Whole Life Carbon Assessment

(RIBA Stage 3-4)

Charlton Brown Architecture & Interiors Limited

82 Fitzjohn's Avenue
London
NW3 6NP

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	12.03.2020	Yin Mui Tang	Iain Turrell	Iain Turrell
1	B	16.03.2020	Yin Mui Tang	Iain Turrell	Iain Turrell

The figures within this report may be based on indicative modelling and an assumed specification outlined within the relevant sections. Therefore, this modelling may not represent the as built emission or energy use of the Proposed Development and further modelling may need to be undertaken at detailed design stage to confirm precise performance figures. Please contact SRE should you have any questions, or should you wish further modelling to be undertaken post planning.

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Executive Summary

This Whole Life Carbon Assessment (WLCA) has been written by SRE on behalf of Charlton Brown Architecture and Interiors Limited (The Architect) to demonstrate the embodied and operational carbon emissions for the proposed extension and refurbished residential development at The White House, 82 Fitzjohn's Avenue.

The Proposed Development consists of the part removal of the existing structures – all of which were extensions to the original house on the site – and the new extension of the original house to form a modern residential dwelling of 860m^2.

The aim of this assessment is to model the whole life carbon impact of the proposed design, and compare this to an alternative scheme where the existing fabric is retained, enhanced and extended to provide an identical floor area of residential accommodation. Then a comparison can be made in relation to the potential future impacts of the Proposed Development.

Using Elmhurst Design SAP and OneClick LCA software, SRE has undertaken this assessment in line with the RICS Whole Life Carbon Assessment for the Built Environment, which forms the basis for this initial assessment to RIBA Stage 4.

The assessment has taken into account embodied and regulated operational energy of the proposed scope of works, commencing from a "cleared flat site" in accordance with RICS guidelines.

The overall results show that the Proposed Development will have a cradle to grave emission of 1108.72 tonnesCO_2e – less than that associate with the retained and extended Refurbished scenario.

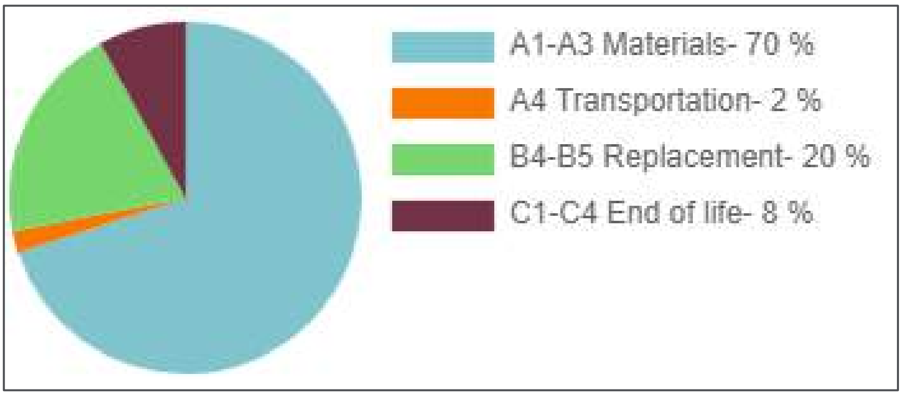

Figure 1: Summary of Whole Life Carbon Assessment Proposed Development – OneClick LCA

Scenarios	Description	Cradle-to-Grave Carbon Emissions (tonCO_2e)
Refurbishment	Refurbishment of the main elements (excluding elements itemised) and extension to meet Building Regulations Part L1B minimum requirements.	1452.83
Proposed	The proposed Scheme including part demolition and rebuild and addition of proposed extension	1108.72

Table 1: LCA modelling scenarios

Introduction

1.0 Introduction

This Whole Life Carbon Assessment has been written by SRE for Charlton Brown Architecture and Interiors Limited (The Architect) to demonstrate the embodied and operational carbon emissions incorporated for the renovation and extension of the residential dwelling at 82 Fitzjohn's Avenue, London (the Proposed Development), located within the London Borough of Camden.

The Whole Life Carbon Assessment (WLCA) is being undertaken in accordance with the 'RICS Whole Life Carbon Assessment for the Built Environment' (First Edition, November 2017) which outlines the process of WCLA, and what is, and what is not included. The aim of the RICS document provides clarity on the EN 15978: 2011 for the sustainability assessment of buildings and on the approach required within this methodology.

The aim of this assessment will be to model the whole life carbon impact of two scenarios: the proposed design (hereafter known as the Proposed Scenario) and compare this to an alternative scheme (hereafter known as the Refurbishment scenario) where the existing fabric is retained, enhanced and extended to provide the identical floor area of residential accommodation. Then a comparison can be made in relation to the potential future impacts of the Proposed Development.

The assessment utilises recognised industry software and Elmhurst Energy SAP modelling to evaluate the lifecycle carbon content of materials and M&E fittings of the site, over a 60-year lifespan. The assessment of the materials' carbon emissions also includes the replacement of certain items in line with industry standards.

2.0 The Site and Proposed Development

The Application Site currently consists of a residential dwelling which has been extended numerous times over the years and is a mix of architectural styles and construction quality as a result - many of which are in a poor state of repair. The Proposed Development consists of the part removal of the existing structures – all of which were extensions to the original house on the site – and the extension of the original house to form a modern residential dwelling of 860m^2 GIA.

Elements of the original dwelling on the site are to be retained, with extensions to be constructed to a high quality of architectural design, with finishes and design elements which complement and enhance the existing, retained property.

Overall the Proposed Development aims to retain and enhance the existing structure – which is of architectural interest – and extend and enhance the living conditions to provide longer term sustainable, efficient residential accommodation.

Figure 2 – South Elevation of the Proposed Development (Charlton Brown Architecture & Interiors)

Methodology and Standards

3.0 Methodology and Standards

There are multiple definitions of Zero Carbon Development which can impact the method of reporting. For the purpose of this assessment, the following definition from the UK Green Building Council would be used[1]:

Net Zero Carbon – Whole Life: *"When the amount of carbon emissions associated with the building's embodied and operational impacts over the life of the building, including its disposal, are zero or negative"*

To this end, the Whole Life Carbon Assessment (WLCA) has been undertaken in accordance with the 'RICS Whole Life Carbon Assessment for the Built Environment' (First Edition, November 2017) which outlines the process of WCLA, and what is, and what is not included. The aim of the RICS document provides clarity on the EN 15978: 2011 for the sustainability assessment of buildings, and provides clarity on the approach required within this methodology.

In addition to the above guidance, an Elmhurst Energy SAP model of the proposed residential dwelling has been constructed to ascertain predicted operational energy use (and associated carbon emissions) and, through the use of 'OneClick LCA' software, material quantities and embodied carbon associated with building elements have been analysed.

In line with the above guidance, the WLCA has been undertaken prior to RIBA Stage 4.

The following data has been used to formulate the WLCA model:

- OneClick LCA material & component database
- Drawings, plans, sections, elevations from Charlton Brown Architecture & Interiors Limited
- M&E Input
- Initial materials assumptions from Charlton Brown Architecture & Interiors Limited

The minimum requirements of the assessment, as listed within the RICS document, are outlined below:

Minimum requirements for whole life carbon assessment	
Building Parts to be included	1. Substructure 2. Superstructure
Life stages to be included	Product Stage (A1-A3) Construction Process Stage (A4-A5) Replacement Stage (B4) Operational Energy Use (B6)
Assessment Timing	At design stage – prior to technical design

Table 2: Minimum requirements for whole life carbon assessment

The RICS Document[2] states the following in relation to the baseline to which the LCA should take place. This is described as follows:

"New build projects assessed are considered to commence their development on a cleared, flat site for consistency purposes. Demolition works are often decoupled from new construction, hence the responsibility for any emissions arising from demolition is not necessarily solely attributable to the new build project. Therefore,

[1] Outlined in SRE's 'Zero/Net Carbon Approach and Definition' document.
[2] RICS, Whole life carbon assessment for the built environment. First Edition, November 2017 (Page 9, Section 3.2.2)

all carbon emissions associated with works as listed under 'Demolition'……should be reported separately and not aggregated with the rest of the project emissions. However, due to potential opportunities for recovery, reuse and recycling, and for improving the deconstruction and demolition process, pre-demolition assessments should be carried out where possible."

The scope and approach of this assessment is outlined below:

- Demolition Waste – included and reported separately
- Construction Stages (both new and existing) – included
- Offset Measures – to be calculated and including/informing any on-site generation and potential GHG Offset.

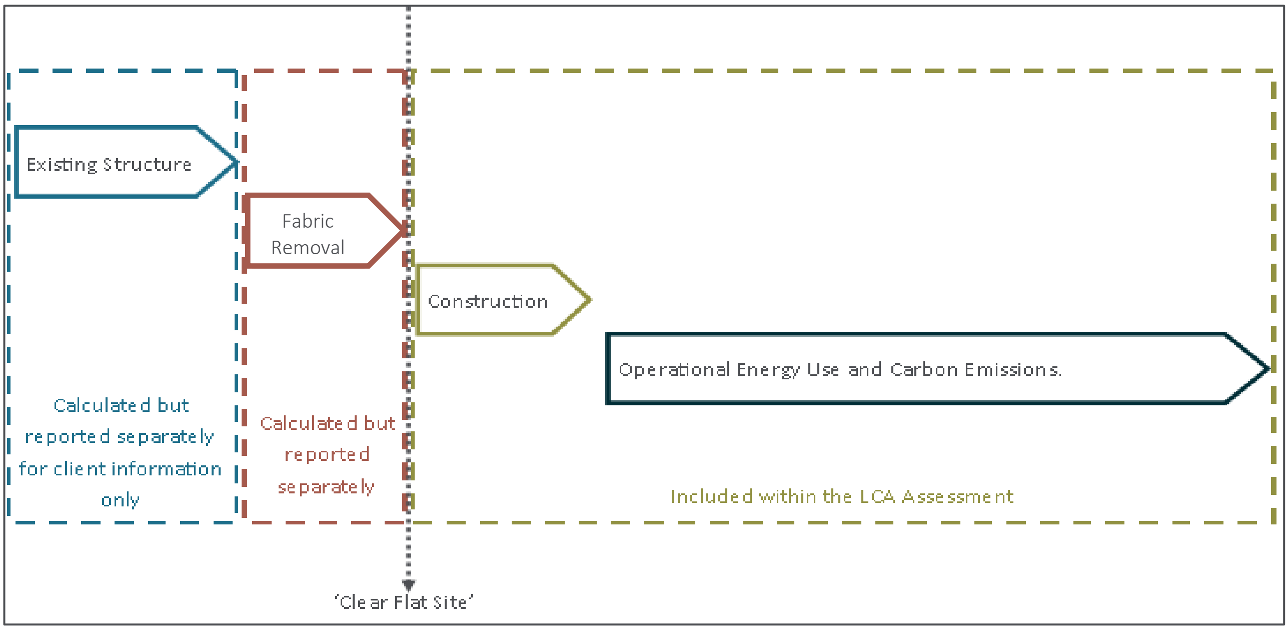

Figure 3: Process of Assessment Diagram

3.1.1 Lifecycle Stages

The embodied carbon of a site included within this assessment, are separated into the following sections:

Stage	Stage Identifier	Stage Name and Scope	Description
Product Stage	A1 – A3	Product Stage	Raw material to Product Completion
Construction Process Stage	A4 – A5	Construction Process Stage: Transport to site and construction installation process.	Transportation of goods to site and installation on-site
Use Stage	B1	In Use Emissions	Emissions arising during the life of the building from its components – such as the emissions from GHG and HFC blown insulation, which leeches over time.
	B2	Maintenance, cleaning and associated works	Emissions associated with energy and products for maintenance
	B3	Repair Emissions	Reasonable allowance for repairing unpredictable damage over and above the standard maintenance regime.
	B4	Replacement Emissions	Emissions associated with the replacement of items within the building, in accordance with the standard expected lifespan.
	B6	Operational Energy Use	Emissions associated with the operation of the building through the operation of its technical systems over the life of the building.
	B7	Operational Water Use	Emissions associated with the water use during the operation of a building during its operational life.
End of Life Stage	C1	Deconstruction and Demolition Emissions	Emissions covered by all site activity required to dismantle, deconstruct and/or demolish the built asset
	C2	Transport Emissions	Transport emissions associated with the discarded items from site
	C3	Waste Processing for reuse, recovery or recycling emissions	Processing emissions for waste arising from the demolition of the site when processing for recycling, reuse or recovery
	C4	Disposal Emissions	Emissions associated with the disposal of materials which are not being recycled and are to be disposed of.

Table 3: Outline of all assessment elements covered by the WLCA

With regards to the above stages, the following approach has been taken:

Construction Stage

Construction activities on site have been informed by the 'scope of work' with calculations based on the building dimensions and the geographical location of the site. This, in turn, will inform the total energy use and associated carbon emissions of the proposed works. This is calculated within the OneClick LCA software.

Use Stage

Operational energy demands for the site have been based on the SAP modelling carried out in Elmhurst Energy– as used for Building Regulations Part L compliance. The 'regulated' (heating, cooling, lighting, ventilation) emissions are taken into account to accurately represent the scheme's energy consumption and associated carbon emissions. The emissions associated with 'un-regulated' (appliances and process loads based on intended usage) energy are not covered by the current Part L, and is often difficult to predict and determine until very late on in the design process. This has therefore not been included in the current WLCA modelling.

3.1.2 Limitations

The Assessment has been conducted as accurately as possible, with the utmost care taken to ensure that modelling and materials reflect the proposed building and any retained and new hard landscaping onsite, as well as the systems and material installations proposed within the building specification of works. However, as with all early-stage assessments, the products used within this assessment may not exactly reflect those being installed on site at a later date. The changing of products will alter the embodied carbon information used within the LCA model, in addition to the mileage associated with transport to the site.

Mileage and the effect of travel has been assessed within the OneClick software, albeit at a default setting. The setting gives values for the transportation of goods as outlined below within Table 4. These assumptions will be reviewed post completion in line with RICS guidance.

Transport Scenario	km by road*	km by sea**
Locally manufacturer e.g. Concrete, aggregate, earth	50	-
Nationally manufactured e.g. plasterboard, blockwork, insultation	300	-
European manufacturers e.g. CLT, façade modules, carpet	1,500	-
Globally manufactured e.g. specialist stone cladding	200	10,000
* Means of transport assumed as average rigid HGV with average laden – average laden as per BEIS carbon conversion factors. ** Means of transport assumed as average containership		

Table 4: Default Transport scenarios for UK projects

The replacement of building elements is also considered within the WLCA based on information within the RICS documentation. The lifespan of a product is generic, and is based on the element type. This will therefore not represent actual building use, or the precise product selected. By way of an example, a product with a 10-year lifespan prediction, will need to be replaced 5 times through the 60-year lifespan – in addition to the first installation.

The lifespan of the products is based on the information contained within Table 5.

Building Part	Building Elements/Components	Expected Lifespan
Roof	Roof Coverings	30 years
Superstructure	Internal partitioning and dry lining	30 years
Finishes	Wall Finishes: render/paint	30/10 years respectively
	Floor finishes: Raised Access Floor (RAF)/Finish Layers	30/10 years respectively
	Ceiling finishes: substrate/paint	20/10 years respectively
Furniture, fixings and Equipment (FF&E)	Loose furniture and fittings	10 years
Services/MEP	Heat source, e.g. boiler, calorifiers	20 years
	Space heating and air treatment	20 years
	Ductwork	20 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installations and controls	15 years
	Water and disposal installations	25 years
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
Façade	Opaque modular cladding e.g. rain screens, timber panels	30 years
	Glazed cladding/curtain walling	35 years
	Windows and external doors	30 years

Table 5: Assumed lifespan of materials

All assumptions made by SRE are included in Appendix C. These relate to specifications, inputs into OneClick and modelling software.

Results

4.0 Results

4.1 Outcomes and Units

The units required to be used within the outputs for the WLCA are clearly defined by the RICS documentation. This is to ensure that the results can be compared to peer projects meaningfully and fairly. Therefore, the following normalisation units are utilised for the proposed building use at the site:

- Buildings; planning use classes C1-C4: *$kgCO_2e/m^2$ of Net Internal Area*

4.2 Outcomes per lifecycle stage

The embodied WLC for the Proposed scheme has been based on the full OneClick material component database and the Elmhurst Energy SAP model, and summarised within Table 6 below:

Module	Sitewide
A1-A5 Construction Process stage	428,442 $kgCO_2e$
B1-B7 Use Stage	634,598 $kgCO_2e$
C1-C4 End of Life stage	45,679 $kgCO_2e$
Total GWP ($kgCO_2e$)	1,108,720 $kgCO_2e$
Total GWP (C3 usage, $kgCO_2e/m^2$)	1,176 $kgCO_2e/m^2$

Table 6: WLCA Emission Results per Lifecycle Stage

It should be noted that the figures presented in Table 6 are the result of a point-in-time assessment, based on the information available at the time of the assessment. As more quantities and details of the components become available, the WLCA model will be updated to capture the embodied carbon emissions for the development more accurately.

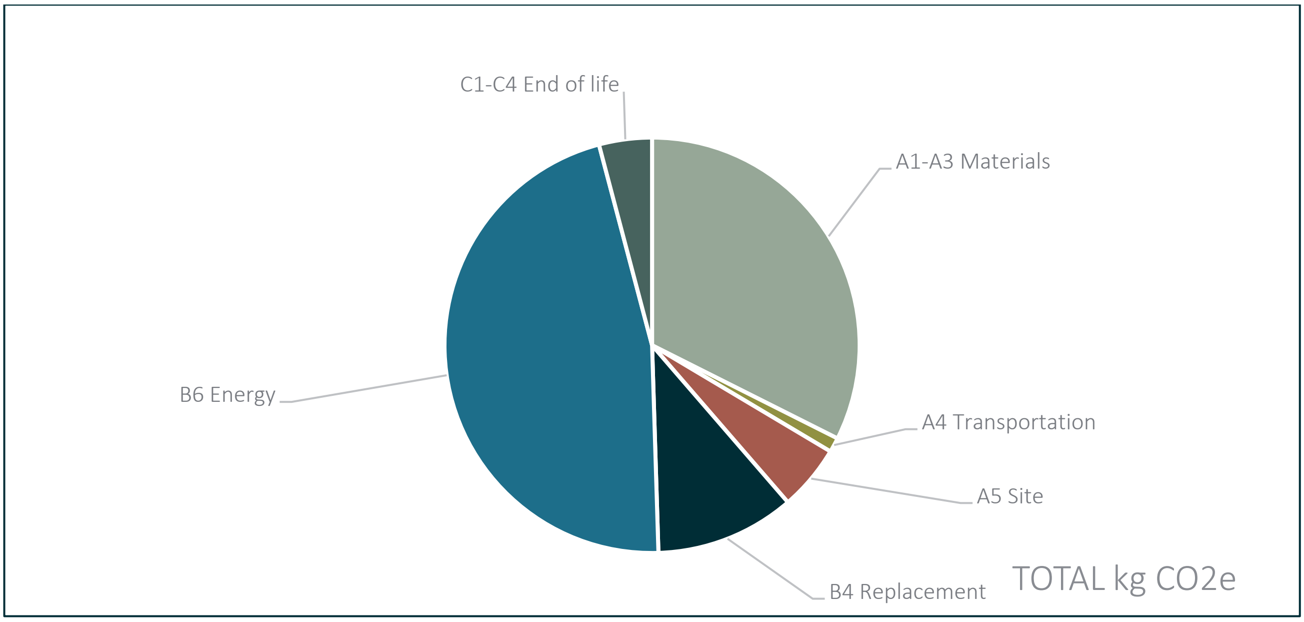

Figure 4: Breakdown of Carbon Emissions by Lifecycle Stage

Figure 4 shows that life cycle stage B6, Operational Energy Use, accounts for by far the greatest quantities of carbon emissions. The other two major source of carbon emissions are linked with life cycle stage A1-A3, Materials & Product stage, and B4, Replacement.

4.3 Most Contributing Building Elements & Materials

In order to capture a more detailed picture of carbon emissions related to A1-A3 lifecycle stages, Figure 5 and Figure 6 give a breakdown of the contribution of different building elements and materials to the overall total carbon emissions in the Proposed scenario.

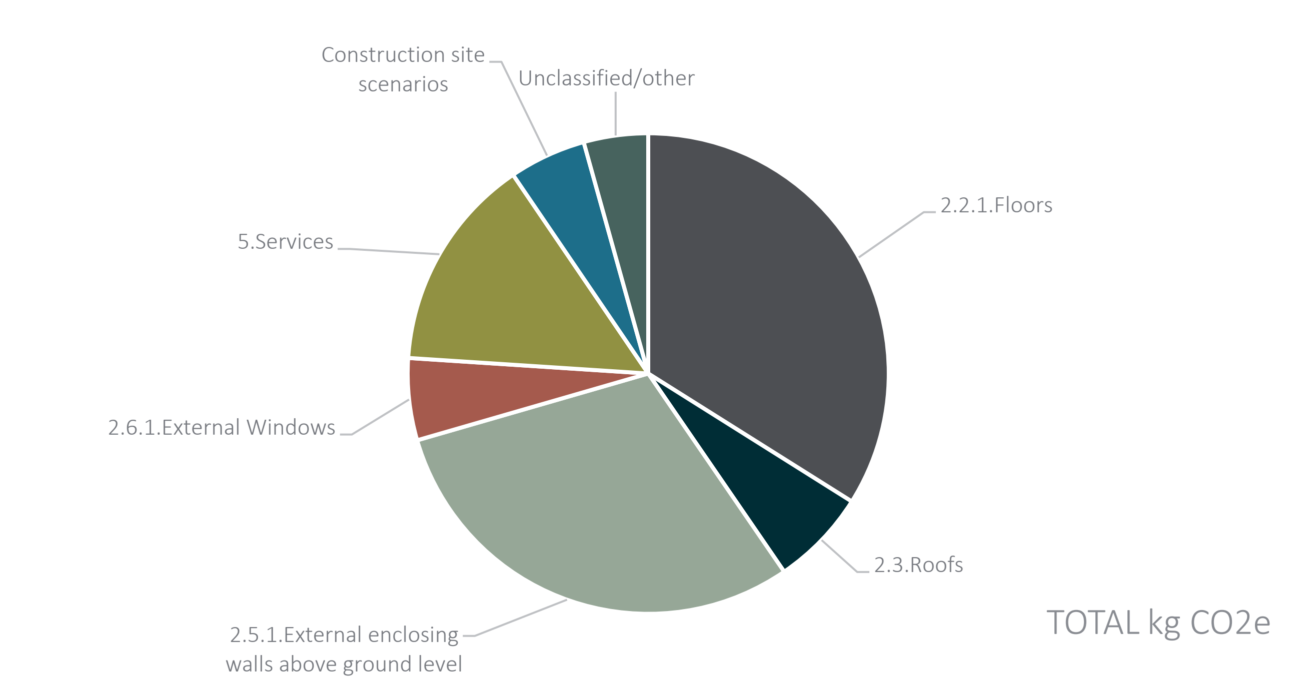

Figure 5: Most Contributing Building Elements (A1-A3)

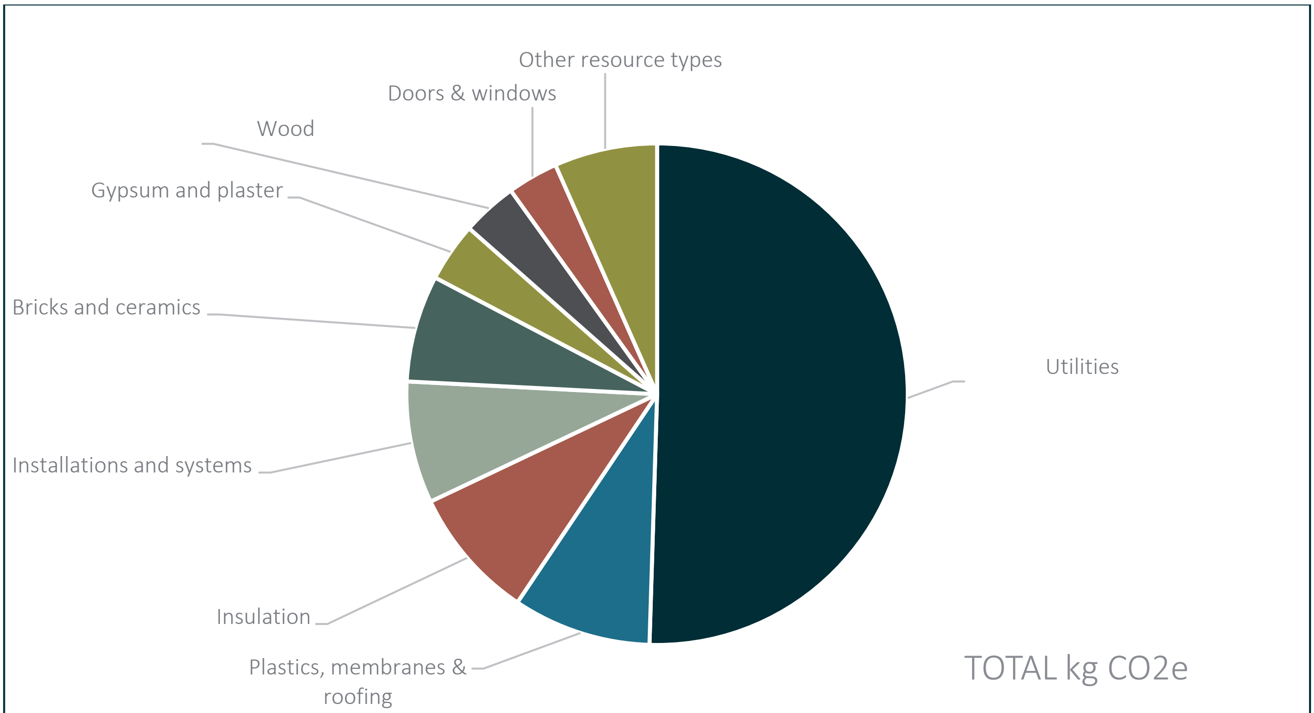

Figure 6: Most Contributing Building Materials (A1-A3)

4.4 Discussion of Results.

The WLCA modelling has been carried out for both the Proposed and Refurbishment scenarios. By completing the WLCA model for both scenarios and reviewing the design information available to date, the following observations have been made.

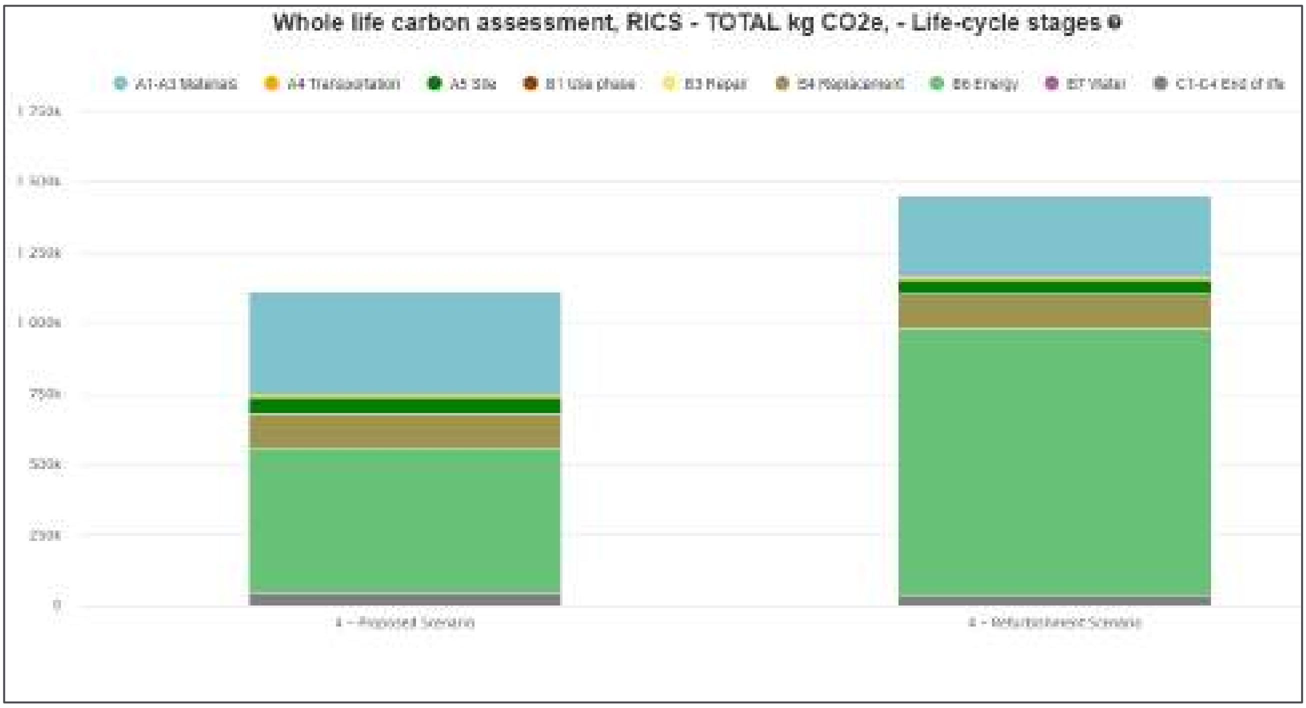

Figure 7 – Comparison of Lifecycle Stage Elements for the Proposed and Refurbishment scenarios

Figure 7 shows the total kgCO_2e impact of both the Proposed and Refurbishment scenarios at all life-cycle stages from Cradle-to-Grave. It can be observed that the embodied carbon associated with materials in the Proposed scenario is greater due to the inclusion of a greater amount of insulation in the building fabric and materials for the new elements that would otherwise be retained and enhanced in the Refurbished scenario. However, the better performing building fabric in the Proposed scenario clearly shows that the new construction will be a less carbon intensive option when taking into account all factors. This is because the carbon emissions associated with operational energy will be significantly reduced in the Proposed scenario and will hence be less carbon intensive in the long run. The quantities of materials included in the WLCA model are based on information provided from the Design Team to-date, and include estimations of quantities of muck-away, and materials reclaimed from current site.

It has also been assumed that the existing structure will have a lifespan of 60 years. In reality, there are parts of the existing building structure that are worn and not in good shape – particularly the later extensions. It is not therefore a reasonable assumption that these later extensions will last the assumed 60 years. This may result in some elements needing to be replaced more often than currently modelled. As mentioned in Section 3.1.2, the lifespan of the products used in the modelling are generic and based on element type as per Table 5. However, it is likely that the existing structure will need additional works and new materials to address its longevity concerns. This has not been taken into consideration in the present modelling and may therefore result in greater embodied carbon in lifecycle stage B4, Replacement, in the Refurbished scenario than what is currently modelled.

4.4.1 Operational Energy Use

As can be seen in Section 4.2**Error! Reference source not found.**, carbon emissions within the lifecycle stage B6, Operational Energy Use, has the most significant impact on the WLC performance of the scheme.

A SAP model has been completed for the Proposed Development to represent the energy performance of the scheme in line with Part L requirements. Energy use related to building services (heating, cooling, hot water, ventilation) and lighting, known as the regulated energy, has been considered and listed below. Figure 8 shows the operational energy consumption in the Proposed scenario, and Figure 9 shows the operational energy consumption in the Refurbishment scenario.

Water heating fuel used	2656.3569 (219)
Annual totals kWh/year	
Space heating fuel - main system	17260.6097 (211)
Space heating fuel - secondary	831.3690 (215)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	1849.5690 (232)
Total delivered energy for all uses	21797.5248 (238)

Figure 8 - Proposed Scenario Energy Consumption by End Use

Water heating fuel used	2257.3646 (219)
Annual totals kWh/year	
Space heating fuel - main system	36461.8293 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
Total electricity for the above, kWh/year	30.0000 (231)
Electricity for lighting (calculated in Appendix L)	1365.2644 (232)
Total delivered energy for all uses	40114.4483 (238)

Figure 9 - Refurbishment Scenario Energy Consumption by End Use

As can be seen from Figures 8 and 9, the total operational energy in the Refurbishment scenario accounts to a total of 40,114 kWh/year, whereas the operational energy in the Proposed scenario shows a significantly lower level of operational energy at 21,798 kWh/year. This can be attributed to the ability to improve the building fabric performance to a greater level and consistency across the site in the Proposed scenario, and as such will ultimately end up being the more carbon sensitive approach in the longer term.

4.4.2 Concrete

Concrete's environmental impact can be reduced by replacing a proportion of the ordinary Portland Cement and sand content with recycled alternatives such as fly ash or ground granulated blast furnace slag (GGBS). The default RICS guidance is an allowance of 20% cement replacement as included within this WLCA. Therefore, the team should ensure that a minimum of 20% Portland Cement replacement is incorporated into the technical specifications, and aim to increase the proportion of Portland Cement substitution further.

4.4.3 Glass

A detailed Thermal Comfort Analysis has been undertaken by SRE, which reviewed the thermal performance of the specified glazing units. This assessment has been undertaken under a climate change scenario to ensure a thermally comfortable environment can be achieved during the lifespan of the buildings.

Meanwhile, the use of aluminium with higher recycled content should be considered to reduce the usage of raw materials and the associated embodied carbon emissions.

4.4.4 Transportation

At this stage, the RICS recommended transport distances (see Table 4) have been adopted. It is recommended that locally sourced materials with an EPD should be used where possible.

4.4.5 Waste Removal

Removal of waste has been taken into account as part of Stage D of the WLCA – This will offset the amount of embodied carbon in the scheme.

5.0 Conclusion

The WLCA shows the following carbon emission results for the proposed development:

RICS Cradle-to-Grave Carbon Results		
Element	Carbon Emissions (Proposed)	Carbon Emissions (Refurbished)
Lifecycle Stages A1-A5	428,442 $kgCO_2e$	350,664 $kgCO_2e$
Lifecycle Stage B1-B7	634,598 $kgCO_2e$	1,066,897 $kgCO_2e$
Lifecycle Stage C1-C4	45679 $kgCO_2e$	35266 $kgCO_2e$
Total GWP	1,108,720 $kgCO_2e$	1,452,828 $kgCO_2e$
Module D	-129,569 $kgCO_2e$	-121,915 $kgCO_2e$

Table 7: WLCA Result comparison between Proposed and Refurbishment Scenarios

Results from the WCLA modelling indicate that the new construction will ultimately end up being a more carbon sensitive approach in the longer term, taking all factors into account, and is therefore the preferred option going forward.

Appendices

Appendix A – Carbon Reporting – Embodied and Operational emissions (Proposed Scenario)

Whole life carbon assessment, RICS

This is the project whole life carbon assessment according to RICS methodology and EN 15978. To see the detailed results report, please click More actions > Detailed report

	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B3 Repair	B4 Replacement	B6 Operational Energy use	B7 Operational Water use	C1-C4 End of life	D External impacts (not included in totals)	TOTAL kg CO2e
1 Substructure		1 529			0				2 195	−6 431	3 723
2.1-2.4 Superstructure	163 185	5 058	16 043		0	31 579			30 928	−76 051	246 790
2.5-2.6 Superstructure	141 586	2 093	9 233		0	34 243			9 649	−29 245	196 804
2.7-2.8 Superstructure	15 948	586	1 556		0	878			2 346	−7 870	21 311
3 Finishes	13 821	863	879		0	882			557	−2 641	17 002
4 Fittings, furnishings & equipments											
5 Services (MEP)	24 593	2 254	231		0	52 918			4	−7 330	79 999
6 Prefabricated buildings and building units											
7 Work to existing building											
8 External works	176	202	3		0				1		383
Other materials - TOTAL											
Site, energy and water			28 807				514 101				542 707
TOTAL kg CO2e	359 308	12 583	56 551		0	120 498	514 101		45 679	−129 569	1 108 720

Appendix B – Carbon Reporting – Embodied and Operational emissions (Refurbishment Scenario)

Whole life carbon assessment, RICS

This is the project whole life carbon assessment according to RICS methodology and EN 15978. To see the detailed results report, please click More actions > Detailed report.

	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B3 Repair	B4 Replacement	B6 Operational Energy use	B7 Operational Water use	C1-C4 End of life	D External impacts (not included in totals)	TOTAL kg CO2e
1 Substructure		1 529			0				2 195	-6 431	3 723
2.1-2.4 Superstructure	134 225	4 150	13 352		0	31 885			21 882	-68 035	205 495
2.5-2.6 Superstructure	107 618	1 955	7 263		0	34 243			8 147	-28 803	159 225
2.7-2.8 Superstructure	15 948	586	1 556		0	876			2 346	-7 870	21 311
3 Finishes	5 466	472	480		0	882			692	-3 447	7 992
4 Fittings, furnishings & equipments											
5 Services (MEP)	24 593	2 254	231		0	52 918			4	-7 330	79 999
6 Prefabricated buildings and building units											
7 Work to existing building											
8 External works	176	202	3		0				1		383
Other materials - TOTAL											
Site, energy and water			28 607				946 093				974 699
TOTAL kg CO2e	288 026	11 147	51 491		0	120 805	946 093		35 266	-121 915	1 452 828

Appendix C – RICS WLCA OneClick Inputs & Assumptions Summary

RICS Category		Element Description	Material Used	Total Qty	Unit
1. Foundations and substructure	Foundation	Foundation	Footing foundations for soft soils	550.2	m2
2. Vertical structures and façade	External Wall	Reinforced Concrete	Ready-mix concrete, C32/40, 20% replacement	80.0	m3
		Kingspan GreenGuard	XPS insulation board, 0.033W/m	16.4	m3
		Waterproofing slurry	Cement based slurry, waterproofing	5.4	
		Blockwork	Light weight concrete block, with expanded clay aggregate	50.2	m3
		Kingspan K108 Insulation	Phenolic insulation, low emissivity foil double faced	53.0	m3
		Brickwork	Clay brick	132308.0	kg
		Timber Studs	Softwood laminate	3.4	m3
		Waterproofing membrane	Waterproofing membrane, single component	2.1	m3
		OSB board	Oriented Strand Board (OSB), generic	1.0	m3
		Kingspan K12	Phenolic insulation, low emissivity foil double faced	15.7	m3
		Kingspan K118	Phenolic insulation, low emissivity foil double faced	4.7	m3
		Kingspan K18	Phenolic insulation, low emissivity foil double faced	8.9	m3
		Wet plaster	Gypsum plasterboard, 12.5mm	10.0	m2
	Internal Wall	Gypsum plasterboard, fire resistant	Gypsum plasterboard, fire resistant, 12.5mm	0.5	m3
		Blockwork	Light weight concrete block, with expanded clay aggregate	50.9	m3
		Batt insulation	Glas wool insulation batt, unfaced	1.4	m3
		Wet plaster	Gypsum plasterboard, regular, generic	17.7	m3
		Timber studs	Softwood laminate	0.3	m3

RICS Category		Element Description	Material Used	Total Qty	Unit
3. Horizontal structures:beams, floors and roofs	Flat Roof	Single ply membrane	Waterproofing membrane, single component	162.0	m2
		Kingspan TR27	PIR insulation boards, coated	162.0	m2
		Vapour check bituminous	Plastic vapour control layer	162.0	m2
		Plywood decking	Plywood, generic	162.0	m2
		Plaster and skim	Gypsum plasterboard, regular, generic	162.0	m2
		Timber joists	Softwood laminate	162.0	m2
	Pitched New	Plaster and skim	Gypsum plasterboard, regular, generic	46.0	m2
		Vapour check	Plastic vapour control layer	46.0	m2
		Kooltherm K7	Phenolic insulation, low emissivity foil double faced	46.0	m2
		Timber Rafters	Softwood laminate	46.0	m2
	Existing Pitched Roof	Kingspan K7 Insulation	Phenolic insulation, low emissivity foil double faced	268.0	m2
		Timber Rafters	Softwood laminate	268.0	m2
		Kingspan K118 Insulation	Phenolic insulation, low emissivity foil double faced	268.0	m2
		Membrane	Waterproofing membrane, single component	268.0	m2
		Kooltherm K108 Insulation	Phenolic insulation, low emissivity foil double faced	268.0	m2
	Floor	Setting bed	Mortar (1:3 cement:sand mix)	7236.6	kg
		Screed	Flooring screed	36.1	m3
		VCL	Plastic vapour control layer	0.2	m3
		Kingspan Kooltherm K103	Phenolic insulation, 160mm	118.1	m3
		Waterpoofing slurry	Cement based slurry, waterproofing	0.1	m3
		Reinforced Concrete	Ready-mix concrete, C32/40, 20% replacement	266.9	m3
		Kingspan GreenGuard	XPS insulation board, 0.033 W/mK	6.7	m3
		Levelling Compound	Levelling compound, for floors, walls	7.0	m3
		Cavity drain membrane	Waterproofing membrane, single component	2.9	m3
		Plywood decking	Plywood, generic	7.0	m3
		Chipboard	Timber, Chipboard	184.6	kg
		EPS panel	EPS insulation panel	0.2	m3
		Acoustic isolator	Gypsum plasterboard, regular, generic	0.1	kg
		Gyproc plank	Glass wool/mineral wool insulation, acoustic parition roll	0.3	m3
		Isover Roll Insulation Wool	Glass wool/mineral wool insulation, acoustic parition roll	1.6	m3
		Gypsum Soundbloc plasterboard	Gypsum plasterboard, sound blocking	0.5	m3
		Timber joists/Timber deckboard	Softwood laminate	5.4	m3

RICS Category		Element Description	Material Used	Total Qty	Unit
4. Other structures and materials	Windows and Doors	Internal doors	Interior doors with wooden frame	54.8	m2
		Double-glazed window	Double glazing windows with wooden frame	63.6	m2
		Single-glazed window	Top hung casement wooden window	4.4	m2
		Half-glazed door (single-glazed)	Top hung casement wooden window	2.5	m2
		Double-glazed rooflight	Roof window (skylight)	43.0	m2
		Triple-glazed window	Triple glazing windows with wooden frame	41.9	m2
		Half-glazed door (triple-glazed)	Triple glazing windows with wooden frame	21.9	m2
	Finishes and coverings	Ceramic floor tile	Clay/Ceramic Floor Tile	1.0	m3
		Cermaic floor and mosaic tiles	Mosaic Floor Tile	1833.4	kg
		Flooring tiles from natural stone	Natural Stone Tiling	4.0	m3
		Timber, Hardwood	Hardwood flooring	2291.9	kg
		Resilient synthetic rubber flooring	Rubber interlocking tiles	25.9	m2
5. External areas and site elements	Materials and constructions for external areas	Soil	Clay soil. Loose, dry density	0.5	m3
		Driveway	Clay brick paver	122.6	m2
6. Building technology	Building systems and installations	LED lighting	LED lighting, P=40W	200	unit
		Fluorescent lighting	Fluorescent lamp, T8-18W	40	unit
		500L cylinder	Water heater (water cylinder)	3	unit
		FCU	Air handling unit, with heat recovery	17	unit
		Heated Tower Rail	Electric heated towel rail	9	unit
		ASHP	Air-to-air heat pump, external unit	2	unit

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