Whole Life Carbon Assessment

Former MSD Facility, Breakspear Road, Ickenham

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Rev.02

Revision History

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24.08.2022	00	Draft
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1.0 Introduction

This document is a whole life carbon assessment for the development at the former MSD Facility, Breakspear road, Ickenham in the London Borough of Hillingdon. This assessment has been prepared in accordance with GLA guidance and guidance set out in the RICS PS whole life carbon assessment for the built environment guidance.

This report will be presented in conjunction with GLA WLC templates to ensure that the Breakspear road development meets all planning requirements.

Scope

The scope of work is defined by the RICS PS whole life carbon assessment for the built environment guidance in conjunction with the GLA WLC guidance document published in March 2022, a summary of building elements included can be seen in the adjacent table. Life cycle stages A1-A5, B1-B7, C1-C4 and module D have been included for all building elements where appropriate. At least 95% of building materials are included within the results.

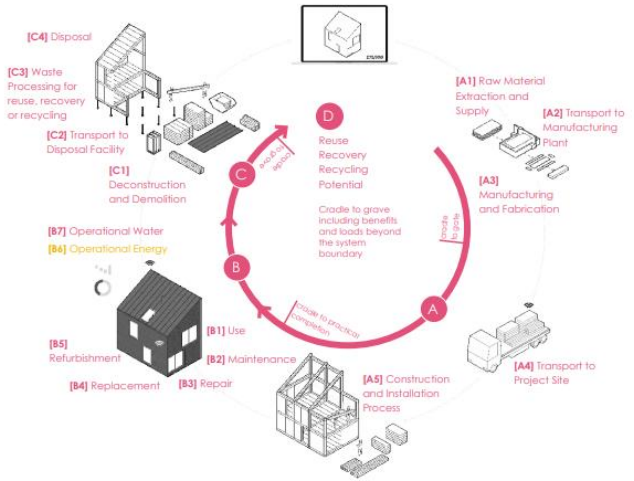


Figure 1

Building Part/Element Group	Included?
Demolition	Yes
Substructure	Yes
Superstructure	Yes
Finishes	Yes
Fittings, furnishings, and equipment (FF&E)	Yes
Building Services	Yes
Prefabricated Buildings and Building Units	Yes
Work to Existing Building	Yes
External works	Yes

2.0 Description of the development

The Existing Site

The proposed location is a vacant site adjacent to the Breakspear Road, highlighted in figure 2

Figure 2

Figure 3

The existing site has 16 no. existing buildings all of which are currently vacant and comprises a range of built structures, hardstanding, and poor-quality landscaping. Immediately to the south of the site, is occupied by HS2. These works occupy land that was formerly part of the MSD site

The subject lands have been vacant for circa 2 years following the site becoming surplus to MSD requirements. This is a previously developed site with extensive hardstanding and built structures, however, buildings are small, not fit for purpose and the layout is convoluted and therefore not suitable for reuse for a modern employment operator. The previous employment use was a mix of office, light industrial, and research facilities.

The proposed site

The proposed site is set to consist of 4 no. warehouses and 1 no. office buildings, plans of proposed site are in figure 3. Area plan for the proposed site can be seen below:

Building Number	Level	GIA (sqm)
Block 1	00	645
	01	645
Block 2	00	900
	01	900
Block 3	00	900
	01	900
Block 4	00	900
	01	900
Block 5	00	480
Total		7170

3.0 Regulations and Technical Guidance

London Policy

The New London Plan 2021 has introduced a range of topics including areas relating to whole life carbon assessment. Sections relating to a WLC are covered in section SI 2 (specifically point F) and can be seen below:

Policy SI 2 Minimising greenhouse gas emissions

A Major development should be net zero-carbon.[151] This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1) be lean: use less energy and manage demand during operation
2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
4) be seen: monitor, verify and report on energy performance.

B Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C A minimum on-site reduction of at least 35 per cent beyond Building Regulations[152] is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

1) through a cash in lieu contribution to the borough's carbon offset fund, or
2) off-site provided that an alternative proposal is identified and delivery is certain.

D Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

151 Where zero-carbon is used in the Plan it refers to net zero-carbon – see Glossary for definition.

152 Building Regulations 2013. If these are updated, the policy threshold will be reviewed. https://www.gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l

E Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

F Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

RICS Professional Statement

GLA guidance mandates the use of the RICS PS to inform the method for WLC assessments for use in GLA planning applications. The objective of the RICS PS as set out within the introduction of the document is to:

"Standardise whole life carbon assessment and enhance consistency in outputs by providing specific practical guidance for the interpretation and implementation of the methodology in EN 15978 in carbon calculations – see section 2 for more detail. This is to achieve coherent and comparable results that can be used to benchmark the whole life carbon performance of built assets."

4.0 Methodology

The Whole life Carbon emissions of the building is calculated from combining the operational carbon emissions with the embodied carbon emissions. Full details of operational energy modelling can be found in the accompanying Energy Strategy. Section 4 of this report will outline the methodology used in completing embodied carbon modelling.

One Click LCA has been selected to carry out the WLC assessment using their GLA compliant tool which is aligned with the RICS PS.

Pre-Construction Demolition

The GLA WLC guidance issued in March 2022 mandates that applications include carbon figures associated with pre-construction demolition section 3.1.4 states:

“To calculate the carbon emissions associated with pre-construction demolition, actual figures should be used where possible. If actual figures are not available, applicants can apply a standard assumption of 50kgCO2e/m2 to the GIA of the existing areas being demolished that fall within the boundary line.”

At this stage of the design actual carbon figures for pre-construction demolition are not available therefore GLA guidance has been used and a figure of 50kgCO2e/m2 will be used to account for pre-construction demolition.

Material Selection and Accuracy

At this early design stage, a cost plan is unavailable so in order to maintain accuracy in the embodied carbon assessment requests for information (RFI) have been sent to various members of the design team to ensure accuracy in material inputs. 3D thermal models have also been used to inform the quantities of materials.

GLA guidance states that when it is too early in the design process for specific manufacturers to be known for materials:

“Then sector level data (e.g. EPDs that use data covering several manufacturers) should be used”

In line with this approach generic material EPDs have been selected, a full list of EPD databases used can be found in Appendix C.

To Ensure accuracy in the post construction stage of the assessment specific materials and quantities should be provided and approved by the quantity surveyor.

Maintenance and Repair Emissions (B2 and B3)

The GLAs guidance on WLC assessments published in March 2022 recognises the difficulty of calculating maintenance and repair emissions at the early design stage. Section 2.5.12 of the guidance states:

“During the design stage, modules B2 and B3 will be more challenging to estimate. Applicants can estimate how much electricity may be used multiplied by the expected number of days of planned maintenance each year. Alternatively, for module B2 emissions, a total figure of 10 kgCO2e/m2 gross internal area (GIA) may be used to cover all building element categories, or 1 per cent of modules A1-A5, whichever is greater. For module B3 emissions, these may be estimated as 25 per cent of module B2, as per the RICS PS (item 3.5.3.3).”

At this stage of the Breakspear development estimates on electricity usage for maintenance and repair are not available therefore the GLA figures of 10 kgCO2e/m2 for module B2 have been used and 2.5 kgCO2e/m2 for module B3. When reporting the figures, the standard emission rates have been split between the RICS categories in line with the breakdown of a typical development in the GLA guidance, the breakdown can be seen below.

Substructure: 1 per cent
Superstructure: 4 per cent
Façade: 21 per cent
Internal finishes: 27 per cent
FFE: 9 per cent
Services/MEP: 35 per cent
External works: 3 per cent

Operational Energy Analysis

Operational energy analysis for the project has been carried out using EDSL TAS modelling software which is approved for UK building regulations Part L modelling amongst other outputs. TM54 modelling is not yet available at this stage of development to calculate unregulated energy loads. The BRUKL produced from the TAS model however allows for unregulated loads to be calculated and input into the One Click LCA software. One click can then calculate the operational energy consumption over the 60 year life cycle selected for the WLC assessment. TM54 modelling will be considered as design develops.

Regulated energy has been calculated to result in 895,992 kg CO2e with unregulated sources resulting in 1,522,844 kg CO2e. This results in total B6 emissions of 2,394,451 kg CO2e or 349 kg CO2e/m2 GIA

Full details of the operational energy analysis can be found in the supporting energy strategy.

MEP Systems

At the early stage of design specific manufacturers have not yet been selected for MEP systems, in order to carry out TM65 analysis manufacturers need to be contacted in order to give a material breakdown of their products. As this is not possible generic MEP systems have been selected in order to estimate embodied carbon of the MEP systems. Full details of the generic materials selected and the EPD database they are selected from can be seen in Appendix C.

Refrigerants

The GLA WLC guidance published in March 2022 has placed emphasis on the need to report emissions due to refrigerants. As the site at Breakspear road will utilise air source heat pumps for heating and cooling. There will be refrigerant usage on site therefore this has been included in WLC calculations. At this stage of design it is assumed that R-410A will be used in the heat pumps, full details of refrigerant use can be seen in the table opposite.

Refrigerant	Charge of refrigerant (kg)	GWP of refrigerant ($kgCO_2e/kg$)	Annual Leakage rate (%)	End of life Recovery Rate (%)
R-410A	43	2087.5	4	98

Ensuring Data Quality

To ensure data quality the GLA WLC guidance mandates the use of third-party quality assurance mechanisms to ensure accuracy in WLC studies, section 2.3.3 states:

“Applicants and developers should adopt third-party quality assurance mechanisms to ensure accuracy in their submissions.”

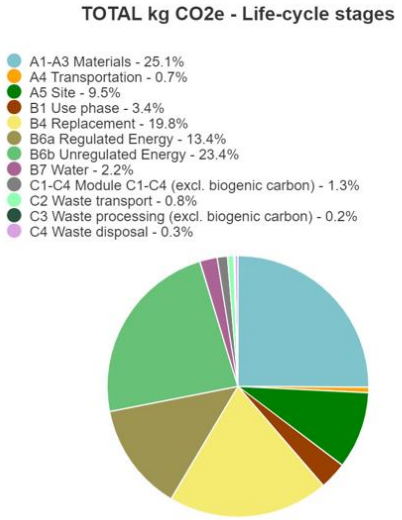
In order to ensure data quality throughout IN2 have sent RFIs to various members of the design team to ensure accuracy in material selections. One click LCA includes a completeness and plausibility check feature which was used throughout the study to ensure all features required for the WLC assessment were captured and accurate. IN2 also employed a thorough internal quality assurance process ensuring all work is reviewed and any necessary changes made before issue.

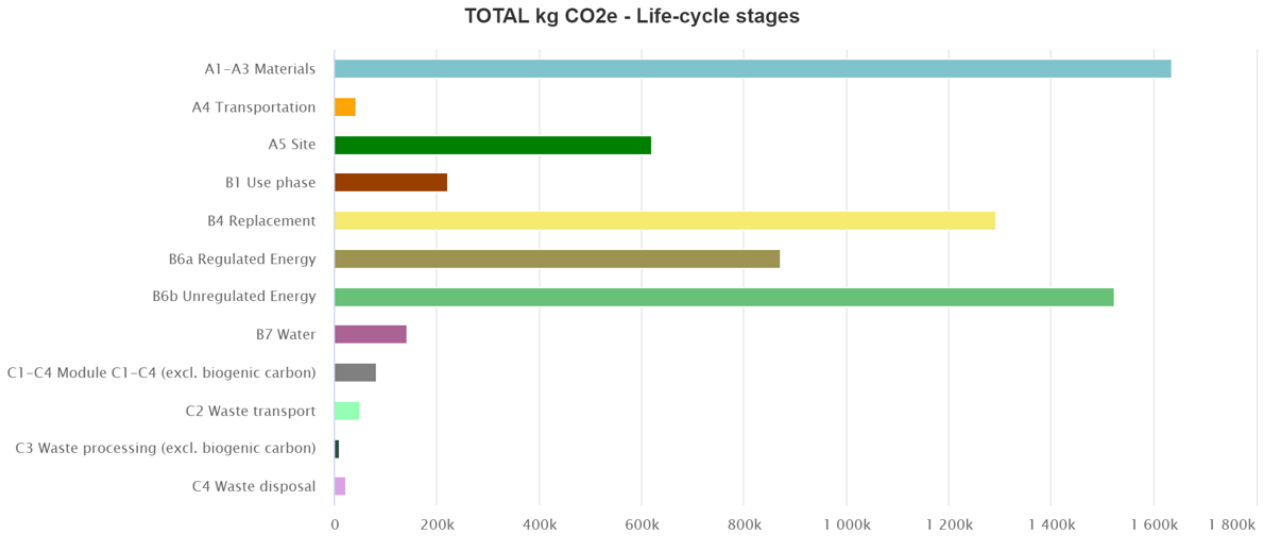
5.0 Results

Below are results of the WLC study carried out for the development at Breakspear Road South.

Full results of the WLC assessment can be seen in appendix A of this report along with the accompanying GLA WLC spreadsheet.

	Module A1-A5 (excluding sequestered carbon)	Modules B-C (excl B6 & B7)	Modules A-C (excluding B6-B7; including sequestered carbon)
TOTAL kg CO_2e	2,297,969	1,701,185	3,982,790
TOTAL kg CO_2e/m^2 GIA	320.5	237.3	555.480





Comparison of Results with GLA benchmarks

The below table extracted from the GLA WLC assessment spreadsheet compares the results for the Breakspear development with the WLC benchmarks set. The benchmarks for an office have been chosen as most appropriate for the building type as some office space is present at the development and there are no specific benchmarks set by the GLA for a warehouse space.

	Module A1-A5 (excluding sequestered carbon)	Modules B-C (excl B6 & B7)	Modules A-C (excluding B6-B7; including sequestered carbon)
TOTAL kg CO_2e	2,297,969	1,701,185	3,982,790
TOTAL kg CO_2e/m^2 GIA	320.5	237.3	555.48
Benchmark Type		Office	
WLC Benchmark	*<950*	*<450*	*<1400*
Aspirational WLC Benchmark	*<600*	*<370*	*<970*

As can be seen from the table above in all categories the Breakspear Road development is meeting and exceeding the aspirational benchmarks set by the GLA. This is as a result of careful selection of products with low embodied carbon but also due to how the building is classified. The majority of building is open plan warehouse spaces which will by default have a lower embodied carbon value than a traditional office space for various factors such as:

- Open plan- No internal walls to account for which according to LETI can account for around 7% of a building embodied carbon emission.
- The Warehouse spaces will not have the same level of finish to walls, floors and ceilings as a traditional office space would.
- Upper Floor constructions decreased due to use of building- LETI embodied carbon primer suggest that upper floor constructions can account for over 20% of embodied emissions.

Other aspects of the buildings design have also contributed to the good results for example the project has benefitted from the innovative reuse of steel from other demolition projects.

Embodied Carbon Reduction Measures

This section will discuss in more detail features included in the design to reduce embodied carbon of the development.

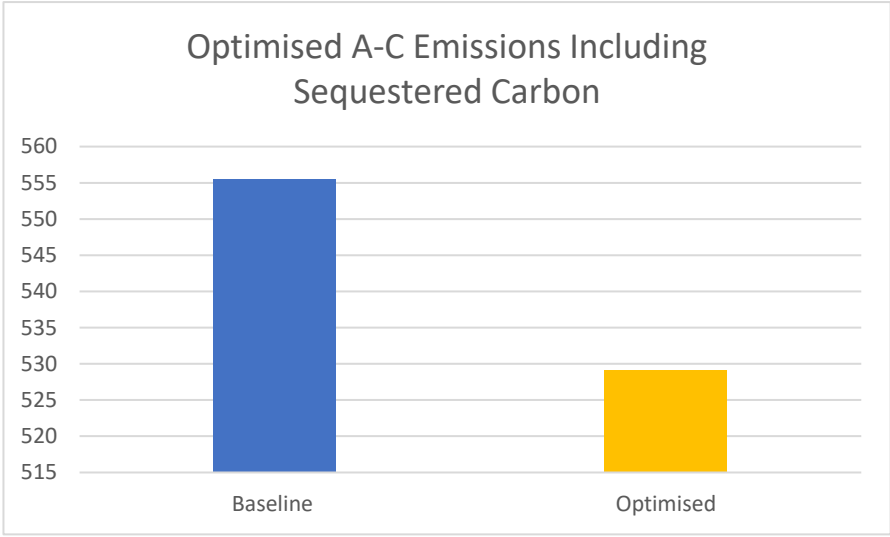
5.1.1 Reuse of Materials in Office Block

A Pre-Demolition audit has deemed that the office block of the development (Block 1) is appropriate for refurbishment rather than demolition like other buildings on the site. The current plan for the office is to reuse as much of the existing materials as possible.

When looking at this from the WLC perspective it has been assumed that all the substructures will be reused as well as concrete blocks, masonry mortar, steel frame and concrete roof assembly. This reuse of existing materials on site has resulted in an embodied carbon reduction of 177,632 kg CO_2e or 24.77 kg CO_2e/m^2 (site wide) GIA.

5.1.2 Warehouse Precast concrete section

The external wall of the 4 industrial buildings are designed to have a 2.4m high strip of pre cast concrete wall as their base and the remainder of the wall will be constructed of insulated sandwich panels. It was recognised in the design process that the use of GGBS in the precast concrete sections could reduce overall embodied emissions of the project therefore it was decided to change to a 20% GGBS concrete element. This resulted in a saving of 10760 kg CO_2e or 1.5 kg CO_2e/m^2 GIA.



6.0 Appendix A GWP for all life cycle modules (used for GLA WLC Excel)

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES (kgCO2e) (See		Sequestered (or biogenic) carbon (negative value) (kgCO2e)	Product stage (kgCO2e)	Construction process stage (kgCO2e)		Use stage (kgCO2e)							End of Life (EoL) stage (kgCO2e)				TOTAL Modules A-C kgCO2e	Benefits and loads beyond the system boundary (kgCO2e)
				Module A		Module B							Module C					Module D
Building element			[A1] to [A3]	[A4]	[A5]	[B1]	[B2]	[B3]	[B4]	[B5]	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		
0.1	Demolition: Toxic/Hazardous/Contaminated stage												[Where only a single C1-C4 is known, please include it here]	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e
0.2	Demolition Works												[Where only a single C1-C4 is known, please include it here]	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e
0.3	Temporary Supports to Adjacent Structures	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e
0.4	Specialist Ground Works	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e
0.5	Temporary Diversion Works	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e	0 kgCO2e
1	Substructure	0 kgCO2e	441,346 kgCO2e	20,038 kgCO2e	24,099 kgCO2e	0 kgCO2e	717 kgCO2e	179 kgCO2e	0 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	13,543 kgCO2e	2,659 kgCO2e	22,368 kgCO2e	524,949 kgCO2e	-94,241 kgCO2e
2.1	Superstructure: Frame	0 kgCO2e	163,648 kgCO2e	964 kgCO2e	5,738 kgCO2e	0 kgCO2e	478 kgCO2e	120 kgCO2e	0 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	8,764 kgCO2e	498 kgCO2e	0 kgCO2e	180,209 kgCO2e	-11,152 kgCO2e
2.2	Superstructure: Upper Floors	0 kgCO2e	73,488 kgCO2e	1,178 kgCO2e	344 kgCO2e	0 kgCO2e	478 kgCO2e	120 kgCO2e	0 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	2,335 kgCO2e	276 kgCO2e	0 kgCO2e	78,210 kgCO2e	-34,929 kgCO2e
2.3	Superstructure: Roof	0 kgCO2e	121,695 kgCO2e	119 kgCO2e	17,798 kgCO2e	0 kgCO2e	478 kgCO2e	120 kgCO2e	164,874 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	3,157 kgCO2e	2,029 kgCO2e	82 kgCO2e	311,751 kgCO2e	+40,499 kgCO2e
2.4	Superstructure: Stairs and Ramps	0 kgCO2e	476 kgCO2e	3 kgCO2e	25 kgCO2e	0 kgCO2e	478 kgCO2e	120 kgCO2e					[Where only a single C1-C4 is known, please include it here]	29 kgCO2e	2 kgCO2e	0 kgCO2e	1,132 kgCO2e	-173 kgCO2e
2.5	Superstructure: External Walls	0 kgCO2e	164,199 kgCO2e	1,434 kgCO2e	1,710 kgCO2e	0 kgCO2e	7,529 kgCO2e	1,883 kgCO2e	89,698 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	3,239 kgCO2e	251 kgCO2e	90 kgCO2e	269,432 kgCO2e	-51,203 kgCO2e
2.6	Superstructure: Windows and External	-110 kgCO2e	73,845 kgCO2e	188 kgCO2e	0 kgCO2e	0 kgCO2e	7,529 kgCO2e	1,883 kgCO2e	74,812 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	831 kgCO2e	128 kgCO2e	10 kgCO2e	159,036 kgCO2e	-16,599 kgCO2e
2.7	Superstructure: Internal Walls and Partitions	-7,704 kgCO2e	71,309 kgCO2e	463 kgCO2e	6,594 kgCO2e	0 kgCO2e	478 kgCO2e	120 kgCO2e	51,416 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	4,070 kgCO2e	7,091 kgCO2e	10 kgCO2e	134,647 kgCO2e	-877 kgCO2e
2.8	Superstructure: Internal Doors	-6,537 kgCO2e	6,078 kgCO2e	20 kgCO2e	0 kgCO2e	0 kgCO2e	478 kgCO2e	120 kgCO2e	6,156 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	15 kgCO2e	6,579 kgCO2e	2 kgCO2e	12,910 kgCO2e	0 kgCO2e
3	Finishes	0 kgCO2e	13,898 kgCO2e	36 kgCO2e	1,691 kgCO2e	0 kgCO2e	19,359 kgCO2e	4,840 kgCO2e	58,135 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	12 kgCO2e	2,959 kgCO2e	6 kgCO2e	100,926 kgCO2e	0 kgCO2e
4	Fittings, Furnishings & Equipment	-2,013 kgCO2e	22,534 kgCO2e	52 kgCO2e	907 kgCO2e	0 kgCO2e	6,453 kgCO2e	1,613 kgCO2e	90,670 kgCO2e	0 kgCO2e			[Where only a single C1-C4 is known, please include it here]	21 kgCO2e	2,070 kgCO2e	3 kgCO2e	122,319 kgCO2e	0 kgCO2e
5	Services (MEP)	0 kgCO2e	244,667 kgCO2e	1,107 kgCO2e	2,095 kgCO2e	220,816 kgCO2e	25,095 kgCO2e	6,274 kgCO2e	497,191 kgCO2e	0 kgCO2e	871,610 kgCO2e	1,522,641 kgCO2e	141,318 kgCO2e	[Where only a single C1-C4 is known, please include it here]	1,831 kgCO2e	164 kgCO2e	16 kgCO2e	3,525,994 kgCO2e	-276,777 kgCO2e
6	Prefabricated Building						0 kgCO2e	0 kgCO2e						[Where only a single C1-C4 is known, please include it here]				0 kgCO2e	
7	Work to Existing Building						0 kgCO2e	0 kgCO2e						[Where only a single C1-C4 is known, please include it here]				0 kgCO2e	
8	External works	0 kgCO2e	237,294 kgCO2e	17,512 kgCO2e	0 kgCO2e		2,151 kgCO2e	538 kgCO2e	267,583 kgCO2e	0 kgCO2e				[Where only a single C1-C4 is known, please include it here]	11,675 kgCO2e	1,193 kgCO2e		537,855 kgCO2e	-31,326 kgCO2e
	Other site construction impacts or proposed construction				560,081 kgCO2e												560,081 kgCO2e	
TOTAL kgCO2e		-16,365 kgCO2e	1,633,787 kgCO2e	43,112 kgCO2e	621,871 kgCO2e	220,816 kgCO2e	71,700 kgCO2e	17,926 kgCO2e	1,291,935 kgCO2e	0 kgCO2e	2,344,451 kgCO2e	141,318 kgCO2e	0 kgCO2e	49,523 kgCO2e	26,498 kgCO2e	22,588 kgCO2e	6,519,559 kgCO2e	-577,773 kgCO2e
TOTAL		-2 kgCO2e/m2 GIA	228 kgCO2e/m2 GIA	6 kgCO2e/m2 GIA	87 kgCO2e/m2 GIA	31 kgCO2e/m2 GIA	10 kgCO2e/m2 GIA	3 kgCO2e/m2 GIA	180 kgCO2e/m2 GIA	0 kgCO2e/m2 GIA	334 kgCO2e/m2 GIA	20 kgCO2e/m2 GIA	0 kgCO2e/m2 GIA	7 kgCO2e/m2 GIA	4 kgCO2e/m2 GIA	3 kgCO2e/m2 GIA	909 kgCO2e/m2 GIA	-81 kgCO2e/m2 GIA

7.0 Appendix B- Bill of Quantities

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) including assumed material/product lifespans and annual maintenance/repair %	Declare 'end of life' scenario as per project's Circular Economy Statement, and used in the WLC assessment to produce Module C results	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						
0.2	Major Demolition Works						
0.3	Temporary Support to Adjacent Structures						
0.4	Specialist Ground Works						
1	Substructure	Warehouse-EPS Insulation	13104	As Building	Platic Based material incineration	0 kg	0 kg
		Warehouse-Ready Mix concrete	2358720	As Building	Concrete Crushed to aggregate	0 kg	2,358,720 kg
		Warehouse-Plastic Vapour control layer	606	As Building	Plastic based material recycling	0 kg	606 kg
		Warehouse-Reinforcement Steel	17415	As Building	Steel Recycling	0 kg	17,415 kg
		Warehouse- Self Levelling Mortar	91728	As Building	Cement/Mortar use in backfill	0 kg	91,728 kg
		Office-EPS Insulation	2580	As Building	Platic Based material incineration	0 kg	0 kg
		Office-Ready Mix concrete	464400	As Building	Concrete Crushed to aggregate	0 kg	464,400 kg
		Office-Plastic Vapour control layer	119	As Building	Plastic based material recycling	0 kg	119 kg
		Office-Reinforcement Steel	88465	As Building	Steel Recycling	0 kg	88,465 kg
		Office- Self Levelling Mortar	18060	As Building	Cement/Mortar use in backfill	0 kg	0 kg
		Warehouse-Reinforcement Steel-Pilings	8697	As Building	Steel Recycling	0 kg	8697
		Warehouse-Ready mix concrete-Pilings	125399	As Building	Concrete Crushed to aggregate	0 kg	125399
		Office-Reinforcement Steel-Pilings	1712	As Building	Steel Recycling	0 kg	1712
		Office-Ready mix concrete-Pilings	24686	As Building	Concrete Crushed to aggregate	0 kg	24686
2.1	Superstructure: Frame	Structural Steel Profile- S355	64669	As Building	Steel Recycling	0 kg	64,669 kg
		Structural Steel Profile- S355	150628	As Building	Steel Recycling	0 kg	150,628 kg
		Steel Purlins	13564	As Building	Steel Recycling	0 kg	13,564 kg
2.2	Superstructure: Upper Floors	Office-Hollow core concrete slab	282136	As Building	Concrete Crushed to aggregate	0 kg	282136
		Office- Self Leveling mortar	3444	As Building	Cement/Mortar use in backfill	0 kg	3444
		Warehouse-Hollowcore concrete slab	506271	As Building	Concrete Crushed to aggregate	0 kg	506271
		Warehouse- Self Leveling mortar	6181	As Building	Cement/Mortar use in backfill	0 kg	6181

2.3	Superstructure: Roof	Sandwich Panel	35116	50 years	Sandwich panel recycling	0 kg	35,116 kg
		Glass wool insulation panels	3628	As Building	Plstic Based material incineration	0 kg	0 kg
		EPS insulation	774	As Building	Plstic Based material incineration	0 kg	0 kg
		Plastic vapour control layer	113	30 Years	Plastic based material recycling	0 kg	113 kg
		Ready mix concrete	61320	30 years	Concrete Crushed to aggregate	0 kg	61,320 kg
		reinforecement steel rebar	18575	As Building	Steel Recycling	0 kg	18,575 kg
2.4	Superstructure: Stairs and Ramps	Ready Mix Concrete	2250	As Building	Concrete Crushed to aggregate	0 kg	2,250 kg
		Reinforcement steel	748	As Building	Steel Recycling	0 kg	748 kg
2.5	Superstructure: External Walls	Wall sandwich panels	28711	50 years	Sandwich panel recycling	0 kg	28,711 kg
		Render Mortar	18140	30 years	Cement/Mortar use in backfill	0 kg	18,140 kg
		Lightweight concrete block	30384	As Building	Concrete Crushed to aggregate	0 kg	30,384 kg
		masonry mortar	4081	As Building	Cement/Mortar use in backfill	0 kg	4,081 kg
		rock wool insulation	10078	As Building	Landfill	0 kg	0 kg
		lightweight concrete block	66617	As Building	Concrete Crushed to aggregate	0 kg	66,617 kg
		masonry mortar	8775	As Building	Cement/Mortar use in backfill	0 kg	8,775 kg
		gypsum plaster board	5404	As Building	Gypsum Recycling	0 kg	5,404 kg
		gypsum plaster	1662.87	30 years	Landfill	0 kg	0 kg
		Precast Concrete Wall	63120	As Building	Concrete Crushed to aggregate	0 kg	63,120 kg
2.6	Superstructure: Windows and External Doors	Double Glazed Window	17337	30 Years	Glas containing product recycling	0 kg	17,337 kg
		Garage steel doors	3487	30 Years	Metal Product Recycling	0 kg	3,487 kg
		External Steel Door	602.31	30 Years	Metal Product Recycling	0 kg	603 kg
		Glass Doors	258.27	40 Years	Glas containing product recycling	0 kg	258 kg

2.7	Superstructure: Internal Walls and Partitions	Gypsum Plasterboard	1079	30 Years	Gypsum Recycling	0 kg	1,079 kg
		Planed Timber	4872	At Building	wood product recycling	0 kg	4,872 kg
		Glass wool insulation panels	2224	At Building	Landfill	0 kg	0 kg
		Gypsum Plasterboard	1079	30 Years	Gypsum Recycling	0 kg	1,079 kg
2.8	Superstructure: Internal Doors	Wooden internal Door	4023	40 Years	Wood Product recycling	0 kg	4,023 kg
3	Finishes	Carpet	1432	15 Years	Landfill	0 kg	0 kg
		Interior paint	2656.1	10 Years	Landfilll	0 kg	0 kg
4	Fittings, furnishings & equipment (FFE)	Desk	3056.954	12 years	Wood product incineration	0 kg	0 kg
		Conference Table	284.118	12 years	Wood product incineration	0 kg	0 kg
		Office Chair	2243	12 years	Landfill	0 kg	0 kg
5	Services (MEP)	Office-Drinking water pipework	99.33	At Building	Metal Product recycling	0 kg	99 kg
		Warehouse-Drinking water pipework	360.36	At Building	Metal Product recycling	0 kg	360 kg
		Heat distribution piping	1326.45	At Building	Metal Product recycling	0 kg	1,326 kg
		Sewage Piping	430.2	At Building	Metal Product recycling	0 kg	430 kg
		Electricity distribution system	1326.45	25 Years	Metal Product recycling	0 kg	1,326 kg
		Ceramic Toilet	352.8	20 Years	Landfilling	0 kg	0 kg
		Ceramic Urinal	108	20 Years	Landfilling	0 kg	0 kg
		Porcelain Sink	473.6	20 Years	Landfilling	0 kg	0 kg
		Brass tap	9.6	At Building	Metal Product recycling	0 kg	10 kg
		Ventilation system	13121	25 Years	Metal Product recycling	0 kg	13,121 kg
		LED lighting	345	17 Years	Landilling	0 kg	0 kg
		Air source Heat Pump	4104	22 Years	Metal Product recycling	0 kg	4,104 kg
6	Prefabricated Buildings and Building Units						
7	Work to Existing Building						
8	External works	Asphalt	3989595	30 Years	Asphalt reuse via reprocessing	0 kg	3,989,595 kg
Refrigerants		**Refrigerant name**	**Initial Charge (kg)**	**Annual leakage rate %**	**Refrigerant GWP (kgCO2e/kg)**	**End of Life recovery rate %**	
a	Refrigerants Type 1 (if applicable) - please see CIBSE TM65 for methodology	R-410A	43	4	2087.5	98	
b	Refrigerants Type 2 (if applicable) - please see CIBSE TM65 for methodology						
c	Refrigerants Type 3 (if applicable) - please see CIBSE TM65 for methodology						
		TOTAL	8,665,616 kg			0 kg	8,602,511 kg
		Material intensity (kg/m2 GIA)	1,209 kg/m2 GIA			0 kg/m2 GIA	1,200 kg/m2 GIA

8.0 Appendix C- EPD Databases Used

Section 4 of this report goes into detail on how material EPDs have been selected. Below is a list of all EPD databases that have been used within this WLC assessment to select generic material types.

EPDs used in assessment
BRE
INIES
One Click LCA
IBU
Ift Rosenheim
Inside/Inside
RTS
EPD Norge

9.0 Appendix D- Example of information Received from Design Team

Material quantities and volumes table

Project:22002 Breakspear Road South, Ickenham, Uxbridge

Date:26/09/22

Checkd by: MA

CLASS	Item	Material	Volume	Unit	Weight	Unit
FOUNDATION	Piling and pilecaps	Concrete - Cast Insitu	689.12	m³	1724217.2	kg
RETAINING WALLS	RC Retaining Walls	Concrete - Cast Insitu	514.96	m³	1288466.744	kg
SLAB	Slab L00 - RC Slab	Concrete - Cast Insitu	926.74	m³	2318752.626	kg
SLAB	Slab L01 - Hollowcore	Concrete - Cast Insitu	228.36	m³	571376.5682	kg
RC CONCRETE REINFORCEMENT (Estimated)	Slab mesh, reinforcement bars	Reinforcement - Steel rebar	40.11	m³	4692.87	kg
COLUMNS	Steel columns	S355 Steel	8.23	m³	64669.36053	kg
BEAMS	Steel beams	S355 Steel	19.17	m³	150628.8828	kg
ROOF PURLINS	Metsec roof purlins	Light Gauge Steel	1.73	m³	13564.20075	kg
			2428.42	m³	6136368.452	kg

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