Whole Life Carbon Assessment

(RIBA Stage 3-4)

Martin Robeson Planning Practice (MRPP)

38 Frognal Lane
Camden
London
NW3 6PP

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	21.05.2021	Yin Mui Tang	Dominique Mole	Iain Turrell
1	B	24.05.2021	Yin Mui Tang	-	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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Contents

Executive Summary

Executive Summary

This Whole Life Carbon Assessment (WLCA) has been written by SRE on behalf of MRPP (The Client) to demonstrate the embodied and operational carbon emissions for the proposed replacement dwelling at 38 Frognal Lane, London Borough of Camden.

The Proposed Development consists of the demolition of the existing dwelling and construction of a new 5-bed detached dwelling to replace the existing house on site.

The aim of this assessment is to model the whole life carbon impact of the proposed design, and compare this to the previous consented scheme (ref. 2019/4220/P). A comparison is then 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 273.6 tonnesCO_2e – less than that associated with the original consented scheme, which has a cradle to grave emission of 277.6 tonnesCO_2e.

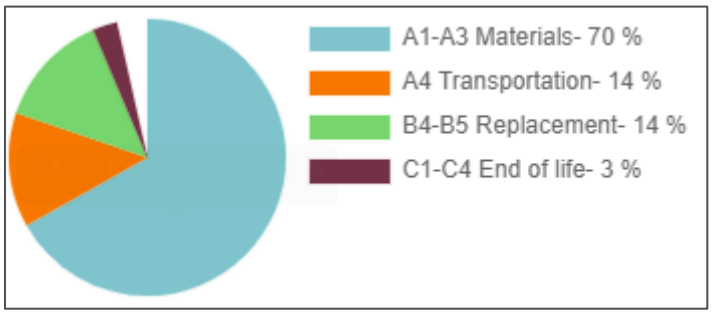

Figure 1: Embodied Carbon of the Proposed scheme by Life Cycle – OneClick LCA

Introduction

1.0 Introduction

This Whole Life Carbon Assessment has been written by SRE on behalf of MRPP (The Client) to demonstrate the embodied and operational carbon emissions incorporated for construction of a new 5-bed detached dwelling to replace the existing house at 38 Frognal Lane (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 WLCA, 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 the Proposed Development and compare this to the previous consented scheme (ref. 2019/4220/P). 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 Design 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 Site is located at 38 Frognal Lane and lies within the Redington and Frognal Conservation Area within the administrative boundary of the London Borough of Camden. The existing house was originally constructed in the 1890s and was substantially remodelled in the 1930s. It has very poor energy efficiency, having no floor, wall or roof insulation, single glazing and building services that require upgrading to more energy efficient alternatives.

The Proposed Development consists of the demolition of the existing dwelling on site, and construction of a new 5-bed detached dwelling to replace the existing house. The proposed new dwelling will have enhanced fabric efficiency and high efficiency HVAC systems to minimize its carbon footprint.

Figure 2: Front Elevation of the Proposed Development

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 WLCA, 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

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 1: 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 – included
- Offset Measures – to be calculated and including/informing any on-site generation and potential GHG Offset.

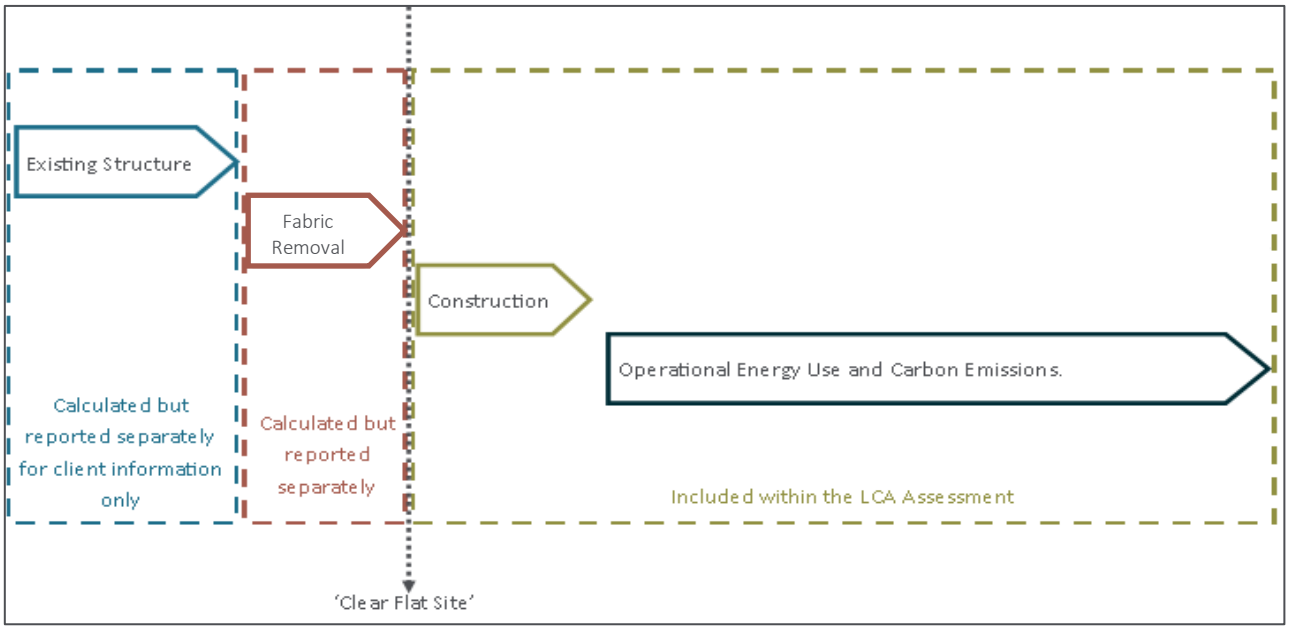

Figure 3: Process of Assessment Diagram

3.1.1 Lifecycle Stages

The embodied and operational 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 over its operational life.
End of Life Stage	C1	De-construction 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 2: 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 3. 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 3: 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 4.

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 4: Assumed lifespan of materials

All assumptions made by SRE are included in Appendix C and D. 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 er Life Cycle 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 5 below:

Module	Sitewide
A1-A5 Construction Process Stage	167,814 $kgCO_2e$
B1-B7 Use Stage	101,308 $kgCO_2e$
C1-C4 End of Life Stage	4,476 $kgCO_2e$
Total GWP ($kgCO_2e$)	273,599 $kgCO_2e$
Total GWP (C3 usage, $kgCO_2e/m^2$)	407 $kgCO_2e/m^2$

Table 5: WLCA Emission Results per Lifecycle Stage of the Proposed scheme

It should be noted that the figures presented in Table 5 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.

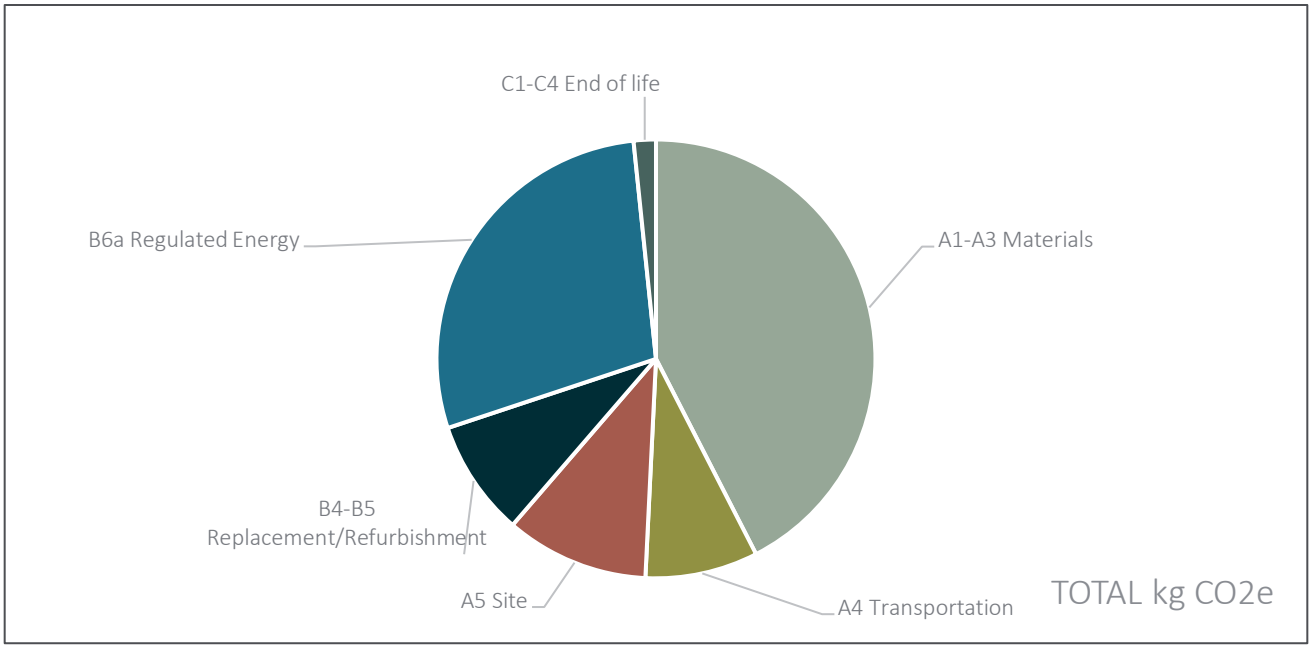

Figure 4: Breakdown of Carbon Emissions by Lifecycle Stage

Figure 4 shows that life cycle stageA1-A3, Materials & Product Stage, and B6, Operational Energy Use account for by far the greatest quantities of carbon emissions.

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.

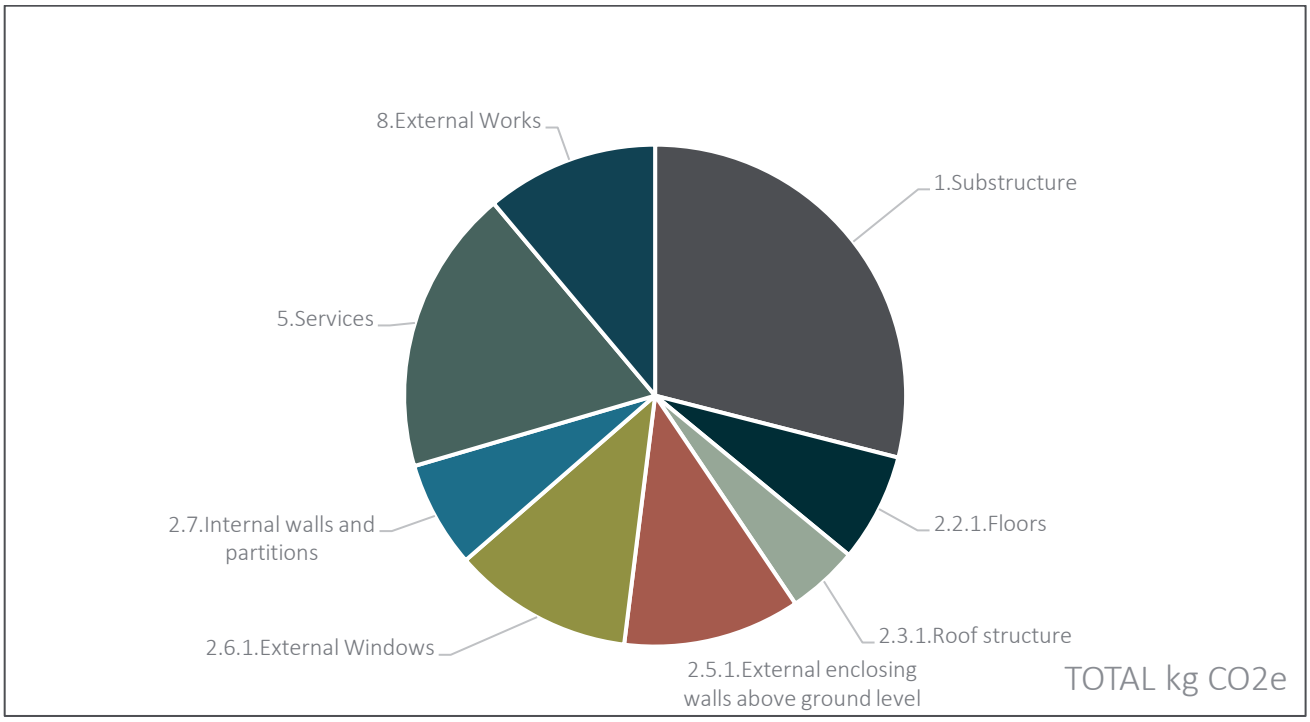

Figure 5: Most Contributing Building Elements (A1-A3)

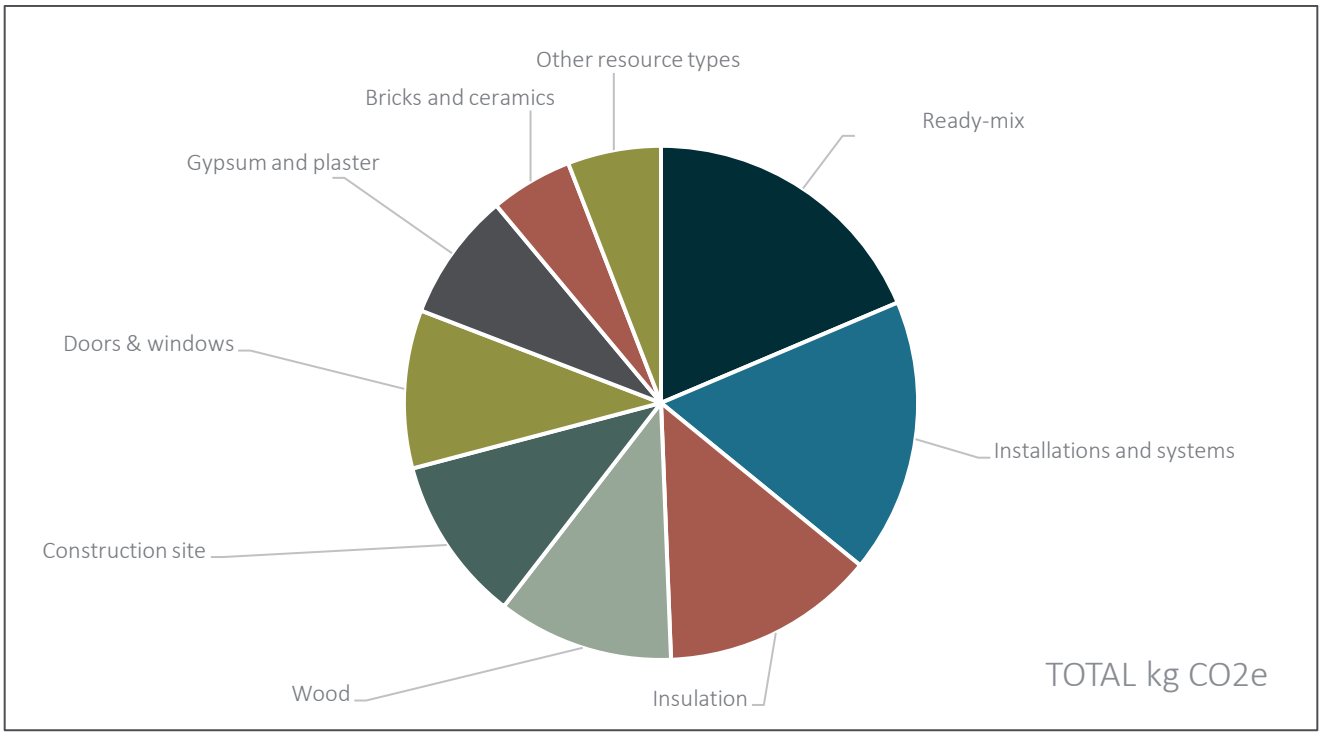

Figure 6: Most Contributing Building Materials (A1-A3)

4.4 Discussion of Results

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

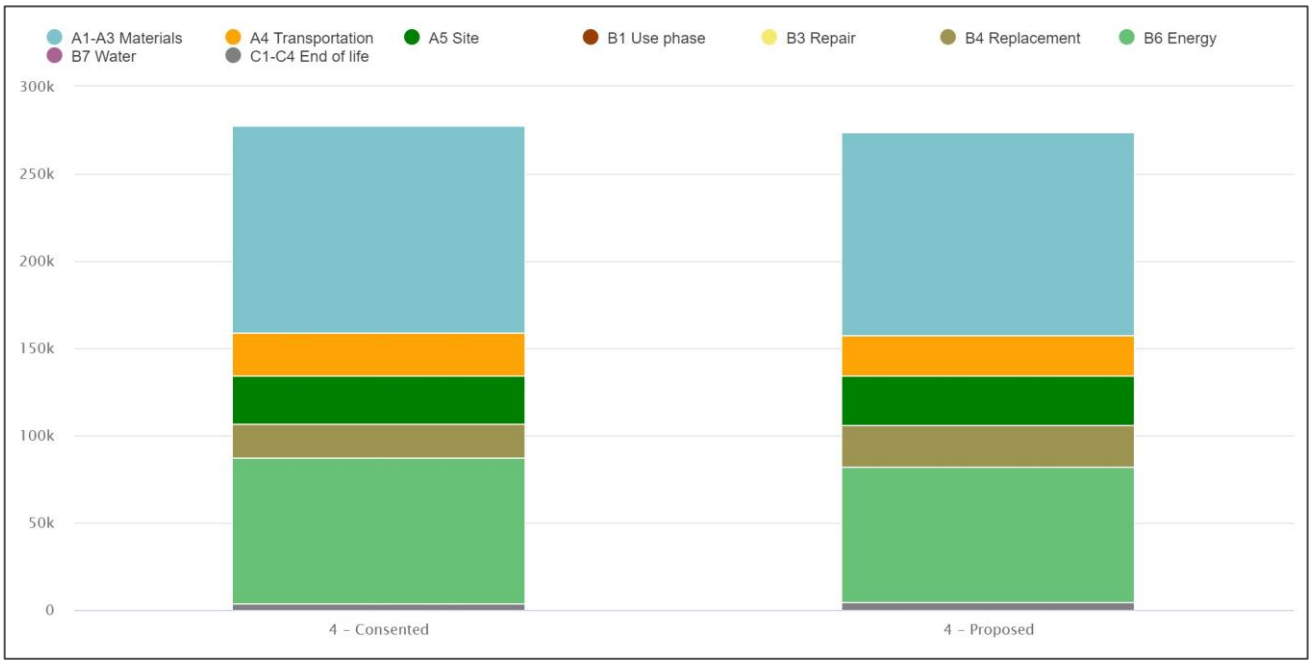

Figure 7: Comparison of Lifecycle Stage Elements for the Proposed and Consented scenarios

Figure 7 shows the total kgCO_2e impact of both the Proposed and Consented schemes at all life-cycle stages from Cradle-to-Grave. It can be observed that the carbon emissions in the Proposed scheme is slightly lower than that of the Consented. This is because while the Proposed scheme has a larger floor area and therefore requires a greater amount of materials to construct, the embodied carbon of the Proposed scheme has managed to be kept relatively low through careful selection of materials. These include specification of locally sourced bricks in the Proposed Scheme as compared to generic clay bricks in the Consented Scheme, the use of 50% GGBS ready mixed concrete (RICS assumes a default of 20% recyclable content in concrete for substructure and superstructure), and selection of medium density screed to be used for concrete floors/flat roofs.

The operational energy of the Proposed scheme is also observed to be lower than the Consented scheme. This is achieved by specifying high performance building fabric and higher efficiency ASHPs than that proposed for the Consented scheme, in addition to the installation of PV. The Proposed scheme also includes the installation of a high performance whole-dwelling mechanical ventilation with heat recovery (MVHR) system, which reduces the overall heating demand of the dwelling. A total of 2.8kWp of PV has been proposed for the dwelling to match the PV quantity initially proposed for the Consented scheme.

By implementing the above measures, the Proposed scheme is able to achieve a lower overall Cradle-to-Grave Emission than the Consented.

4.4.1 Operational Energy Use

As can be seen in Section 4.2, carbon emissions within the lifecycle stage B6, Operational Energy Use, has the second largest 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, and results compared to that of the SAP modelling results of the Consented Scheme provided to SRE. 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 scheme, and Figure 9 shows the operational energy consumption in the Consented scheme.

Water heating fuel used		1448.0950 (219)
Annual totals kWh/year		
Space heating fuel - main system		6553.9961 (211)
Space heating fuel - secondary		0.0000 (215)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)		
mechanical ventilation fans (SFP = 1.0000)		2509.6657 (230a)
Total electricity for the above, kWh/year		2509.6657 (231)
Electricity for lighting (calculated in Appendix L)		1161.0154 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.80 * 951 * 1.00) =	-2129.3798	-2129.3798 (233)
Total delivered energy for all uses		9543.3923 (238)

Figure 8 - Proposed Scenario Energy Consumption by End Use

Water heating fuel used		1433.1509 (219)
Annual totals kWh/year		
Space heating fuel - main system		10170.0057 (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)		895.3907 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.80 * 1029 * 1.00) =	-1482.0289	-2285.2258
PV Unit 1 (0.80 * 1.00 * 1004 * 1.00) =	-803.1970	-2285.2258 (233)
Total delivered energy for all uses		10243.3215 (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 Consented scheme accounts to a total of 10,243 kWh/year, whereas the operational energy in the Proposed scheme shows a lower operational energy consumption of 9543 kWh/year. This can be attributed to the better HVAC specifications discussed in Section 4.4 above. As can be observed in Figure 8, space heating makes up the greatest contribution to the overall operational energy use of the scheme.

4.4.2 Materials, Assumptions, and Recommendations

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. An increased proportion of GGBS to 50% has been proposed for the Proposed scheme.

Screed

Screed used for the floor construction of the ground floor, basement floor, swimming pool, and flat roofs has been specified as medium density screed to reduce overall embodied carbon. It is recommended for the screed to be sourced from reused or recycled material, as this will disregard the carbon impacts related to initial manufacturing (A1-A3) and installation (A5), thereby reducing the embodied carbon impact.

Bricks

The external walls of the Proposed Development is proposed to be of cavity wall construction. Locally sourced clay bricks are proposed to be used in the Proposed Development to minimize the carbon impact related to transportation.

Glass and Frame

Timber window frames have been proposed to reduce the embodied carbon emissions over standard aluminium framed units.

Transportation

At this stage, the RICS recommended transport distances (see Table 3) have been adopted. It is recommended that locally sourced materials with an EPD should be used where possible.

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 (Consented)
Lifecycle Stages A1-A5	167,814 $kgCO_2e$	170,962 $kgCO_2e$
Lifecycle Stage B1-B7	101,308 $kgCO_2e$	103,205 $kgCO_2e$
Lifecycle Stage C1-C4	4,476 $kgCO_2e$	3,478 $kgCO_2e$
Total GWP	273,599 $kgCO_2e$	277,646 $kgCO_2e$
Module D	-23,245 $kgCO_2e$	-19,928 $kgCO_2e$

Table 6: WLCA Result comparison between Proposed and Refurbishment Scenarios

Results from the WLCA modelling indicate that the Proposed new construction has an overall lower carbon impact than the Consented taking all factors into account, and is therefore the preferred option going forward.

Appendices

Appendix A – Carbon Reporting – Embodied and Operational Emissions (Proposed Scheme)

Whole life carbon assessment, Greater London Authority

This is the project whole life carbon assessment according to RICS methodology, EN 15978 and Greater London Authority guidance for whole life-cycle carbon assessments. 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	B2 Maintenance	B3 Repair	B4-B5 Material replacement and refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1-C4 End of Life stage	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.													
0.2 Demolition													
0.3 Supports													
0.4 Groundworks													
0.5 Diversion													
1 Substructure	46 357	2 505	2 606			0					1 733	53 201	−10 344
2.1 Frame													
2.2 Upper Floors	14 448	682	1 548			0	2 176				464	19 317	−3 806
2.3 Roof	10 889	249	1 666			0	99				1 071	13 974	−3 036
2.4 Stairs & Ramps													
2.5 Ext. Walls	19 132	256	1 050			0					516	20 955	−1 752
2.6 Windows & Ext. Doors	10 512	335	10			0	10 512				100	21 469	−90
2.7. Int. Walls & Partitions	10 252	214	1 602			0					528	12 596	−2 164
2.8 Int. Doors													
3 Finishes													
4 Fittings, furnishings & equipments													
5 Services (MEP)	4 580	18 503	9			0	10 648				64	33 805	−2 052
6 Prefabricated													
7 Existing bldg													
8 Ext. works			20 410					77 874				98 284	
Unclassified / Other													
TOTAL kg CO2e	116 171	22 743	28 900			0	23 434	77 874			4 476	273 599	−23 245

Appendix B – Carbon Reporting – Embodied and Operational emissions (Consented Scheme)

Whole life carbon assessment, Greater London Authority

This is the project whole life carbon assessment according to RICS methodology, EN 15978 and Greater London Authority guidance for whole life-cycle carbon assessments. 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	B2 Maintenance	B3 Repair	B4-B5 Material replacement and refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1-C4 End of Life stage	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.													
0.2 Demolition													
0.3 Supports													
0.4 Groundworks													
0.5 Diversion													
1 Substructure	34 664	1 806	1 938			0					1 238	39 646	−7 140
2.1 Frame													
2.2 Upper Floors	18 779	3 485	1 791			0	3 511				484	28 051	−4 896
2.3 Roof	10 385	249	1 549			0	111				922	13 216	−2 713
2.4 Stairs & Ramps													
2.5 Ext. Walls	38 679	260	1 986			0					424	41 348	−1 647
2.6 Windows & Ext. Doors	5 350	167	0			0	5 350				39	10 906	−216
2.7. Int. Walls & Partitions	5 985	199	949			0					308	7 441	−1 264
2.8 Int. Doors													
3 Finishes													
4 Fittings, furnishings & equipments													
5 Services (MEP)	4 580	18 503	9			0	10 648				64	33 805	−2 052
6 Prefabricated													
7 Existing bldg													
8 Ext. works			19 648					83 585				103 233	
Unclassified / Other													
TOTAL kg CO2e	118 422	24 670	27 870			0	19 620	83 585			3 479	277 646	−19 928

Appendix C – RICS WLCA OneClick Inputs & Assumptions Summary (Proposed)

RICS Category		Element Description	Material Used	Total Qty	Unit
1. Foundations and substructure	Foundation	Foundation	Footing foundations for soft soils	218.79	m2
	Basement	Basement Wall - concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	288.38	m2
		Basement Wall - insulation	PIR insulation boards, aluminum composite foil faced	288.38	m2
		Basement Wall – plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	288.38	m2
		Basement Wall – screed	Screed mortar, cement mortar, 1500kg/m3	19862.7	kg
		Basement floor – insulation	PIR insulation boards, aluminum composite foil faced	203.72	m2
		Basement floor – concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	203.72	m2
		Basement Roof- insulation	PIR insulation boards, aluminum composite foil faced	70.18	m2
		Basement Roof-membrane	Waterproofing membrane, single component, cold applied, from PU, 1.3mm	70.18	m2
		Basement Roof-screed	Screed mortar, cement mortar, 1500kg/m3	5263.5	kg
		Basement Roof-concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	70.18	m2
		Basement Roof-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	70.18	m2
		Swimming pool floor-concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	26.75	m2
		Swimming pool floor-screed	Screed mortar, cement mortar, 1500kg/m3	26.75	m2
		Swimming pool floor-insulation	PIR insulation boards, aluminum composite foil faced	26.75	m2
		pool services floor-concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	29.07	m2
		pool services floor-screed	Screed mortar, cement mortar, 1500kg/m3	29.07	m2
		pool services floor-insulation	PIR insulation boards, aluminum composite foil faced	29.07	m2
2. Vertical structures and façade	External Wall	Ext wall-brick	Red brick, average production, UK	328.75	m2
		Ext Wall-PIR insulation	PIR insulation boards, aluminum composite foil faced	328.75	m2
		Ext Wall-concrete block	Medium density concrete block, 100mm thickness	49312.5	kg
		Ext wall-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	328.75	m2
		Sheltered wall-brick	Red brick, average production, UK	8.03	m2

RICS Category		Element Description	Material Used	Total Qty	Unit
3. Horizontal structures: beams, floors and roofs	External Wall	Sheltered wall-PIR insulation	PIR insulation boards, aluminum composite foil faced	8.03	m2
		Sheltered wall-concrete block	Medium density concrete block, 100mm thickness	1204.5	kg
		Sheltered wall-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	8.03	m2
		Dormer wall-timber board	Softwood, spruce	90.376	kg
		Dormer wall-insulation	Phenolic insulation	10.27	m2
		Dormer wall-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	10.27	m2
		Dormer wall-timber studs	Softwood, spruce	54.23	m2
	Internal Wall	Internal wall plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	746.51	m2
		Mineral wool insulation	Rock wool insulation, unfaced	746.51	m2
		Internal wall plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	746.51	m2
		Timber studs	Softwood,spruce	2436.11	kg
	Roof	Roofing Tiles	Clay roofing tile	211.04	m2
		Pitched Roof (Rafters) - insulation	Rock wool insulation, unfaced	97.25	m2
		Pitched Roof Rafters	Softwood,spruce	1160.7	kg
		Pitched roof (rafters)-insulated plasterboard	Phenolic insulation	97.25	m2
		Pitched roof-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	97.25	m2
		Flat Roof-PIR insulation	PIR insulation boards, aluminum composite foil faced	11.89	m2
		Flat Roof-membrane	Waterproofing membrane, single component, cold applied, from PU, 1.3mm	11.89	m2
		Flat roof-screed	Screed mortar, cement mortar, 1500kg/m3	891.75	kg
		Flat roof-Timber deck	Softwood,spruce	784.74	kg
		Flat roof-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	52.62	m2
		Pitched Roof - mineral wool	Rock wool insulation, unfaced	81.92	m2
		Pitched Roof - mineral wool between joists	Rock wool insulation, unfaced	81.92	m2
		Pitched roof- Joists	Softwood,spruce	931.76	kg
	Floor	GF -concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	128.6	m2
		GF PIR insulation	PIR insulation boards, aluminum composite foil faced	128.6	m2
		GF Screed	Screed mortar, cement mortar, 1500kg/m3	12538.5	kg

RICS Category		Element Description	Material Used	Total Qty	Unit
3. Horizontal structures: beams, floors and roofs	Floor	Exposed floor-insulation between joists	Rock wool insulation, unfaced	3.88	m2
		Intermediate floor-insulation between joists	Rock wool insulation, unfaced	192.73	m2
		Floor joists	Softwood, spruce	1978.7	kg
4. Other structures and materials	Windows and Doors	External solid door	External wood door	2.61	m2
		Triple glazed window	Triple glazing windows with wooden frame	118.31	m2
		Internal window	Float glass, single pane, generic	72.52	m2
6. Building technology	Building systems and installations	LED lighting	LED lighting, P=40W	80	unit
		ASHP	Electric heat pump (air-water), 14kW	1	unit
		300L hot water cylinder	Electric water heater (water cylider), 300 litres	300	L
		Solar PV	Solar panel photovoltaice system, EU Average	13.6	m2
		LED lighting	LED lighting, P=40W	80	unit

Appendix D – RICS WLCA OneClick Inputs & Assumptions Summary (Consented)

RICS Category		Element Description	Material Used	Total Qty	Unit
1. Foundations and substructure	Foundation	Foundation	Footing foundations for soft soils	179.69	m2
	Basement	Basement Wall	Ready-mix concrete, normal strength generic, with 20% fly ash content	159.45	kg
		Basement Wall	Gypsum plasterboard, 12.5mm, 8.985kg/m2	159.45	m2
		Basement Wall	PIR insulation boards, aluminum composite foil faced	159.45	m2
		Basement floor	Flooring screed, C32/50	19518.2	kg
		Basement floor	Ready-mix concrete, normal strength generic, with 50% GGBS content	150.14	m2
		Basement Roof	PIR insulation boards, aluminum composite foil faced	150.14	m2
		Basement Roof	Waterproofing membrane, single component, cold applied, from PU, 1.3mm	31.22	m2
		Basement Roof	Flooring screed, C32/50	31.22	m2
		Basement Roof	Ready-mix concrete, normal strength generic, with 50% GGBS content	31.22	m2
		Basement Roof	Gypsum plasterboard, 12.5mm, 8.985kg/m2	31.22	m2
		Swimming pool floor	Ready-mix concrete, normal strength generic, with 20% fly ash content	20.24	m2
		Swimming pool floor	Flooring screed, C32/50	20.24	m2
		Swimming pool floor	PIR insulation boards, aluminum composite foil faced	20.24	m2
2. Vertical structures and façade	External Wall	Ext wall-brick	Clay brick, one brick	64115.8	kg
		Ext Wall-PIR insulation	PIR insulation boards, aluminum composite foil faced	312.76	m2
		Ext Wall-concrete block	Medium density concrete block, 100mm thickness	46914	kg
		Ext wall-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	312.76	m2
		Dormer wall-timber board	Softwood, spruce	35.2	kg
		Dormer wall-insulation	Phenolic insulation	4	m2
		Dormer wall-timber studs	Softwood, spruce	21.12	kg
		Dormer wall-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	4	m2

RICS Category		Element Description	Material Used	Total Qty	Unit
2. Vertical structures and façade	Internal Wall	Internal wall plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	435.79	m2
		Mineral wool dinsulation	Rock wool insulation, unfaced	435.79	m2
		Internal wall plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	4735.79	m2
		Timber studs	Softwood,spruce	1422.13	kg
3. Horizontal structures: beams, floors and roofs	Roof	Roofing Tiles	Clay roofing tile	249.06	m2
		Pitched Roof (Rafters) - insulation	Rock wool insulation, unfaced	78.38	m2
		Pitched Roof Rafters	Softwood,spruce	1369.83	kg
		Pitched roof (rafters)-insulated plasterboard	Phenolic insulation	78.38	m2
		Pitched roof-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	78.38	m2
		Flat Roof-PIR insulation	PIR insulation boards, aluminum composite foil faced	4.49	m2
		Flat Roof-membrane	Waterproofing membrane, single component, cold applied, from PU, 1.3mm	4.49	m2
		Flat roof-screed	Flooring screed, C32/50	4.49	m2
		Flat roof-Timber deck	Softwood,spruce	293.34	kg
		Flat roof-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	38.12	m2
		Pitched Roof - mineral wool	Rock wool insulation, unfaced	119.01	m2
		Pitched Roof - mineral wool between joists	Rock wool insulation, unfaced	119.01	m2
		Pitched roof- Joists	Softwood,spruce	931.37	kg
		Pitched roof-plasterboard	Gypsum plasterboard, 12.5mm, 8.985kg/m2	119.01	m2
	Floor	GF -concrete	Ready-mix concrete, normal strength generic, with 50% GGBS content	165.49	m2
		GF PIR insulation	PIR insulation boards, aluminum composite foil faced	165.49	m2
		GF Screed	Flooring screed, C32/50	165.49	m2
		Exposed floor-insulation between joists	Rock wool insulation, unfaced	1.46	m2
		Intermediate floor-insulation between joists	Rock wool insulation, unfaced	146.56	m2
		Floor joists	Softwood, spruce	1484.15	kg

RICS Category		Element Description	Material Used	Total Qty	Unit
4. Other structures and materials	Windows and Doors	External solid door	External wood door	6.3	m2
		Triple glazed window	Triple glazing windows with wooden frame	65.1	m2
6. Building technology	Building systems and installations	LED lighting	LED lighting, P=40W	80	unit
		ASHP	Electric heat pump (air-water), 14kW	1	unit
		300L hot water cylinder	Electric water heater (water cylider), 300 litres	300	L
		Solar PV	Solar panel photovoltaice system, EU Average	13.6	m2
		LED lighting	LED lighting, P=40W	80	unit

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