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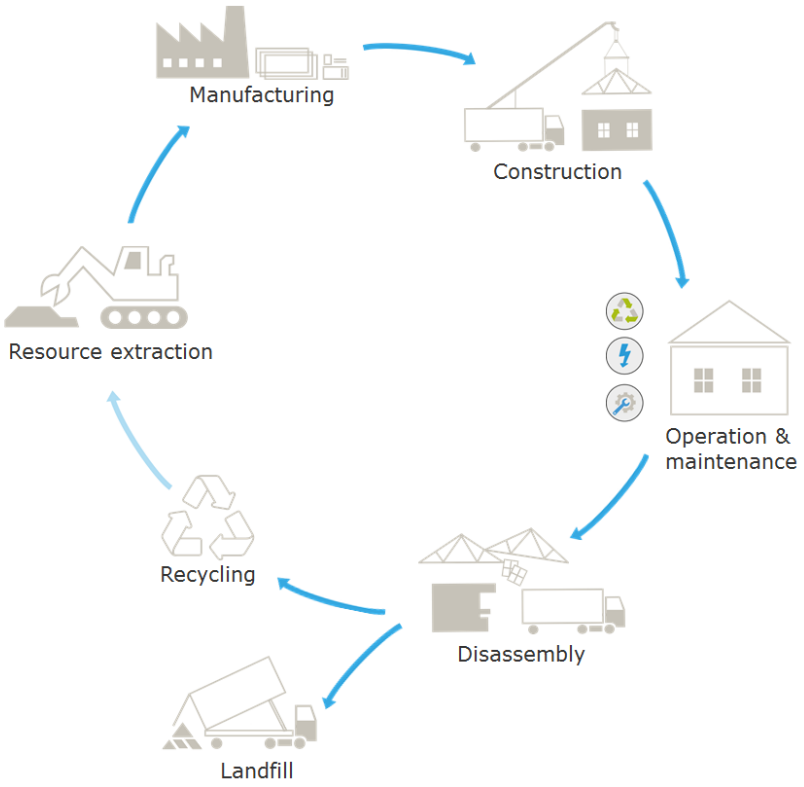
CAMDEN GOODS YARD, JUNIPER BUILDING (PETROL FILLING STATION SITE (PFS) S73

WHOLE LIFE-CYCLE CARBON ASSESSMENT



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CAMDEN GOODS YARD, JUNIPER BUILDING (PETROL FILLING STATION SITE (PFS) S73
WHOLE LIFE-CYCLE CARBON ASSESSMENT

Project name	**Camden Goods Yards, Juniper Building (Petrol Filling Station Site (PFS) S73**
Project no.	**1620013832**
Recipient	**St. George West London Limited**
Version	**1.2**
Date	**30/11/2022**
Prepared by	**Antonia Vavanou**
Checked by	**Tom Harley-Tuffs**
Approved by	**Sarah Ord**
Description	**Whole Life-Cycle Carbon Assessment in line with GLA requirements**

Revision History

25/07/22	1.0: First issue for planning application
18/08/22	1.1: Revised GIA and planning drawings
25/11/22	1.2: Scope of assessment has been expanded to include B1 emissions arising from refrigerants

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CONTENTS

1. EXECUTIVE SUMMARY

Ramboll UK Limited have been appointed by St. George West London Limited to prepare a Whole Life-Cycle Carbon Assessment (WLCA) for the **Camden Goods Yard, Juniper Building** (Petrol Filling Station Site (PFS)) located in Camden, London. The WLCA accompanies the S73 (Minor Material Amendment) application.

The proposed development will comprise up to 6 storeys and up to 13,342 m^2 (GIA) floorspace to accommodate an office, retail, and winter garden floorspace.

The report summarises the development's carbon emissions over its 60-year lifetime, accounting for its embodied and operational carbon emissions and post 'end of life'.

Embodied Carbon
1,124*
kgCO$_2$e/m^2 GIA
(A1-A5, B1-B4, C1-C4)

Operational Energy
37.0 kWh/m^2/yr

Operational Carbon
(SAP10, includes PV benefits)
855
kgCO$_2$e/m^2 GIA (B6)

Operational Water Use
4,734 m^3/yr

Operational Water Carbon
0.43
kgCO$_2$e/m^2 GIA (B7)

Whole Life-cycle Carbon
1,979
kgCO$_2$e/m^2 GIA
(A1-A5, B1-B4, B6, B7, C1-C4)

***Including carbon sequestration**

Figure 1: Camden Goods Yard, Juniper Building, 3d view (Makower Architects visuals, April 2022)

2. INTRODUCTION

Ramboll UK Limited (Ramboll) have been appointed by St. George West London Limited (the 'Client') to undertake a Whole Life-Cycle Carbon Assessment (WLCA) in line with the GLA requirements for the Camden Goods Yard: PFS Site - Juniper Building Revisions (the former Petrol Filling Station (PFS) site), (hereafter referred to as the 'development'), located in Chalk Farm Road, Camden, London (hereafter referred to as the 'site'). The WLCA accompanies the S73 (Minor Material Amendment) application.

The proposed development will comprise up to 6 storeys and up to **13,342 m²** GIA floorspace to accommodate a retail, office, and winter garden floorspace.
Note that this WLCA was undertaken on a slightly earlier iteration of the scheme. As such this analysis herein refers to a floor area of **13,028 m²** GIA, however the assessment and study conclusions are still valid for the latest scheme submitted for planning.

This document presents the WLCA study which has been prepared to satisfy the requirements of the Greater London Authority (GLA) 'Whole Life-Cycle Carbon Assessments' guidance, published in March 2022. The report summarises the development's carbon emissions over its lifetime, accounting for its operational carbon emissions, embodied carbon emissions and any future potential carbon emissions 'benefits', post 'end of life'.

It should be noted that although the application is a S73 to vary permission across the whole site, changes are only proposed to the PFS site, and as such the scope of the WLCA in line with the latest GLA guidance has been limited to this site only.

2.1 The Site

The site is located in Camden, within the Regent's Canal Conservation Area, and is part of the Camden Goods Yard development (Figure 2), the former Morrisons petrol filling station that is currently in use as the temporary Morrisons supermarket.

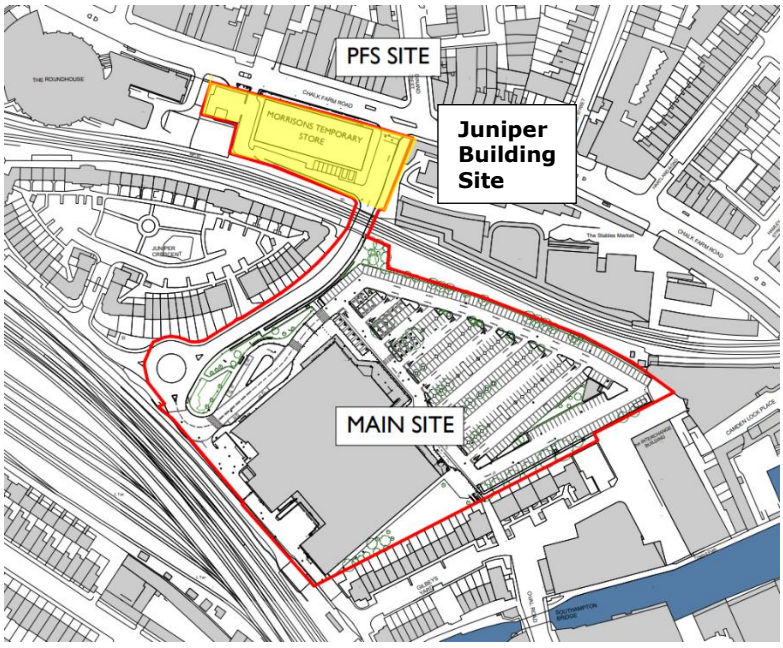


Figure 2: Camden Goods Yard, site location and red line boundaries (St George).

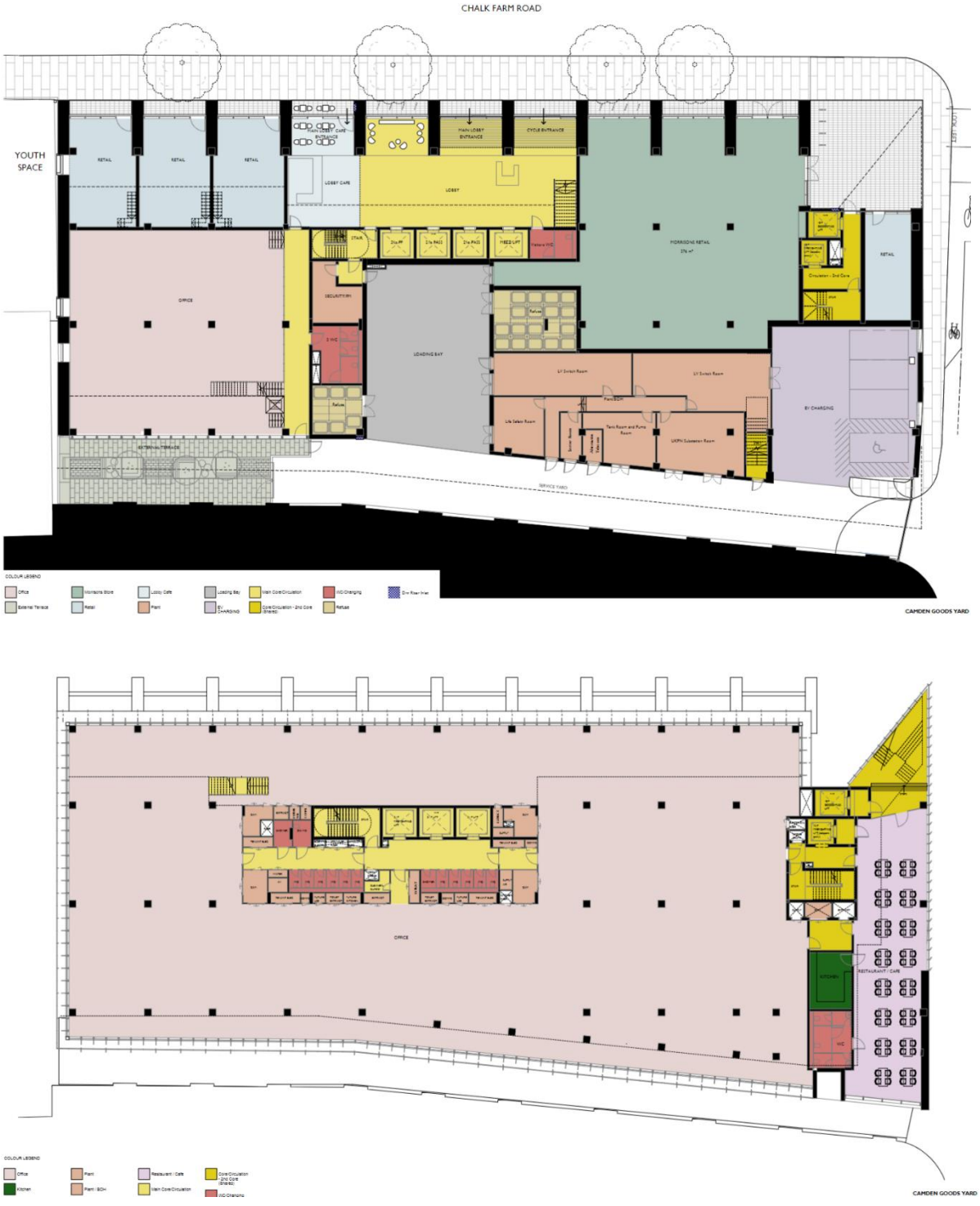


Figure 3: Camden Goods Yard, the Juniper Building – Proposed Ground Floor and First Floor Plans (Makower Architects).

3. WHOLE LIFE-CYCLE CARBON ASSESSMENT (WLCA) - BACKGROUND

With 49% of the total Green House Gas emissions produced in the UK being attributed to the construction and operation of the built environment, it is evident that the building sector has a significant role to play in reducing carbon emissions and responding to the climate emergency. Carbon emissions associated with the operation of buildings have been the subject of regulation and until recently, the primary focus for reducing the environmental impact of buildings. With increasing building energy efficiency and increasing decarbonisation of electricity supply, building operational carbon emissions are being acknowledged to be rapidly reducing. While we must continue to focus on reducing operational carbon, there must also be increased efforts to address the embodied carbon emissions

Embodied carbon emissions

All emissions associated with the manufacturing, transportation, construction, and end of life (EoL) stages of all built assets and **contribute around 11% of all global carbon emissions** and can be quantified by undertaking a Life Cycle Assessment study.

Life Cycle Assessment (LCA)

Established methodology of assessing the cumulative environmental impacts associated with all lifecycle stages of a product, process, or a whole construction project. An LCA can help inform decision making not only in terms of identifying measures to reduce carbon emissions, but also in relation to other environmental indicators such as material, water, and energy use across the whole lifecycle.

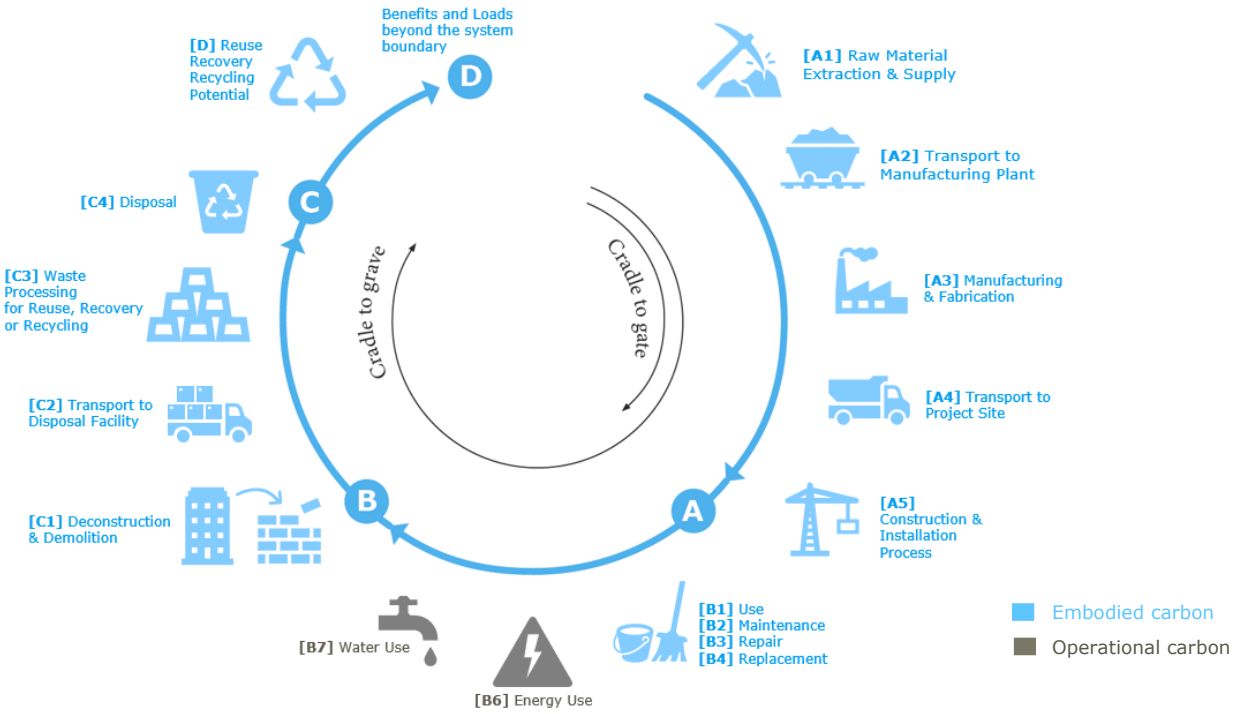


Figure 4: Life Cycle Stages diagram in line with BS EN 15978.

3.1 GLA Whole Life-Cycle Carbon Assessment Guidance

The Greater London Authority 'Whole Life-Cycle Carbon Assessments' guidance (published in March 2022) provides guidance on how to prepare a Whole Life-Cycle Carbon assessment in line with Policy SI 2 of the London Plan 2021. Policy SI 2 applies to planning applications which are referred to the Mayor.

In developing a WLC assessment for compliance with GLA Policy SI 2, applicants should follow BS EN 15978 using the RICS Professional Statement (PS) as the methodology for assessment. The RICS PS: Whole Life Carbon assessment for the built environment is a useful guide to the practical implementation of the BS EN 15978 principles. It sets out technical details and calculation requirements as well as indicative values.

3.2 GLA Data Benchmarking

A set of embodied carbon benchmarks for various building types have been developed by GLA and are provided within GLA's Whole Life-Cycle Carbon Assessment guidance (March 2022). Embodied carbon results for the proposed scheme will be compared against the recommended GLA WLC benchmark and aspirational benchmark for **Office Buildings** as the closest available match. Aspirational benchmarks are based on a 40% reduction in WLC emissions on the first set of WLC benchmarks, which is based on the World Green Building Council's target to achieve a 40% reduction in WLC emissions by 2030.

GLA Offices suggests a *WLC benchmark* of **1,400** $kgCO_2e/m^2$ GIA with the *WLC aspirational benchmark set* at **970** $kgCO_2e/m^2$ GIA (stages A-C, excl. B6-B7) (Figure 5).

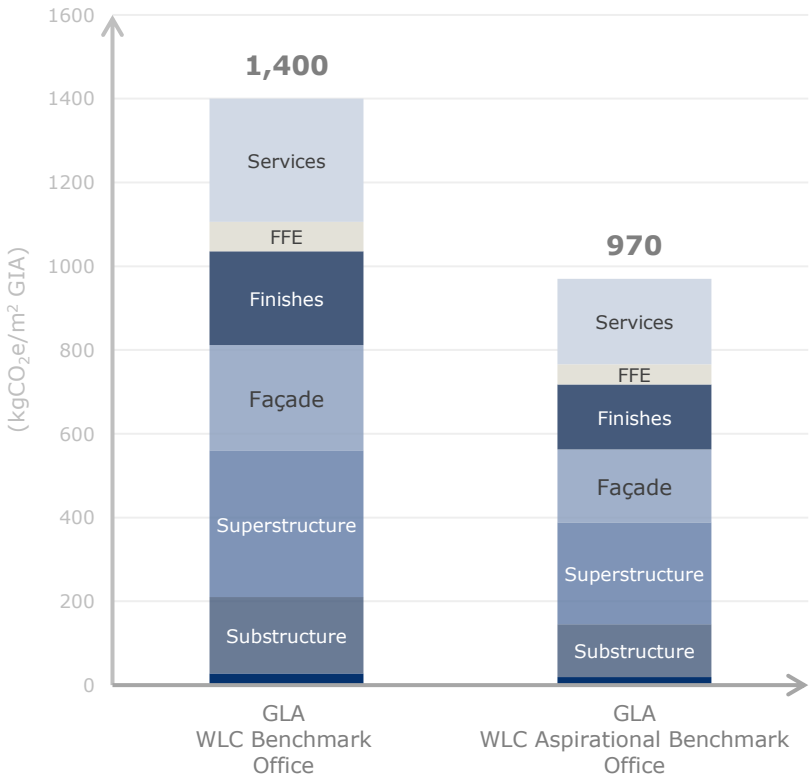


Figure 5: GLA WLC benchmarks for Office Buildings, Scope A – C (excluding B6 & B7)

4. WLCA - METHODOLOGY

4.1 Scope of assessment

The assessment of the scheme's WLC emissions includes the following sections: embodied carbon emissions and operational carbon emissions (regulated and unregulated). A more detailed explanation of what the Stages A - C and module D cover is provided below (Table 1).

- Stages A1 - A5 (Product sourcing and construction stage),
- Stages B1 - B7 (Use stage),
- Stages C1 - C4 (End-of-life stage),
- Module D (Benefits and loads beyond the system boundary).

Table 1: Life cycle stages and scope of assessment in line with BS EN 15978: 2011.

WHOLE LIFE CARBON ASSESSMENT INFORMATION														
PROJECT LIFE CYCLE INFORMATION													SUPPLEMENTARY INFO	
A1 – A3 PRODUCT STAGE			A4 – A5 CONSTRUCTION PROCESS STAGE		B1 – B7 USE STAGE					C1 – C4 END OF LIFE STAGE				D BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
RAW MATERIAL EXTRACTION AND SUPPLY	TRANSPORT TO MANUFACTURING PLANT	MANUFACTURING AND FABRICATION	TRNSPORT TO PROJECT SITE	CONSTRUCTION AND INSTALLATION PROCESS	USE	MAINTENANCE	REPAIR	REPLACEMENT	REFURBISHMENT	DECONSTRUCTION DEMOLITON	TRANSPORT TO DISPOSAL FACILITY	WASTE PROCESSING	DISPOSAL	REUSE, RECOVERY, RECYCLING POTENTIAL
					B6 – OPERATIONAL ENERGY USE									
					B7 – OPERATIONAL WATER USE									

Embodied carbon
Operational carbon

The WLC assessment for the Camden Goods Yard, Juniper Building covers all building elements listed in Table 2 that are applicable to the project. The building elements are broken down according to the RICS New Rules of Measurement (NRM) classification system level 2 sub-elements. The unit of area measurement to be used is m² of Gross Internal Area (GIA).

Table 2: WLC assessment, building elements (RICS PS).

	Building part/ Element Group	**Building element (NRM level 2)**	**Included in WLCA?**
	Demolition	0.1 Toxic/hazardous/contaminated material treatment	Included (0.2) (Pre-construction demolition – estimated based on GLA standard assumption of **50**kgCO_2e/m^2 GIA since actual figures are not available at this stage)
		0.2 Major demolition works	
0	Facilitating works	0.3 & 0.5 Temporary/enabling works	N/A

		0.4. Specialist groundworks	
1	Substructure	1.1 Substructure	Included
2	Superstructure	2.1 Frame 2.2 Upper floors incl. Balconies 2.3 Roof 2.4 Stairs and ramps	Included
		2.5 External walls 2.6 Windows and External doors	Included
		2.7 Internal walls and Partitions 2.8 Internal doors	Included
3	Finishes	3.1 Wall finishes 3.2 Floor finishes 3.3 Ceiling finishes	Included
4	Fittings, furnishings and equipment (FF&E)	4.1 Fittings, Furnishings & Equipment incl. building related and non-building related	Included (Estimated based on GLA current WLC benchmarks for Office buildings at **60** $kgCO_2e/m^2$ GIA, due to Stage 2 cost plan data limitations)
5	Building services/MEP	5.1-5.14 Services incl. building related and non-building related	Included (Based on OneClick benchmark data due to Stage 2 cost plan data limitations)
6	Prefabricated buildings and building units	6.1 Prefabricated buildings and building units	N/A
7	Work to existing buildings	7.1 Minor demolition and Alteration works	N/A
8	External works	8.1 Site preparation works 8.2 Roads, Paths, Pavings and Surfacing 8.3 Soft landscaping, Planting, and Irrigation systems 8.4 Fencing, Railings and Walls 8.5 External fixtures 8.6 External drainage 8.7 External services 8.8 Minor building works and ancillary buildings	Included (Items 8.2 & 8.6) Remaining items excluded due to lack of available data

Note: 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 projects, hence the responsibility for any emissions arising from demolition is not necessarily solely attributable to the new build project.

4.2 Coverage Adjustment factor

According to RICS PS '*Whole life carbon assessment for the built environment, November 2017*', a minimum of 95% of the cost allocated to each building element category should be accounted for in the assessment. To account for the impacts of the items not quantified, the subtotal carbon budget of each category is multiplied by the following adjustment factor:

Coverage adjustment factor = (100% / % of cost covered in the given category)

The percentage of building elements excluded from the assessment (e.g., due to Cost Plan data limitations) has been calculated and the following adjustment factors have been used (Table 3) with the overall percentage coverage of the assessment at 97%.

Table 3: WLC data percentage completion - RICS adjustment factors

RICS Building Part/Element Group	RICS Building Element	LCA Data Completeness (%)	RICS Adjustment Factors
0 Facilitating Works	0.3 and 0.5 Temporary/enabling works 0.4 Specialist groundworks	**N/A**	**N/A**
1 Substructure	1.1. Substructure	**93%**	**1.07**
2.1-2.4 Superstructure	2.1 Frame 2.2. Upper floor 2.3. Roofs 2.4. Stairs and ramps	**93%**	**1.08**
2.5-2.6 Superstructure	2.5. External walls 2.6. Windows and external doors	**100%**	**1.00**
2.7-2.8 Superstructure	2.7. Internal walls and partitions 2.8. Internal Doors	**100%**	**1.00**
3 Finishes	3.1. Wall finishes 3.2. Floor finishes 3.3. Ceiling finishes	**100%**	**1.00**
4 Fittings, furnishings & equipment	4.1. Fittings, Furnishings & Equipment	**100%** (Estimated based on GLA Benchmarks due to cost plan data limitations)	**1.00**
5 Services (MEP)	5.1. Sanitary installations 5.2. Services equipment 5.3. Disposal installations 5.4. Water installations 5.5. Heat source 5.6. Space heating and Airconditioning 5.7. Ventilation systems 5.8. Electrical installations 5.9. Fuel installations and systems 5.10. Lift and conveyor installations/systems 5.11. Fire and lightning protection 5.12. Communication, Security and Control Systems 5.13. Special installations	**100%** (Items 5.3, 5.4, 5.6, 5.7, 5.8, 5.10) Estimated based on OneClick Benchmarks due to cost plan data limitations)	**1.00**
6 Prefabricated buildings and building units	6.1. Prefabricated Buildings and Building Units	**N/A**	**N/A**
7 Work to existing building	7.1. Minor Demolition and Alteration Works	**N/A**	**N/A**
8 External works	8.1 Site Preparation works 8.2 Roads, Paths, Pavings and Surfaces 8.3 Soft landscaping, planting and Irrigation Systems 8.4 Fencing, Railings and Walls 8.5 External fixtures 8.6 External drainage 8.7 External Services 8.8 Minor Building Works and Ancillary Buildings	**62%** (Items 8.2, 8.4 & 8.6) Remaining items excluded due to lack of available data	**1.61**

4.3 WLCA tool

The WLCA has been undertaken using the Bionova Ltd. 'OneClick LCA' software. OneClick LCA has been developed to comply with the BS EN 15978: 2011 – *Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method* requirements. The OneClick LCA software includes a large database of Environmental Product Declarations (EPDs) and generic material data.

4.4 Data sources and assumptions

Material specifications and quantities at this stage (Stage 2) have been assessed based on the following data (Table 4) received from the wider design team.

Table 4 : Sources of design information used for LCA

Design Information	Sender	Received	File name
Stage 2 Cost Plan Rev B	Core Five	July 2022	*Stage 2 Cost Plan Rev B - June 2022 - Appendix A Elemental Cost Plan.xlsx*
Design team response to material quantities and specification queries	St George	July 2022	*Camden Goods Yard Phase 3 PFS 2nd S73 Application - email*
Potable water consumption	Energist UK	July 2022	*BREEAM_UK_NC_2014_Wat01_Calculator_v1.0 (4)*
Operational energy figures	Waterman Group	July 2022	*be_seen_spreadsheet_v2_mar2021 (1) (003)*
Refrigerant allowance	Waterman Group	November 2022	*Email received from Mark Terndrup on 28/11/2022*

The relevant data was summarised in the Life Cycle Inventory (LCI) spreadsheet developed by Ramboll UK. Any assumptions made regarding specifications are also presented to create the most accurate LCA model possible at this stage. The LCI sheet is included in Appendix A.

Where possible EPDs of the equivalent or closely similar products have been used to extract the material embodied carbon emissions, as these represent the most accurate source of information. Where there are no EPDs available, generic carbon data has been used. The most recent geographically and technologically appropriate data has been selected depending on project location and subject to anticipated supply chains. It should be noted that the certainty of the input data decreases the further into the future life cycle of the asset that the assessment covers.

Table 5 below summarises inputs and assumptions made for all Life Cycle Stages of the study.

Table 5: Main project data sources and key assumptions.

<table>
<tr><th>Life cycle stage</th><th>Data sources and assumptions</th></tr>
<tr><td>A1 – A3
Construction materials</td><td>Material quantities and material description provided as noted above (Table 4).

Where details on the material specification were not provided, appropriate assumptions have been made and the default specifications included within the RICS guidance 'Whole life carbon assessment for the built environment, November 2017', Table 6 has been used.</td></tr>
<tr><td>A4
Transportation to site</td><td>With regards to (A4) emissions, the following assumptions have been made for transport distances in alignment with RICS guidance 'Whole life carbon assessment for the built environment, November 2017':

Materials sourced locally (50km transport distance by road assumed): concrete, cement, soil, aggregates & mortar.

Materials sourced nationally (300km transport distance by road assumed): brick, steel products, insulation, plasterboard, raised access floor tiles and pedestals, paint, concrete blocks & precast paving products.

Materials sourced from Europe (1500km transport distances by road assumed): membranes, carpet tiles, epoxy flooring, ceramic tiles, timber, aluminium, aluminium curtain walls, glass, plastic pedestals, drainage layer, services components & photovoltaic panels.</td></tr>
<tr><td>A5
Construction and installation process</td><td>In the absence of more specific information, average figures have been used to capture the Building Construction Site Emissions (A5) at 30.34 $kgCO_2e/m^2$ of GIA and Excavation works at 1.4 $kgCO_2e/m^3$ of removed masses based on OneClick benchmarks.

Default assumptions for the on-site Waste Rates of Materials (A5) have been made based on the standard wastage rates provided by OneClick, WRAP and IstructE. See below material waste rate assumptions (Table 6).
Table 6: Material waste rate assumptions, Module A5.
<table>
<tr><th>Material</th><th>Waste rate (%) assumed</th></tr>
<tr><td>Concrete</td><td>5</td></tr>
<tr><td>Steel profiles/sheets</td><td>1</td></tr>
<tr><td>Screed</td><td>5</td></tr>
<tr><td>Reinforcement</td><td>5</td></tr>
<tr><td>Precast concrete pavers</td><td>5</td></tr>
<tr><td>Mineral wool</td><td>8</td></tr>
<tr><td>XPS</td><td>4</td></tr>
<tr><td>Membranes</td><td>10</td></tr>
<tr><td>Glass</td><td>2.5</td></tr>
<tr><td>Aluminium louvres</td><td>1</td></tr>
<tr><td>Internal wooden doors</td><td>2.5</td></tr>
<tr><td>Bricks</td><td>5</td></tr>
<tr><td>Ceramic tiles</td><td>8</td></tr>
<tr><td>Paint</td><td>10</td></tr>
<tr><td>Plasterboard</td><td>12.5</td></tr>
<tr><td>Carpet tiles</td><td>5</td></tr>
<tr><td>Stainless steel</td><td>2.5</td></tr>
<tr><td>Mortar</td><td>5</td></tr>
</table></td></tr>
<tr><td>B1
In use emissions</td><td>In use emissions (B1) arising from refrigerants are based on estimated figures provided by Waterman (Table 7) in line with the CIBSE TM65 methodology.</td></tr>
</table>

Table 7: Refrigerant allowance, Module B1.

CGY-S73 Systems	Total refrigerant charge (in kgs) of the systems	Type of refrigerant	Refrigerant leakage scenario from Table 4.4 TM65*
Heat pump chillers	193.2 (4 units x 48.3 kg/unit)	R454B	4% annual leakage rate and 2% end-of-life leakage rate
AHU	112 (4 units x 28 kg/unit)	R410A	4% annual leakage rate and 2% end-of-life leakage rate
Hot water heat pump	18 (2 units x 9 kg/unit)	R134A	4% annual leakage rate and 2% end-of-life leakage rate
UPS	7 (2 units x 3.5 kg/unit)	R410A	4% annual leakage rate and 2% end-of-life leakage rate
VRF (BOH)	82.5 (1 unit x 42.5kg & 1 unit 40 kg)	R410A	6% annual leakage rate and 3% end-of-life leakage rate

*Embodied carbon in building services: a calculation methodology, CIBSE TM65: 2021

B2-B3
Maintenance and repair emissions

Maintenance (B2) stage emissions have been estimated based on GLA standard assumption of **10** $kgCO_2e/m^2$ of gross internal area (GIA) to cover all building element categories (>1% of modules A1-A5: 6.43 $kgCO_2e/m^2$ GIA) in the absence of more specific information.

Repair (B3) stage emissions, the following assumptions (Table 8) have been made for the repair emissions (B3) in the absence of project specific data (e.g., maintenance strategy reports, O&M manuals etc.)

Table 8: Repair rate assumptions, Module B3.

Element	Percentage of material repaired [%]	Repair frequency [years]	Annual repair rate [%]
Aluminium louvres	1	15	0.07
Aluminium curtain wall	2	10	0.2
Steel profiles/sheets	1	15	0.07
Raised access floor tiles	1	15	0.07
External doors	2	10	0.2
Internal doors	2	10	0.2
Plasterboard	2	10	0.2
Paint finish	2	10	0.2

	Epoxy floor covering	2	10	0.2
	Ceramic tiles	1	10	0.1
	Carpet tiles	1	5	0.2
	Precast concrete pavers	1	5	0.2

B4 Replacement emissions

Lifespans used **(B4)** in the assessment are presented below (Table 9):

Table 9: Replacement cycles / Service life assumptions.

Material group	Service life (years)
Substructure	60
Concrete	60
Screed	60
Rebar	60
Internal walls / Partitions – metal framing components	30
Internal walls / Partitions – gypsum boards	30
Curtain walling	30
External Doors – aluminium/steel	30
Internal Doors - timber	30
Timber	30
Wall/Floor Ceramic tiles	30
Suspended Ceiling – gypsum boards	30
Membranes	30
Paint	10
Carpet tiles	15
Epoxy floor covering	15
Precast concrete pavers	60
Raised access floor tiles	30
Raised access floor pedestals	60
Plastic pedestals	30
Photovoltaic Panels (PVs)	25
Lifts	20
HVAC	20-60 depending on component

B5 Refurbishment emissions

In the absence of any proposed refurbishment activities, emissions associated with refurbishments **(B5)** have been **excluded** at this stage.

B6 – B7 Operational energy use and Operational water use

(B6) emissions are based on the Watermans energy model with regulated usage (Part L) = 331,360 kWh/annum and unregulated energy usage (TM54) = 481,809 kWh/annum (see paragraph 5.2 and Figure 10).

(B7) emissions are based on the Energist's BREEAM Wat01 potable water consumption estimates of **18.4** litres/person/day for Office buildings, for **253** annual days/operation and **1017** occupants have been used to calculate the operational water usage (see paragraph 5.3 and Figure 11).

C1 - C4 End-of-Life (EoL) stages

Deconstruction and demolition emissions (C1) include the carbon emissions arising from any on or off-site deconstruction and demolition activities, including any energy consumption for site accommodation and plant use.

According to RICS PS, in the absence of more specific information, an average rate of **(C1) 3.4 kgCO_2e/m² GIA** (rate from monitored demolition case studies in central London) based on aggregated data is used.

End-of-life scenarios for Stages **(C2-C4)** for key material groups are presented in Table 10.

Table 10: End-of-life scenarios for key material groups.

Material group	End-of-Life scenario (C2-C4)
Concrete	Crushed into aggregates
Steel	Recycling
Concrete blocks	Crushed into aggregates
Concrete Reinforcement	Steel recycling
Membranes	Incineration
Mineral Wool insulation	Landfilling
Clay Bricks	Crushed to aggregates
Aluminium elements	Recycling
Timber elements	Incineration
Gypsum Plasterboard	Recycling
Glass Panes	Recycling
Mortar (bricklaying)	Landfilling
Paint	Landfilling
Ceramic Tiles	Crushed to aggregates
Carpet Tiles	Recycling
Precast Concrete staircase	Rebar separated (2%), concrete to aggregate

D Benefits and loads beyond the system boundary

Module D benefits and loads have been calculated using the above End-of life scenarios (Table 10), which follow the EN 15978 standard.

5. WLCA - RESULTS

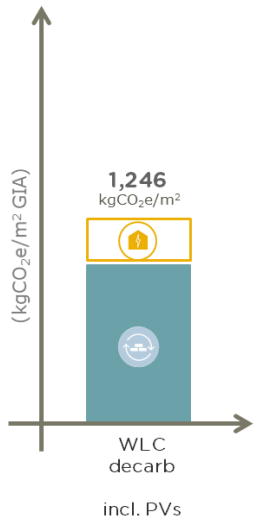
Tables 11 and 12 present the estimated WLC emissions for the development including Photovoltaic Panels benefits for non-decarbonised and decarbonised grid scenarios.

Table 11: WLCA Results Summary – Non-decarbonised grid (SAP10)

GIA: 13,028 m²

Embodied Carbon (A1-A5, B1-B4, C1-C4)	**1,124** kgCO₂e/m² of GIA	**14,632** tonCO₂e
including Timber Sequestered Carbon (A1-A3)	**28** kgCO₂e/m² of GIA	**365** tonCO₂e
including PVs embodied carbon (A-C)	**20** kgCO₂e/m² of GIA	**265** tonCO₂e
Operational Carbon (B6), Fixed Grid electricity emissions SAP10	**855** kgCO₂e/m² of GIA over 60-year lifespan	**11,140** tonCO₂e over 60-year lifespan
including PVs operational carbon saving (B6)	**-18** kgCO₂e/m² of GIA	**-229** tonCO₂e
Operational Water Carbon (B7)	**0.43** kgCO₂e/m² of GIA over 60-year lifespan	**5.6** tonCO2e over 60-year lifespan
Whole Life Carbon (A-C, incl. PVs)	**1,979** kgCO₂e/m² of GIA	**25,772** tonsCO₂e

Table 12: WLCA Results Summary – With grid decarbonisation (FES 2021 Steady Progression Scenario)



GIA: 13,028 m²

Embodied Carbon (A1-A5, B1-B4, C1-C4)	**1,124** kgCO₂e/m² of GIA	**14,632** tonCO₂e
including Timber Sequestered Carbon (A1-A3)	**28** kgCO₂e/m² of GIA	**365** tonCO₂e
including PVs embodied carbon (A-C)	**20** kgCO₂e/m² of GIA	**265** tonCO₂e
Operational Carbon (B6), Fixed Grid electricity emissions SAP10	**122** kgCO₂e/m² of GIA over 60-year lifespan	**1,587** tonCO₂e over 60-year lifespan
including PVs operational carbon saving (B6)	**-3** kgCO₂e/m² of GIA	**-33** tonCO₂e
Operational Water Carbon (B7)	**0.43** kgCO₂e/m² of GIA over 60-year lifespan	**5.6** tonCO2e over 60-year lifespan
Whole Life Carbon (A-C, incl. PVs)	**1,246** kgCO₂e/m² of GIA	**16,219** tonsCO₂e

The energy generated by installing Photovoltaic Panels (PVs) on site will contribute to the operational energy demand of the building, thus offsetting part of the operational carbon emissions, depending on the PVs area, efficiency, and grid electricity conversion factor scenarios. It is proposed to install 338 m^2 of PVs horizontally on the flat roof and 140 m^2 vertically on the façade of the building (overall approx. 478 m^2), with an estimated annual electricity output of 16,348 kWh (Waterman, Stage 2 Energy Strategy Report, July 2022). Tables 11 and 12 show that as the UK grid decarbonises, the embodied carbon emissions are significantly higher (~93% of overall emissions) compared to the operational carbon emissions.

A detailed list of materiality inputs and assumptions is provided within Appendix A.

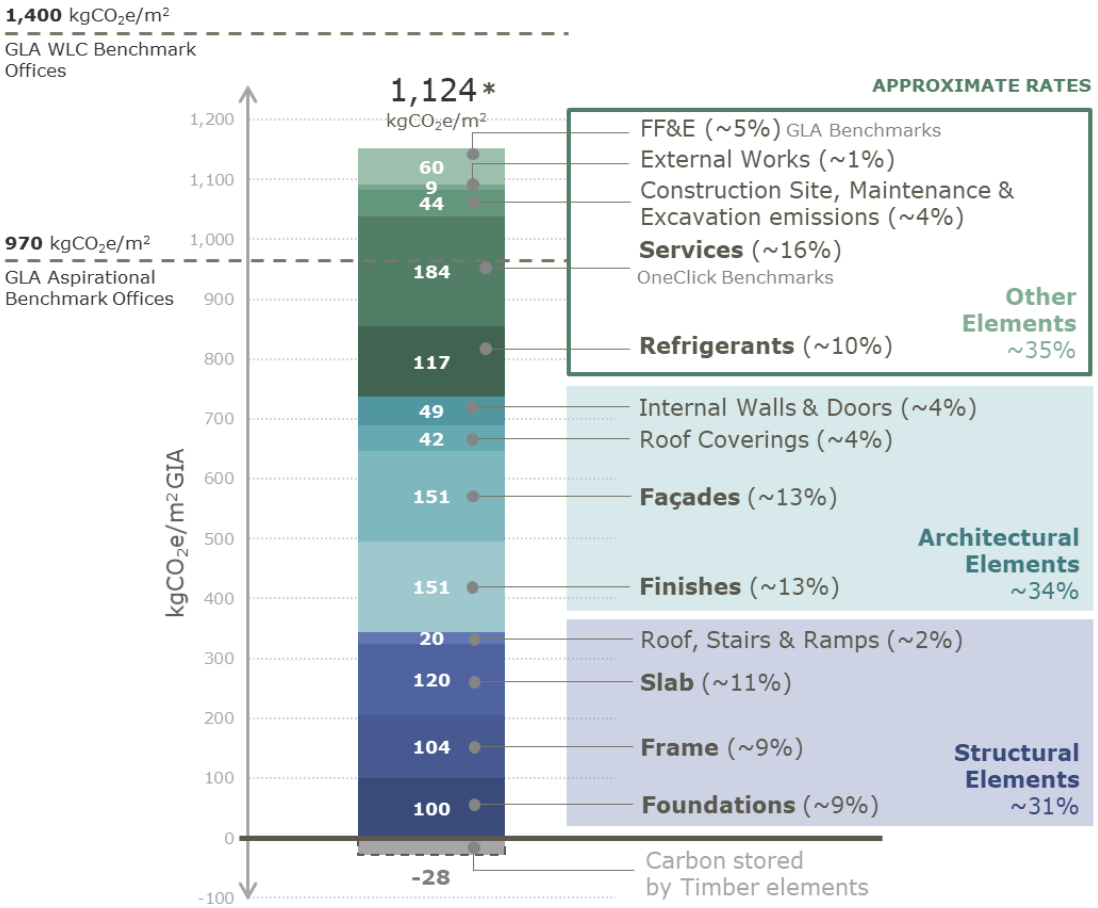
5.1 Embodied Carbon

Figure 6 presents the overall embodied carbon emissions for the development broken down by building elements. The scope of the assessment covers stages A1-A5, B1-B4 and C1-C4. The overall embodied carbon emissions for Stage 2 have been calculated to be at **1,124** $kgCO_2e/m^2$ GIA (including carbon sequestration -28 $kgCO_2e/m^2$).

Module D potential carbon savings for this project are calculated at **-292** $kgCO_2e/m^2$ GIA, using Table 10 End-of life scenarios which follow the EN 15978 standard. As seen in Figure 6 the development's emissions (1,124 $kgCO_2e/m^2$ GIA) fall within range of the GLA WLC (1,400 $kgCO_2e/m^2$ GIA) and Aspirational (970 $kgCO_2e/m^2$ GIA) Office benchmarks.

These results are likely to change on later stages as more detail and materials are added to the design and construction specifications are provided. Due to stage 2 cost plan data limitations and lack of industry data availability, approximate rates and benchmarks have been specified for the FF&E, Construction Site Emissions (A5 & C1), Maintenance Emissions (B2) and Services.

According to Figure 6, other Elements have the highest percentage of influence around 35%, followed by Architectural and Structural elements with 34% and 31% respectively. The greatest carbon contributors are the Services (16%), Facades (13%), Finishes (13%) and Slabs (11%).



*Range includes sequestered carbon from the use of timber For approximate rates, assumptions and exclusions regading the LCA stages and building elements included in the assessment refer to Tables 2, 3 & 5.

Figure 6: Embodied Carbon Breakdown of Building Elements (A1-A5, B1-B4, C1-C4)

Figure 7 presents the breakdown by LCA stages, from A to C (excl. B6 & B7). Emissions up to practical completion of the project (upfront carbon emissions A1-A5) are significant and account for **56%** of the total embodied carbon emissions, followed by In-use (B1,B2, B3 & B4) emissions associated with refrigerants, maintenance, repair, and replacement cycles of materials (39%) and End-of-life emissions (C1-C4).

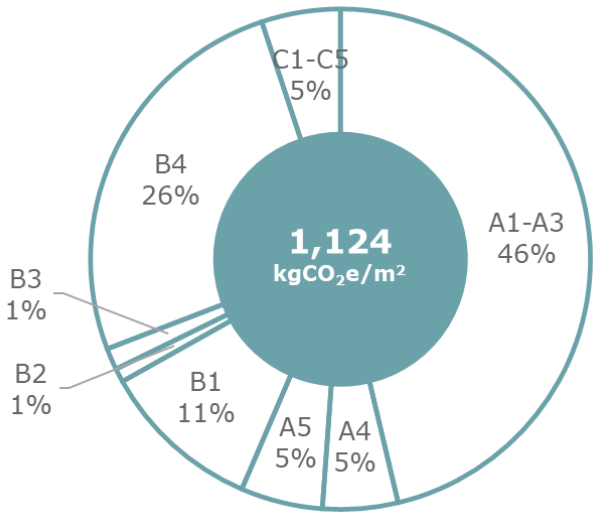


Figure 7: Embodied Carbon Breakdown by LCA Stages

Figure 8 presents the major building element carbon hotspots, rated from the highest to the lowest contributor. Each element has been further broken down in LCA stages (A1-A5, B1, B3-B4, C1-C4). Among the highest contributors and on the top of the list are the services and finishes followed by external walls, slab, frame, and foundations.

Services is the highest contributor with use stage emissions (Stage B) to be responsible for more than 70% of the total services emissions. This is mainly due to Stage B1 and the increased uptake of refrigerants of the mechanical engineering equipment. The carbon emissions from refrigerants (refrigerant charge) including annual and end-of-life leakage rates are significant, reaching 117 $kgCO_2e/m^2$ GIA. For assumptions regarding refrigerants see Table 7. Also, replacement cycles play an important role (Stage B4) ranging from 20 to 60 years depending on the systems used. The embodied carbon of services is estimated using OneClick benchmarks.

Finishes and external walls are next on the list, with **finishes** having the highest amount of carbon under B4 Stage - replacement emissions due to the replacement cycles of raised access floor tiles (assuming at least one replacement during 60-year lifespan). As for the **facade**, the largest proportion of A1-A3 product stage emissions arise from the glazed elements (assuming double-glazed curtain walls) and their replacement cycles (Stage B4).

Regarding **slabs**, the largest proportion of A1-A3 product stage emissions arise from concrete material emissions (25% GGBBS cement replacement). Similar trend is observed for other building elements like the **frame** and **foundations**.

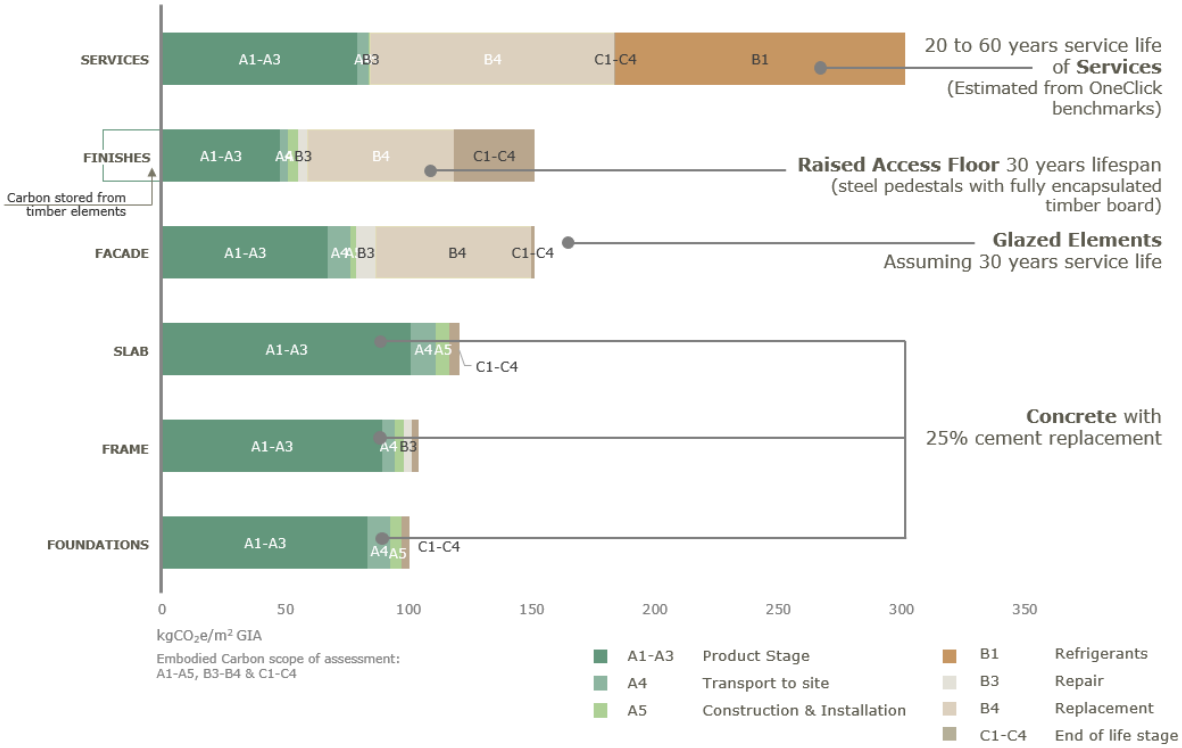


Figure 8: Embodied Carbon Breakdown by Building Elements & LCA Stages (A1-A5, B1, B3-B4, C1-C4)

As shown in Figure 9 below for A1-A5 upfront carbon emissions, concrete with 25% cement replacement and double-glazed curtain walls are the two most carbon intensive materials used, followed by steel reinforcement (rebar), structural steel profiles, lightweight concrete blocks and raised access floor tiles.

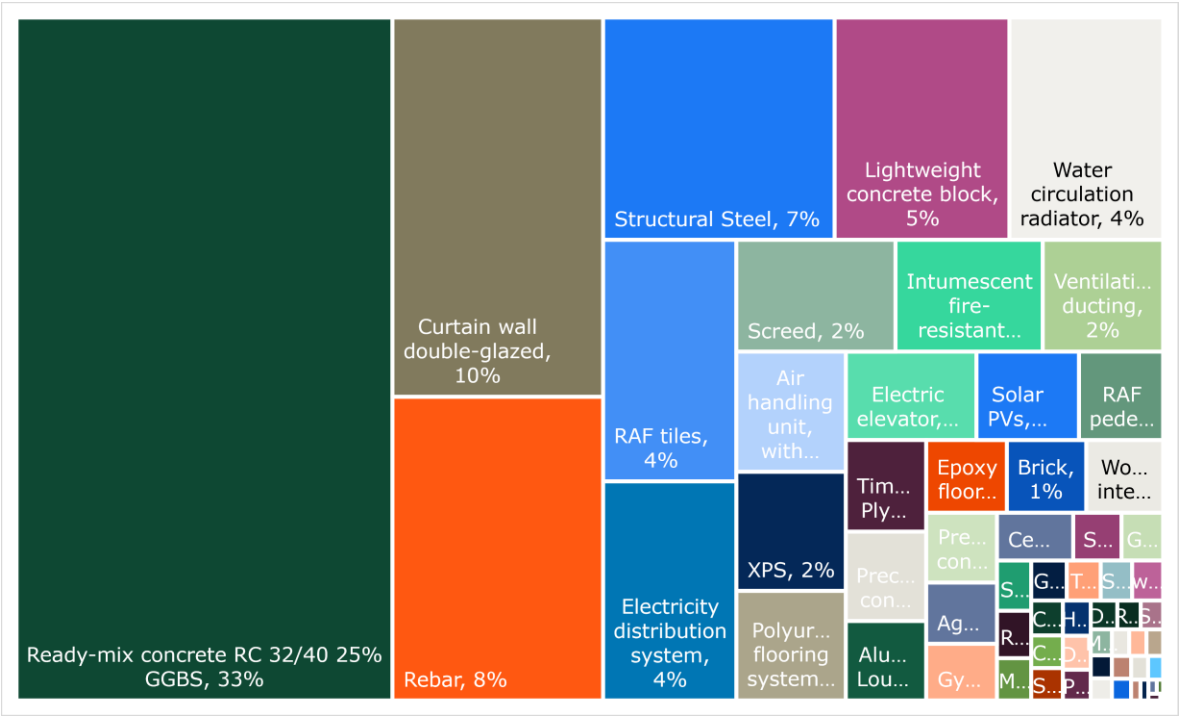


Figure 9: Embodied Carbon Breakdown by Materials (A1-A5), all building elements included.

5.2 Operational Carbon (B6)

The (B6) emissions associated with running the mechanical and electrical systems in the building have been extracted from the Part L and TM54 energy models undertaken by Waterman in July 2022. The estimated annual energy consumption (excluding Photovoltaic panels) is 25.4 kWh/m^2 of GIA for regulated and 37.0 kWh/m^2 of GIA for unregulated energy use. Regarding the operational carbon emissions two scenarios have been considered:

- **SAP10** grid electricity emissions factor 0.233 $kgCO_2e$/kWh fixed for 60 years
- **Decarbonised grid FES 2021** Steady Progression Scenario, average grid electricity emissions factor 0.0332 $kgCO_2e$/kWh for 2020-2079 (assuming electricity conversion factors remain constant from 2050 onwards)

The predicted operational carbon rate (B6) is around ~873 $kgCO_2e/m^2$ (SAP10, excl. PVs) over 60 years lifespan and ~124 $kgCO_2e/m^2$ (decarbonised grid FES 2021, excl. PVs) (Figure 10).

*Excluding energy savings from Photovoltaic Panels

Figure 10: Predicted Energy Use & Carbon Scenario

5.3 Operational Water Carbon (B7)

The **(B7)** Operational water carbon emissions associated with water use during the operation of the building are estimated at **0.43 $kgCO_2e/m^2$** over 60 years lifespan (Figure 11). A benchmark figure of 18.4 litres/person/day based on the Energist's BREEAM Wat01 potable water consumption estimates for Office buildings (253 annual days/operation, 1017 occupants) has been used to quantify the Potable Water use for the project. The water conversion factor applied is estimated at 0.0196 $kgCO_2e/m^3$ and is based on Thames Water Utilities for clean, tap water.

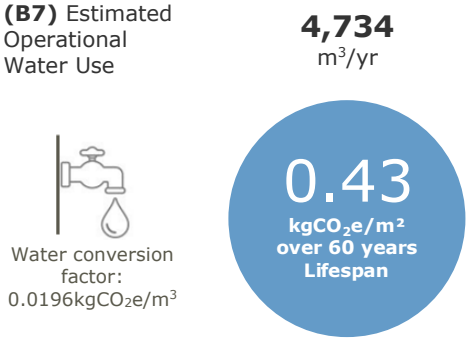


Figure 11: Estimated Operational Water Use/Carbon for potable water (B7)

5.4 Photovoltaic Panels (PVs) Operational & Embodied Carbon

The energy generated by installing Photovoltaic Panels (PVs) on site will contribute to the operational energy demand of the building, thus offsetting part of the operational carbon emissions depending on the PVs area, efficiency, and grid electricity conversion factor scenarios. It is proposed to install 338 m^2 of PVs horizontally on the flat roof and 140m^2 vertically on the façade of the building (overall approx. 478 m^2), with an estimated annual electricity output of **16,348** kWh (Waterman, Stage 2 Energy Strategy Report, July 2022) or **1.25** kWh/m^2/yr GIA. The embodied carbon impact of 478 m^2 PV panels is approximately 264,615 $kgCO_2e$ (i.e., ~20.3 $kgCO_2e/m^2$ of GIA or ~554 $kgCO_2e/m^2$ of panel) for stages A1-A5, B3-B4, C1-C4 (see Figure 12). Material production and grid decarbonisation has not been considered for the future embodied carbon emissions of replacement PV panels, so embodied carbon could be considered an overestimate.

Regarding the operational carbon savings of the PVs two scenarios have been considered:

- **SAP10** grid electricity emissions factor 0.233 $kgCO_2e/kWh$ fixed for 60 years
- **Decarbonised grid FES 2021** Steady Progression Scenario, average grid electricity emissions factor 0.0332 $kgCO_2e/kWh$ for 2020-2079 (assuming electricity conversion factors remain constant from 2050 onwards)

According to Figure 12, the embodied carbon impact of the PVs (~20.3 $kgCO_2e/m^2$ GIA) is offset by 12% by their savings in the decarbonised grid scenario (-2.5 $kgCO_2e/m^2$ GIA) and 86% in the SAP10 fixed grid scenario (-17.5 $kgCO_2e/m^2$ GIA).

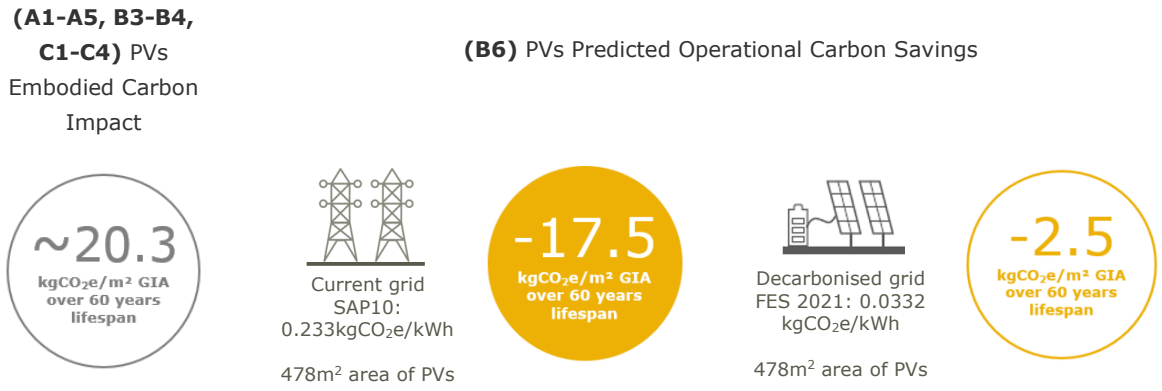


Figure 12: Predicted PVs Operational Carbon savings (B6) & Embodied Carbon (A1-A5, B3-B4, C1-C4)

6. OPPORTUNITIES FOR REDUCING WHOLE LIFE CARBON

The core philosophy for minimising embodied carbon emissions is indicated in Figure 13. As the building geometry and external envelope are more or less fixed at the end of RIBA Stage 2 further reductions will be achieved through refinements to the design to minimise material usage and appropriate specification of low carbon products.

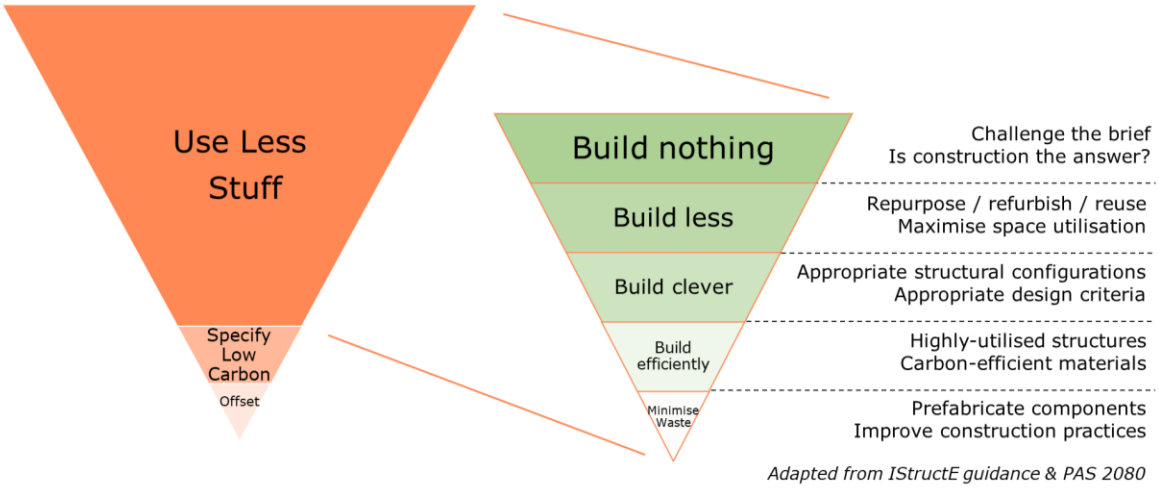


Figure 13: Embodied carbon reduction hierarchy

Based on the high impact materials identified earlier in the report the following design changes are proposed for consideration at the commencement of the next stage. Refer to Table 13 for further details.

Other general recommendations to further reduce whole life-cycle emissions include:

- Undertake a whole life carbon **optimisation study of HVAC system** at the next stage of design, with consideration of embodied carbon, operational carbon and refrigerant leakage considered in parallel
- Specify products with a high **recycled content** and consider 'cradle-to-cradle' certified products
- Procure materials with Environmental Product Declarations (**EPDs**) to allow for accurate comparisons and the most informed procurement choices
- Procure materials from suppliers that offer **take back schemes** where possible
- For the steel sections, **bolted connections** and clamped fittings should be preferred to welded joints to facilitate the re-use of the steel section after their end of life (EoL)

Table 13: Carbon reduction opportunities

Element	Baseline option	Potential method of carbon saving	Potential change against baseline*	Other considerations	Whole building saving (A-C)
Steel frame	20% recycled content	Specify Electric Arc Furnace – 80% recycled content	**40-50%** ↓ reduction possible depending on specific mill	Increased cost of imported steel from EU	**~250** tonsCO_2e ~2%
Concrete frame and slabs	C32/40 concrete with 25% GGBS replacement	Increase to 50% cement replacement	**~15%** ↓ reduction depending on quantity of cement replacement	Slower strength gain in high cement replacement mixes (no effect from 30-50% replacement)	**~200** tonsCO_2e ~2%
Concrete Foundations	C32/40 concrete with 25% GGBS replacement	Increase to 75% cement replacement	**~45%** ↓ reduction depending on quantity of cement replacement	Slower strength gain in high cement replacement mixes (no effect from 30-50% replacement)	**~350** tonsCO_2e ~3%
Raised access floor	New Kingspan RG3 system	Reclaimed RAF tiles with new pedestals	**~75%** ↓ reduction depending on supplier	Warranty and longer lead times	**~500** tonsCO_2e ~4%
Internal partitions	140mm concrete block walls	Change to lightweight metal stud and plasterboard walls	**~75%** ↓ reduction depending on wall build-up	Acoustics, durability, secondary steel framing	**~150** tonsCO_2e ~1%
Glazed façade	Aluminium framed curtain wall	Replace aluminium frames with composite alu-timber system	**~25%** ↓ reduction depending on framing specification	Detailing to ensure low maintenance and durability of timber	**~400** tonsCO_2e ~3%
Construction site operations	Business as usual	Best practice approach with HVO fuel, electric plant, waste diversion, local supply chain	**~25%** ↓ reduction depending on contractor methodology	Tender process includes contractor sustainability evaluation	**~100** tonsCO_2e ~1%
				TOTAL POTENTIAL REDUCTION	**~2100** tonsCO_2e ~16%

* Changes are based on carbon factor for one unit of the specific material, so consider A1-A3 carbon only. Effects on the overall carbon intensity have been quantified where possible.

APPENDIX A – INPUT DATA AND ASSUMPTIONS

LIFE CYCLE INVENTORY

Life Cycle Inventory (LCI) Spreadsheet

Project:	Camden Goods Yard 3rd S73 PFS- LCA
Location:	Camden, London
Type of LCA:	RICS/GLA
Scope of LCA:	A1-A5, B2-B4, C1-C4, D
RIBA Stage:	Stage 2
GIA (m^2):	13,028
GFA (m^2):	
NIA (m^2):	
Number of bed spaces:	N/A
Project value (£):	42.9M

Author:	Antonia Vavanou
Checked by:	Tom Harley-Tuffs - 18/07/22
Revision:	01
Date:	19.07.2022

Source List:	
OC	OneClickLCA, Generic material or product data
RICS	RICS, Whole Life Carbon Assessment for the Built Environment (2017), Table 6: Default specifications for main building materials
1	Stage 2 Cost Plan Rev B - June 2022 - Appendix A Elemental Cost Plan.xlsx - excel spreadsheet received on 05/07/22 by Joshua Hawkes
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Definition of GIA, GFA

	GFA	GIA
Occupied Areas	Included	Included
Communal Areas (lifts, stairs, toilets (if outside user boundary)	Included	Included
Plant rooms/risers	Included	Included
External wall thickness	Included	Excluded
Non-load bearing partitions	Included	Included
Load bearing partitions	Included	Included
Columns	Included	Included
Covered rooftop plantrooms	Included	Included
Roofs no access	Excluded	Excluded
Roofs, access intended, including terraces and balconies	Included	Included
Carparks below the building	Included	Included
External car parks	Excluded	Excluded
External landscaping	Excluded	Excluded

Life-cycle stages, Adapted from EN 15978: 2011

WHOLE LIFE CARBON ASSESSMENT INFORMATION

PROJECT LIFE CYCLE INFORMATION

A1 – A3 PRODUCT STAGE			A4 – A5 CONSTRUCTION PROCESS STAGE		B1 – B7 USE STAGE					C1 – C4 END OF LIFE STAGE				SUPPLEMENTARY INFORMATION
														D BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
RAW MATERIAL EXTRACTION AND SUPPLY	TRANSPORT TO MANUFACTURING PLANT	MANUFACTURING AND FABRICATION	TRNSPORT TO PROJECT SITE	CONSTRUCTION AND INSTALLATION PROCESS	USE	MAINTENANCE	REPAIR	REPLACEMENT	REFURBISHMENT	DECONSTRUCTION DEMOLITON	TRANSPORT TO DISPOSAL FACILITY	WASTE PROCESSING	DISPOSAL	REUSE, RECOVERY, RECYCLING POTENTIAL
					B6 – OPERATIONAL ENERGY USE									
					B7 – OPERATIONAL WATER USE									

RAMBOLL LCI - SUBSTRUCTURE

Rev 01	19.07.2022

CONSTRUCTION SITE OPERATIONS

Category	Building Element Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
1.Construction site scenarios	Assumption for Average site impacts - Construction Emissions A5a	13,028	M2	Ramboll	Average Site impacts	Construction emissions	Average production of construction waste	OC	Average site impacts - temperate climate (North) (per GFA)	OC	0
2.Deconstruction/demolition scenarios (C1)	Assumption for Demolition C1	13,028	M2	Ramboll	Average Site impacts	Deconstruction & Demolition	Deconstruction and Demolition activities	OC	Average deconstruction and demolition process (per GIA)	OC	0
1.Construction site scenarios	Piled Foundations, disposal of excavated material 45m3 +8m3, Pile Caps 102m3+128m3+1m3, Core Cap 152m3+121m3, Ground Beams 172m3	608	M3	1	Excavation Works	Soil excavation works	Excavation works, fuel and energy use	OC	Excavation works, kg or m3 of removed masses (Required for IMPACT calculations)	OC	0
1.Construction site scenarios	Substructure - Allowance for excavation and removal of material from general excavation, area 1,737m2, depth 700mm, - 1,216m3 (confirmed by email (Josh), 14/07/22)	1,216	M3	1	Excavation Works	Soil excavation works	Excavation works, fuel and energy use	OC	Excavation works, kg or m3 of removed masses (Required for IMPACT calculations)	OC	0
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

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RAMBØLL LCI - SERVICES | Rev 01 | 19.07.2022

5. Services - Applicable only to GLA/RICS assessments

*default values from Carbon Designer benchmarks

RICS category	*Default Building Elements	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
5.3.Disposal installations	Sewage water drainage piping network	13,028	M2	Ramboll	Services	Sewage water piping network -Office buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Sewage water drainage piping network, per m2 GIFA (office buildings)	OC	0
5.4.Water installations	Drinking water supply piping network	13,028	M2	Ramboll	Services	Drinking water piping network - Office buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Drinking water supply piping network, per m2 GIFA (office buildings)	OC	0
5.6.Space heating and Airconditioning	Heat distribution system	13,028	M2	Ramboll	Services	Heat distribution system	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Heat distribution system	OC	0
5.7.Ventilation systems	Ventilation system	13,028	M2	Ramboll	Services	Ventilation system -Office and care buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Ventilation system for office and care buildings	OC	0
5.8.Electrical installations	Electricity distribution system	13,028	M2	Ramboll	Services	Electricity distribution system	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Electricity distribution system, cabling and central, for all building types, per m2 GFA	OC	0
5.8.5.Local electricity generation systems	Photovoltaic Panels - Total PVs area: 478 m2 (Flat Roof: 338m2 & Vertical Plan Screen: 140m2)	478	M2	4	Services	Photovoltaic Panels	Solar PVs generic	Ramboll	Solar panel photovoltaic system, EU average	OC	Provide area in m2
5.10.1.Lift and enclosed hoists	Allowance for office lifts; 8 stops, 5nr	40	UNIT	1	Services	Elevator/Lift	Max. transported gross weight 630kg	Ramboll	Electric elevator elements dependent of the number of floors, 422 kg/unit, max load: 1600 kg, DONNEE PAR DEFAUT (DED)	EPD	Electric elevator elements dependent of the number of floors
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

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RAMBOLL LCI - SUBSTRUCTURE | Rev 01 | 19.07.2022

1.SUBSTRUCTURE

RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
1.1.1.Standard foundations	Allowance for Piling Mat; assume 700mm deep (Quantity adjusted as per Client instruction 21/06/22)	1,216	M3	1	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	OC	Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
1.1.1.Standard foundations	Piled Foundations - 600 diameter CFA piles; 26m long; 161nr	1,183	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Piled Foundations - 600 diameter CFA piles; 16m long; 30nr	136	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Pile Caps - RC concrete pile caps, 3 pile pilecaps, 102m3	102	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Pile Caps - Reinforcement to 3 pile pilecaps @ 250kg/m3, 26t	26,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Pile Caps - Formwork to 3 pile pile caps, 237m2	711	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
1.1.1.Standard foundations	Pile Caps - RC concrete pile caps, 2 pile pilecaps, 128m3	128	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Pile Caps - Reinforcement to 2 pile pilecaps @ 250kg/m3, 32t	32,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Pile Caps - Formwork to 2 pile pile caps, 380m2	1,140	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
1.1.1.Standard foundations	Pile Caps - RC concrete pile caps, 1 pile pilecaps, 1m3	1	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Pile Caps - Reinforcement to 1 pile pilecaps @ 250kg/m3, 0.2t	200	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Pile Caps, Formwork to 1 pile pile caps, 36m2	108	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
1.1.1.Standard foundations	Core Cap under main stair core - RC concrete pile caps, 14 pile pilecap, 152m3	152	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Core Cap under main stair core - Reinforcement to 14 pile pilecaps @ 250kg/m3, 38t	38,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Core Cap under main stair core - Formwork to 14 pile pile caps, 86m2	258	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
1.1.1.Standard foundations	Core Cap under emergency stair core - RC concrete pile caps, 9 pile pilecap, 121m3	121	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Core Cap under emergency stair core - Reinforcement to 9 pile pilecaps @ 250kg/m3, 30t	30,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Core Cap under emergency stair core - Formwork to 9 pile pile caps, 56m2	168	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
1.1.1.Standard foundations	Ground Beams - RC concrete ground beams, 1500 x 1500 deep, 172m3	172	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Ground Beams - Reinforcement to ground beams @ 180kg/m3, 31t	31,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Ground Beams - Formwork to ground beams, 305m2	915	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
1.1.1.Standard foundations	Ground Beams - Allowance for RC retaining wall to rear of the building; assume 50% of GEA perimeter; 1000mm high x 250mm wide, 134m2	34	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.1.Standard foundations	Ground Beams - Allowance for RC retaining wall to rear of the building; assume 50% of GEA perimeter; 1000mm high x 250mm wide, 134m2 - Extra over for waterproof additive, Assuming 25mm thick cement mortar waterproofing layer	6,700	KG	1	Mortar	Cement	Assumed Cement Mortar	Ramboll	Cement mortar, gross density: 2000 kg/m3	EPD	Assuming 100kg/m2 (50mm thick)
1.1.1.Standard foundations	Ground Beams - Allowance for RC retaining wall to rear of the building; assume 50% of GEA perimeter; 1000mm high x 250mm wide, 134m2 - Extra over for insulation and membrane to outside face, 200mm thick PIR insulation (insulation thickness and type confirmed by St George, email on 12/07/22)	858	KG	1	Insulation	Floors/Roofs/Ext. Walls RICS - PIR	PIR	RICS	PIR insulation boards, aluminum composite foil faced, 66 mm, L = 0.022 W/mK, R = 3 m2K/W, 2.11 kg/m2, 32 kg/m3, Eco-Protect Plus (EcoTherm (2021))	EPD	6.4kg/m2 (200mm thick), 8kg/m2 (250mm thick), 3.2kg/m2 (100mm thick), 7kg/m2 (220mm thick)
1.1.1.Standard foundations	Ground Beams - Allowance for RC retaining wall to rear of the building; assume 50% of GEA perimeter; 1000mm high x 250mm wide, 134m2 - Extra over for insulation and membrane to outside face	15	KG	1	Membrane	Substructure - damp proof	Assumed plastic film for damp proofing	Ramboll	Plastic film for damp proofing, 12 / 15 / 20 mm, RaniMoBar (Rani Plast)	EPD	Assuming 0.11kg/m2 (0.12mm thick membrane)

1.1.1.Standard foundations	Ground Beams - Allowance for RC retaining wall to rear of the building; assume 50% of GEA perimeter; 1000mm high x 250mm wide, 134m2 - Reinforcement @ 200kg/m3, 27t	27,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
1.1.1.Standard foundations	Ground Beams - Blinding; 50mm thick, 87m3	87	M3	1	Concrete	Screed Non-structural	Assumed Floor screed mortar, cement screed	Ramboll	Mortar, self-levelling floor screed, 1700 kg/m3 (bulk), 2100 kg/m3 (mixture), Conplan Eco R (Mapei)	EPD	63kg/m2 (30mm thick), 105kg/m2 (50mm thick)
1.1.1.Standard foundations	Ground Beams - DPM, area 1737m2	191	KG	1	Membrane	Substructure - damp proof	Assumed plastic film for damp proofing	Ramboll	Plastic film for damp proofing, 12 / 15 / 20 mm, RaniMoBar (Rani Plast)	EPD	Assuming 0.11kg/m2 (0.12mm thick membrane)
1.1.3.Lowest floor construction	RC ground bearing slab; 350thick, 608m3	608	M3	1	Concrete	Substructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
1.1.3.Lowest floor construction	Reinforcement to basement slab @ 170kg/m3, 103t	103,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

SOURCE LIST:	
OC	OneClickLCA, Generic material or product data
RICS	RICS, Whole Life Carbon Assessment for the Built Environment (2017), Table 6: Default specifications for main building materials
1	Stage 2 Cost Plan Rev B - June 2022 - Appendix A Elemental Cost Plan.xlsx - excel spreadsheet received on 05/07/22 by Joshua Hawkes
2	Design team response to material quantities and specification queries - email received on 12/07/22 by Richard Syddall
3	Stage 2 Cost Plan queries - email received on 12/07/22 by Joshua Hawkes
4	PVs area confirmed by Richard Syddall on 15/07/22
5	
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RAMBOLL LCI- SUPERSTRUCTURE | Rev 01 | 19.07.2022

2.1 FRAME

	RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.1.4.Concrete frames	**RC Core walls - 250mm thick, 570m3**	570	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.1.4.Concrete frames	**RC Core Walls - Reinforcement to RC Core walls @ 125kg/m3, 71t**	71,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**RC Core Walls - Formwork to core walls, 2278m2**	6834	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.1.4.Concrete frames	**RC columns; 600 x 600, 419m3**	419	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.1.4.Concrete frames	**Reinforcement @ 125kg/m3, 52t**	52,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**Formwork to 600x600 columns, 2,796m2**	8388	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
Shell & Core	2.1.4.Concrete frames	**RC columns; 1000 x 300, 79m3**	79	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.1.4.Concrete frames	**Reinforcement @ 125kg/m3, 10t**	10,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**Formwork to 1000x300 columns, 704m2**	2112	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.1.4.Concrete frames	**PT transfer beam; 1200 x 1200; first floor, 60m3**	60	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.1.4.Concrete frames	**Loose bar Reinforcement @ 100kg/m3, 6t**	6,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**PT Tendons @20kg/m3, 1t**	1,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**Formwork to underside of slab, 50m2**	150	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.1.4.Concrete frames	**Formwork to edge of slab, 109m, assuming 260mm thick slab**	85	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.1.4.Concrete frames	**PT Transfer beam; 460 deep; second floor, 57m3**	57	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.1.4.Concrete frames	**Loose bar Reinforcement @ 47kg/m3, 3t**	3,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**PT Tendons @ 31kg/m3, 2t**	2,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.1.4.Concrete frames	**Formwork to underside, 124m2**	372	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.1.4.Concrete frames	**Formwork to edge, 230m, assuming 260mm width**	179.4	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.1.1.Steel frames	**Steel vierendeel; assume 500kg/m, 46t**	46,000	KG	1	Steel	Structural steel sections	Assumed hot rolled sections	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)	EPD	Provide kg or m3
Shell & Core	2.1.1.Steel frames	**100x200 RHS hangers to wintergarden corner; assume 50kg/m, 3t**	3,000	KG	1	Steel	Structural steel sections	Assumed hot rolled sections	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)	EPD	Provide kg or m3
Shell & Core	2.1.1.Steel frames	**Steel columns; 158kg/m, 35t**	35,000	KG	1	Steel	Structural steel sections	Assumed hot rolled sections	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)	EPD	Provide kg or m3
Shell & Core	2.1.1.Steel frames	**Steel beams; 149kg/m, 87t**	87,000	KG	1	Steel	Structural steel sections	Assumed hot rolled sections	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)	EPD	Provide kg or m3
Shell & Core	2.1.1.Steel frames	**Steel hangers to level 1 mezzanine 90x90 SHS; 14kg/m, 1t**	1,000	KG	1	Steel	Structural steel sections	Assumed hot rolled sections	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)	EPD	Provide kg or m3
Shell & Core	2.1.1.Steel frames	**Fittings & Connections @ 15%, 25t**	25,000	KG	1	Steel	Structural steel sections	Assumed hot rolled sections	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)	EPD	Provide kg or m3
Shell & Core	2.1.1.Steel frames	**Fire proofing (intumescent paint - 120min), 72t**	72,000	KG	1	Paint	M60 Steelwork Fire Protection	Assumed coating for structural steelwork fire protection	IstructE	Intumescent fire-resistant coating, for steel surfaces, 0.26 - 4.05 kg/m2, Amotherm Steel WB, Amotherm Steel WB HI (J.F. Amonn)	EPD	Provide area in m2
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.2 UPPER FLOORS

RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions

Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - PT Slab; 260mm thick; 2,384m3 - Subtracting Roof Slab 364m3	2,020	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Loose bar Reinforcement @10kg/m2, 92t - Subtracting Roof Slab Reinforcement 13t	79,000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - PT Tendons @16kg/m2, 147t - Subtracting Roof Slab PT Tendons 21t	126000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to underside of slab, 9169m2 - Subtracting Roof Slab Formwork 1,342m2	23481	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to edge of slab, 1839m, assuming 260mm width, Subtracting Roof formwork to edge of slab 294m	1205	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - PT Slab; 290mm thick;	900	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Loose bar Reinforcement @10kg/m2, 31t	31000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - PT Tendons @16kg/m2, 50t	50000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to underside of slab, 3103m2	9309	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to edge of slab, 981m, assuming 290mm width	853	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - PT Slab; 310mm thick;	440	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Loose bar Reinforcement @10kg/m2, 14t	14000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - PT Tendons @16kg/m2, 23t	23000	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to underside of slab, 1419m2	4257	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to edge of slab, 186m, assuming 310mm width	173	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - RC Slab to cover, 260mm thick	6	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)	ICE	Provide m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Reinforcement @10kg/m2, 0.2t	200	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to underside of slab, 23m2	69	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood
Shell & Core	2.2.1.Floors	Slabs (GF Mezz - Roof) - Formwork to edge of slab, 31m, assuming 260mm width	24	KG	1	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.3 ROOFS

RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.3.2.Roof coverings	Allowance for waterproofing & insulation; incl lift overruns; area 1691m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	1691	M2	1	Membrane	Roof Waterproofing	Assumed flexible bitumen membrane/sheets for roof	Ramboll	Multi layer waterproofing system with flexible sheets for roofing, fully torched, European average, 3.8 (top) + 3.1 (bottom) mm, 4.8 (top) + 3.9 (bottom) kg/m2 (EWA)	EPD	Provide area in m2
Shell & Core	2.3.2.Roof coverings	Allowance for waterproofing & insulation; incl lift overruns; area 1691m2, assuming XPS 250mm thick (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	422.75	M3	1	Insulation	Roof/Wall - XPS	Assumed XPS	Ramboll	XPS insulation board, 0.033 W/mK, 34 kg/m3, Roofboard Extra, Floorboard Extra, Laminating Board Extra (Polyfoam XPS Ltd (2021))	EPD	Provide m3
	2.3.2.Roof coverings			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.3.2.Roof coverings	Extra over for paving slab finish to plant area Assuming Concrete pavers (50mm), Plastic pedestals (25mm), XPS insulation (250mm), Waterproofing membrane, area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	42.3	M3	1	Concrete	Precast Concrete Paving	Assumed Precast concrete	Ramboll	Precast concrete paving products, 2350 kg/m3 (BPCF)	EPD	Provide m3 or kgs, Assuming 72kg/m2 (30mm thick), 192kg/m2 (80mm thick)
Shell & Core	2.3.2.Roof coverings	Extra over for paving slab finish to plant area Assuming Concrete pavers (50mm), Plastic pedestals (25mm), XPS insulation (250mm), Waterproofing membrane, area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	1404.4	KG	1	Plastic	Paving support pads/ Paving pedestals - Polypropylene	Assumed - 1.66 kg/m2 (0.5kg/item - 3.33 items/m2)	Ramboll	Floor raising element, from polypropylene, 2.96 kg/m2, LEADER EMX Igni avec Isorupteur (KP1)	EPD	Assuming 1.66kg/m2

Shell & Core	2.3.2.Roof coverings	Extra over for paving slab finish to plant area Assuming Concrete pavers (50mm), Plastic pedestals (25mm), **XPS insulation (250mm)**, Waterproofing membrane, area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	211.5	M3	1	Insulation	Roof/Wall - XPS	Assumed XPS	Ramboll	XPS insulation board, 0.033 W/mK, 34 kg/m3, Roofboard Extra, Floorboard Extra, Laminating Board Extra (Polyfoam XPS Ltd (2021))	EPD	Provide m3
Shell & Core	2.3.2.Roof coverings	Extra over for paving slab finish to plant area Assuming Concrete pavers (50mm), Plastic pedestals (25mm), XPS insulation (250mm), **Waterproofing membrane**, area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	846	M2	1	Membrane	Roof Waterproofing	Assumed flexible bitumen membrane/sheets for roof ı	Ramboll	Multi layer waterproofing system with flexible sheets for roofing, fully torched, European average, 3.8 (top) + 3.1 (bottom) mm, 4.8 (top) + 3.9 (bottom) kg/m2 (EWA)	EPD	Provide area in m2
Shell & Core	2.3.2.Roof coverings	Extra over to green / brown roof - **Assuming Soil substrate (100mm)**, Filter, drainage layer (50mm), waterproofing layer, XPS insulation (250mm), area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	70218	KG	1	Soil	Green roof growing medium	Green roof substrate	Ramboll	Soil substrates for green roofs, 10 mm, 8.25 kg/m2, 825 kg/m3, SOPRAFLOR X (SOP	EPD	Assuming 66kg/m2 (80mm thick), 83kg/m2 (100mm thick)
Shell & Core	2.3.2.Roof coverings	Extra over to green / brown roof - Assuming Soil substrate (100mm), **Filter**, drainage layer (50mm), waterproofing layer, XPS insulation (250mm), area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	846	M2	1	Membrane	Geotextile	Assumed Geotextile	Ramboll	Geotextile, generic, 312 g/m2 (1.02 oz/ft2), Composition: PP net, non-woven PE felt	OC	Provide area in m2
Shell & Core	2.3.2.Roof coverings	Extra over to green / brown roof - Assuming Soil substrate (100mm), Filter, **drainage layer (50mm)**, waterproofing layer, XPS insulation (250mm), area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	1903.5	KG	1	Plastic	Drainage Layer	Assumed 1.8kg/m2 (40mm thick) High Density polyet	Ramboll	High density polyethylene (HDPE) plastic pipe, 0% recycled content (TRACI)	OC	Assuming 1.8kg/m2 (40mm thick)
Shell & Core	2.3.2.Roof coverings	Extra over to green / brown roof - Assuming Soil substrate (100mm), Filter, drainage layer (50mm), **waterproofing layer**, XPS insulation (250mm), area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	846	M2	1	Membrane	Roof Waterproofing	Assumed flexible bitumen membrane/sheets for roof ı	Ramboll	Multi layer waterproofing system with flexible sheets for roofing, fully torched, European average, 3.8 (top) + 3.1 (bottom) mm, 4.8 (top) + 3.9 (bottom) kg/m2 (EWA)	EPD	Provide area in m2
Shell & Core	2.3.2.Roof coverings	Extra over to green / brown roof - Assuming Soil substrate (100mm), Filter, drainage layer (50mm), waterproofing layer, **XPS insulation (250mm)**, area 846m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	211.5	M3	1	Insulation	Roof/Wall - XPS	Assumed XPS	Ramboll	XPS insulation board, 0.033 W/mK, 34 kg/m3, Roofboard Extra, Floorboard Extra, Laminating Board Extra (Polyfoam XPS Ltd (2021))	EPD	Provide m3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.3.2.Roof coverings	Terraces Above ground Only - Allowance for **waterproofing** & insulation, area 489m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	489	M2	1	Membrane	Roof Waterproofing	Assumed flexible bitumen membrane/sheets for roof ı	Ramboll	Multi layer waterproofing system with flexible sheets for roofing, fully torched, Europe	EPD	Provide area in m2
Shell & Core	2.3.2.Roof coverings	Terraces Above ground Only - Allowance for waterproofing & **insulation**, area 489m2 Assuming XPS 250mm thick (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	122.25	M3	1	Insulation	Roof/Wall - XPS	Assumed XPS	Ramboll	XPS insulation board, 0.033 W/mK, 34 kg/m3, Roofboard Extra, Floorboard Extra, Lan	EPD	Provide m3
Shell & Core	2.3.2.Roof coverings	Terraces Above ground Only - Extra over for **paving slab** finish, Assuming 50mm thick concrete pavers, area 489m2 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	24.45	M3	1	Concrete	Precast Concrete Paving	Assumed Precast concrete	Ramboll	Precast concrete paving products, 2350 kg/m3 (BPCF)	EPD	Provide m3 or kgs, Assuming 72kg/m2 (30mm thick), 192kg/m2 (80mm thick)
Shell & Core	2.3.2.Roof coverings	Terraces Above ground Only - Extra over for paving slab finish, Assuming 25mm **plastic pedestals** support system, area 489m3 (Assumptions regarding roof coverings confirmed by email on 12/07/22 by St George)	811.74	KG	1	Plastic	Paving support pads/ Paving pedestals - Polypropylene	Assumed - 1.66 kg/m2 (0.5kg/item - 3.33 items/m2)	Ramboll	Floor raising element, from polypropylene, 2.96 kg/m2, LEADER EMX Igni avec Isoru	EPD	Assuming 1.66kg/m2
Shell & Core	2.3.6.Roof features	**Balustrades** to terraces; assume glazed, 120m, Assuming height 110mm, toughened glass 10mm thick	1.32	M3	1	Glass	Toughened glass	Assumed toughened glass no frame	Ramboll	Toughened glass - no frame, 1 mm, ex frame	ICE	Provide m3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.3.1.Roof structure	**Concrete** Roof Slab, 364m3	364	M3	3	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast fur	ICE	Provide m3
Shell & Core	2.3.1.Roof structure	Roof **Loose bar Reinforcement** - 13t	13000	KG	3	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.3.1.Roof structure	Roof **PT Tendons** - 21t	21000	KG	3	Steel	Reinforcement bars	Assumed reinforcement support for concrete	IstructE	Reinforcement steel (rebar), 10-40mm (BRC)	EPD	Provide kg/m3
Shell & Core	2.3.1.Roof structure	Roof - **Formwork** to underside of slab, 1,342m2	4026	KG	3	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3

Shell & Core	2.3.1.Roof structure	Roof - Formwork to edge of slab, 294m, assuming 260mm width	229	KG	3	Timber	Formwork (ICE)	Assumed Plywood (ICE database)	Ramboll	Timber, Plywood	ICE	Assuming 9 kg/m2 of 18mm thick plywood (density 500kg/m3). ATTENTION! Divide estimated material quantity by 3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.4 STAIRS AND RAMPS

	RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.4.1.Stair and ramp structure	Main Stair (Grd - L5) - Allowance for core staircases, concrete structure, 7nr, 2.5m wide x 5.8m long incl landings (email from Richard on 14/07/22)	81.2	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Main Stair (Grd - L5) - Allowance for staircases, metalwork handrails, Assuming 5.8m per staircase, 7nr	40.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Main Stair (Grd - L5) - Allowance for staircases, metalwork balustrade, Assuming 1000mm height @500mm centres, 7nr	81.2	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Secondary Escape Stair (1nr Grd - L4) - Allowance for core staircases, concrete structure, 6nr, 2.5m wide x 5.8m long incl landings (email from Richard on 14/07/22)	69.6	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Secondary Escape Stair (1nr Grd - L4) - Allowance for staircases, metalwork handrails, 6nr Assuming 5.8m per staircase	34.8	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Secondary Escape Stair (1nr Grd - L4) - Allowance for staircases, metalwork balustrade, 6nr, Assuming 1000mm height @500mm centres	69.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Secondary Escape Stair (1nr Grd - Grd Mezz) - Allowance for core staircases, concrete structure, 1nr, 2.5m wide x 5.8m long incl landings (email from Richard on 14/07/22)	11.6	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Secondary Escape Stair (1nr Grd - Grd Mezz) - Allowance for staircases, metalwork handrails, 1nr Assuming 5.8m per staircase	5.8	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Secondary Escape Stair (1nr Grd - Grd Mezz) - Allowance for staircases, metalwork balustrade, 1nr, Assuming 1000mm height @500mm centres	11.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Feature Stair to Office Reception - Allowance for core staircases, concrete structure, 1nr, 2.5m wide x 5.8m long incl landings (email from Richard on 14/07/22)	11.6	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Feature Stair to Office Reception - Allowance for staircases, metalwork handrails, 1nr Assuming 5.8m per staircase	5.8	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Feature Stair to Office Reception - Allowance for staircases, metalwork balustrade, 1nr, Assuming 1000mm height @500mm centres	11.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Feature Stair to Ground Floor Office (Grd - Grd Mezz) - Allowance for core staircases, concrete structure, 1nr, 2.5m wide x 5.8m long incl landings (email from Richard on 14/07/22)	11.6	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Feature Stair to Ground Floor Office (Grd - Grd Mezz) - Allowance for staircases, metalwork handrails, 1nr Assuming 5.8m per staircase	5.8	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Feature Stair to Ground Floor Office (Grd - Grd Mezz) - Allowance for staircases, metalwork balustrade, 1nr, Assuming 1000mm height @500mm centres	11.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Feature Stair to First Floor Office (L1 - L1 mezz) - Allowance for core staircases, concrete structure, 1nr, 2.5m wide x 5.8m long incl landings (email from Richard on 14/07/22)	11.6	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Feature Stair to First Floor Office (L1 - L1 mezz) - Allowance for staircases, metalwork handrails, 1nr Assuming 5.8m per staircase	5.8	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)

Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Feature Stair to First Floor Office (L1 - L1 mezz) - Allowance for staircases, metalwork balustrade, 1nr, Assuming 1000mm height @500mm centres	11.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Corner building stair (L1 - L4) - Allowance for core staircases, concrete structure, 4nr, Assuming 2.5m wide x 5.8m long incl landings (email from Ramboll on 14/07/22)	46.4	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 17 steps, width. 140cm, 1841.5kg/m, CEM III/A, VD (SORIBA)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Corner building stair (L1 - L4) - Allowance for staircases, metalwork handrails, 4nr Assuming 5.8m per staircase	23.2	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Corner building stair (L1 - L4) - Allowance for staircases, metalwork balustrade, 4nr, Assuming 1000mm height @500mm centres	46.4	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	Temporary Stairs to GF Mezz retail - Allowance for core staircases, steel structure, 1nr, Assuming length 5.8m/per staircase, 1000mm wide	5.8	M2	1	Steel	Steel Staircase straight	Galvanised steel straight staircase	Ramboll	Galvanized steel staircase, straight, 207.21 kg/m2	EPD	Provide area in m2
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Temporary Stairs to GF Mezz retail - Allowance for staircases, metalwork handrails, 1nr Assuming 5.8m per staircase	5.8	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
Shell & Core	2.4.3.Stair and ramp balustrades and handrails	Temporary Stairs to GF Mezz retail - Allowance for staircases, metalwork balustrade, 1nr, Assuming 1000mm height @500mm centres	11.6	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)	EPD	Provide length (m)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.4.1.Stair and ramp structure	External Stair from level 4 terrace, 1nr, Assuming steel stair length 5.8m/per staircase, 1000mm wide	5.8	M2	1	Steel	Steel Staircase straight	Galvanised steel straight staircase	Ramboll	Galvanized steel staircase, straight, 207.21 kg/m2	EPD	Provide area in m2
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.5 EXTERNAL WALLS

RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2 (Assumptions confirmed by email on 12/07/22 by St George)	129.5	M3	Ramboll	Clay	Clay Bricks - Façade	Assumed red brick, average production	Ramboll	Red brick, average production, UK, 215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3 (Brick Development Association (BDA) Ltd (2019))	EPD	Provide m3
	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Bricklaying Mortar Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	31,069.8	KG	Ramboll	Mortar	Masonry/Bricklaying Mortar	Mortar modelled with CEM I	Project Speci	Mortar, Mortar (1:1:6 Cement:Lime:Sand mix), Modelled with CEM I	ICE	Provide kg/ton Assuming density 1600kg/m3 - Calculating quantity Assuming 15% of brickwork (6% for blockwork) elevation area (m2) x 102.5mm (brick or block thickness)
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	315.75	M3	Ramboll	Insulation	Ext. Walls - Rainscreen - Rockwool	Rockwool	Ramboll	Rock wool insulation panels, L=0.035 W/mK, R=4.29 m2k/W, 150 mm, 9 kg/m2, 60 kg/m3, Lambda=0.035 W/(m.K), Rainscreen Duo Slab 150mm (ROCKWOOL, UK plant)	EPD	Provide m3
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	246	KG	Ramboll	Membrane	External Walls - breather membrane	Assumed nonwoven material made of HDPE	Ramboll	Laminated HDPE underlay, 0.195 kg/m2, 1.5 m x 50 m, 820 µm, Tyvek UV Facade (Isola)	EPD	Assuming 0.195kg/m2 (0.82mm thick membrane)
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	15534.9	KG	Ramboll	Weatherboard/Sheathing/Cementitious board	External/Internal Walls	Assumed thick cement particle board	Ramboll	Gypsum board, water resistant, 12.3 kg/m2, WEATHER DEFENCE BD 13, AQUABOARD BA13, Defentex BD13 (ETEX France Building Performance : SINIAT - SALSI)	EPD	Assuming 12.3kg/m2 of elevation(m2, kg, ton)

Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	7,325	KG	Ramboll	Steel	SFS - 150.50.12 @ 600mm centres	Assumed Galvanised steel, 15% Recycled Content	RICS	Steel sheets, generic, 15% recycled content, S235, S275 and S355	OC	Assuming 5.8 kg/m2 of elevation (including vertical and horizontal studs)
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	189.5	M3	Ramboll	Insulation	Ext.Walls - between SFS - Rockwool	Rockwool	Ramboll	Rock wool insulation panels, L=0.037 W/mK, R=2.63 m2k/W, 100 mm, 3.3 kg/m2, 33 kg/m3, Lambda=0.037 W/(m.K), FLEXI 1200x600x100 (ROCKWOOL, UK plant)	EPD	Provide m3
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	176.82	KG	Ramboll	Membrane	External Walls vapour-proof	Assumed Vapour-proof membrane	Ramboll	Vapour-proof membrane, 0.15 mm, 140 g/m2, Baca Dampsperre (Baca Plastindustri)	EPD	Assuming 0.14kg/m2 (0.15mm thick membrane)
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS (Brick 102.5mm, Rock Wool 250mm, Breather membrane, cementitious board 12mm, Metal Studs - SFS 150mm @600mm centres, Rock Wool between SFS 150mm, VCL, 2 layers of Plasterboard 15mm each), area 1,263m2	37.9	M3	Ramboll	Plasterboard	Ext. Walls/Ceilings - Fire rated - Gyproc Habito	Gypsum plasterboard A2 fire class	Ramboll	Gypsum plasterboard, fire resistant, 12.5 mm, 12.22 kg/m2, 996 kg/m3, L = 0.25 W/Mk, Fire resistance class = A2-d0, s1, 12.5mm Gyproc Habito. (British Gypsum)	EPD	Assuming 12.22kg/m2 of elevation area (12.5mm thick) (m3, kg, ton)
	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS, Support System for Brick (Steel channel and wall ties 1.22kg/m2 of elevation), area 1,263m2	1540.9	KG	Ramboll	Steel	Stainless steel	Assumed stainless steel sheets or plates	Ramboll	Stainless steel sheets or plates, 7900 kg/m3 (Outokumpu Oyj)	EPD	Provide kg or m3
	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS, Support System for Brick (Steel shelf 5mm gauge every slab 2kg/m2 of elevation), area 1,263m2	2526.0	KG	Ramboll	Steel	Stainless steel	Assumed stainless steel sheets or plates	Ramboll	Stainless steel sheets or plates, 7900 kg/m3 (Outokumpu Oyj)	EPD	Provide kg or m3
	2.5.1.External enclosing walls above ground level	External Walls – Solid façade; assume brick – Assuming Brick on SFS, Support System for Brick (Steel bracket @600mm every slab 1.13kg/m2 of elevation), area 1,263m2	1427.2	KG	Ramboll	Steel	Stainless steel	Assumed stainless steel sheets or plates	Ramboll	Stainless steel sheets or plates, 7900 kg/m3 (Outokumpu Oyj)	EPD	Provide kg or m3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Glazed Façade (ground to Level 1, Level 1 to 2, Level 2 to 5, to wintergarden, glazed façade/roof to wintergarden, louvre/glazing to carpark and cycle store), area 5,669m2, Assuming double-glazed aluminium curtain wall	5669	M2	1	Aluminium	Curtain walls - Double glazed	Assumed curtain wall system with aluminium frame, (	Ramboll	Glass facade, size: 3.6 x 7.2m, double glazing, 51.67 kg/m2, Curtain wall Concept Wall® CW 60 – CW 60 HI (Reynaers)	EPD	Provide area in m2
	2.5.1.External enclosing walls above ground level	External Walls - Louvre / glazing to carpark and cycle store; non acoustic, area 73m2, Assuming 14.5kg/m2 for louvre door/window (excl. frame), 15 horizontal items/ meter of height, 1.5mm gauge, approx. 1kg/liner meter for each item	1059	KG	1	Aluminium	Sheets	General European mix - ICE	Ramboll	Aluminium sheet, European Mix, Inc Imports	ICE	Assuming 1.90kg/m2 for 0.7mm thick profile, 2.7kg/m2 for 1mm thick profile
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.5.1.External enclosing walls above ground level	Metal coping to façade at roof level, 300m Assuming – Aluminium 3mm thick 500mm width, 6.48kg per m of perimeter	1944	KG	1	Aluminium	Sheets	General European mix - ICE	Ramboll	Aluminium sheet, European Mix, Inc Imports	ICE	Assuming 1.90kg/m2 for 0.7mm thick profile, 2.7kg/m2 for 1mm thick profile
Shell & Core	2.5.1.External enclosing walls above ground level	Allowance for insulated metal tiled soffit to overhangs / service yard, 318m2, assuming 15mm thickness 16kn/m2	5088	KG	1	Select	Select	N/A	N/A	Stone wool building panel for façade cladding, roof detailing soffits and fascias, 3050x1250 mm, Durable (ROCKPANEL)	N/A	N/A
Shell & Core	2.5.1.External enclosing walls above ground level	External Walls – Allowance for louvre plant screen; non-acoustic; assume 3m high, 381m2– Assuming 14.5kg/m2 for louvre door/window (excl. frame), 15 horizontal items/ meter of height, 1.5mm gauge, approx. 1kg/liner meter for each item	5524.5	KG	1	Aluminium	Sheets	General European mix - ICE	Ramboll	Aluminium sheet, European Mix, Inc Imports	ICE	Assuming 1.90kg/m2 for 0.7mm thick profile, 2.7kg/m2 for 1mm thick profile
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.6 EXTERNAL WINDOWS

	RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.6.2.External doors	Office Entrance door; Double door or similar; automated, 2nr	8.8	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Legnica)	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	External doors to cores, plantroom etc doors; Single leaf, 8nr	18	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Legnica)	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	External doors to cores, plantroom etc doors; Double leaf, 5nr	22	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Legnica)	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	External door to substation / LV room; double leaf; sunray or similar, 2nr	8.8	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwing	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	Retail entrance door; double door, 7nr	30.8	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwing	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	External doors to wintergarden at terrace level 4; single leaf, 1nr	2.2	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwing	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	External doors to terraces; double leaf, 5nr	22	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwing	EPD	Provide area in m2
Shell & Core	2.6.2.External doors	Allowance for automated roller shutter to car park, 74m2	74	M2	1	Select	Select	N/A	N/A	Garage steel doors, motorized, per m2, 2 x 2 m, 36.23 kg/m2	N/A	N/A
Shell & Core	2.6.2.External doors	Allowance for automated roller shutter to service yard, 61m2	61	M2	1	Select	Select	N/A	N/A	Garage steel doors, motorized, per m2, 2 x 2 m, 36.23 kg/m2	N/A	N/A
Shell & Core	2.6.2.External doors	Allowance for automated gate to car access to service yard, 1nr	1	UNIT	1	Select	Select	N/A	N/A	Gate opening mechanism, automatic, French average, DONNEE PAR DEFAUT (DED)	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.7 INTERNAL WALLS AND PARTITIONS

	RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.7.1.Walls and Partitions	Internal Walls - Blockwork walls; incl. head restraint, windposts etc; Grd & Grd Mezz, 4,939m2, Assuming 140mm thick lightweight concrete block (confirmed by St George, email 12/07/22)	691.5	M3	1	Concrete	Concrete block wall - Lightweight - 140mm	Assumed lightweight concrete blocks	Ramboll	Lightweight concrete block, 13N, 0.35 W/mK, 1183.93 kg/m3, Thermal Liteblock (Roadstone)	EPD	Provide m3
Shell & Core	2.7.1.Walls and Partitions	Internal Walls - Metal stud partitions; incl insulation and two layers of plasterboard; L1-L5, Assuming 92 AS 50 Studs, 3177m2	6036	KG	1	Steel	Metal framing components - Gypframe 92 AS 50 Studs	Assumed hot-dip galvanized sheet steel - light gauge	Ramboll	Metal framing components for gypsum plasterboard, 7750 kg/m3, Gypframe (British Gypsum Saint Gobain (2021))	EPD	Assuming Gypframe® 92 AS 50 AcouStud 1.9kg/m2 @600mm centres (0.82kg/linear meter)
Shell & Core	2.7.1.Walls and Partitions	Internal Walls - Metal stud partitions; incl insulation and two layers of plasterboard; L1-L5, Assuming isover insulation between the studs 50mm thick, 3177m4	2859	KG	1	Insulation	Internal Walls - Glass wool	Glass wool - Isover	Ramboll	Glass wool/mineral wool insulation, acoustic partition roll, L = 0.039W/mK, T: 50-65 mm, 18 kg/m3, APR1200 (Isover)	EPD	Assuming 0.9kg/m2 (50mm thick)
Shell & Core	2.7.1.Walls and Partitions	Internal Walls - Metal stud partitions; incl insulation and two layers of plasterboard; L1-L5, Assuming 12.5mm plasterboard 2 layers 50mm thick, 3177m5	53373.6	KG	Select	Plasterboard	Partitioning/Ceiling - Gyproc Wallboard	Gypsum plasterboard	Ramboll	Gypsum plasterboard, tapered or square edges, 12.5 mm, 8.44 kg/m2, 675 kg/m3, 10µ water vapour resistance, Gyproc WallBoard (British Gypsum (2019))	EPD	Assuming 8.4kg/m2 of elevation area (12.5mm thick)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.7.1.Walls and Partitions	Lining to outer face of RC Concrete walls, block walls etc, assuming 12.5mm 1 layer of plasterboard, 2280m2	19152	KG	Select	Plasterboard	Partitioning/Ceiling - Gyproc Wallboard	Gypsum plasterboard	Ramboll	Gypsum plasterboard, tapered or square edges, 12.5 mm, 8.44 kg/m2, 675 kg/m3, 10µ water vapour resistance, Gyproc WallBoard (British Gypsum (2019))	EPD	Assuming 8.4kg/m2 of elevation area (12.5mm thick)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	2.7.2.Balustrades and handrails	Glazed balustrade to GF mezz and corner stair levels; 1100mm high, 86m	0.946	M3	1	Glass	Toughened glass	Assumed toughened glass no frame	Ramboll	Toughened glass - no frame, 1 mm, ex frame	ICE	Provide m3
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

2.8 INTERNAL DOORS

	RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	2.8.Internal Doors	Single leaf internal doors to communal areas, nr 230	506	M2	1	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2
Shell & Core	2.8.Internal Doors	One & half leaf internal doors to communal areas, 3nr	10	M2	1	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2
Shell & Core	2.8.Internal Doors	Double leaf internal doors to communal areas, nr1	4	M2	1	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2
Shell & Core	2.8.Internal Doors	Single internal doors to WC cubicles, nr92	147	M2	1	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2
Shell & Core	2.8.Internal Doors	Single internal riser doors (assume 10nr per floor), 71nr	156	M2	1	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2
Shell & Core	2.8.Internal Doors	Double internal riser doors (assume 15nr per floor), 43nr	189	M2	1	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

3. INTERNAL FINISHES

	RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Shell & Core	3.1.Wall finishes	**Emulsion Paint** as dust sealer to internal face of lift shaft walls, 2280m2	552	KG	1	Paint	Acrylic emulsion - Indoor/Outdoor use	External/Internal application	Ramboll	Paint, acrylic emulsion, indoor and outdoor use, 12 m2/l, Johnstones Acrylic Durable Matt (PPG)	EPD	Assumed 0.242kg/m2 for 2 coats (0.167mm thick coat)
Shell & Core	3.1.Wall finishes	**Painting** to dry lining & partitions in communal areas, 11,293m2	1095	KG	1	Paint	Water based - Indoor use	Indoor use	Ramboll	Paint, water-based, mid sheen finish, indoor use, 1090-1230 kg/m3, 12 m2/l, Johnstone's Trade Acrylic Durable Eggshell Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Assumed 0.097kg/m2 (0.8mm thick coat)
Shell & Core	3.1.Wall finishes	**Painting** Extra over for feature wall to reception assume 50% of wall area), 39m2	39	KG	1	Paint	Water based - Indoor use	Indoor use	Ramboll	Paint, water-based, mid sheen finish, indoor use, 1090-1230 kg/m3, 12 m2/l, Johnstone's Trade Acrylic Durable Eggshell Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Assumed 0.097kg/m2 (0.8mm thick coat)
Shell & Core	3.1.Wall finishes	**Painting** Extra over for tiled finish to WCs (assume wc stalls 100% tiled), 497m2	48	KG	1	Paint	Water based - Indoor use	Indoor use	Ramboll	Paint, water-based, mid sheen finish, indoor use, 1090-1230 kg/m3, 12 m2/l, Johnstone's Trade Acrylic Durable Eggshell Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Assumed 0.097kg/m2 (0.8mm thick coat)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	3.2.1.Finishes to floors	Allowance for **screed** to communal areas, 3530m2, assuming 50-65mm thick - 120kg/m2, confirmed by St George, email 12/07/22	203	M3	1	Concrete	Screed Non-structural Finish	Assumed Floor screed mortar, cement screed	Ramboll	Mortar, self-levelling floor screed, 1700 kg/m3 (bulk), 2100 kg/m3 (mixture), Conplan Eco R (Mapei)	EPD	63kg/m2 (30mm thick), 105kg/m2 (50mm thick)
Shell & Core	3.2.1.Finishes to floors	**Entrance mat** well to reception porch area, 32m2	32	M2	1	Carpet	Carpet Tiles	Assumed carpet tiles with 50% recycled content and :	Ramboll	Modular carpet tiles, tufted, 4.8 kg/m2, pile material of polyamide (PA) 6.6, max. 1.1 kg/m2, with a bitumen backing, Graphlex (Interface Europe Manufacturing BV)	EPD	Provide area in m2
Shell & Core	3.2.1.Finishes to floors	**Tiled finish** to reception, 215m2	215	M2	1	Ceramics	Wall/Floor Tiles	Assumed ceramic tiles 18.65kg/m2	Ramboll	Ceramic tiles, Italian average, 10mm, 19.9 kg/m2 (Confindustria Ceramica	EPD	Provide area in m2
Shell & Core	3.2.1.Finishes to floors	**Tiled finish** to WC & Shower areas, 301m2	301	M2	1	Ceramics	Wall/Floor Tiles	Assumed ceramic tiles 18.65kg/m2	Ramboll	Ceramic tiles, Italian average, 10mm, 19.9 kg/m2 (Confindustria Ceramica	EPD	Provide area in m2
Shell & Core	3.2.1.Finishes to floors	**Carpet finish** to Communal circulation space and corridors, 867m2	867	M2	1	Carpet	Carpet Tiles	Assumed carpet tiles with 50% recycled content and :	Ramboll	Modular carpet tiles, tufted, 4.8 kg/m2, pile material of polyamide (PA) 6.6, max. 1.1	EPD	Provide area in m2
Shell & Core	3.2.1.Finishes to floors	**Floor finishes** to Winter garden area, 96m2 assuming ceramic tiles	96	M2	1	Ceramics	Wall/Floor Tiles	Assumed ceramic tiles 18.65kg/m2	Ramboll	Ceramic tiles, Italian average, 10mm, 19.9 kg/m2 (Confindustria Ceramica	EPD	Provide area in m2
Shell & Core	3.2.1.Finishes to floors	**Painted finish** to cycle store, plantrooms etc, 2,019m2 assuming epoxy floor	2019	M2	1	Epoxy	Epoxy floor	Assumed epoxy flooring	Ramboll	Epoxy floor covering, 2 mm, 5.188 kg/m2	EPD	Provide area in m2
Shell & Core	3.2.1.Finishes to floors	**Painted MDF skirting generally to communal areas,** assuming 800m length skirting 120mm height 12mm thick(based on 30% of internal wall areas blockwork & metal stud partitions)	576	KG	Ramboll	Timber	Skirting boards	Assumed MDF generic	Ramboll	Timber, MDF	ICE	Provide kg (density 500kg/m3)
	3.2.1.Finishes to floors	**Painted MDF skirting generally to communal areas,** assuming 800m length skirting 120mm height 12mm thick(based on 30% of internal wall areas blockwork & metal stud partitions)	23	KG	1	Paint	Acrylic emulsion - Indoor/Outdoor use	External/Internal application	Ramboll	Paint, acrylic emulsion, indoor and outdoor use, 12 m2/l, Johnstones Acrylic Durable Matt (PPG)	EPD	Assumed 0.242kg/m2 for 2 coats (0.167mm thick coat)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Shell & Core	3.3.1.Finishes to ceilings	Allowance for painted **plasterboard finishes**, 1511m2	12692	KG	Select	Plasterboard	Partitioning/Ceiling - Gyproc Wallboard	Gypsum plasterboard	Ramboll	Gypsum plasterboard, tapered or square edges, 12.5 mm, 8.44 kg/m2, 675 kg/m3, 10µ water vapour resistance, Gyproc WallBoard (British Gypsum (2019))	EPD	Assuming 8.4kg/m2 of elevation area (12.5mm thick)
Shell & Core	3.3.1.Finishes to ceilings	Allowance for painted plasterboard finishes, 1511m2	147	KG	1	Paint	Water based - Indoor use	Indoor use	Ramboll	Paint, water-based, mid sheen finish, indoor use, 1090-1230 kg/m3, 12 m2/l, Johnsto	EPD	Assumed 0.097kg/m2 (0.8mm thick coat)
Shell & Core	3.3.1.Finishes to ceilings	Painted **Plasterboard finishes** EO for enhancement to reception, 215m2	1806	KG	Select	Plasterboard	Partitioning/Ceiling - Gyproc Wallboard	Gypsum plasterboard	Ramboll	Gypsum plasterboard, tapered or square edges, 12.5 mm, 8.44 kg/m2, 675 kg/m3, 10µ water vapour resistance, Gyproc WallBoard (British Gypsum (2019))	EPD	Assuming 8.4kg/m2 of elevation area (12.5mm thick)
Shell & Core	3.3.1.Finishes to ceilings	**Painted** Plasterboard finishes EO for enhancement to reception, 215m2	20.86	KG	1	Paint	Water based - Indoor use	Indoor use	Ramboll	Paint, water-based, mid sheen finish, indoor use, 1090-1230 kg/m3, 12 m2/l, Johnstone's Trade Acrylic Durable Eggshell Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Assumed 0.097kg/m2 (0.8mm thick coat)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Office CAT A Fit Out	3.1.Wall finishes	Painted **plasterboard** finish, 3,790m2	31836	KG	Select	Plasterboard	Partitioning/Ceiling - Gyproc Wallboard	Gypsum plasterboard	Ramboll	Gypsum plasterboard, tapered or square edges, 12.5 mm, 8.44 kg/m2, 675 kg/m3, 10µ water vapour resistance, Gyproc WallBoard (British Gypsum (2019))	EPD	Assuming 8.4kg/m2 of elevation area (12.5mm thick)
Office CAT A Fit Out	Select	**Painted** plasterboard finish, 3,790m2	368	KG	1	Paint	Water based - Indoor use	Indoor use	Ramboll	Paint, water-based, mid sheen finish, indoor use, 1090-1230 kg/m3, 12 m2/l, Johnsto	EPD	Assumed 0.097kg/m2 (0.8mm thick coat)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Office CAT A Fit Out	3.2.1.Finishes to floors	Two coats **sealer**, 8712m2	8712	M2	1	Select	Select	N/A	N/A	Polyurethane flooring system, 4.07 kg/m2 total system weight, ComfortFloor PS-23, constituents: Sikafloor-161 primer, Sikafloor-330 base, Sikafloor-305 top sealer (Sika)	N/A	N/A
Office CAT A Fit Out	3.2.2.Raised access floors	Raised access floor; 350mm high zone, Assuming general office use **tiles**, 8712m2	8712	M2	1	Steel	Raised Access Floor - Tiles - General Office use	RAF Tiles, encapsulated high density particle chipboard	Ramboll	Raised access flooring panels, chipboard in galvanized steel envelope, per m2, 600 x 600 mm, 28.6 kg/m2, RG3 (Kingspan Access Floors)	EPD	Provide area in m2
Office CAT A Fit Out	3.2.2.Raised access floors	Raised access floor; 350mm high zone, Assuming steel **pedestals**, 8712m3	17424	KG	1	Steel	Raised Access Floor - Pedestals	RAF Pedestals, hot-dip galvanized/zinc coated steel	Ramboll	Raised access floor pedestals, for zinc-plated steel, height 16-620 mm, Europed, Alpha III, Alpha V (Kingspan Access Floors)	EPD	Assuming 2kg/m2, (0.5kg per pedestal, No.4 pedestals/m2)
	Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

SOURCE LIST:

OC	OneClickLCA, Generic material or product data
RICS	RICS, Whole Life Carbon Assessment for the Built Environment (2017), Table 6: Default specifications for main building materials
1	Stage 2 Cost Plan Rev B - June 2022 - Appendix A Elemental Cost Plan.xlsx - excel spreadsheet received on 05/07/22 by Joshua Hawkes
2	Design team response to material quantities and specification queries - email received on 12/07/22 by Richard Syddall
3	Stage 2 Cost Plan queries - email received on 12/07/22 by Joshua Hawkes
4	PVs area confirmed by Richard Syddall on 15/07/22
5	
6	
7	
8	
9	

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8. External Works

RICS category	Material Description	Quantity	Units	Source	Material	Details	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
8.2.1.Roads, paths and pavings	Allowance for paving generally; incl. base layer (Marshalls or equivalent) assuming **Concrete Pavers (30mm thick)**, Mortar bedding (100mm thick), Geotextile membrane, Gravel (800mm), area 983m2	70,776	KG	Ramboll	Concrete	Precast Concrete Paving	Assumed Precast concrete	Ramboll	Precast concrete paving products, 2350 kg/m3 (BPCF)	EPD	Provide m3 or kgs, Assuming 72kg/m2 (30mm thick), 192kg/m2 (80mm thick)
8.2.1.Roads, paths and pavings	Allowance for paving generally; incl. base layer (Marshalls or equivalent) assuming Concrete Pavers (30mm thick), **Mortar bedding (100mm thick)**, Geotextile membrane, Gravel (800mm), area 983m2	196,600	KG	Ramboll	Mortar	Cement	Assumed Cement Mortar	Ramboll	Cement mortar, gross density: 2000 kg/m3	EPD	Assuming 100kg/m2 (50mm thick)
8.2.1.Roads, paths and pavings	Allowance for paving generally; incl. base layer (Marshalls or equivalent) assuming Concrete Pavers (30mm thick), Mortar bedding (100mm thick), **Geotextile** membrane, Gravel (800mm), area 983m2	983	M2	Ramboll	Membrane	Geotextile	Assumed Geotextile	Ramboll	Geotextile, generic, 312 g/m2 (1.02 oz/ft2), Composition: PP net, non-woven PE felt	OC	Provide area in m2
8.2.1.Roads, paths and pavings	Allowance for paving generally; incl. base layer (Marshalls or equivalent) assuming Concrete Pavers (30mm thick), Mortar bedding (100mm thick), Geotextile membrane, **Gravel (800mm)**, area 983m2	1,258,240	KG	Ramboll	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	OC	Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
8.2.1.Roads, paths and pavings	**Hard Paving** to external office terrace area, area 101m2, assuming concrete pavers 30mm thick	7,272	KG	Ramboll	Concrete	Precast Concrete Paving	Assumed Precast concrete	Ramboll	Precast concrete paving products, 2350 kg/m3 (BPCF)	EPD	Provide m3 or kgs, Assuming 72kg/m2 (30mm thick), 192kg/m2 (80mm thick)
8.4.1.Fencing and railings	**Balustrade** to external office terrace area, 28m, assuming glazed balustrade 1100mm height	0.308	M3	1	Glass	Toughened glass	Assumed toughened glass no frame	Ramboll	Toughened glass - no frame, 1 mm, ex frame	ICE	Provide m3
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
8.6.1.Surface water and foul water drainage	External Works - Provisional Allowance for **below ground drainage**, Area 1,760m2	1,760	M2	Ramboll	Services	Sewage water piping network -Office buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Sewage water drainage piping network, per m2 GIFA (office buildings)	OC	0
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A

SOURCE LIST:

OC	OneClickLCA, Generic material or product data
RICS	RICS, Whole Life Carbon Assessment for the Built Environment (2017), Table 6: Default specifications for main building materials
1	Stage 2 Cost Plan Rev B - June 2022 - Appendix A Elemental Cost Plan.xlsx - excel spreadsheet received on 05/07/22 by Joshua Hawkes
2	Design team response to material quantities and specification queries - email received on 12/07/22 by Richard Syddall
3	Stage 2 Cost Plan queries - email received on 12/07/22 by Joshua Hawkes
4	PVs area confirmed by Richard Syddall on 15/07/22
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