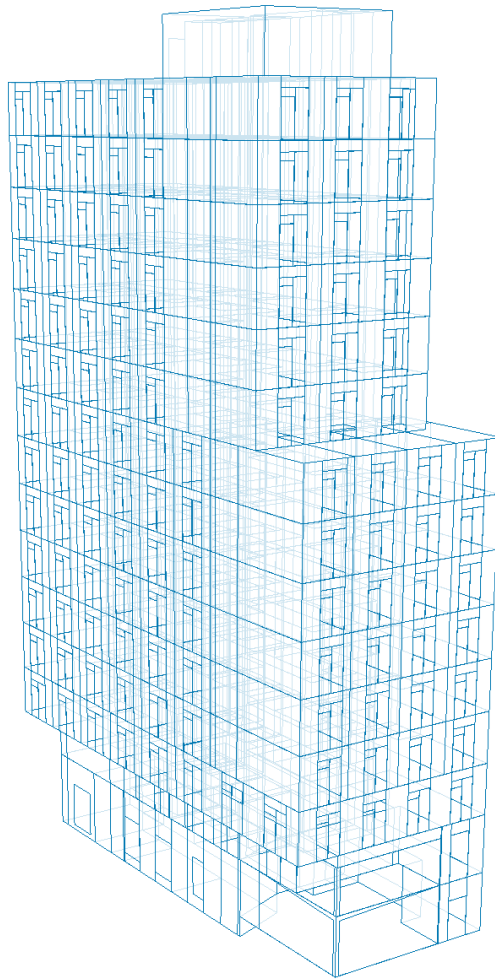


Charles Street

Whole Life Carbon Assessment and Circular Economy Statement



Caldwell



B1106 Charles Street Student Accommodation

Embodied Carbon and Circular Economy Statement

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1 Executive summary

This embodied carbon statement has been prepared in support of the planning application for the development of on Charles Street, Manchester. The application site is located within the administrative boundary of Manchester City Council.

The development comprises of:

“Full planning permission for the erection of 15-storey purpose-built student accommodation building, including site preparation works, works over the public highway and associated works.”

Analysis using the One Click LCA online software has been undertaken to calculate the Embodied carbon using the RIBA target of $<800\text{kgCO}_2\text{e/m}^2$ however the aspiration for the development is to achieve the RIBA 2030 Challenge target of $<625\text{kgCO}_2\text{e/m}^2$.

This report outlines the Whole Life Carbon Assessment which has been undertaken in line with the RICS guidelines. This document is split into a life cycle assessment and a circular economy commentary which overall shows the benefits of using recyclable and recycled material. This analysis was undertaken using the One Click LCA software.



1.1 *Summary of the approach, key commitments, and targets*

The design team's strategic approach for the proposed development is longevity and adaptability.

To achieve their objectives the design team is committed to monitor their waste arising from demolition, excavation and construction and promote reuse on site where possible. Construction materials used will prioritise those with a higher recycling rate.

Based on the analysis completed to date the working values are a total kgCO₂e/m² of 643 which is higher than the RIBA 2030 challenge target of 625KgCO₂e/m².

We have also allowed for a miscellaneous addition of 150kgCO₂/m², which makes the total embodied carbon 793kgCO₂/m². This allowance will be taken up during design development when more detailed information is supplied and therefore the materials applied to this development can be updated, which could increase the embodied carbon figure. Our inspiration is to still achieve the RIBA 2030 target of 625kgCO₂/m².



2 Introduction

This Circular Economy and Whole Life cycle Analysis has been prepared on behalf of Jadebricks (Charles Street) Ltd in support of their full planning application for Charles Street Student Accommodation.

This report is to accompany the energy and sustainability statement, with particular reference to the Manchester Climate Change 2020-25 and A Roadmap to Net zero Carbon New Buildings In Manchester

This report will demonstrate how the proposed development will incorporate Circular Economy measures.

2.1 Development areas:

- 107 studios
- External and internal amenity areas.
- NIA: 2020m²
- GIA 4155m²

The application site location is highlighted below.

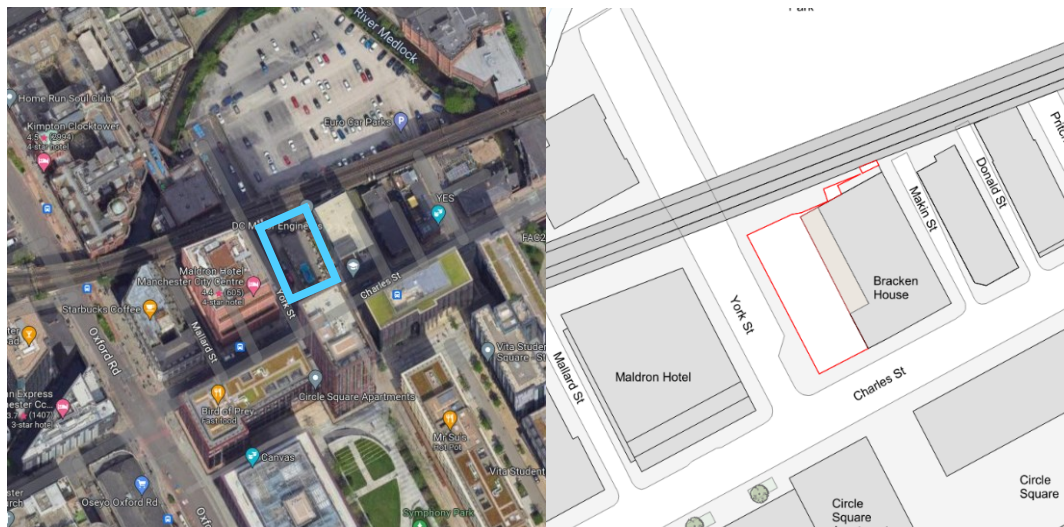


FIGURE 1 – GENERAL LOCATION OF THE DEVELOPMENT AND SITE PLAN



2.2 *Method statement (including key outcomes from workshops/meetings)*

A summary of the process followed up to the point of submission and how the team approached the application of circular economy principles and the production of the Statement.

Workshops have been held with the design teams to discuss and raise awareness of the circular economy.

2.3 *Circular economy aspirations*

The design team has engaged with the circular economy principles.

The team has looked at the following aspects and strategies to address circular economy principles:

- Reuse as much of the building as possible to limit the extent of demolition.
- Materials arising from demolition and remediation works shall be reused or recycled where possible.
- The design proposal and construction shall reduce material demands and enable building materials, components and products to be disassembled and re-used at the end of their useful life.
- Identify opportunities for managing as much waste as possible on site.
- Provide adequate and easily accessible storage space and collection systems to support recycling and reuse.
- Predict how much waste the proposal is expected to generate and how and where the waste will be managed in accordance with the waste hierarchy.
- How performance will be monitored and reported.

2.4 *Data Sources*

Using the One Click LCA tool, a model has been created which relies on the following data sources for building information.

TABLE 1 DATA SOURCES SUMMARY

DATA TYPE	DATA SOURCE
Material quantities (A1-A3)	Planning drawings, planned quantities, Revit and SBEM models as delivered by the client and the designers acting on the client's behalf.
Material transport distances (A4)	Regionally applicable transportation scenarios from One Click LCA. Those represent regionally typical transportation distances and methods for product types, which are relevant when no decisions on suppliers are made.



Construction and installation (A5)	Impacts are based on conservative default values from One Click LCA.
Material impacts in use (B1-B5)	Material service lives are based on the typical values for the materials in question.
End of life impacts (C1-C4)	End of life impacts are based on One Click LCA's scenarios which represent the typical end of life processing for material types in compliance with the requirements of the EN 15804+A1

2.5 Methodology

Workshops have been held with the design team to confirm material quantities and set embodied carbon targets for the development, as well as raise awareness of the circular economy.

Meetings/workshop	Attendance	Action
26 th October 2023	Design Team	Discussed embodied carbon options for BREEAM
8 th November 2023	Design Team	Update meeting regarding material quantities and choices.
14 th November 2023	Simpson Haugh	Meeting to go through external wall buildups.

The building elements included have been chosen based on RICS guidance on whole life carbon assessments.



3 Whole Life Cycle Analysis

A Whole Life Cycle Analysis (WLCA) assessment has been carried out using One Click LCA software which follows the BS EN 15978 and RICS PS scope. Refer to the accompanying GLA spreadsheet for details of the WLCA.

The below Figure 4 represents the total materials circularity both in use of materials for the project as well as end of life handling. It is calculated as the average of materials recovered and materials returned.

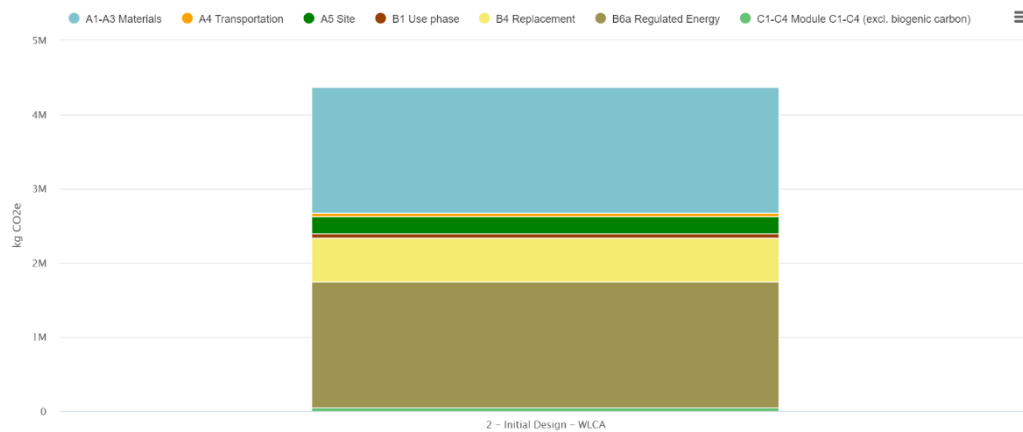


FIGURE 2 – WHOLE LIFE CYCLE ASSESSMENT INCLUDING ENERGY AND SERVICES

Figure 3 below this excludes the energy and services to show focus just on the materials used to construct the building without MEP. As shown from the graphs there is significant reduction in embodied carbon when the energy use and MEP services of the building are removed which indicates the significance of their inclusion when conducting a whole life carbon assessment.

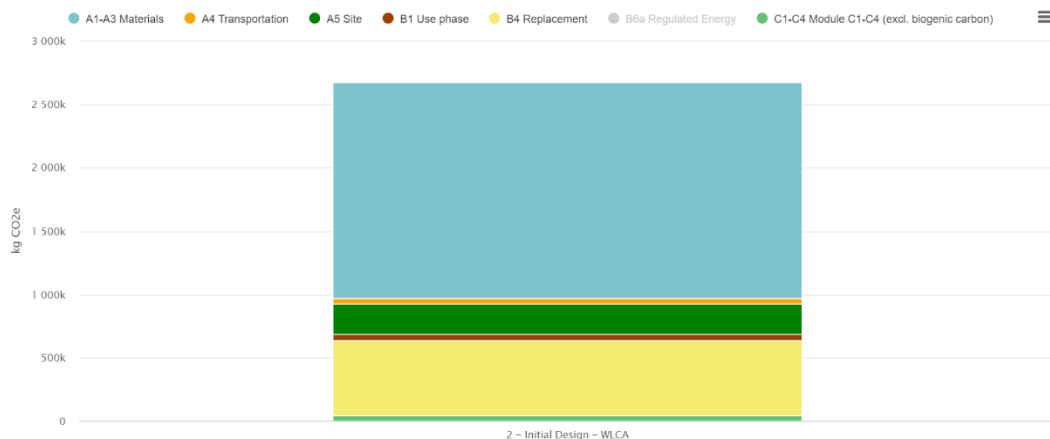


FIGURE 3 – WHOLE LIFE CYCLE ASSESSMENT

Furthermore, a concept design Life cycle assessment has been submitted for BREEAM purposes which goes into specific detail regarding the choices for the superstructure, the substructure and hard landscaping.



4 Circular Economy goals and strategic approach

4.1 Strategic approach(es)

The following sections provide a summary of the strategic approach:

4.1.1 Circular economy approach for the site

PHASE/ BUILDING/ AREA	No Demolition, minimal excavation to even ground.
STEERING APPROACH	Use of recycled materials where possible, recyclable and able to disassemble where possible.
EXPLANATION	Waste classification of demolition works and construction works
TARGET	95% diversion from landfill
SUPPORTING ANALYSIS	Pre-Demolition report / Site Waste Management Plan

4.1.2 Circular economy approach for municipal waste during operation

PHASE/ BUILDING/ AREA	In use phase
STEERING APPROACH	Reusability
EXPLANATION	Segregation of operational waste
SUPPORTING ANALYSIS	Operational waste management

4.2 Explaining the strategic approach(es)

An early workshop has been carried out with the design team identifying the strategic approach is 'Longevity' and 'Durability' depending on the areas of the development.

The design should meet the long-term needs while being durable and resilient or able to cope with change with little modification, readiness for alternative technologies, different ways of living/working and a changing climate.

The design is considering the needs of the present but with consideration of how those needs might change in the future and designed for change in the forms of periodic remodelling including alterations or replacement on non-structural parts.

4.3 Circular Economy

The following sections outline the potential targets and commitments based on the nine principles following the GLA guidance:

4.3.1 Minimise the quantities of materials used.

A Pre-demolition report will be carried out before any demolition is taking place on the site to maximise the reuse or recycling of the materials.



4.3.2 *Minimise the quantities of other resources used (energy, water, land)*

The site is located on a brownfield land and not using virgin land for the development. The energy statement introduces elements low thermal envelope and Heat Pump technology to minimise operational energy. Recycled materials are used where possible.

4.3.3 *Specify and sourcing materials and other resources responsibly and sustainably*

The development is using the Sustainable Procurement Plan principles to ensure best practice in relation to procurement and resourcing procedures.

4.3.4 *Design for longevity, adaptability or flexibility and reusability or recoverability*

The refurbishment will extend the life and further small modifications could be made in the future to revert to other similar applications such as care homes or other accommodation types.

4.3.5 *Design out construction, demolition, excavation and municipal waste arising*

The Construction Environmental Waste Management plan will include the hierarchy of material disposal and shall be monitored by the main contractor.

4.3.6 *Manage demolition waste*

The Pre-demolition report shall include a demolition strategy and segregation of the materials to maximise reuse or recycling of the materials and divert them from landfill. This report is also used for Wst 01 credit for BREEAM assessment. The predicted and actual demolition waste shall be reported in the Site Waste Management Plan.

4.3.7 *Manage excavation waste*

Excavation waste is minimal due to the nature of the site prior to construction.

4.3.8 *Manage construction waste*

The construction waste shall be segregated and monitored on Smartwaste portal or similar and the predicted and actual waste shall be reported in the Site Waste Management Plan. This is part of the BREEAM assessment Wst 01 credit. Functional Adaptability studies shall be completed for construction waste occurred during operational phase due to maintenance, refurbishment and at the end of life.

4.3.9 *Manage municipal waste*

The development shall provide area for recycling waste and recycling bins within the occupied area to enhance recycling rates.



5 Circular economy commitments

5.1 Key commitments

These are based on the 9 principles set out in the 'Circular Economy statement guidance' document. This is based on the GLA circular economy guidance. The 'layers' are described as follows:

- Site – The geographical setting, urban location and external works.
- Substructure – Excavation, foundations, basements and ground floors.
- Superstructure – Load-bearing elements above plinth including roof supporting structure.
- Shell/skin – The layer keeping out water, wind, heat, cold, direct sunlight and noise.
- Services – Installations to ensure comfort, practically.
- Space – The layout, internal walls, ceilings, floors, finishes, doors, fitted furniture.
- Stuff – Anything that could fall if the building was turned upside down.
- Construction Stuff – Any temporary installations/ works/ materials, packaging and equipment.
- Summary – Brief summary of how well the measures will work in contributing to achieve requirements, targets, aspirations.
- Challenge – Any potentially conflicting measures re noted here.
- Counter Actions – Addresses the challenges identified.
- Plan to prove and quantify – How performance will be quantified and monitored.

5.1.1 Section A Conserve Resources

TABLE 2 – SECTION A - MINIMISING THE QUANTITIES OF MATERIALS USED

Layers	Comment
Site	Site previously used as a car park, so no demolition but minimal excavation. Materials to either be reused on site or transported to other sites for use.
Substructure	Built from precast concrete and recycled steel which can be recycled after use.
Superstructure	Materials used to be recycled where possible. The steel frames used for SFS can be recycled at end of use.
Shell/skin	The terracotta west and east façade can be crushed and reused for new cladding. Similarly, the brick façade on the south and north of the building
Services	The services strategy is to use VRF for heating/cooling and an ASHP for the DHW. This equipment can easily be recycled at the end of use.
Space	Spaces have been designed efficiently, with stud internal walls that can be disassembled.
Stuff	Furniture layouts have been examined to improve efficiency of the manufacturing process and maximise functionality.
Construction Stuff	Limited construction site area
Summary	As much materials as possible will be reusable or recyclable at the end of use.
Challenge	To limit materials going to landfill.
Counter Actions	Detailed specification, efficient communications
Plan to prove and quantify	Whole Life Cycle Assessment / Functional Adaptability / Material Efficiency / Pre-demolition report

TABLE 3 – SECTION A - MINIMISING THE QUANTITIES OF OTHER RESOURCES USED (ENERGY, WATER, LAND)

Layers	Comment
Site	No demolition taking place, minor excavation which limits amount of energy used to prepare site for construction.



Layers	Comment
Substructure	Precast foundations used to limit the need for onsite construction.
Superstructure	Curtain walling pre sized and cut off site for the ground floor areas which reduces excess use of materials.
Shell/skin	Sustainable choices of material where possible to reduce energy usage. Steel frame system used for façade which contains previously recycled materials.
Services	Energy efficient heating and cooling systems / energy efficient lighting and zoning / water flow restrictions. An ASHP for DHW as a renewable energy.
Space	Designing for fit for purpose
Stuff	Refer to Table 1
Construction Stuff	Local work force/ use reclaimed water for the construction
Summary	Minimising energy, water and land use
Challenge	Higher initial capital costs associated with specific manufacturers or technology.
Counter Actions	Ensure the decisions are not solely driven by lowest capital cost
Plan to prove and quantify	Monitoring construction waste & transport (BREEAM Wst 01). Life cycle analysis

TABLE 4 – SECTION A - SPECIFYING AND SOURCING MATERIALS RESPONSIBLE AND SUSTAINABLY

Layers	Comment
Site	No site boundary required
Substructure	Materials will be sourced locally to site, with use of EPD's where possible.
Superstructure	Materials will be sourced locally to site, with use of EPD's where possible.
Shell/skin	Materials will be sourced locally to site, with use of EPD's where possible.
Services	Refer to Table 2
Space	Refer to Table 2
Stuff	Locally produced furniture when included in the scope.
Construction Stuff	Minimal as no demolition, no major excavation as no basements.
Summary	Locally sourced materials and work force
Challenge	Gathering all documentations and aware of all of the local material providers
Counter Actions	Extensive research of the local area
Plan to prove and quantify	EPD certificates, Manufacturer's specification

5.1.2 Section B: Design to Eliminate Waste (And for Ease of Maintenance)

TABLE 5 – SECTION B - DESIGNING FOR REUSABILITY RECOVERABILITY/ LONGEVITY/ ADAPTABILITY/ FLEXIBILITY

Layers	Comment
Site	No site modification anticipated.
Substructure	Refer to Table 2
Superstructure	Protection measures at exposed areas
Shell/skin	Cleaning maintenance strategy
Services	Regular maintenance to increase life expectancy
Space	Ceiling is washable, durable and easy clean floor finishes
Stuff	Furniture that meets the need of the building users
Construction Stuff	Organise skips to minimise road trips
Summary	Design and maintain the development in such way that material waste is minimised through increasing life span of the materials and services
Challenge	Identifying vulnerable and exposed parts of materials
Counter Actions	Research and studies



Layers	Comment
Plan to prove and quantify	Designing for durability and resilience (BREEAM Mat 05); Operational manual

TABLE 6 – SECTION B - DESIGNING OUT CONSTRUCTION, DEMOLITION, EXCAVATION AND MUNICIPAL WASTE ARISING

Layers	Comment
Site	Attention to techniques that clean and enable reuse of excavation materials from clearing the car park.
Substructure	As above
Superstructure	Optimising the load bearing structure mass.
Shell/skin	Just in time delivery and secure on-site storage avoiding damage to the materials thus replacement, particularly the more delicate items such as glazing and curtain walling.
Services	The services are designed as per best practise and standards to minimise energy usage during building operation
Space	Easy replacement of damaged materials and fitted furniture
Stuff	Minimisation of packaging, off cuts and damage.
Construction Stuff	Secure on-site storage is limited which will encourage usage of Just in Time (JIT) for construction equipment to avoid damage
Summary	Maintenance and lean design
Challenge	Lack of research and innovation
Counter Actions	Undertake precedent searches, modelling etc.
Plan to prove and quantify	Lean design option appraisal, Construction Environmental Waste Management,

5.1.3 Section C: Manage Waste

TABLE 7 – SECTION C - DEMOLITION WASTE (HOW WASTE FROM DEMOLITION OF THE LAYERS WILL BE MANAGED)

Layers	Comment
Site	Independent pre-demolition audit, implementing demolition strategies, segregation of materials, monitoring waste flows to maximise reuse/recycling
Substructure	Refer to Table 8
Superstructure	As 'Site' comments
Shell/skin	As 'Site' comments
Services	As 'Site' comments
Space	As 'Site' comments
Stuff	As 'Site' comments
Construction Stuff	Any demolished materials for potential temporary construction road works (crushed stones)
Summary	An independent third-party pre-demolition report is required
Challenge	Noise, vibration, dust, vehicle movements or congestion
Counter Actions	Different working hours, screens covers
Plan to prove and quantify	Pre-demolition audit, Site waste management plan (BREEAM Wst 01)

TABLE 8 – SECTION C - EXCAVATION WASTE (HOW WASTE FROM EXCAVATION WILL BE MANAGED)



Layers	Comment
Site	Using excavation waste as a resource within the construction site or other local construction projects before sending it to the landfill
Substructure	As above
Superstructure	As above
Shell/skin	As above
Services	As above
Space	As above
Stuff	As above
Construction Stuff	As above
Summary	Prioritise reuse of excavation waste over sending it to landfill
Challenge	Logistical/ space constraints/ supply delay
Counter Actions	Identify vacant sites
Plan to prove and quantify	Site Waste Management Plan (BREEAM Wst 01)

TABLE 9 – SECTION C - CONSTRUCTION WASTE (HOW WASTE ARISING FROM CONSTRUCTION OF THE LAYERS WILL BE REUSED OR RECYCLED)

Layers	Comment
Site	Construction waste measures go above and beyond standards.
Substructure	As above
Superstructure	As above
Shell/skin	Construction waste can occur after the construction phase during operational phase due to maintenance, refurbishment and at the end of life
Services	As above
Space	As above
Stuff	As above
Construction Stuff	Construction waste measures go above and beyond standards.
Summary	Monitoring and managing construction waste
Challenge	Health & Safety concerns, attitude
Counter Actions	Increase awareness of the brief, tool box talks
Plan to prove and quantify	Site Waste Management Plan, (BREEAM Wst 01) Site sustainability manager, Functional adaptability studies (BREEAM Wst 06) Considerate Construction Scheme

TABLE 10 – SECTION C - MUNICIPAL AND INDUSTRIAL WASTE (HOW THE DESIGN WILL SUPPORT OPERATIONAL WASTE MANAGEMENT)

Layers	Comment
Site	Provide sufficient space for waste collection lorries for manoeuvring and collection. Advocate space for recycling bins in refuse area
Substructure	As above
Superstructure	As Above
Shell/skin	As above
Services	As above
Space	Provide recycling bins in every kitchen and studio
Stuff	As above
Construction Stuff	As above
Summary	Segregation of operational waste throughout the building
Challenge	Social behaviour
Counter Actions	Leaflets of appropriate recycling materials



Plan to prove and quantify	Operational Waste Management Plan (BREEAM Wst 03)
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5.2 Reporting forms for numerical targets and commitments:

5.2.1 Bill of Materials

Refer to table below:

TABLE 11 - BILL OF MATERIALS

Section	Result category	Material quantity kg	Material intensity kg/m2 Gross Internal Area	Recycled content by value %	Reused content by value %
1	1 Substructure	1176613.7	283.18	5.16	0
2.1	2.1 Superstructure: Frame	2178504.29	524.31	34.48	0
2.2	2.2 Superstructure: Upper Floors	1762542.9	424.2	8.26	0
2.3	2.3 Superstructure: Roof	283946.5	68.34	23.51	0
2.4	2.4 Superstructure: Stairs and Ramps	146666	35.3	29.61	0
2.5	2.5 Superstructure: External Walls	321045.35	77.27	23.22	0
2.6	2.6 Superstructure: Windows and External doors	11405.92	2.75	30.03	0
2.7	2.7 Superstructure: Internal Walls and Partitions	192607.64	46.36	5.76	0
2.8	2.8 Superstructure: Internal doors	26375.36	6.35	0	0
3	3 Finishes	67955.04	16.36	12.84	0
4	4 Fittings, furnishings & equipments	6834.88	1.64	0	0
5	5 Services (MEP)	293581.94	70.66	5.15	0
6	6 Prefabricated buildings and building units				
7	7 Work to existing building				
8	8 External works	2998.18	0.72	2.55	0
0	0 Unclassified / Other				
TOTAL	Total	6471077.7	1557.42	16.72	0



6 Conclusion

This LCA exercise has been beneficial to get an early gauge of the predicted embodied carbon of the development. As the design develops the current score is likely to increase however through this exercise and by exploring material use that has a low embodied carbon, we will be able to reduce this and reach the RIBA 2030 targets.

The development will aspire to follow circular economy principles as through the use of recycled materials where possible, with the potential for design for disassembly has reduced the embodied carbon. Through principles set out in BREEAM concerning waste and monitoring of material transport this is will further assist in the overall impact of the development.

TOTAL kg CO₂e - Life-cycle stages

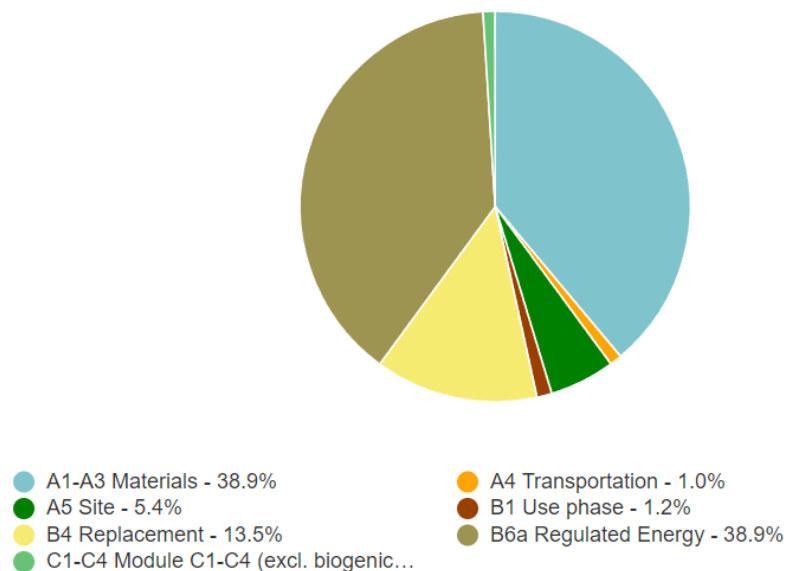


FIGURE 4 – LIFE CYCLE STAGES FROM LCA

The current scoring outlines that it is possible for the development to achieve the RIBA 2030 target of <625 kgCO₂e/m² however this will be explored further as the design needs to be developed further to include our allowances and explore options for selecting materials with a smaller embodied carbon. A contractor's supply chain will be crucial in the actual embodied carbon values and this is an unknown element at this stage. This should be manageable for the current target of <800kgCO₂e/m².



7 Appendices

7.1 LETI 2030 Calculator tool Output

Project Name Charles Street Student Accom Project Sector Residential (6+ storeys) Assessment Date 01/12/2023 Assessment By (company) BPP Location of Data -	Upfront Embodied Carbon A1-5 exc. sequestration (kgCO ₂ e/m ²)	Life Cycle Embodied Carbon A1-5, B1-5, C1-4 (kgCO ₂ e/m ²)
A++	100	150
A+	200	300
A	300	450
B	400	625
C	500	800
D	675	1000
E	850	1200
F	1000	1400
G		
Non-Listed Typology:		
Sequestered Carbon:	-20 kgCO ₂ e/m ²	
Module D:		-146 kgCO ₂ e/m ²

v0.4.1 04/03/2022

The RIBA Targets are based on the LETI calculational method, and the chart above shows current levels being within the <800 kg CO₂e /m² target. Note that the LETI calculation does not include B6: Energy as part of the score which would indicate why this appears lower.



7.2 LCA Building Full Results

Whole life carbon assessment, Greater London Authority [Download Results Summary](#)

This is the project whole life carbon assessment according to RICS methodology, EN 15978 and Greater London Authority guidance for whole life-cycle carbon assessments. To see the detailed results report, please click [More actions > Detailed report](#).

	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material replacement - materials	B5 Material refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.																		
0.2 Demolition																		
0.3 Supports																		
0.4 Groundworks																		
0.5 Diversion																		
1 Substructure	0	173 655	8 727	7 970			0						3 734	2 833			196 918	-38 713
2.1 Frame	0	483 993	15 662	18 864			0						12 905	1 075			532 499	-104 072
2.2 Upper Floors	0	269 971	12 229	16 901			0						7 569	719			307 389	-54 411
2.3 Roof	0	44 163	2 043	2 346			0	2 914	0				1 245	260	19		52 989	-9 080
2.4 Stairs & Ramps	0	22 944	1 052	1 076			0						875	73			26 019	-6 026
2.5 Ext. Walls	0	81 329	714	4 511			0	2 004	0				1 217	949	28		90 751	-6 679
2.6 Windows & Ext. Doors	0	27 942	31	1 199			0	14 002	0				427	8	0		43 609	-12 268
2.7 Int. Walls & Partitions	0	63 151	395	7 538			0						3 443	109	45		74 681	-383
2.8 Int. Doors	-30 343	31 708	131	0			0	32 225	0				101	30 614	14		64 451	0
3 Finishes	-43 629	24 220	235	2 461			0	29 911	0				792	44 176	10		57 976	-14 254
4 Fittings, furnishings & equipments	-7 913	12 565	61	509			0	50 890	0				25	7 981	3		64 121	0
5 Services (MEP)	0	464 810	2 372	9 343	53 979		0	459 586	0	1 703 645			3 709	340	62		2 697 846	-358 757
6 Prefabricated																		
7 Existing bldg																		
8 Ext. works	0	2 262	7	107			0						11	1			2 388	-132
Other or overall site construction				164 595													164 595	
Unclassified / Other																		
TOTAL kg CO2e	-82 085	1 702 713	43 658	237 420	53 979		0	591 532	0	1 703 645			36 052	89 138	182		4 376 233	-604 775

Assessment of impacts divided by the GIFA

This table shows the impacts of construction materials divided by the GIFA, excludes biogenic carbon.

	Module A1-A5 (excl. biogenic carbon)	Module B1-B5	Module C1-C4 (excl. biogenic carbon)	Total embodied carbon kg CO2e
GWP / GIFA kg CO2e/m ²	477	155	10	643