon emissions (building services can often account for >30% of total embodied emissions in refurbishments). If deemed technically feasible, the boilers will either be replaced with heat pumps or the option for connecting to the site wide DHW network.

Further details of the assumptions used in the CIBSE TM54 Assessment may be found in Appendix D.

Building Fabric	Input	Unit	Comments
New-build Elements			
External Wall U-Value	0.15	W/m2k	Include unheated areas
Roof U-Value	0.12	W/m2k	-
Ground Floor U-Value	0.12	W/m2k	-
Window U-Value	1.3	W/m2k	-
Doors U-Value	1.2	W/m2k	-
Thermal Bridge Y-Value	<0.1	W/m2k	-
Window G-Value	0.5	-	-
Air Permeability	3	@50Pa (m.h3/m2)	A low air permeability required to improve mech vent efficiency

Building Fabric	Input	Unit	Comments
Existing Building			
External Wall U-Value	0.35/0.55	W/m2k	external or internal/cavity
Roof U-Value	0.18	W/m2k	-
Ground Floor U-Value	0.25	W/m2k	-
Window U-Value	1.6	W/m2k	-
Doors U-Value	1.5	W/m2k	-
Window G-Value	0.5	-	-
Air Permeability	<15	@50Pa (m.h3/m2)	-

Limitations

This WLCA Assessment has been completed using the most up to date information available pertaining to the project, as at the date of this report. Information pertaining to the operational and embodied carbon footprints may change as the design progresses.

Limited information was available in relation to Fittings, Furnishings and Equipment (FFE) and therefore certain assumptions were made as to likely inclusions. This should be reassessed at a later design stage, once as built drawings and specifications are available.

As acknowledged in GLA guidance, during the design stages, module B can be challenging to estimate. On this basis, modules B2 and B3 have been calculated in accordance with paragraph 2.5.12 of the GLA WLCA note.

Other assumptions that have been made relating to quantities are listed below. These may change once detailed design details are available at the Technical Design Stage:

- Transportation, Waste Factors and Material Life Spans are presently unknown, and therefore are temporarily listed as per default figures associated to EPDs within One Click LCA.
- The quantities of recycled content and recycling rates for modules C-D are set in coherence with RICS default values as per the RICS PS assumption document. The calculations currently allow for 50% recycled GGBS replacement in the concrete, it is the developer's intention that this figure is retained, or improved upon. Calculations also take in to account that all reinforcement steel required will be from at least a >90% recycled source.

Specification of M&E services has not yet been finalised, and therefore a combination of both CIBSE TM65 methodology, and generic EPD data provided by One Click LCA for building services, has been used which are based on GFA. to calculate the embodied carbon emissions associated with Building Services. All EPDs pertaining to Building Services comply with EN15804 standards. At the later design stages once M&E has been specified, the assessment should be updated to reflect more accurate information.

Section Three

3 Mitigating Embodied Carbon

Steps Taken to Reduce Embodied Carbon

Embodied Carbon Comparisons

Love Design Studio were appointed during the very early stages of this scheme, which allowed for involvement with the specification of materials based on their potential embodied carbon emissions.

In accordance with LETI guidance, multiple embodied carbon comparisons were undertaken at the early design stages reviewing different construction methods and materials.

These assessments looked at iterations of the superstructure and frame, balcony construction as well as external facade options. An example of how these assessments have helped steer design can be seen from modelling the structural framing options, which suggested that a concrete frame with 50% recycled GGBS coupled with 100% recycled steel reinforcement, would outperform a Steel Metaframe option with <60% recycled content, when reviewing life cycle stages A1 - A3.

An example of some of the structures assessed can be observed in the figure below.

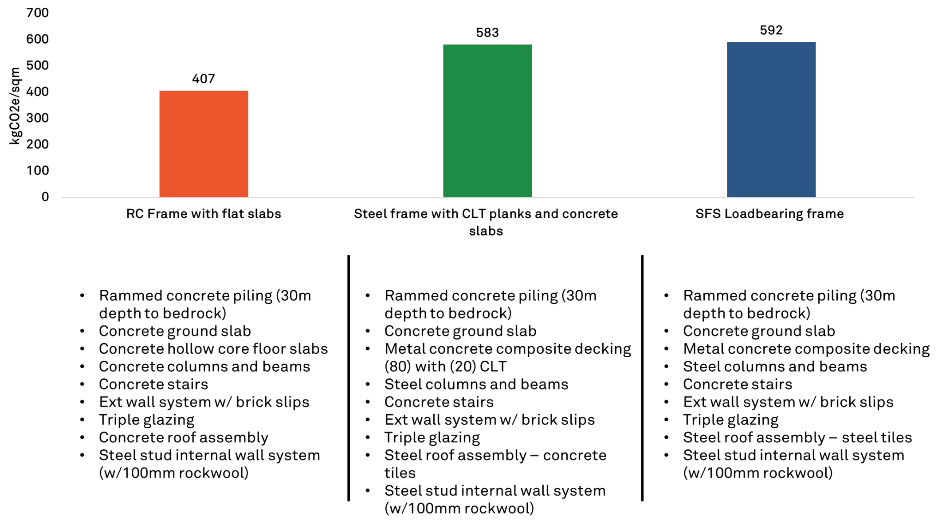


Figure 6 - Examples of structural design iterations assessed based on embodied carbon emissions.

Integrating principles of the GLA WLCA Guidance

All of the WLC principles contained in Table 2.1 of the GLA guidance have been considered within this design, and many are also elaborated upon in the Circular Economy Statement. Some of the principles which have resulted in significant embodied carbon savings are listed below. A full list of these principles, and how they have been integrated in to the design can be found in the appendices.

1. Reuse and retrofit of existing buildings

Embodied carbon assessments were undertaken to assess the impact of demolishing the existing building on site, versus retaining and refurbishing. This assessment indicated that refurbishment of the existing building would result in embodied carbon savings of approximately 2,800tCO2e in comparison with demolishing the existing building and reconstructing a building with the same Gross Floor Area (GFA). Therefore, it was decided that the most sustainable and feasible option was to refurbish the existing hotel building onsite.

2. Use repurposed or recycled materials

Early stage embodied carbon comparisons assisted in demonstrating to the team the importance of specifying materials with recycled content. All concrete used within the superstructure will utilise a minimum of 40% recycled binder, which is a component of concrete that typically has high embodied carbon emissions. This design decision has resulted in embodied carbon savings of approximately 1,100tCO2e

Similar savings have been made on multiple construction materials across the scheme, including the specification of recycled steel reinforcement for the concrete.

3. Material selection

Where LDS were able to input on material specification, emphasis on avoiding metal was utilised. This enabled the design team to make educated decisions, particularly on finishes, where metal raised access panels and suspended ceilings can have an unexpectedly large impact on embodied carbon as explained in the LETI Embodied Carbon Primer document. Self finishing materials such as concrete, and other exposed materials and services will therefore be implemented as far as is feasible within the scheme.

4. Minimise operational energy use

As per the accompanying energy statement, careful design and extensive dynamic simulation modelling of the scheme has been carried out to result in a building with a low energy demand.

9. Designing for durability and flexibility

As a result of the incubator space on the lower floors of the building, durability and flexibility was implemented at the heart of the scheme's design. Functional adaptability was embedded in these areas, part of this was achieved through the use of non-loadbearing internal walls throughout the building, which will allow future tenants of the incubator space to grow and adapt the area, without compromising the building's structural integrity.

14. Minimising Waste

A construction waste management plan will be implemented and adhered to minimise the amount of unnecessary waste caused along the construction process. Further information is set out in the Circular Economy Statement.

16. Circular Economy

A circular approach to this development has underpinned the design of this scheme to date, and more information is available in the supporting Circular Economy Statement.

Section Four

4 Embodied Carbon Results

Embodied Carbon Results

Summary

The approximate embodied carbon emissions for the proposed development is **11,812 tonnes CO2e** (modules A-C, excluding B6 & B7, including sequestration), or **580kgCO2e/m2** GIA based on the total GFA of 20,372 m2. This is broken down in the table below.

Benchmark Comparison

The results indicate that the scheme currently outperforms the GLA aspirational targets across all stages. This is attributable to the circular approach adopted; prioritising refurbishment first and thereafter, specifying low carbon materials, together with the use of hard wearing finishes and facades.

Future Steps

A static assessment should be undertaken at the as built stage, to provide accurate comparison of the benchmark results for the scheme, as advised in paragraph 1.4 of the RICS WLCA guidance.

Table 2: Embodied Carbon Results for the proposed scheme at Uxbridge Road.

Module	GLA WLC Benchmark (kgCO2e/m2 GIA)	Aspirational WLC Benchmark (kgCO2e/m2 GIA)	Uxbridge Road (kgCO2e/m2 GIA)
A1 - A5 (excluding sequestration)	<850	<500	**369**
B - C (excluding B6 & B7)	<350	<300	**211**
A - C (excluding B6 & B7, including sequestration)	<1200	<800	**580**

Embodied Carbon Analysis

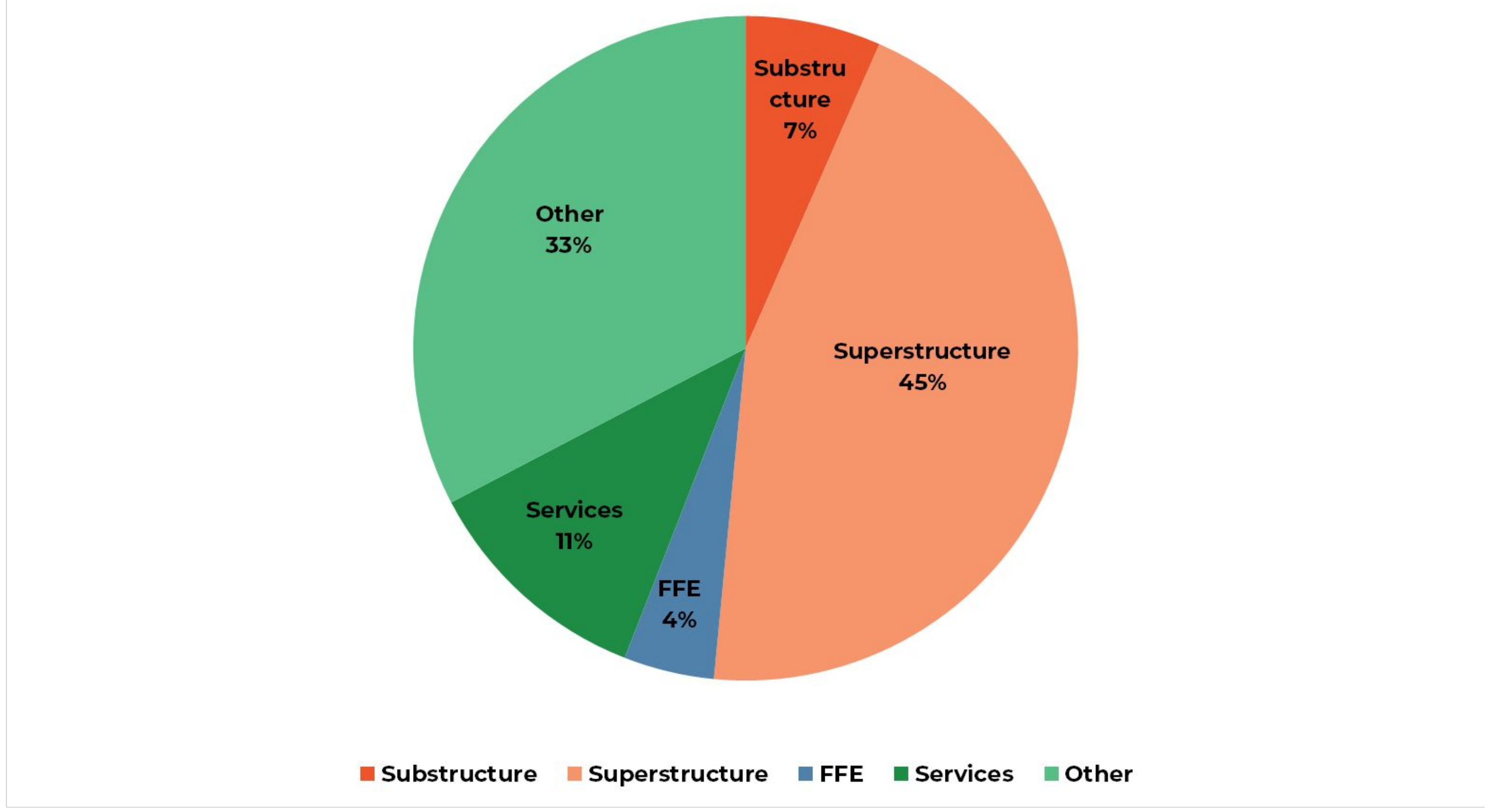
Embodied Carbon - By Building Element

The study has demonstrated that the superstructure of the proposed scheme will have the highest impact on the overall embodied carbon emissions. Note that in this graph, the superstructure includes the facade and internal finishes. The substructure is relatively low in comparison to the GLA average breakdown figures. This can be attributed to the use of rammed concrete piling, as opposed to utilising steel core piling foundations, which generally have far higher A1-A5 emissions.

Embodied Carbon - By Life Cycle Stage

As acknowledged in most WLCA guidance, module A of the lifecycle stage should be expected to represent the highest contributing category to a buildings embodied carbon emissions as a result of the energy intensive processes involved across A1 - A5. 56% of the emissions by life cycle stage are emanate from the Product Stage, and a further 17% during the Construction Process. Transportation emissions have been reduced by emphasising the importance of sourcing local materials where possible to the design team across several workshops.

Module B represents the Use stage, and in this instance accounts for 24% of the scheme's total embodied carbon emissions, primarily attributable to the assumed replacements and repairs that are likely to be required over the buildings 60 year life span. In terms of quantitative emissions, the scheme performs well at the Use stage, as many hard wearing finishes have been specified, including exposed and polished concrete, as well as an ultra high performance concrete which is to be used on the facade of the building that requires less maintenance than traditional concrete.



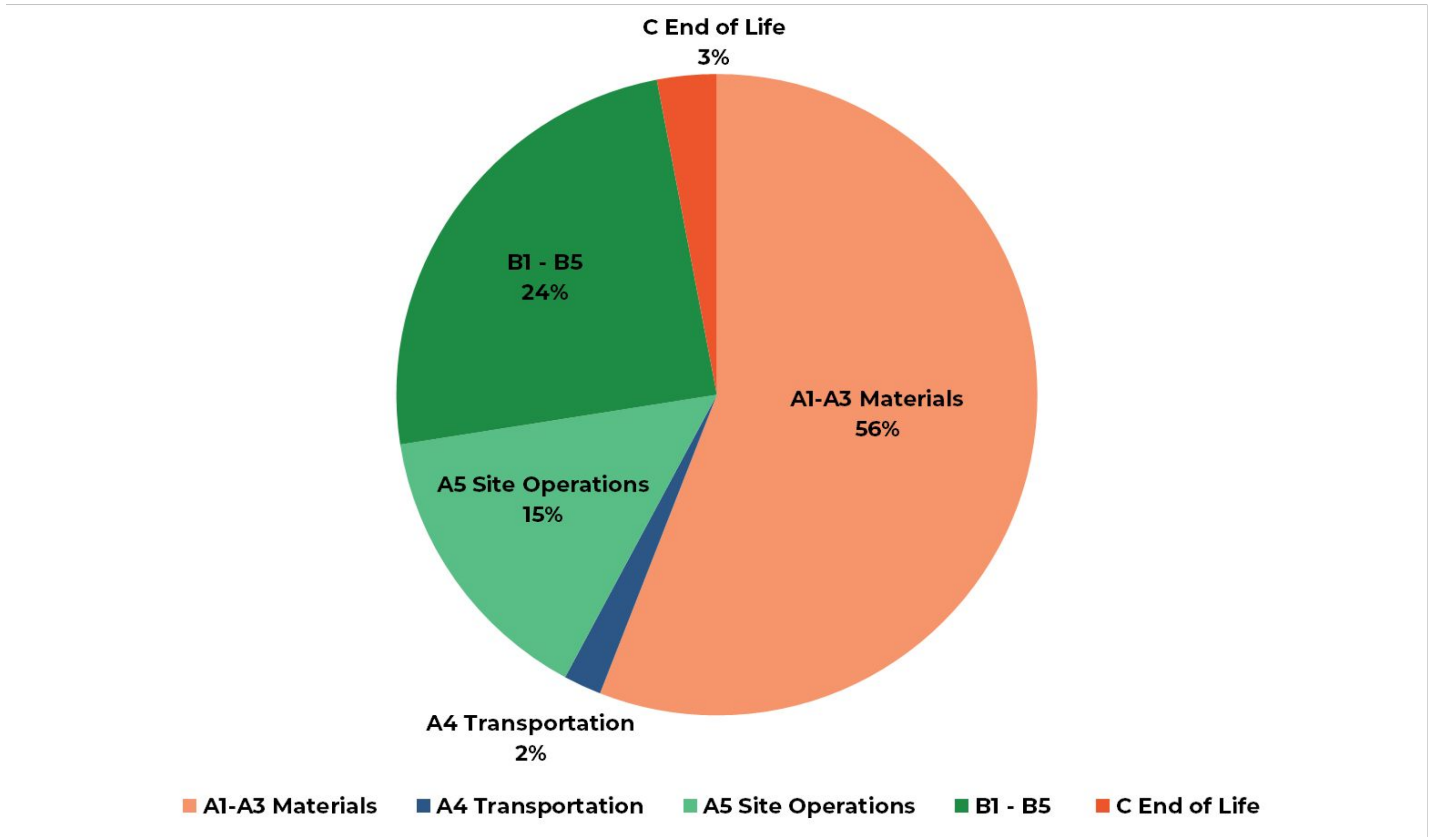


Figure 7 - Embodied carbon results for the proposed scheme based on building component (top) and life cycle stage (bottom)

Section Five

5 Operational Carbon Results

Operational Carbon Results

The estimated total operation carbon emissions have been calculated over a 60-year life span based on two sets of carbon factors, as requested in the GLA guidance.

TM54 analysis indicates that the total operational emissions for the proposed development over a period of 60 years are 24,415tCO_2e, or 1,198kgCO_2e/m2.

The graph to the right indicates that the highest contributors are domestic hot water, lighting and auxiliary, which is to be expected from a building of this use type.

To capitalise on the energy associated with DHW, Wastewater Heat Recovery systems (WWHRS) are being considered. Further information on how energy demand has been reduced in design can be found in the Energy and Sustainability Statement.

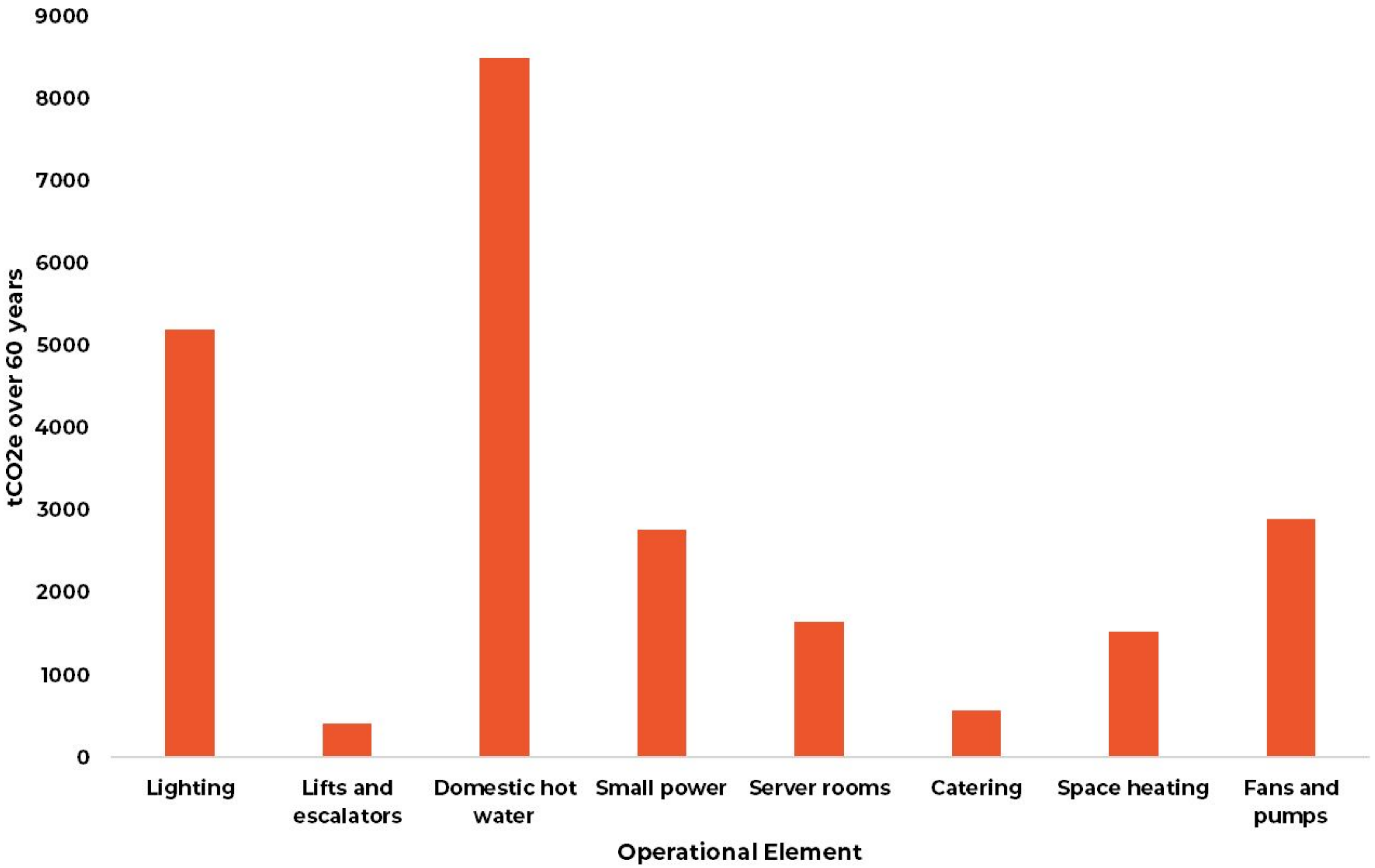


Figure 8 - Operational Carbon Results calculated using TM54 analysis by building operation

Section Six

6 Whole Life-Cycle Carbon Results

Whole Life Cycle Carbon Results

The total whole life-cycle carbon emissions using SAP10 carbon factors are estimated at 36,227tCO2e or 1,804kgCO2e / m2 over the buildings assumed lifespan of 60 years.

At this stage, the design has an embodied carbon value of approximately 580kg CO2e/m2 and a whole life cycle value of 1,778kg CO2e/m2 when including operational use.

The pie chart to the right shows that the embodied carbon accounts for approximately 33% of the buildings overall carbon emissions, while operational accounts for around 67%.

From an operational perspective, the energy strategy has complied with all principles of the London Energy Hierarchy and either met or exceeded the required quantum of CO2 reduction in accordance with both policy and latest Part L Building Regulations.

The embodied carbon emissions of this proposed scheme at Uxbridge Road demonstrate exemplary performance, achieving and exceeding the targets that were set at the outset of the feasibility stage, based upon LETI and RIBA 2030 guidance.

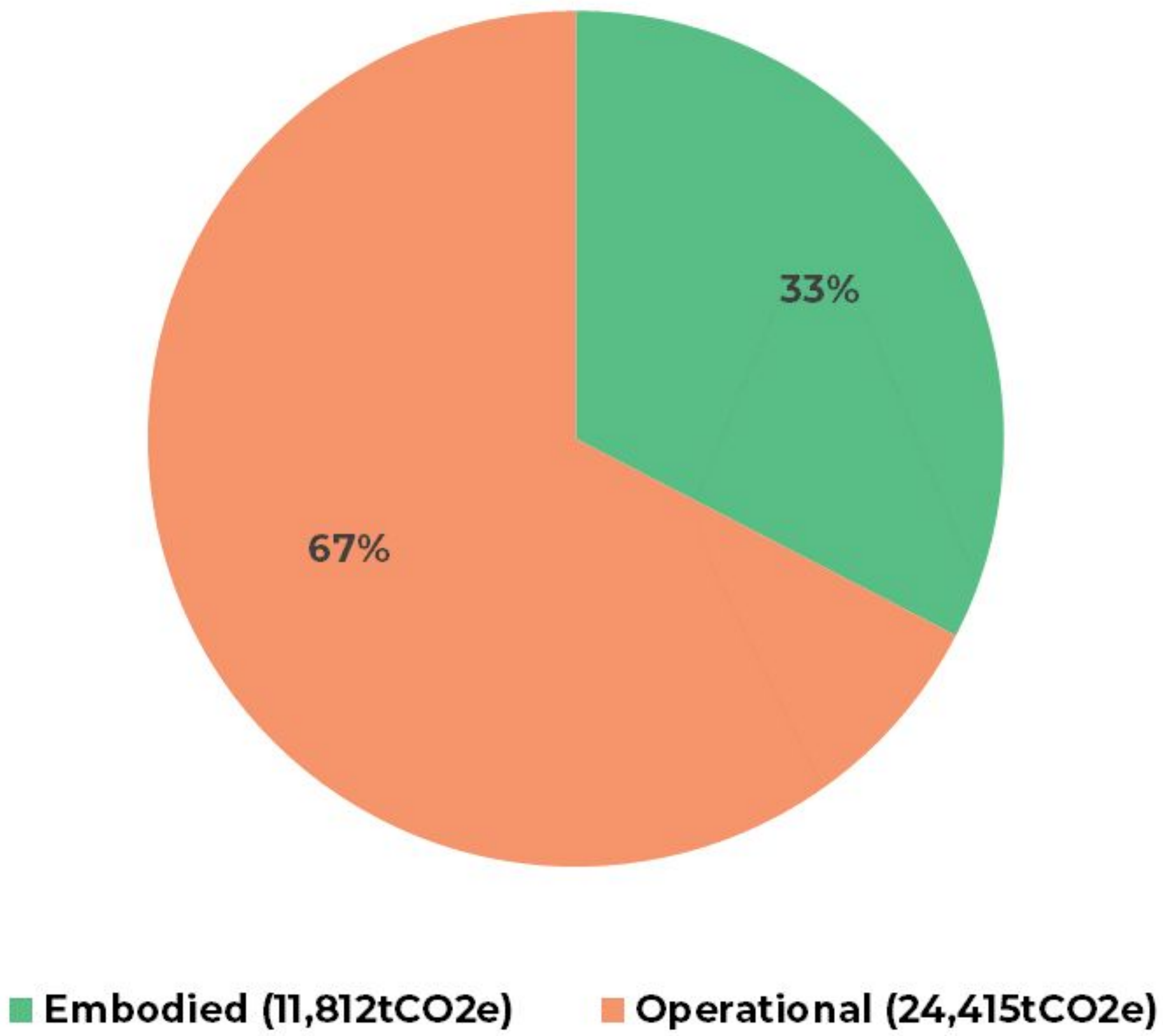


Figure 9 - Breakdown of the proposed developments overall emissions by embodied (green) and operational (red)

Section Seven

7 Further Opportunities

Future Opportunities for Reductions

As the scheme progresses through the design stages, there will be several further opportunities for additional embodied carbon reductions to be made.

Source Sustainably

Efforts to source and specify local materials should be of paramount importance, in conjunction with the implementation of a Sustainable Procurement Plan. Such measures will also assist the scheme in achieving its internal target of BREEAM Very Good.

This assessment has demonstrated that almost 220 tonnes CO2e are currently attributed to transportation of materials and therefore this figure can be reduced by reducing transportation distances.

Design to Eliminate Waste

During the demolition phase, pre demolition audits should be undertaken prior to any demolition works going ahead. These reports will be made available to the architects and structural engineers, to assess whether on site circularity is viable, and also to review opportunities for closed loop recycling.

Manage Waste Sustainably

Once cost plans have been finalised for the construction stage, a construction waste management plan will be implemented and managed by the construction company on site, to avoid unnecessary waste.

Integrate Circularity

Above all, the principles of the accompanying Circular Economy statement should also be followed to assist in reducing emissions across all life cycle stages.

Cement Replacements and Recycled Steel

Within this assessment, all concrete within the superstructure has been included with a minimum of 40% recycled binder content, and all reinforcement steel within the superstructure has been reclaimed or recycled from other projects. There is the potential for additional recycled content to be used within the concrete, and depending on the structural integrity requirements, recycled content for both steel and concrete could also be implemented within the substructure.

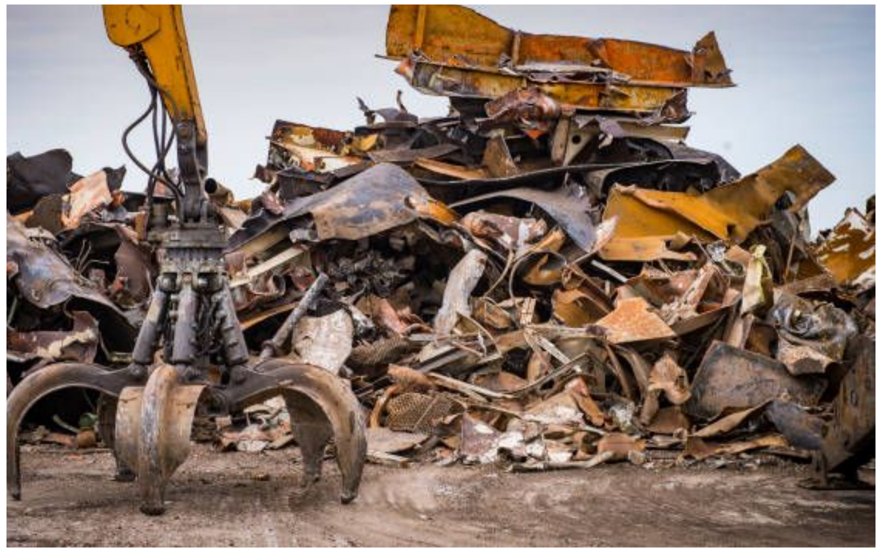
Timber Based Products

Consider using natural materials and timber based products across all building elements where feasible. If the opportunity should arise, then timber should replace any steel or concrete counterpart, providing that all fire safety requirements are adhered to. Additionally, specification of timber suspended ceilings and flooring can result in very significant embodied carbon savings. Therefore, when the detailed design process commences, consideration should be given to natural and timber products which are both regenerative and contribute to sequestration of CO2 from the atmosphere.

Design for Adaptability and Disassembly

The scheme has already given consideration to adaptability within the incubator spaces on the lower floors. This principle should be rolled out across the entire scheme if possible, with functional adaptability at the forefront of design decisions.

To reduce emissions at the end of life cycle stages, the scheme should consider ease of disassembly, and prioritise materials that are capable of closed loop recycling.



Section Eight

8 Conclusion

Conclusion

Whole Life-Cycle Carbon

been prepared on behalf of Infinite Partners (the applicant) as part of a planning application to the London Borough of Hillingdon (the Local Planning Authority).

The WLCA has been undertaken pursuant to Policy SI 2 of the London Plan (2021) and in accordance with London Plan Guidance on WLCA (March 2022). The report should be read in conjunction with the WLCA Template, contained within Appendix E.

The scheme set WLCA targets based on the aspirational targets of the GLA, and other best practice guidance, such as those included in LETI's Embodied Carbon Primer, the 40% reduction target set by the UKGBC and the RIBA 2030 climate challenge.

The total whole life-cycle carbon emissions using SAP10 carbon factors are estimated at 36,227tCO2e or 1,778kgCO2e / m2 over the buildings assumed lifespan of 60 years.

The results indicate that at this stage the scheme is outperforming the GLA aspirational targets and achieving some of the aspirational targets set by LETI and RIBA.

Embodied Carbon

The embodied carbon footprint of the scheme totals 11,812tCO2e over an assumed life span of 60 years.

This can be broken down as 580 kgCO2e/ m2.

Significant embodied carbon savings have been made in the early design stages through careful material specification and by designing to retain and refurbish the existing building on site, rather than demolishing and rebuilding. Once complete, the refurbished building accounts for around 40% of the GIA of the proposed development.

There is the potential for further savings to be made as the design progresses to the detailed design stage, which are expanded upon in the body of this report.

The largest contributing life-cycle stage factors to the overall embodied carbon footprint are A1-A3, which accounts for 54% of the total embodied carbon emissions.

The most contributing element of the building is the superstructure, which is accountable for approximately 45% of the schemes embodied carbon.

The results indicate that at this stage the scheme is outperforming the GLA aspirational WLCA targets.

Operational Carbon

The results of the TM54 Energy assessment indicate that the operational Carbon Footprint for the proposed scheme over an assumed life span of 60 years totals 24,415tCO2e.

This can be broken down as 1,198 kgCO2e/m2.

In accordance with GLA and LPA policy, the scheme has been carefully designed to reduce its carbon emissions in Operation.

The scheme adopted the principles of the energy hierarchy, Be Lean, Be Clean, Be Green to maximise on-site carbon reduction and then uses a carbon offset any remaining emissions. Please refer to the energy statement for further detail.

The most contributing elements to the operational carbon footprint are domestic hot water, fans and pumps and space heating.

Section Nine

9 Appendices

Appendix A - Table of Results

Whole Life-Cycle Carbon Assessment

Result Category	Biogenic Carbon (kgCO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site Operation	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material Replacement	B6 Operational Energy Use	B7 Operational Water Use	C1 Deconstruction	C2 Wast transportation	C3 Waste processing	C4 Waste disposal	Total kg CO2e	D External Impacts
0.1 Toxic Materials		2612													2612	
0.2 Demolition											17360				17360	
0.3 Supports		83264	772	2896								1578	104		88614	-33274
0.4 Gound works																
0.5 Diversion																
1 Substructure		937796	32057	42461								39283	10381	1	1061980	-325208
2.1 Frame		495759	27642	20245								18928	1805		564380	-177842
2.2 Upper Floors	-108279	2608717	121162	123515				1151160				82048	230582	228	4209134	-1482784
2.3 Roof	-6663	47816	877	2034				9041				938	13019	84	67147	-35623
2.4 Stairs and Ramps		257383	1562									1990	235		261170	-29983
2.5 Ext. Walls		751760	30460	47668				81061				14474	1453	195	927071	-137566
2.6 Windows & Ext. Doors	-46696	529871	843					536740				5578	47060	85	1073480	-26883
2.7 Int. walls and partitions		204591	1135	27114				216914				10839	350		460942	-2385
2.8 Int. Doors	-10578	12209	31					12532				258	10610	2	25065	-26417
3 Finishes	-24065	142442	1460	15954				231147				2537	25454	1363	396291	-119636
4 FFE	-14080	107280	178	1676				341032				65	14179	30	450360	0
5 Services (MEP)		420174	902	4872	8098			845482				3213	289	22	1589053	-484565
6 Prefabricated																
7 Existing bldg																
8 Ext. works		19088	732									588.2	63		20471	-3681
Unclassified / other	-93361			700000		44823	50930						93361		744823	
TOTAL kgCO2e	-303721	6620763	219812	1684383	8098	248543	50930	3425109	24415126	306000	17360	182318	448944	2009.57	11959952	-2885849

Appendix B - Principles of WLCA guidance

No	Principle	Description	Relevant life-cycle modules
1	Reuse and retrofit of existing built structures	Embodied carbon assessments were undertaken to assess the impact of demolishing the existing building on site, versus retaining and refurbishing. This assessment indicated that refurbishment of the existing building would result in embodied carbon savings of approximately 2,800tCO2e in comparison with demolishing the existing building and reconstructing a building with the same Gross Floor Area (GFA). Therefore, it was decided that the most sustainable and feasible option was to refurbish the existing hotel building onsite.	A1-A5, B1-B6, C1-C4, D
2	Use recycled or repurposed materials	Early stage embodied carbon comparisons assisted in demonstrating to the team the importance of specifying materials with recycled content. All concrete used within the superstructure will utilise a minimum of 40% recycled binder, which is a component of concrete that typically has high embodied carbon emissions. This design decision has resulted in embodied carbon savings of approximately 1,100tCO2e Similar savings have been made on multiple construction materials across the scheme, including the specification of recycled steel reinforcement for the concrete. .	A1-A5, B1-B5, C1-C4, D
3	Material selection	Where LDS were able to input on material specification, emphasis on avoiding metal was utilised. This enabled the design team to make educated decisions, particularly on finishes, where metal raised access panels and suspended ceilings can have an unexpectedly large impact on embodied carbon as explained in the LETI Embodied Carbon Primer document. Self finishing materials such as concrete, and other exposed materials and services will therefore be implemented so far as is feasible within the scheme.	A1-A5, B1-B5, C1-C4, D
4	Minimise operational energy use	As per the accompanying energy statement, careful design and extensive dynamic simulation modelling of the scheme has been carried out to result in a building with a low energy demand.	A1-A5, B1- B4, B6
5	Minimise operational water use	Operational water use will be minimised within the scheme, to achieve BREEAM Very Good requirements for Water, as set out in the London Plan Guidance. Low flow appliances will be specified to the hotel units, and leak detection systems will be investigated at the later design stages. Rainwater harvesting will also be provided to the scheme to further reduce onsite water consumption.	A1-A5, B1-B5, B7, C1-C4, D
6	Disassembly and reuse	Designing for future disassembly ensures that products do not become future waste and that they maintain their environmental and economic value. A simple example is using lime rather than cement mortar; the former being removable at the end of a building’s life, the latter not. This enables the building’s components (e.g. bricks) to have a future economic value as they can be reused for their original purpose rather than becoming waste or recycled at a lower level (e.g. hardcore in foundations). Designing building systems (e.g. cladding or structure) for disassembly and dismantling has similar and even broader benefits. Ease of disassembly facilitates easy access for maintenance and replacement leading to reduced maintenance carbon emissions and reduced material waste during the ‘in-use’ and ‘end of life’ phases. This leads to the potential for material and product reuse which also reduces waste and contributes to the circular economy principle.	A1-A5, B1-B5, C1-C4, D

Appendix B - Cont.

No	Principle	Description	Relevant life-cycle modules
7	Building shape and form	Compact efficient shapes help minimise both operational and embodied carbon emissions from repair and replacement for a given floor area. This leads to a more efficient building overall, resulting in lower construction and in-use costs A complex building shape with a large external surface area in relation to the floor area requires a larger envelope than a more compact building. This measure of efficiency can be referred to as the 'wall to floor ratio', or the 'heat loss form factor'. This requires a greater use of materials to create the envelope, and a potentially greater heating and /or cooling load to manage the internal environment.	A1-A5, B1-B6
8	Regenerative design	Removing CO2 from the atmosphere through materials and systems absorbing it makes a direct contribution to carbon reduction. Examples include unfinished concrete, some carpet products and maximising the amount of vegetation.	A1, B1, D
9	Designing for durability and flexibility	As a result of the incubator space on the lower floors of the building, durability and flexibility was implemented at the heart of the scheme's design. Functional adaptability was embedded in these areas, part of this was achieved through the use of non-loadbearing internal walls throughout the building, which will allow future tenants of the incubator space to grow and adapt the area, without compromising the building's structural integrity.	A1-A5, B1-B5, C1-C4, D
10	Optimisation of the relationship between operational and embodied carbon	Extensive dynamic simulation modelling has been undertaken over the course of the design process to monitor likely performance of the building. The building fabric is to a high standard,, while all windows are available to allow for natural ventilation to take place.Fully glazed facades have been avoided where possible, and cooling via exposed thermal mass has been put at the forefront of the design. There is a good relationship between the operational and embodied carbon emissions at this scheme.	A1-A5, B1-B6
11	Building life expectancy	Longevity has been prioritised with the facade design, which will be comprised of an ultra high performance concrete and require little to no maintenance throughout its use. The use of exposed finishes internally also increase the longevity of the scheme.	A1-A5, B1-B5, C1-C4, D
12	Local sourcing	Sourcing local materials reduces transport distances and therefore supply chain lengths and has associated local social and economic benefits e.g. employment opportunities. It also has benefits for occupiers as replacement materials are easier to source. Transport type is also highly relevant. A product transported by ship will have a significantly lower carbon cost per mile than one sent by HGV. A close understanding of the supply chain and its transport processes is therefore essential when selecting materials and products.	A1-A5, B3- B4

Appendix B - Cont.

No	Principle	Description	Relevant life-cycle modules
13	Minimising waste	Waste represents an unnecessary and avoidable carbon cost. Buildings should be designed to minimise fabrication and construction waste, and to ease repair and replacement with minimum waste, which helps reduce initial and in-use costs. This can be achieved through the use of standard sizes of components and specification and by using modern methods of construction. Where waste is unavoidable, the designers should establish the suppliers' processes for disposal or preferably reuse of waste.	A1-A5, B1-B7, C1-C4, D
14	Efficient fabrication	A construction waste management plan will be implemented and adhered to minimise the amount of unnecessary waste caused along the construction process. Further information is set out in the Circular Economy Statement.	A1-A5, B1-B7, C1-C4, D
15	Lightweight construction	Lightweight construction uses less material which reduces the carbon footprint of the building as there is less material to source, fabricate and deliver to site. Foundations can then also be reduced with parallel savings. Lightweight construction can also be easier to design for future disassembly and reuse. The benefits of lighter construction should be seen in the context of other principles such as durability.	A1-A5, C1- C4, D
16	Circular economy	A circular approach to this development has underpinned the design of this scheme to date, and more information is available in the supporting Circular Economy Statement.	A1-A5, B1-B5,C1-C4, D

Appendix C - EPD Data

Main > Uxbridge Road for Planning WLCA > Design 2 for planning > Whole life carbon assessment, GLA / RICS

Design 2 for planning - Whole life carbon assessment, GLA / RICS

Project basic information

Result report: Design 2 for planning

Project	Uxbridge Road for Planning WLCA - Design 2 for planning
User	Andrew Love - 01.08.2022
Tool	Whole life carbon assessment, GLA / RICS
Details	This tool meets the RICS professional statement and guidance, whole life carbon assessment for the built environment 1st edition, November, 2017 and RIBA Embodied and whole life carbon assessment for architects.
General information	
Type	Hotels and similar buildings
Country	United Kingdom
Address	Uxbridge Road, London
Gross Floor Area (m²)	20372
Number of above ground floors	13
Frame type	concrete

Carbon Heroes Benchmark

Results

Completeness (%) and plausibility checker (-)

Most contributing materials

Graphs

Data sources

Sources

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Adjustable table	24 kg/unit	Enlite	KI	SCS Global	SCS-EPD-04593	EPD KI Office tables	ISO14040	Third-party verified (as per ISO 14025)

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Aluminium frame window	24.27 kg/m2, 2.3 m2/unit		Organisation professionnelle représentative des concepteurs, fabricants et installateurs de menuiseries extérieures en profilés aluminium	INIES	INIES_CFEN20181017_145645, 8715	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Aluminium framed double glazed doors, per m2	79.5% glass, 15.7% aluminium, 2.2% steel, 44 kg/m2, width:1.23m, height:2.18m, 6mm toughened and 8.8mm laminated glass	Edge Symmetry	Optima	International EPD System	S-P-05433	EPD Aluminium Framed Double Glazed Doors	EN15804+A1, EN15804+A2	Third-party verified (as per ISO 14025)
Asphalt, generic, compacted	5/95% bitumen-aggregate ratio, 2350 kg/m3			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Bitumen vapour barrier for roofs	0.35 kg/m2	DONNEE PAR DEFAUT	DED	INIES	INIES_DSGU20220304_165616, 29395	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Bitumen-polymer membrane roofing, 2 layer, fully torched			EWA	EPD Norge	NEPD00269E	Multi layer fully torched modified bitumen roof waterproofing system, Bitumen Waterproofing Association	EN15804+A1	Third-party verified (as per ISO 14025)
Cellar and service door with metal frame	24.28 kg/m2	TRADIMETAL PLANIMETAL JARDIN	KEYOR	INIES	INIES_INNT20220310_183545, 29566	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Concrete balcony assembly	200 mm			One Click LCA		One Click LCA generic construction definitions		
Concrete ground slab assembly incl. insulation	550 mm			One Click LCA		One Click LCA generic construction definitions		
DPL laminate flooring	8 mm, 800-1200 kg/m3		EPLF	IBU	EPD-EPL-20150021-CBE1-EN	EPD Direct Pressure Laminate Floor Covering (DPL Floor Covering) European Producers of Laminate Flooring e.V.	EN15804+A1	Third-party verified (as per ISO 14025)

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Drinking water supply piping network, per m2 GIFA (residential buildings)				One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
EPS Insulation	T: 10-2400 mm, 600 x 1200 mm, 0.031 W/m2K, 16 kg/m3		EPS-gruppen	EPD Norge	NEPD-1236-244-EN	EPD Lavlambda EPS 80 isolasjon (trykklasse 80) EPS-gruppen	EN15804+A1	Third-party verified (as per ISO 14025)
Emulsion matt paint for allround interior use	Pigment: Lightfast Pigments, binder: PVA Copolymer emulsion , solvent: Water, 1.443 kg/l, 18m2/l, 0.16 kg/m2	Supermatt White, Almond White, Gardenia, Magnolia, Light Base, Medium Base	Dulux Trade	MRPI	1.1.00023.2017	EPD Dulux Trade Supermatt	EN15804+A1	Third-party verified (as per ISO 14025)
Excavation works		kg or m3 of removed masses	Required for IMPACT calculations	One Click LCA	-		EN15804	Internally verified
Extensive green roof system	40mm, 23.34 kg/m2	Urbanspace	Knauf	IBU	EPD-KNI-20160071-CBA1-EN	EPD URBANSCAPE Extensive Green Roof System	EN15804+A1	Third-party verified (as per ISO 14025)
Exterior aluminum doors, glazed	37.2 kg/m2	ALU80, ALU60	CETIH MACHECOUL	INIES	INIES_IXYF20220311_084509, 29441	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
External wall, for apartment building, concrete sandwich element, mineral wool	U = 0.14 W/m2K (Pykälä 33)			One Click LCA		One Click LCA generic construction definitions		
Fibre cement facade cladding panel	8 mm, 13.2 kg/m2, 1650 kg/m3, Lambda=0.407 W/(m.K)	NATURA, TEXTRUA, MATERIA	Eternit GmbH (Neubeckum plant)	IBU	EPD-ELH-20180136-CAC1-EN	EPD NATURA, TEXTURA and MATERIA Fiber-Cement Panels	EN15804+A1	Third-party verified (as per ISO 14025)
Fibre cement facade cladding panel	13 mm, 1200 x 2500-3600 mm, 26-31.5 kg/m2, 2000-2400 kg/m3, Lambda=2 W/(m.K)	öko skin	Rieder Faserbeton-Elemente GmbH	IBU	EPD-RSE-20180069-IAD1-DE	EPD concrete skin' and 'öko skin' – Glass-fibre-reinforced concrete Rieder Sales GmbH	EN15804+A1	Third-party verified (as per ISO 14025)
Filter fabric N2				One Click LCA	-	Polypropylene (PP), Environmental Product Declarations of the European Plastic Manufacturers	ISO14040	Internally verified

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatio
Floor screed mortar, cement screed	1500 kg/m3, EPD coverage: > 1500 kg/m3		quickmix Gruppe GmbH & Co. KG	IBU	EPD-QMX-20160208-IBC1-DE	Oekobau.dat 2017-I, EPD Mineralische Werkmörtel: Estrichmörtel - Zementestrich quick-mix Gruppe GmbH & Co. KG	EN15804+A1	Third-party verified (as per ISO 14025)
Foam backed vinyl (PVC) flooring, heterogeneous	2.6 mm, 1.8 kg/m2	TX Classic	Tarkett	International EPD System	S-P-01347	EPD Tapiflex and TX heterogeneous vinyl flooring	EN15804+A1	Third-party verified (as per ISO 14025)
Formwork concrete elements for floor slabs	127.9 kg/m2	Gamme PREDALLE BA RECTOR BAS CARBONE de 50 à 70 mm d`épaisseur	RECTOR LESAGE SAS	INIES	INIES_IPRE20210701_155415, 27636	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Formwork for load-bearing wall, without filling concrete	274.34 kg/m2	Gamme PREMUR RECTOR Bas Carbone de 18 à 40 cm d`épaisseur	RECTOR LESAGE SAS	INIES	INIES_IPRE20210701_151337, 26776	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Galvanized steel suspended ceiling panels for interior use	47 mm, 6.42 kg/m2	Easy-Klima Plus® panels	Interalu NV	MRPI	1.1.00258.2021	EPD Interalu Easy-Klima Plus ceiling	EN15804+A1, EN15804+A2	Third-party verified (as per ISO 14025)
Glass facade	size: 3.6 x 7.2m, double glazing, 51.67 kg/m2	Curtain wall Concept Wall® CW 60 – CW 60 HI	Reynaers	European Aluminium	EPD EUROPEAN ALUMINIUM 2020 – REYNAERS 14	EPD Curtain wall Concept Wall® CW 60 – CW 60 HI Declaration	EN15804+A1	Third-party verified (as per ISO 14025)
Glass, sky light or roof, with frame, per kg				ICE	-	ICE database August 2019, V3.0	EN15804+A1	Self declared
Green roof assembly, with hollow-core concrete deck				-		One Click LCA generic construction definitions		
Gypsum plaster for facades and interior walls	24 kg/m2	PRB OZE	PRODUITS DE REVÊTEMENT DU BÂTIMENT	INIES	INIES_IFHY20211012_143733, 27594	FDES	EN15804+A1	Third-party verified (as per ISO 14025)

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Heat distribution system (water heat distribution) for educational or commercial buildings	per m2 GFA			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Heat distribution system (water heat distribution) for residential building	per m2 GFA			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
High density polyethylene membrane	0.069 kg/m2	Soft Xtra	Isola	IBU	EPD-ISO-20150315-IBE1-EN	EPD Isola Soft Xtra	EN15804+A1	Third-party verified (as per ISO 14025)
Hollow core concrete slabs	B45 M45, 320x1200 mm, 8 rebars/m2, 392 kg/m2	HD 320	Spenncon	EPD Norge	NEPD-14-317-NO	Cover Elements perforated, type HD 265 B45 M45, NEPD-14-223-NO, Spenncon, Consolis	EN15804+A1	Internally verified
Integrated formwork wall, excluding the filling concrete	ep. 0.20m	A2C Préfa, FEHR, KP1, RECTOR, SAPB, SEAC, SORIBA et SPURGIN	CERIB	INIES	INIES_CMCI20190924_155220, 26911	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Interior wooden door with metal frame, fire resistant and sound insulating, biogenic CO2 not subtracted (for CML)	37.9 kg/m2, 1.03m x 2.09m	1V PHONE 1V et 2V UNIPHONE 1V et 2V PORTAPHONE 1V et 2V ISOPHONE 1V ISOPHONE GD 1V et 2V SONIPHONE 1V EI30 MAT AC 1V LOGIPHONE 1V et 2V SP51 AC 1V et 2V TECHNIPHONE	MALERBA	INIES	INIES_IBLO20200211_095019, 29855	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Internal wall with improved sound insulation with steel studs, glass wool core and double panel gypsum board double siding	70mm+4*13mm, 43.23kg/m2, 354.3kg/m3, R=1.75 m2.K/W, Lambda=0.04 W/(m.K)	Cloison Placostil® 120/70 avec Placoplatre® BA 13 et PAR PHONIC 70 mm	PLACOPLATRE	INIES	INIES_ISYS20191223_235109, 26410	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Laminated skirting board, biogenic CO2 not subtracted (for CML)	0.53 kg/m, height 70-100 mm, unsustainable management	DONNEE PAR DEFAUT	DED	INIES	INIES_DPLI20200120_162845, 28784	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
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)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Mineral wool (floor insulation)	L = 0.040 W/mK, 85 kg/m3			OKOBAUDAT	-	Oekobau.dat 2020-II	EN15804+A1	Third-party verified (as per ISO 14025)
PU thermal insulation boards with multi-layer aluminium facing	L = 0.023 W/mK, 31 kg/m3			OKOBAUDAT	-	Oekobau.dat 2020-II	EN15804+A1	Third-party verified (as per ISO 14025)
Paint, anti bacterial acrylic eggshell	14 m2/l spread, 1.19-1.22 kg/l	Steracryl	Crown Paints	BRE	BREG EN EPD 000163	EPD Clean Extreme Anti-Bacterial Acrylic Eggshell	EN15804+A1	Third-party verified (as per ISO 14025)
Partitioning wall system (internal insulated wall) with steel studs, glass wool core and gypsum board double siding	70mm+25mm+25mm, 1.75 K.m2/W, Lambda=0.04 W/(m.K)	High-Stil® 120/70 avec Placo® Duo'Tech® 25	PLACOPLATRE	INIES	INIES_ICLO20191220_143239, 26503	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Plastic vapour control layer	0.2 mm		Tommen Gram	EPD Norge	NEPD-341-230-NO	Gram Dampsperre, Tommen Gram Folie AS (2015)	EN15804+A1	Third-party verified (as per ISO 14025)
Porcelain stoneware floor tiles	21.83 kg/m2		Royal Mosa	INIES	INIES : 6-611:2021	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Precast concrete paving (Blocks, Slabs, Channels and Kerbs)				ICE	-	ICE database August 2019, V3.0	EN15804+A1	Self declared
Precast concrete retaining wall, incl. reinforcement	ep. 0.25m, C25/30 XC4 CEM II/A-S		SNBPE	INIES	INIES_CMUR20190802_161937, 11112	FDES	EN15804+A1	Third-party verified (as per ISO 14025)

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Precast concrete staircase	width 140mm		MDEGD	INIES	INIES_DESC20180223_161126, 13679	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Profiled steel sheet for cladding or roofing	6.66 kg/m2	AMCF, BACACIER, LA MAISON DE L'ETANCHEUR, CISABAC, JORIS IDE, SPO, Tata Steel France – Monopanel	EMB	INIES	INIES_CCOU20120105_154418_1413, 6839	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Rammed concrete piling foundation for hard soils for m2 GFA, model: P270, pile length: 20 m, depth to bedrock: 20 m				One Click LCA		One Click LCA generic construction definitions		
Ready-mix concrete, normal-strength, generic	C20/25 (2900/3600 PSI), 0% recycled binders in cement (240 kg/m3 / 14.98 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Ready-mix concrete, normal-strength, generic	C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Ready-mix concrete, normal-strength, generic	C20/25 (2900/3600 PSI), 55% recycled binders in cement (240 kg/m3 / 14.98 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Ready-mix concrete, normal-strength, generic	C30/37 (4400/5400 PSI), 0% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Ready-mix concrete, normal-strength, generic	C40/50 (5800/7300 PSI), 50% recycled binders in cement (400 kg/m3 / 24.97 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Ready-mix concrete, normal-strength, generic	C30/37 (4400/5400 PSI), 40% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Recycled brick and concrete rubble				AusLCI	-	AusLCI	EN15804+A1	Third-party verified (as per ISO 14025)
Reinforced concrete beam	580x480 mm, 708 kg/m		Betoniteollisuusry	-	-	EPD PALKKIELEMENTTI 480X380 MM, 580X380 MM, 680X380 MM, 580X480 MM, 780X480 MM	EN15804+A1	Self declared
Reinforcement steel (rebar), generic	90% recycled content, A615			One Click LCA	-	One Click LCA	EN15804+A1	Internally

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Reinforcement steel (rebar), generic	80% recycled content, A615			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Reinforcement steel (rebar), generic	90% recycled content, A615		One Click LCA 2022	One Click LCA	-	One Click LCA	EN15804+A1, EN15804+A2	Internally verified
Rock 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	-	-	EPD Stone Wool Thermal Insulation for buildings	EN15804+A1	Third-party verified (as per ISO 14025)
Rock wool insulation panels, unfaced, generic	L = 0.035 W/mK, R = 2.89 m2K/W (16 ft2°Fh/BTU), 50 kg/m3 (3.12 lbs/ft3) (applicable for densities: 25-50 kg/m3 (1.56-3.12 lbs/ft3)), Lambda=0.0346 W/(m.K)			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Sandwich panel with glasswool insulation and double steel siding	U=0.23W/(m2K), 181.1mm (Total), 0.7mm (Outer sheet), 0.4mm (Liner sheet), 180mm (Insulation), 13.37kg/m2, 73.8kg/m3	Twin-Therm	Tata Steel Europe & CA Building Products	TATA Steel	EPD-TS-2018-004	EPD Twin-Therm roof incorporating CA 17 1000L liner	EN15804+A1	Third-party verified (as per ISO 14025)
Secant wall piling per m of of secant piling row, depth: 10 m	diameter: ø500mm with spacing of piles less than diameter.			One Click LCA		One Click LCA generic construction definitions		
Self levelling mortar, for floors, walls and overhead appl.	3-50 mm, 1400 kg/m3	Pericret	PCI Augsburg	IBU	EPD-PCI-20160262-IBE1-DE	Oekobau.dat 2017-I, EPD Ausgleichsmörtel PCI Pericret für Boden, Wand und Decke PCI Augsburg GmbH	EN15804+A1	Third-party verified (as per ISO 14025)
Sewage water drainage piping network, per m2 GIFA (factories and logistics buildings)				One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Sewage water drainage piping network, per m2 GIFA (office buildings)				One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Sewage water drainage piping network, per m2 GIFA (residential buildings)				One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Sheet piling for hard soils for m2 building footprint	sheet pile length: 20 m, depth to bedrock: >30 m, trench depth: 10 m			One Click LCA		One Click LCA generic construction definitions		

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verification
Shower tray made of synthetic material, French average	Long. 90 cm Larg. 90 cm	DONNEE PAR DEFAUT	DED	INIES	INIES_DREC20161116_164640, 5751	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Single or double sheet steel cladding	6.39 kg/m2	AMCF, BACACIER, LA MAISON DE L'ETANCHEUR, CISABAC, JORIS IDE, SPO, Tata Steel France – Monopanel	EMB	INIES	INIES_CBAR20120105_153612_1410, 6836	FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Solar panel photovoltaic system, EU average				One Click LCA	-	One Click LCA	ISO14040	Internally verified
Stainless steel guard railing	15.06 kg/m, Lambda=15.06 W/(m.K)	DONNEE PAR DEFAUT	DED	INIES	INIES_DDWD20220429_151859, 29747	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Structural steel profiles, generic	60% recycled content, I, H, U, L, and T sections, S235, S275 and S355			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Suspended solid wood ceiling with galvanized steel framing, biogenic CO2 not subtracted (for CML)	10 mm, 6.3 kg/m2, unsustainable management	DONNEE PAR DEFAUT	DED	INIES	INIES_DPLA20200120_154617, 28763	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Synthetic membrane for waterproofing of underground walls and foundations, French average	ép. 2mm	DONNEE PAR DEFAUT	DED	INIES	INIES_DMEM20161116_164605, 5719	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)
Ventilation system for educational or commercial building	per m2 GFA			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Ventilation system for residential building	per m2 GFA			One Click LCA	-	One Click LCA	EN15804+A1	Internally verified
Wallpaper	0.53/1.06x10.05/50.00, 0.192kg/m2		Verband der Deutschen Tapetenindustrie	IBU	EPD-VDT-20160259-IBG1-DE	EPD Papiertapeten Verband der Deutschen Tapetenindustrie e.V.	EN15804+A1	Third-party verified (as per ISO 14025)

Help

Resource name	Technical specification	Product	Manufacturer	EPD program	EPD number	Environment Data Source	Standard	Verificatior
Waterproof, protective, flexible coating	1.5 kg/l	Lastogum	PCI Augsburg	IBU	EPD-PCI-20150039-IBE1-DE	Oekobau.dat 2017-I, EPD Wasserdichte, flexible Schutzschicht PCI Lastogum unter Keramikbelägen in Dusche und Bad PCI Augsburg GmbH	EN15804+A1	Third-party verified (as per ISO 14025)
Waterproofing membrane, single component, cold applied, from PU	1.3 mm, 1.79 kg/m2	Sikalastic-618	Sika	BRE	BREG EN EPD000112	BREGENEPD000112	EN15804+A1	Third-party verified (as per ISO 14025)
Wooden cladding and decking, pine or spruce	445 kg/m3, 7-29 mm, 8-18%, moisture content		Stora Enso	International EPD System	S-P-02152	EPD Cladding and Decking by Stora Enso	EN15804+A1, EN15804+A2	Third-party verified (as per ISO 14025)
Wooden sliding closet door, biogenic CO2 not subtracted (for CML)	10 mm, 7.35 kg/m2	DONNEE PAR DEFAUT	DED	INIES	INIES_DBHT20220304_175212, 29397	MDEGD_FDES	EN15804+A1	Third-party verified (as per ISO 14025)

Appendix D - CIBSE TM54 Assumptions

LOVE DESIGN STUDIO Ltd
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London

Uxbridge Road
TM54 Breakdown

Request for Information Type:	ENERGY STRATEGY
Project name:	Uxbridge Road
Project number:	PR 461
Project description:	Hotel refurb + new hotel + amenity space + incubator space
Local Authority:	London Borough of Hillingdon
Project size:	Major
BREEAM requirement:	Very Good
CO2 reduction target:	35% against Part L
Version	V1

Carbon Factors (user to update as necessary)			
Electricity	0.233	kgCO2/kWh	**Ref. 1**
Gas	0.21	kgCO2/kWh	**Ref. 1**

Occupancy	Hotel (existing)	Hotel (new)	Hotel Amenity	Incubator	Plant	
Days per week	7	7	6	6	7	**Assum. 1, 2**
Weeks per year	52	52	48	48	52	**Assum. 1, 2**

Building Design Life	Hotel (existing)	Hotel (new)	Hotel Amenity	Incubator	Plant	
Years	60	60	60	60	60	**Ref. 2**

Efficiencies	Hotel (existing)	Hotel (new)	Hotel Amenity	Incubator	Plant	
DHW efficiency	100%	100%	100%	100%	100%	**Assum. 3**

Area and Occupancies	Hotel (existing)	Hotel (new)	Hotel Amenity	Incubator	Plant	Total m²	
Area	7911	9900	1562	1405	998	20,372	m²
Occupancy	365	365	289	289	365	-	days

CIBSE TM54: 2013

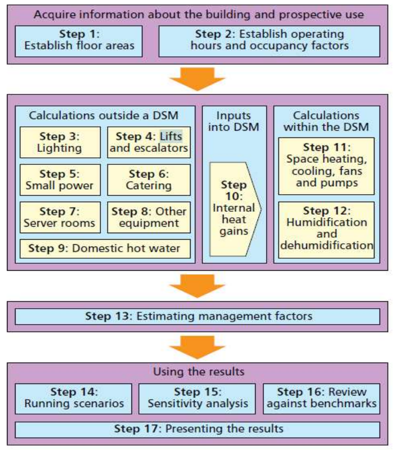

Figure 5 Methodology for evaluating operational energy use at the design stage

CIBSE TM54: 2022

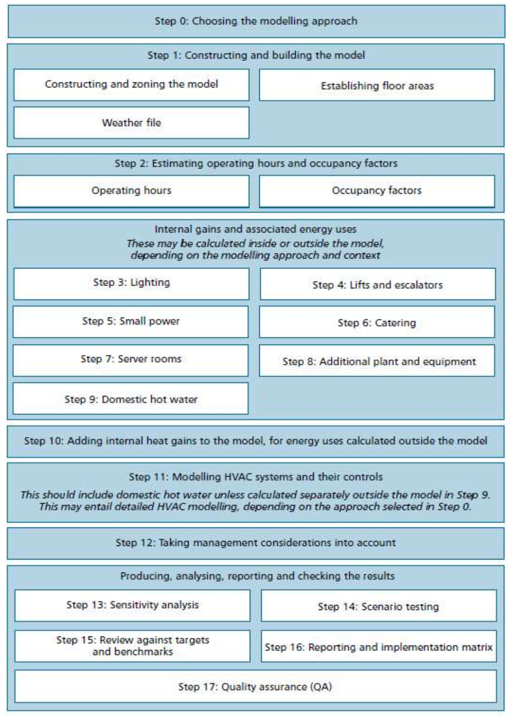

Figure 7.1 Methodology for evaluating operational energy use at the design stage

Building	**Hotel (existing)**	**Hotel (new)**	**Hotel Amenity**	**Incubator**	**Plant**	
Energy Consumption	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	Total MWh/year
Lighting	134.1	167.8	31.0	27.9	10.6	371.5
Lifts and escalators	21.2	8.0	0.0	0.0	0.0	29.1
Domestic hot water	474.1	160.3	14.7	2.4	0.1	651.6
Small power	47.0	73.2	34.0	39.6	4.3	198.1
Server rooms	0.0	0.0	117.4	0.0	0.0	117.4
Catering	0.0	0.0	40.3	0.0	0.0	40.3
Space heating	69.4	28.6	4.5	4.1	2.9	109.4
Cooling	52.4	58.6	9.2	8.3	5.9	134.5
Fans and pumps	73.0	95.8	15.1	13.6	9.7	207.2
PV	0.0	0.0	-69.3	0.0	0.0	-69.3
Total	871.2	592.3	197.0	95.9	33.5	1790.0
					Total kWh/m².year	87.9

	Hotel (existing)	**Hotel (new)**	**Hotel Amenity**	**Incubator**	**Plant**								
	kWh/m².year	kWh/m².year	kWh/m².year	kWh/m².year	kWh/m².year	Utility System 1	Percentage of Energy from Utility System 1	Utility System 2	Percentage of Energy from Utility System 2	Utility System 1 Emission Factor kgCO2/kWh	Utility System 2 Emission Factor kgCO2/kWh	tCO2/year	tCO2/60years
Lighting	17.0	17.0	19.9	19.9	10.6	Electricity	100%	Gas	0%	0.233	0.21	86.6	5193.0
Lifts and escalators	2.7	0.8	0.0	0.0	0.0	Electricity	100%	Gas	0%	0.233	0.21	6.8	407.5
Domestic hot water	59.9	16.2	9.4	1.7	0.1	Electricity	32%	Gas	68%	0.233	0.21	141.7	8500.8
Small power	5.9	7.4	21.8	28.2	4.3	Electricity	100%	Gas	0%	0.233	0.21	46.2	2769.8
Server rooms	0.0	0.0	75.1	0.0	0.0	Electricity	100%	Gas	0%	0.233	0.21	27.4	1641.0
Catering	0.0	0.0	25.8	0.0	0.0	Electricity	100%	Gas	0%	0.233	0.21	9.4	563.3
Space heating	8.8	2.9	2.9	2.9	2.9	Electricity	100%	Gas	0%	0.233	0.21	25.5	1530.1
Cooling	6.6	5.9	5.9	5.9	5.9	Electricity	100%	Gas	0%	0.233	0.21	31.3	1880.7
Fans and pumps	9.2	9.7	9.7	9.7	9.7	Electricity	100%	Gas	0%	0.233	0.21	48.3	2897.1
PV	0.0	0.0	-44.3	0.0	0.0	Electricity	100%	Gas	0%	0.233	0.21	-16.1	-968.2
Total	110.1	59.8	126.1	68.2	33.6							406.9	24415.1

Appendix E - GLA Reporting Spreadsheet

Project details	
Project name	Uxbridge Road
Planning application reference number (if applicable)	
Use Type	C1
Brief description of the project	Refurbishment of existing hotel building on site and construction of a new 12 storey building to provide industrial space on the lower floors and hotel accomodation from first floor and abo
GIA (m^2)	20372
Authors (organisation or individuals)	Love Design Studio
Date of assessment	24 August 2022
Nationally recognised assessment method used	BS EN 15978, with additional guidance from RICS Professional Statement in accordance with GLA Guidance on WLCA (march 2022)
Reference study period (if not 60 years)	
Software tool used	One Click LCA
Source of carbon data for materials and products	EN15804 compliant EPDS
EPD database used	One Click LCA Database

Estimated WLC emissions (Assessment 1)
N.B. This forms the WLC baseline for the development. The results from Assessment 1 below are automatically populated here.

	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
TOTAL kg CO_2e	7,522,313 kg CO2e	3,732,680 kg CO2e	24,721,126 kg CO2e	557,272 kg CO2e	-2,885,849 kg CO2e
TOTAL kg CO_2e/m^2 GIA	369	183	1213	27	-142
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 1 was used to inform design decisions	The scheme aligns with all GLA WLC benchmarks. At the use stage, the scheme provides an improvement on the aspirational targets. This is likely attributable to the specification of hardwearing internal finishes as well as a high performance façade, which requires less maintenance than a typical concrete structure might.				

Estimated WLC emissions (Assessment 2)
N.B. The results from Assessment 2 below are automatically populated here.

	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
TOTAL kg CO_2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e
TOTAL kg CO_2e/m^2 GIA	0	0	0	0	0
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 2 was used to inform design decisions	[Explain the reasons for any divergences from WLC benchmarks, including against the WLC aspirational benchmarks. Please note that grid decarbonisation has not been accounted for in the benchmarks]				

Key site opportunities and constraints in reducing WLC emissions	The building's primary construction constitutes reinforced concrete, with ultrahigh performance concrete to be used on the facade. The substructure includes rammed concrete piling, which is on the lower end of the spectrum for upfront substructure embodied carbon emissions, and this was explaiend to the design team in meetings. The superstructure consists of RC frame, core, slabs and roofs and where feasible, as high as 50% recycled binder content will be used in the superstructure. An opportunity to make significant embodied carbon reudctions was capitalised on, by retaining and refurbishing the existing hotel building on site, which saved approximately 2,800tCO2e, when coomparing the refurbishment embodied carbon to the demolition and reconstruction of a building with a similar GIA.

Summary of key actions to reduce whole life-cycle carbon emissions that have informed this assessment, including the WLC reductions	Action	WLC reduction (kg CO_2e/m^2 GIA)
	Refurbishing the existing building on site, as opposed to demolishing and reconstructing.	137
	Specification of concrete in superstructure with 50% recycled binder content	54
	Specification of rebar with 90% recycled content in comparison to virgin steel	172

Specify further opportunities to reduce the development's whole life-cycle carbon emissions. including the WLC reduction potential	Further potential opportunities	WLC reduction potential (kg CO_2e/m^2 GIA)
	Timber framed windows	TBC
	Timber suspended ceilings	TBC

MATERIAL QUANTITY AND END OF LIFE SCENARIOS		Product and Construction Stage (Module A)		Assumptions made with respect to maintenance, repair and replacement cycles (Module B)	Material 'end of life' scenarios (Module C)	Benefits and loads beyond the system boundary (Module D)	
Building element category		Material type	Material quantity (kg)			Estimated reusable materials (kg)	Estimated recyclable materials (kg)
Note/example		Breakdown of material type in each category [Insert more lines if needed] e.g. Concrete	65000 kg	For all primary building systems (structure, substructure, envelope, MEP services, internal finishes)	Declare 'end of life' scenario as per project's Circular Economy Statement	0 kg	25 kg
		e.g. Reinforcement	5000 kg			2 kg	8 kg
		e.g. Formwork	250 kg			0 kg	0 kg
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment	N/A	0 kg				
0.2	Major Demolition Works	-	0 kg				
0.3	Temporary Support to Adjacent Structures	-	0 kg				
0.4	Specialist Ground Works	-	0 kg				
1	Substructure	Standard Foundation and Lowest Floor Construction	4,500,000 kg	As building	Concrete crushed to aggreagate (for sub-base layers) and reinforcement steel seperated for recycling	450,000 kg	900,000 kg
2.1	Superstructure: Frame	Concrete Frame	3,200,000 kg	As building	Concrete crushed to aggreagate (for sub-base layers) and reinforcement steel seperated for recycling	320,000 kg	640,000 kg
2.2	Superstructure: Upper Floors	Concrete Floor Slabs incl. formwork	15,600,000 kg	As building	Concrete crushed to aggreagate (for sub-base layers) and reinforcement steel seperated for recycling	1,560,000 kg	3,120,000 kg
2.3	Superstructure: Roof	Concrete and Formwork	1,400,000 kg	As building	Formwork reycled. Concrete crushed to aggregate (for sub-base layers)		280,000 kg
2.4	Superstructure: Stairs and Ramps	Precast Concrete Staircase	680,000 kg	As building	Rebar seperated for recycling, Concrete crushed to aggreagate (for sub-base layers)	68,000 kg	136,000 kg
2.5	Superstructure: External Walls	Concrete sandwich element incl. insulation	1,300,000 kg	As building	Concrete crushed to aggreagate (for sub-base layers), Insulation to be sent to a specialist recycling facility		260,000 kg
2.6	Superstructure: Windows and External Doors	All windows and doors	150,000 kg	30 years service life, 2% replacement per annum for windows	Glass to be recycled (80%). Window frame TBC also potential to recycle	30,000 kg	-
2.7	Superstructure: Internal Walls and Partitions	Internal wall with steel studs, glass wool core and double panel gypsum board	410,000 kg	As building	Steel studwork recycled, insulation to be sent to specialist recycling facility	164,000 kg	82,000 kg
2.8	Superstructure: Internal Doors	Internal doors	10,000 kg	30 years service life	All wood containing products to be recycled	4,000 kg	2,000 kg
3	Finishes	Including wall paper, gypsum plaster board, tiles and wooden flooring	670,000 kg	30 years service life, 4% replacement/ repair per annum	Ceramic and concrete tiles crushedd to aggregate (for sub-base layer)	-	134,000 kg
4	Fittings, furnishings & equipment (FFE)	FFE to hotel rooms	20,000 kg	12 years	All wood containing products to be recycled	-	4,000 kg
5	Services (MEP)	All HVAC systems, incl. PV and drainage	80,000 kg	30 years on avg. approx 2% annual replacement	Metal containing products recycled (approx 40%)	32,000 kg	16,000 kg
6	Prefabricated Buildings and Building Units	N/A	0 kg	-	-		0 kg
7	Work to Existing Building	n/a	0 kg	-	-		0 kg
8	External works	Asphalt and Paving	150,000 kg	As building			30,000 kg
		TOTAL	28,170,000 kg			2,628,000 kg	5,604,000 kg
		Material intensity (kg/m2 GIA)	1,383 kg/m2 GIA			129 kg/m2 GIA	275 kg/m2 GIA

Confirm here whether Assessment 1 or Assessment 2 (see below) is to form the basis of design decisions	Assessment 1

ASSESSMENT 1 - current status of the electricity grid

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES[1] (kgCO2e)		Sequestered (or biogenic) carbon (negative value) (kgCO2e)	Product stage (kgCO2e)	Construction process stage (kgCO2e)		Use stage (kgCO2e)				
			Module A			Module B				
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment									
0.2	Major Demolition Works									
0.3	Temporary Support to Adjacent Structures	0kgCO2e	83,263 kg CO2e	772 kg CO2e	2,896 kg CO2e					
0.4	Specialist Ground Works	0 kg CO2e	0 kg CO2e							
0.5	Temporary Diversion Works	0 kg CO2e	0 kg CO2e							
1	Substructure	0 kg CO2e	937,796 kg CO2e	32,057 kg CO2e	42,461 kg CO2e		40,744 kg CO2e	10,186 kg CO2e		
2.1	Superstructure: Frame	-108,279 kg CO2e	495,759 kg CO2e	27,642 kg CO2e	20,245 kg CO2e		40,744 kg CO2e	10,186 kg CO2e		
2.2	Superstructure: Upper Floors	-6,663 kg CO2e	2,608,717 kg CO2e	121,162 kg CO2e	123,515 kg CO2e				1,151,160 kg CO2e	
2.3	Superstructure: Roof	0 kg CO2e	47,816 kg CO2e	877 kg CO2e	2,034 kg CO2e				9,041 kg CO2e	
2.4	Superstructure: Stairs and Ramps	0 kg CO2e	257,383 kg CO2e	1,562 kg CO2e						
2.5	Superstructure: External Walls	-46,696 kg CO2e	751,760 kg CO2e	30,271 kg CO2e	47,668 kg CO2e				81,061 kg CO2e	
2.6	Superstructure: Windows and External Doors	0 kg CO2e	529,871 kg CO2e	667 kg CO2e					536,740 kg CO2e	
2.7	Superstructure: Internal Walls and Partitions	-10,578 kg CO2e	204,591 kg CO2e	1,135 kg CO2e	27,114 kg CO2e				216,914 kg CO2e	
2.8	Superstructure: Internal Doors	-24,065 kg CO2e	12,209 kg CO2e	31 kg CO2e					12,532 kg CO2e	
3	Finishes	-14,080 kg CO2e	142,442 kg CO2e	1,460 kg CO2e	15,954 kg CO2e		40,744 kg CO2e	10,186 kg CO2e	231,147 kg CO2e	
4	Fittings, furnishings & equipment	0 kg CO2e	107,280 kg CO2e	178 kg CO2e	1,676 kg CO2e		40,744 kg CO2e	10,186 kg CO2e	341,032 kg CO2e	
5	Services (MEP)		420,174 kg CO2e	902 kg CO2e	4,872 kg CO2e	8,098 kg CO2e	40,744 kg CO2e	10,186 kg CO2e	845,482 kg CO2e	
6	Prefabricated Buildings and Building Units						44,823 kg CO2e			
7	Work to Existing Building	-93,360 kg CO2e			700,000 kg CO2e					
8	External works		19,088 kg CO2e	732 kg CO2e						
TOTAL kg CO2e		-303,721 kg CO2e	6,618,150 kg CO2e	219,448 kg CO2e	988,436 kg CO2e	8,098 kg CO2e	248,543 kg CO2e	50,930 kg CO2e	3,425,109 kg CO2e	0 kg CO2e
TOTAL - kg CO2e/m2 GIA		-15 kg CO2e/m2 GIA	325 kg CO2e/m2 GIA	11 kg CO2e/m2 GIA	49 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	12 kg CO2e/m2 GIA	3 kg CO2e/m2 GIA	168 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA

Building element category		Use stage (kgCO2e)		End of Life (EoL) stage (kgCO2e)				TOTAL Modules A-C $kgCO_2e$	Benefits and loads beyond the system boundary (kgCO2e)
		Module B		Module C					Module D*
		[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment				1,578 kg CO2e	104 kg CO2e		1,682 kg CO2e	
0.2	Major Demolition Works							0 kg CO2e	-33,274 kg CO2e
0.3	Temporary Support to Adjacent Structures			17,360 kg CO2e				104,291 kg CO2e	
0.4	Specialist Ground Works				39,283 kg CO2e	10,381 kg CO2e	1 kg CO2e	49,666 kg CO2e	
0.5	Temporary Diversion Works				18,928 kg CO2e	1,805 kg CO2e		20,733 kg CO2e	-325,208 kg CO2e
1	Substructure				82,048 kg CO2e	230,582 kg CO2e	228 kg CO2e	1,376,102 kg CO2e	-177,842 kg CO2e
2.1	Superstructure: Frame				938 kg CO2e	13,019 kg CO2e	84 kg CO2e	500,339 kg CO2e	-1,482,784 kg CO2e
2.2	Superstructure: Upper Floors				1,990 kg CO2e	235 kg CO2e		4,000,116 kg CO2e	-35,623 kg CO2e
2.3	Superstructure: Roof				14,474 kg CO2e	1,453 kg CO2e	195 kg CO2e	75,890 kg CO2e	-29,983 kg CO2e
2.4	Superstructure: Stairs and Ramps				5,578 kg CO2e	47,060 kg CO2e	85 kg CO2e	311,668 kg CO2e	-137,566 kg CO2e
2.5	Superstructure: External Walls				10,839 kg CO2e	350 kg CO2e		875,252 kg CO2e	-26,883 kg CO2e
2.6	Superstructure: Windows and External Doors				258 kg CO2e	10,610 kg CO2e	2 kg CO2e	1,078,149 kg CO2e	-2,385 kg CO2e
2.7	Superstructure: Internal Walls and Partitions				2,537 kg CO2e	25,454 kg CO2e	1,363 kg CO2e	468,529 kg CO2e	-26,417 kg CO2e
2.8	Superstructure: Internal Doors				65 kg CO2e	14,179 kg CO2e	30 kg CO2e	14,980 kg CO2e	-119,636 kg CO2e
3	Finishes				3,213 kg CO2e	289 kg CO2e	22 kg CO2e	431,377 kg CO2e	0 kg CO2e
4	Fittings, furnishings & equipment							501,096 kg CO2e	-484,565 kg CO2e
5	Services (MEP)	19,033,514 kg CO2e 5,381,612 kg CO2e	306,000 kg CO2e					26,051,585 kg CO2e	
6	Prefabricated Buildings and Building Units				588 kg CO2e	63 kg CO2e		45,475 kg CO2e	
7	Work to Existing Building							606,640 kg CO2e	-3,681 kg CO2e
8	External works							19,820 kg CO2e	
TOTAL kg CO2e		24,415,126 kg CO2e	306,000 kg CO2e	17,360 kg CO2e	182,318 kg CO2e	355,584 kg CO2e	2,010 kg CO2e	36,533,391 kg CO2e	-2,885,849 kg CO2e
TOTAL - kg CO2e/m2 GIA		1,198 kg CO2e/m2 GIA	15 kg CO2e/m2 GIA	#############	#############	#############	#############	1,793 kg CO2e/m2 GIA	-142 kg CO2e/m2 GIA

Notes:

* Report non-decarbonised values for both material and operational emissions using current status of the electricity grid.

[1] If you have entered a reference study period in cell C10 because the assumed building life expectancy is greater or less than 60 years, this table should be copied and pasted below using the actual assumed life expectancy. This should be done for both GWP reporting tables and should be clearly labelled.

	Mandatary cells for completion
	N/A

LOVE DESIGN STUDIO

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We help design teams within the built environment create sustainable spaces and buildings.

Our work encompasses all stages of a building's lifetime; from advising developers on new development to landowners on improving their building stock. Our experience of each RIBA Stage enabling us to better advise on the other.

Environmental consultants, designers, engineers and technicians in the built environment.

Whether it be a single house extension, commercial property, school, or multi-residential masterplan; Love Design Studio will look to maximise the scheme's sustainability credentials where most value is obtained.