



**ELEMENT
SUSTAINABILITY**

FIRST STREET, BLOCK C

ENERGY AND CARBON STATEMENT

JUNE 2026

REF: 2023.208



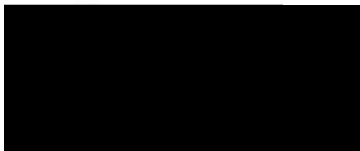
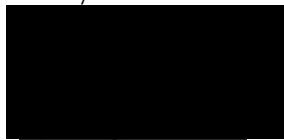
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Carbon & Energy Statement

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ELEMENT
SUSTAINABILITY

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ELEMENT SUSTAINABILITY

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Appendix A – First Street South Block C, Manchester TM54 Report

Appendix B – First Street South Block C, Manchester Part O Overheating Report

Appendix C – First Street South Block C, Mechanical & Electrical Services AD Part L Report

Appendix D – First Street Block C, Whole Life Carbon Assessment

Appendix E – First Street Block C, Proposed PV



1. EXECUTIVE SUMMARY

The purpose of this statement is to summarise the relevant policy background and requirements of Manchester City Council, and to demonstrate how the development responds to the principles of sustainable design and energy efficiency. Whilst the building was designed and specified prior to the adoption of the Greater Manchester Combined Authority (GMCA) Places for Everyone (PfE) policies, the development was designed in accordance with the planning policy and regulatory requirements applicable at the time of construction. This statement therefore provides an overview of the ways in which the development broadly aligns with the objectives of current local and regional energy and carbon planning policy guidance.

Although the proposed purpose-built student accommodation is classified as Sui Generis, meaning it does not fall within a defined planning use class, this Energy and Carbon Statement has been guided using the non-residential methodology for the purposes of the Energy and Carbon Proforma. The non-residential approach was considered the most appropriate, particularly in response to the local planning authority's requirement for a BREEAM assessment and its associated targets, as well as Building Control's requirement for demonstrating Part L compliance using SBEM. Despite the adoption of a non-residential assessment approach, overheating within the habitable areas has been assessed in accordance with Part O using CIBSE TM59. Although primarily intended for domestic buildings, TM59 states that its methodology may also be applied to student accommodation, provided any variations are clearly identified and justified. As such, TM59 has been considered an appropriate basis for assessing overheating risk within the residential areas of the development.

The Energy Hierarchy was used as a framework to guide the energy strategy for this development to achieve practical and cost-effective carbon emission reductions. The form of the building for the scheme is as follows:

- Communal amenity and office areas on the ground and first floor levels; and,
- The remainder of the building consists of, mid and top floor studios and clusters.

The calculated form factor for the development has been calculated, as follows:

- Student Accommodation: 0.5

The proposed material specification to be incorporated within the scheme will limit heat loss and ensure efficient operation of the building. Additionally, the reception, office, management suites, clusters and studios will be fitted with a highly efficient Mechanical Ventilation with Heat Recovery (MVHR) system. These systems provide a continuous supply of fresh air while the heat recovery unit significantly reduces space-heating demand.

Dynamic thermal modelling has been undertaken in accordance with the CIBSE TM54 methodology for the evaluation of operational energy use. The energy model was developed using IESVE with the Apache simulation engine, recognised under CIBSE AM11 as an approved simulation tool for detailed building performance analysis. The calculated space heating and cooling demands associated with the development are set out below:

- Space heating demand = **16.84 kWh/m²/year**
- Space cooling demand = **0.37 kWh/m²/year**



Although the heating demand is slightly above the target, the performance is very close, particularly considering that the scheme was designed prior to the introduction of the updated Places for Everyone requirements. This demonstrates that the development is largely aligned with the current energy performance expectations.

Both regulated + unregulated energy demand has been assessed for the purposes of the Energy Use Intensity (EUI) calculation. The EUI for the development has been calculated, as follows:

- Regulated energy consumption = **31.38 kWh/m²/year**
- Unregulated energy consumption = **19.95 kWh/m²/year**
- Total energy usage intensity = **51.33 kWh/m²/year**

Analysis of the INP file from Abacus Consult Limited Stage 3 BRUKL report shows that 5 credits were achieved under Ene 01, meeting the minimum requirement for an **'Excellent' BREEAM rating** and **demonstrating compliance with the 'Maximise Energy Efficiency'** target set out in the Places for Everyone Carbon Proforma.

A photovoltaic (PV) array has been selected as an appropriate renewable energy technology to contribute to the CO₂ emission reduction target for the student accommodation supports the requirements stipulated within Places for Everyone.

Table 1.1 – Proposed PV area as a percentage of ground floor space

	Solar PV
Ground Floor Area (m ²)	926
PV Area (m ²)	28.4
PV Footprint area (% of Ground floor space)	3%

The proposed specification includes an Air Source Heat Pump (Mitsubishi Qton) serving hot water storage vessels throughout the student accommodation. This system operates with a COP of 3.3.

Space heating for the student accommodation is provided by a combination of electric panel heaters and a Variable Refrigerant Flow (VRF) heat pump system. The electric panel heaters are considered to operate at near 100% point-of-use efficiency, while the VRF system is assumed to achieve a heating COP of 5.7 and cooling SEER of 11.3.

The habitable sections of the student accommodation have been assessed and comply with Building Regulations, Part O and CIBSE's TM59 assessment of overheating, however, the clusters and studios require the following measures to do so:

- The solar control g-value of the glazing is to be specified at g=0.40.
- MVHR to provide fresh air to studios and clusters, detailed flow rates are specified in Chapter 9 of this report

The proposals will contribute towards making more efficient use of non-renewable materials resources, and to reducing the lifecycle impact of materials used in construction.



2. ENERGY AND CARBON PROFORMA

Figure 2.1 – Energy and Carbon Proforma¹

Energy and Carbon Proforma		GMCA	
Non-residential		GREATER MANCHESTER COMBINED AUTHORITY	
Major development (+1,000m ²)			
Version 1.0			
Project Name: First Street, Block C			
Application ref: TBC			
Date: May-26			
	Ref. name	First Street Block C	
	Area (m ² GIA)	18,438	
	Target values	Building 1	
Minimise energy demand	Space heating demand (kWh/m ² GIA/yr)	≤ 15	16.84
	Space cooling demand (kWh/m ² GIA/yr)	≤ 15	0.37
	Calculation methodology used to calculate space heating demand and confirmation that this covers all homes/blocks	Predictive energy model	TM54 Predictive Modelling
	Form factor per building	≤ 2	0.5
	Average external wall U-value (W/m ² K)	≤ 0.15	0.73
	Average window U-value (W/m ² K)	≤ 1 (triple)	0.73
	Air permeability rate (m ³ /h/m ² @ 50 Pa)	≤ 1	3
Maximise energy efficiency	BREEAM Ene 01 rating	Excellent	Excellent
	Energy use intensity (kWh/m ² GIA/yr)	-	51.33
	Calculation methodology used to calculate energy use intensity and confirmation that this covers all homes/blocks	Predictive energy model	TM54 Predictive Modelling
Use renewable energy	PV footprint area (% of ground floor space)	-	3
	Annual renewable energy generation (kWh/m ² building footprint/yr)	-	6.36
	Renewable energy balance (%)	-	0.62
	Total energy used (kWh/yr)	-	946,422
	Total energy generated on-site (kWh/yr)	-	5,885
Use low carbon energy	Fossil fuel free (yes/no)	Yes	Yes
	Heat source	Electric	Electric
	Low Carbon Heat Appraisal completed	Yes	Yes
	Heat network suitability	-	Yes
	Exemption requested	-	-
	Efficiency of heating system (SCOP)	≥ 3.5	5.7
Reduce overheating risk	Carbon content of heat (gCO ₂ /kWh)	≤ 100	35
	Has CIBSE TM52 been used to calculate overheating and does the building pass?	Yes	Yes - TM59
	What percentage of spaces are cooled? (% of GIA)	-	Levels 01-04
	Has a CIBSE TM52 assessment been carried out using DSY2 and DSY3 weather files? Have any additional passive measures been included as a result?	Yes	Yes
Minimise embodied carbon	Upfront embodied carbon (kgCO ₂ e/m ² GIA)	-	707
	List top three materials with the highest upfront embodied carbon emissions (kgCO ₂ e/m ² GIA): Material 1	-	Ready-mix Concrete
	Material 2	-	Glass
	Material 3	-	HVAC componer
	Lifecycle embodied carbon (kgCO ₂ e/m ² GIA) - for large major developments only	-	1021
Offsets	Offset contribution (£)	-	

¹ Whilst the top four floors are provided with VRV heating and cooling, this is not for overheating but instead to achieve Part L compliance. Levels above 01-04 can rely on rapid opening vents and have been subjected to TM59 overheating analysis.



3. INTRODUCTION

Element Sustainability has been commissioned by Downing Living (Manchester South) LPI to review the sustainability and energy performance of the proposed student accommodation development in Manchester.

The purpose of this statement is to summarise the relevant policy background and requirements of Manchester City Council and to demonstrate the ways in which the developer has addressed these aims through their proposals, ensuring all practicable measures have been taken to deliver a sustainable development at this site.

Details of the design attributes, specifications and characteristics of the scheme are appraised in order to demonstrate how the proposals contribute to sustainable development in Manchester and seek to mitigate the environmental impacts of the scheme, providing a sustainability appraisal in support of the planning application.

This report is intended to support the planning application for this development and therefore, establish an approach to the delivery of this scheme which meet the criteria outlined by the council that the developer commits to implement at the site.



4. PROJECT OVERVIEW

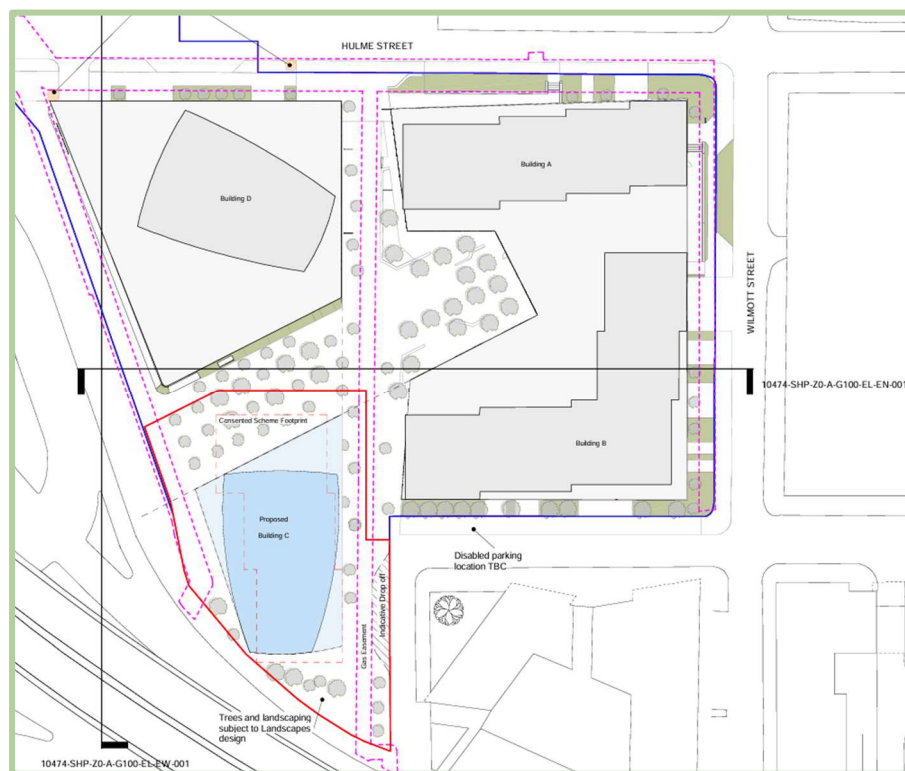
4.1 Development Site Description

The site is located in a highly urbanised area of Manchester City Centre, adjacent to Medlock Street and the Mancunian Way. The Site forms part of the wider First Street Development Framework Area.

The Mancunian Way and Medlock Street encompass the site to the south and west respectively. Bordering the site to the east lies Newcastle Street, which separates the site from the Unite Students Parkway Gate student accommodation building, and another vacant plot of land also within with the First Street Masterplan. Beyond the northern perimeter lies Blocks A/B and D Plot 11, currently under construction to deliver a co-living development.

The site is not in a designated conservation area.

Figure 4.1 – Site Location Plan



4.2 Development Proposals

Planning approval is sought to erect a five hundred and fifty-five room purpose-built student accommodation facility.

Figure 4.2 to 4.9 presents the floor plans and elevations for the First Street, Block C development.



Figure 4.2 –North Elevation

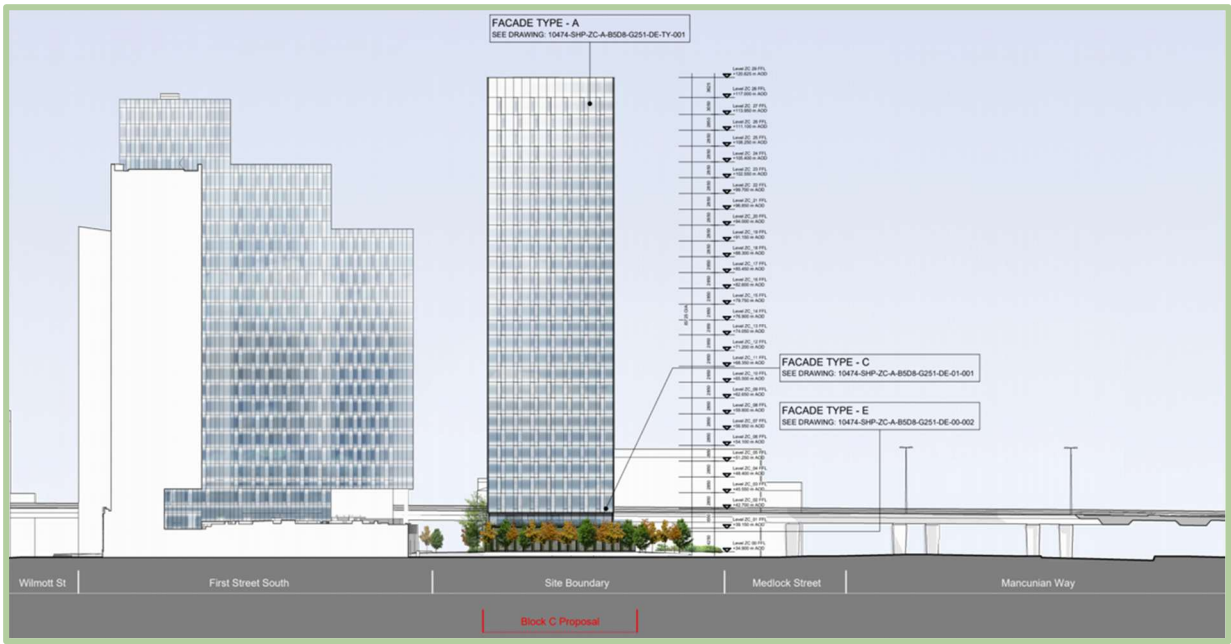


Figure 4.3 –East Elevation



Figure 4.4 – South Elevation



Figure 4.5 – West Elevation



Figure 4.6 – Ground Floor General Arrangement Plan

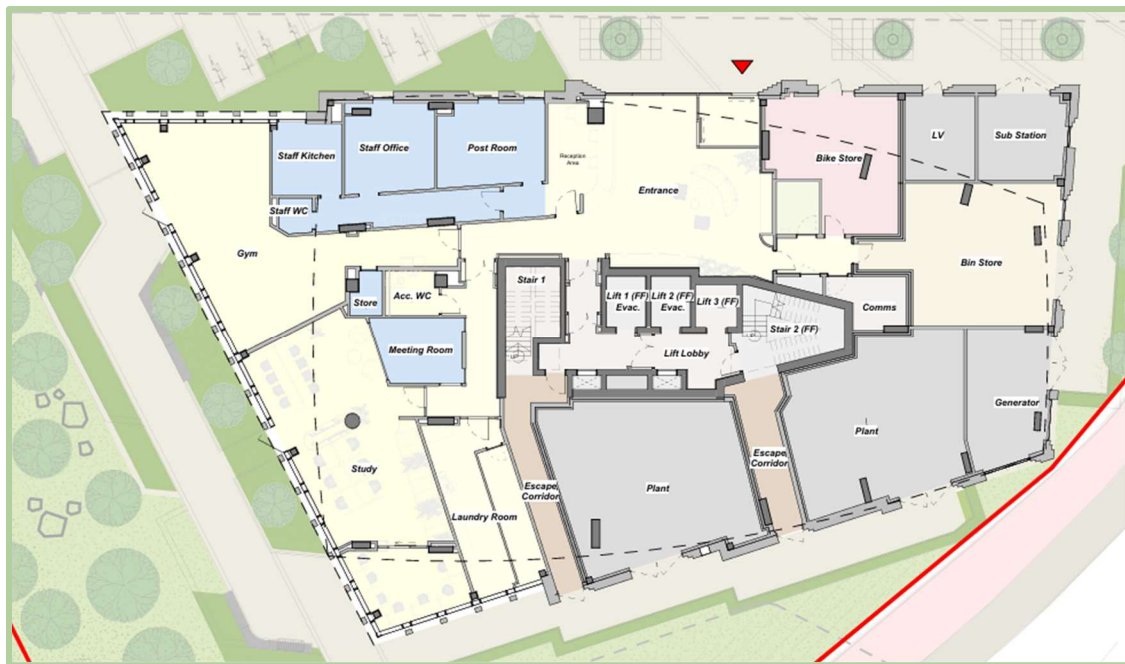


Figure 4.7 – First Floor General Arrangement Plan

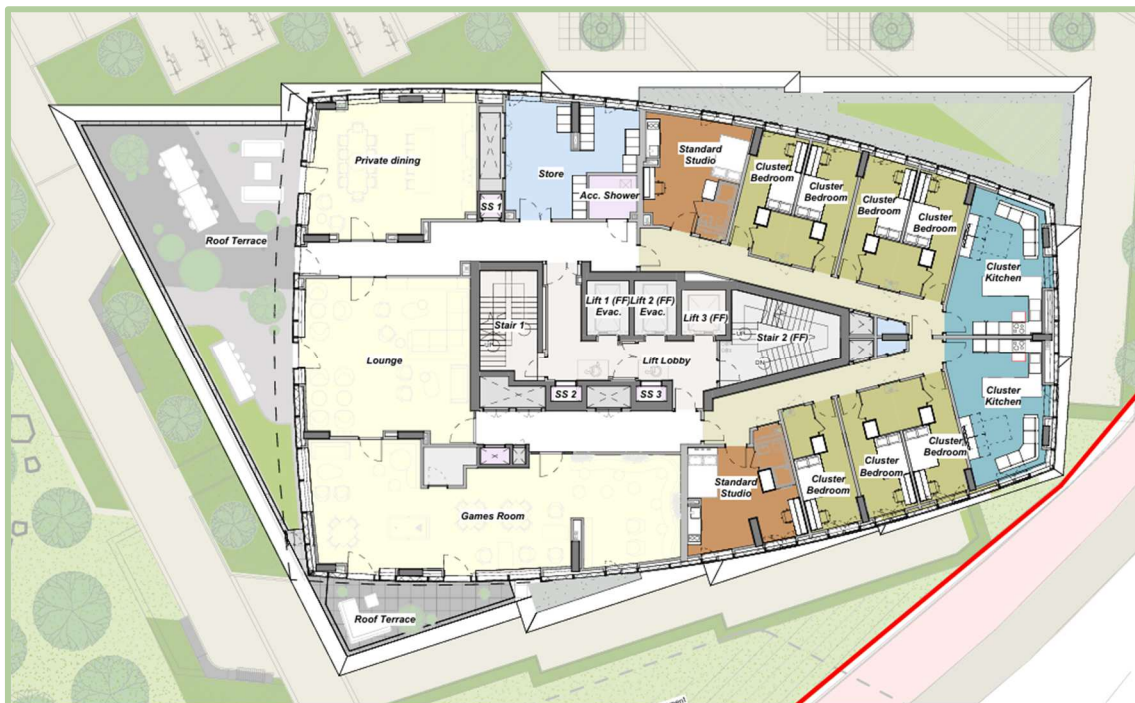
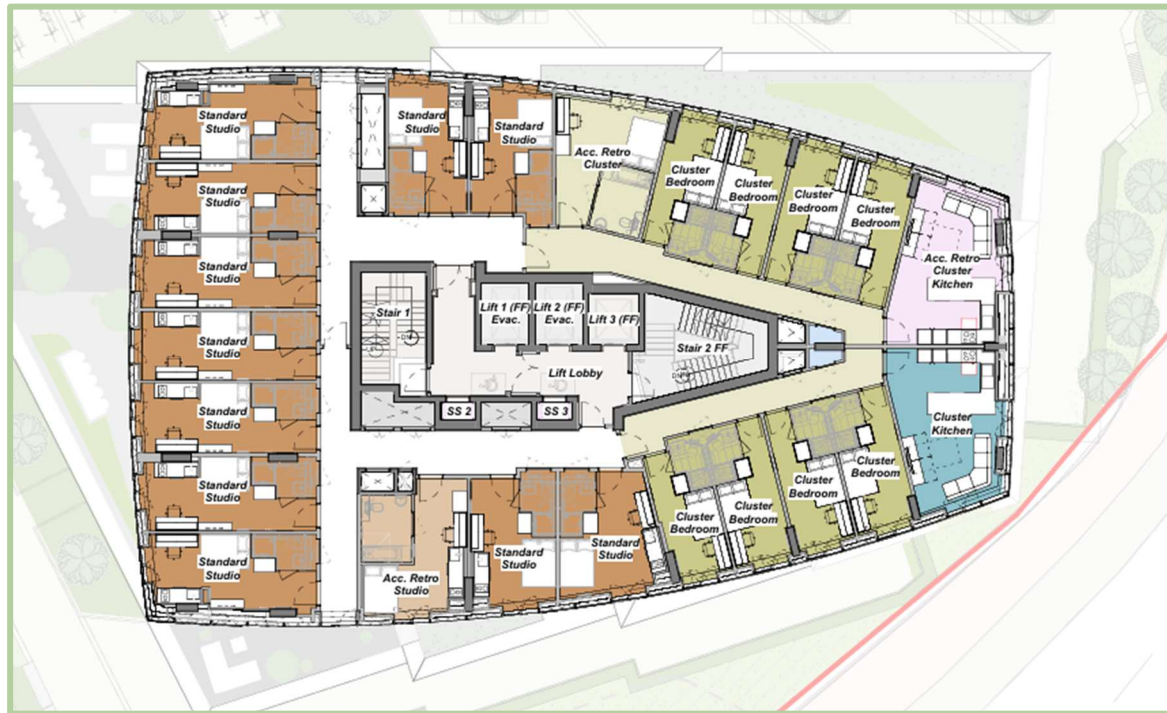
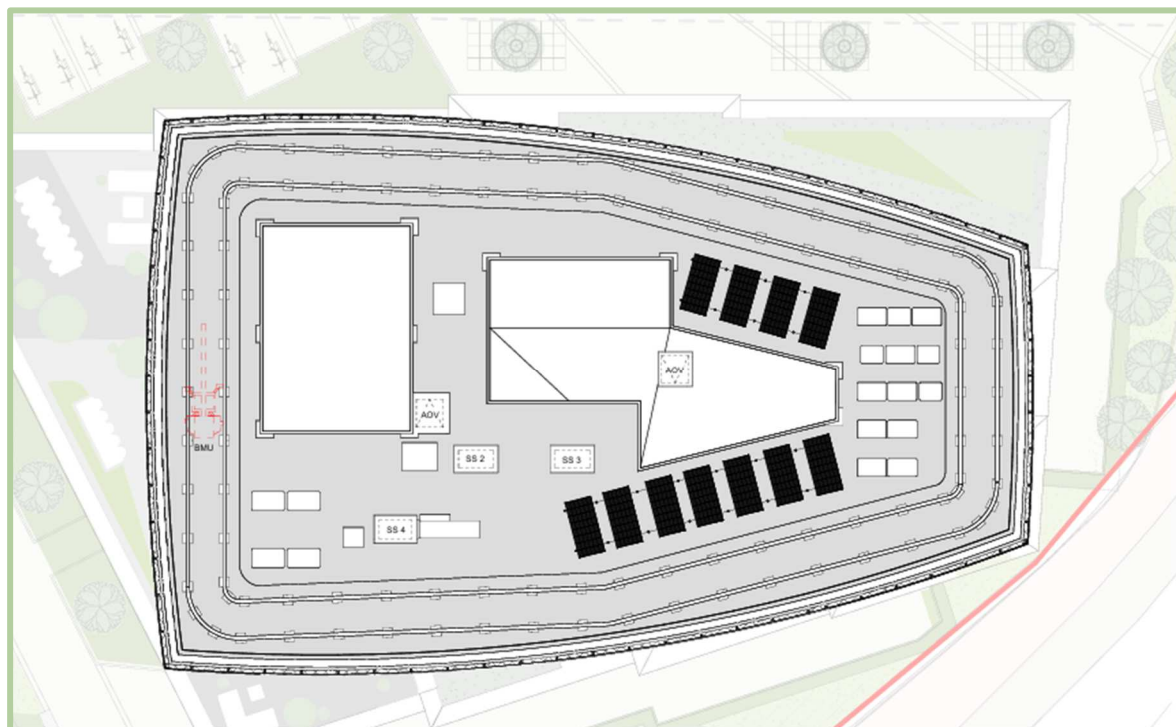


Figure 4.8 – Typical General Arrangement Plan*Figure 4.9 – Roof Plan*

5. POLICY REVIEW

5.1 Regional Planning Policy

5.1.1 Places For Everyone

Places for Everyone (PfE) is the joint development plan of nine Greater Manchester local authorities (Bolton, Bury, **Manchester**, Oldham, Rochdale, Salford, Tameside, Trafford, and Wigan) dealing with strategic planning issues including jobs, homes, transport, and the natural environment.

All nine authorities adopted the PfE Plan on 21st March 2024. Therefore, this document now forms part of the statutory development plan for each of the nine PfE authorities.

As a result, the following policies have been considered as part of the proposed development:

Policy JP-S1: Sustainable Development: To help tackle climate change, development should aim to maximise its economic, social and environmental benefits simultaneously, minimise its adverse impacts, utilise sustainable construction techniques and actively seek opportunities to secure net gains across each of the different objectives.

In bringing forward previously developed sites for development, particular attention will be paid to tackling land contamination and stability issues, ensuring that appropriate mitigation and remediation is implemented to enable sites to be brought back into use effectively.

Addressing Climate Change

Greater Manchester's Vision is to be at the forefront of action on climate change and to make its fair contribution to international commitments by becoming a carbon neutral city region by 2038.

To meet the carbon commitments, the following will be required:

- Be carbon neutral by 2038;
- Hold cumulative carbon dioxide emissions to within the council's carbon budget; and,
- Initiate a programme of mitigation to reduce emissions including by:
 - Significantly upscaling solar photovoltaic energy;
 - Reducing heat demand in homes;
 - Moving away from carbon intensive gas as the primary source of heat; and,
 - Increasing biofuel use.
- In supporting Greater Manchester's ambitions, climate change is a key theme running throughout the plan, rather than being reduced to a single policy, and it is only through this combination of actions that it can be properly addressed. In particular:
 - Methods to de-carbonise the city region through new and existing development, effective land management and through the provision of infrastructure and new technologies Policy JP-S2 'Carbon and Energy'; and,



- The delivery of renewable and low carbon energy schemes Policy JP-S3 'Heat and Energy Networks'.

Carbon and Energy

- Meeting the 2038 carbon neutrality target will require a radical transformation across a range of sectors to drive carbon reduction. Within this, new development will have a critical role to play and all new homes and commercial/industrial buildings will need to achieve net zero carbon by 2028.
- It is expected that development in the plan area will apply a net zero carbon approach to operational emissions up until 2028, thereafter emissions in construction should be considered. Minimum carbon reduction targets will be set in line with the Future Homes Standard of 80% or until such a time this is superseded.
- From 2025, applicants will need to demonstrate carbon reductions have been maximised with an opportunity to offset any residual carbon to a carbon offset fund. The approach will be reviewed in line with future standards as they are introduced.
- By following the energy hierarchy, new development will need to achieve net zero carbon through the maximisation of on-site measures first. However, circumstances where a development has demonstrated that the hierarchy has been followed and there are no reasonable alternatives to meet the minimum carbon reductions, then payment to offset remaining emissions will also be required. Such payments should be expected to fund other carbon saving programmes within Greater Manchester to help meet the 5 Year Environment Plan targets.

Policy JP-S 2 – Carbon and Energy: The aim of delivering a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions, will be supported through a range of measures including:

- Promoting the use of life cycle cost and carbon assessment tools to ensure the long-term impacts from development can be captured;
- Taking a positive approach to renewable and low carbon energy schemes, particularly schemes that are led by, or meet the needs of local communities;
- An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable;
 - Be net zero carbon which applies:
 - From adoption – to regulated operational carbon emissions;
 - From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions;
 - Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to:
 - Minimise energy demand;
 - Maximise energy efficiency;



- Use renewable energy;
 - Use low carbon energy; and
 - Utilise other energy sources.
- From 2025 any residual carbon emissions that cannot be fully mitigated onsite should be offset, in agreement with the relevant local planning authority, through a financial contribution to a carbon offset fund;
 - As an interim measure, development should be consistent with the 2021 Part L Building Regulations unless superseded by changes to building regulations and/or national or local planning policies.
 - Where practicable, prioritise connection to a renewable energy/heating/cooling network in the first instance or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date; and,
 - For renewable energy generation priority should be given to PV installation where technically feasible, alternative technologies will be appropriate where the equivalent generation is evidenced;
 - For non-residential developments, achieve at least BREEAM excellent standard (or equivalent) for the 'Ene 01 – reduction of energy use and carbon emissions' category rising to 'BREEAM outstanding' equivalent for ENE 01 from 2028;
 - Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation. Whole life cycle emissions should be considered where possible.
 - Districts Local Plans may set out specific carbon emission reduction and energy demand targets within Local Plans.

Policy JP-STRAT14 - A Sustainable and Integrated Transport Network: New development will have a significant role in delivering a sustainable and integrated transport network in order to reduce car dependency and increase levels of walking, cycling and public transport.

Policy JP-S3 – Heat and Energy Networks: The provision of decentralised energy infrastructure is critical to the delivery of our objectives for low carbon growth, carbon reductions and an increase in local energy generation. The following measures will help to achieve this:

1. Delivery of renewable and low carbon energy schemes will be supported with particular emphasis on the use of decentralised energy networks in areas identified as “Heat and Energy Network Opportunity Areas”. These have been identified where:
 - a. Existing heat/energy networks are operational or have been commissioned;
 - b. Sufficient density of existing heat demand occurs; and,
 - c. Significant future development is proposed at the strategic development locations.
2. Within the identified “Heat and Energy Network Opportunity Areas”, unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is not practicable or financially viable.



Policy JP-S4 - Flood Risk and the Water Environment: An integrated catchment-based approach will be taken to protect the quantity and quality of water bodies with reference to the North West River Basin Management Plan and managing flood risk, by:

- Working with natural processes and adopting a natural flood management approach to slow the speed of water drainage and intercept water pollutants;
- Locating and designing development so as to minimise the impacts of current and future flood risk, including retrofitting or relocating existing developments, infrastructure and places to increase resilience to flooding;
- Expecting developments to manage surface water runoff through sustainable drainage systems and as close to source as possible;
- Development should achieve greenfield run-off rates unless it is demonstrated to be impracticable; and,
- Ensuring that sustainable drainage systems:
 - Are designed to provide multifunctional benefits wherever possible, including for water quality, nature conservation and recreation;
 - Avoid adverse impacts on water quality and any possibility of discharging hazardous substances to ground;
 - Are delivered in a holistic and integrated manner, including on larger sites split into different phases; and
 - Are managed and maintained appropriately to ensure their proper functioning over the lifetime of the development.
- As a minimum, residential development should meet the mandatory water efficiency standard of 125 litres/person/day as set out in Building Regulations. District local plans may and should consider setting a tighter water efficiency standard of 110 litres/person/day where there is a clear local need with reference to national guidance on housing optional technical standards.

Policy JP-S6 - Resource Efficiency: The achievement of a circular economy and a zero-waste economy will play a key role in meeting Greater Manchester's ambition of becoming a leading green city region by 2038. The following measures will help achieve this:

- Development and implementation of the Zero Waste Strategy for Greater Manchester which promotes overall reduction in the level of waste produced and supports resource efficiency within the Plan area in order to gain the maximum value from the things we produce;
- Recognition of the role of existing infrastructure in managing our waste and protecting such facilities to ensure adequate waste management capacity is maintained; and
- Using sustainable design and construction techniques to reduce carbon emissions, adapt and future proof to the impact of climate change, reduce and recycle waste and minimise water use.

Policy JP-G2 – Green Infrastructure Network: A strategic approach will be taken to the protection, management and enhancement of Greater Manchester's Green Infrastructure in order to protect and enhance the ecosystem services which the Green Infrastructure Network provides, including flood management, climate change mitigation and adaptation.

Wherever practicable, opportunities to integrate new and existing green infrastructure into new development will be taken to protect, enhance and expand the green infrastructure network.



Policy JP-G6: Urban Green Space: To ensure there is an appropriate scale, type, quality and distribution of accessible urban green space that can support a high quality of life and other important green infrastructure functions:

- Existing urban green space will be protected and enhanced in balance with other considerations; and
- Developers and other stakeholders will be required to deliver new high quality urban green spaces.

Development should be designed to support the positive use of nearby green spaces, such as by offering a high-quality setting, providing natural surveillance, and facilitating easy access by walking and cycling.

Policy JP-G7 - Trees and Woodland: the aims and objectives of the Greater Manchester Tree and Woodland Strategy, aiming to significantly increase tree cover, protect and enhance woodland, and connect people to the trees and woodland around them.

This will be done through local planning and associated activities such as:

- Where development would result in the loss of existing trees, requiring replacement on the basis of two new trees for each tree lost, or other measures that would also result in a net enhancement in the character and quality of the treescape and biodiversity value in the local area, with a preference for on-site provision; and
- Protecting trees and woodland during the construction phase of development.

Policy JP-G8: A Net Enhancement of Biodiversity and Geodiversity: Through local planning and associated activities a net enhancement of biodiversity resources will be sought, including, where relevant, by:

- Increasing the quality, quantity, extent and diversity of habitats, particularly priority habitats identified in national or local biodiversity action plans and those that support priority species;
- Improving connections between habitats, to protect and enhance the provision of corridors, ecological networks (including Nature Recovery Networks) and steppingstones that enable the movement of species, especially as the climate changes;
- Enhancing the management of existing habitats, including through habitat restoration, avoiding habitat fragmentation and combating invasive species;
- Protecting sites designated for their nature conservation and/or geological importance, with the highest level of protection given to international and then national designations;
- Facilitating greater access to nature, particularly within urban areas;
- Supporting the development and implementation of the Great Manchester Wetlands Nature Recovery Network; and
- Safeguarding, restoring and sustainably managing our most valuable soil resources, tackling soil degradation/erosion and recovering soil fertility.

Development will be expected to:

- Follow the mitigation hierarchy of:
 - Avoiding significant harm to biodiversity, particularly where it is irreplaceable, through consideration of alternative sites with less harmful impacts, then
 - Adequately mitigating any harm to biodiversity, then
 - Adequately compensating for any remaining harm to biodiversity.



- Achieve a measurable net gain in biodiversity of no less than 10%; and,
- Development proposals should be informed by the findings and recommendations of the appropriate biodiversity/ecological assessment(s) in the PFE evidence base and/or any updated or appropriate biodiversity/ecological assessments submitted as part of the planning application process.

Policy JP-P1 - Sustainable Places: The aim is to become one of the most liveable city regions in the world, consisting of a series of beautiful, healthy and varied places, each having the following key attributes that all development, wherever appropriate, should be consistent with:

- Distinctive, with a clear identity that:
 - Conserves and enhances the natural environment, landscape features, historic environment and local history and culture;
 - Enables a clear understanding of how the place has developed; and
 - Respects and acknowledges the character and identity of the locality in terms of design, siting, size, scale and materials used.
- Resilient, capable of dealing with major environmental events;
- Adaptable, able to respond easily to varied and changing needs and technologies;
- Durable, being built to last and using robust materials that reflect local character, weather well and are easily maintained;
- Resource-efficient with:
 - A low carbon footprint;
 - Efficient use of land;
 - Minimised use of new materials; and,
 - High levels of recycling,
- Supported by critical infrastructure, such as energy, water and drainage and green spaces; and,
- Functional and convenient, enabling people and uses to act efficiently with minimal effort, and responding to needs relating to servicing, recycling facilities, refuse collection and storage.

The success of the Net Zero Carbon design and construction is measured in Policy JP-S2 through a series of metrics and key performance indicators (KPIs). These metrics and KPIs provide an indication of how the design has influenced the performance of the building.

This project is classified as a large major residential scheme as it is to provide over 150 homes. This triggers a specific set of KPIs the scheme must comply with, these can be seen in Chapter 2, Energy and Carbon Proforma.



5.2 Regulatory Framework

Building Regulations, Part L - Conservation of Fuel and Power sets the compliance standards for energy demand and carbon dioxide emissions from buildings. Guidance on how to meet the requirements of this regulation is provided within a number of approved documents. The relevant document is referenced below:

Approved Document Volume 1: Dwellings (2021 Edition) provides guidance on how to comply with Part L of Schedule 1 to the Building Regulations and the energy efficiency requirements for dwellings.

The minimum energy performance requirements shall be approved and expressed in accordance with the methodology for:

- New buildings, in the form of target CO₂ emission rates;
- New buildings in the form of target primary energy rates.

5.3 Applicable Targets

Based upon a review of relevant planning policy requirements, legislative drivers, and client priorities, the following list provides a brief precis of the key criteria that should be targeted for this development:

Places for Everyone

- **Policy JP-S1:** Sustainable Development
- **Policy JP-S2:** Carbon & Energy
- **Policy JP-S3:** Heat and Energy Networks
- **Policy JP-S6:** Resource Efficiency
- **Policy JP-P1** Sustainable Places

Building Regulations, Part L

- **Approved Document Volume 2:** Dwellings (2021 edition)



6. ENERGY HIERARCHY

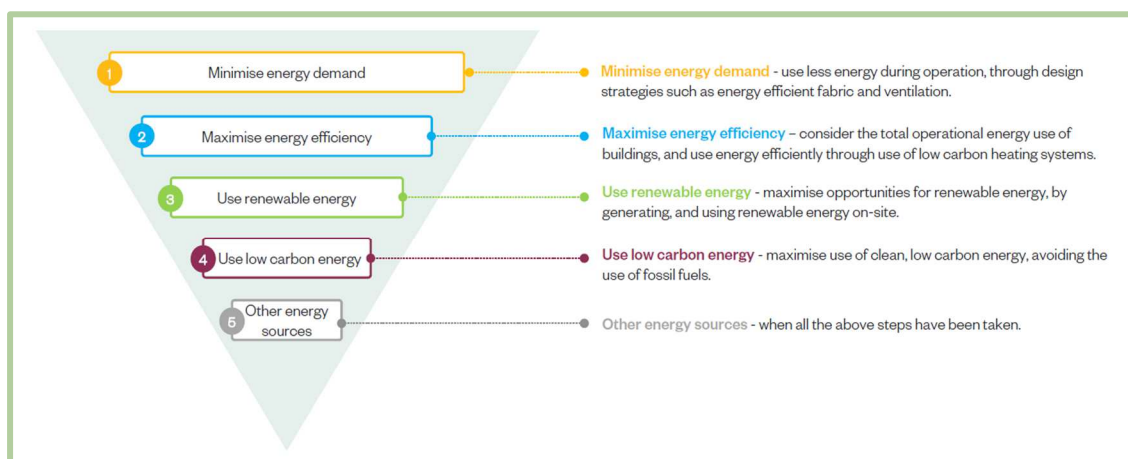
6.1 The Energy Hierarchy

The energy strategy for this development prioritises an enhanced ‘fabric led’ solution coupled with a fossil fuel free (that is, full electric) mechanical and electrical system provision. An enhanced building fabric specification throughout the scheme allied to efficient servicing and controls will achieve compliance with the new build carbon dioxide emission reduction and fabric energy efficiency targets stipulated by Building Regulation Part L, Manchester City Council, and Places for Everyone.

The Energy Hierarchy (see Figure 6.1) provides a framework to guide energy policy and decision making to achieve practical and cost-effective carbon emission reductions. The energy hierarchy is built upon the following guiding principles:

- i. **First Principle**
 - o Reduce the need for energy.
- ii. **Second Principle**
 - o Use energy more efficiently.
- iii. **Third Principle**
 - o Supply energy from renewable sources.
- iv. **Fourth Principle**
 - o Ensure that any continuing use of fossil fuels should use clean technologies and be efficient.

Figure 6.1 – The Energy Hierarchy



Source: GMCA PjE Guidance

The Energy Hierarchy has been used as a framework to guide the energy strategy to achieve practical and cost-effective carbon emission reductions for this building. It is intended that the construction, design and specification proposed for this scheme will deliver dwellings that are inherently efficient and cost-effective during occupation.

The proposed, detailed energy strategy is presented in Section 7.



7. ENERGY STRATEGY

7.1 CIBSE TM54 Modelling and Energy Demand

To demonstrate the energy performance of the proposed development, Abacus Consult Limited have carried out a predictive operational energy use evaluation following CIBSE's TM54 methodology for the student accommodation. The modelling provides a robust indication of the expected space heating, cooling, and overall energy demand. The full report by Abacus Consult Limited can be found in Appendix A.

7.1.1 Overview

The climate emergency is driving a critical need to deliver high-performance buildings, with operational energy use aligned to net-zero targets. To achieve this, design teams require tools and techniques that can reliably model in-use energy performance based on design proposals and guide the development of more efficient design strategies.

Traditional compliance modelling, such as Part L SAP and SBEM calculations, focus only on regulated energy use and therefore do not provide an accurate prediction of how buildings will perform once occupied. This gap between compliance predictions and real-world energy consumption has led to significant performance shortfalls.

The CIBSE TM54 assessment methodology addresses this issue by providing a structured methodology for producing more realistic estimates of operational energy use. It enables engineers and consultants to account for the factors typically overlooked in compliance modelling, including:

- Unregulated loads (small power, equipment, IT)
- Occupant behaviour (schedules, density, usage patterns)
- Heating, cooling, ventilation and domestic hot water performance
- Lighting and controls
- HVAC efficiencies and part-load operation
- Variations in system assumptions and scenarios

By incorporating these elements, TM54 helps to close the gap between Part L predictions, expected operational performance, and actual in-use energy consumption.

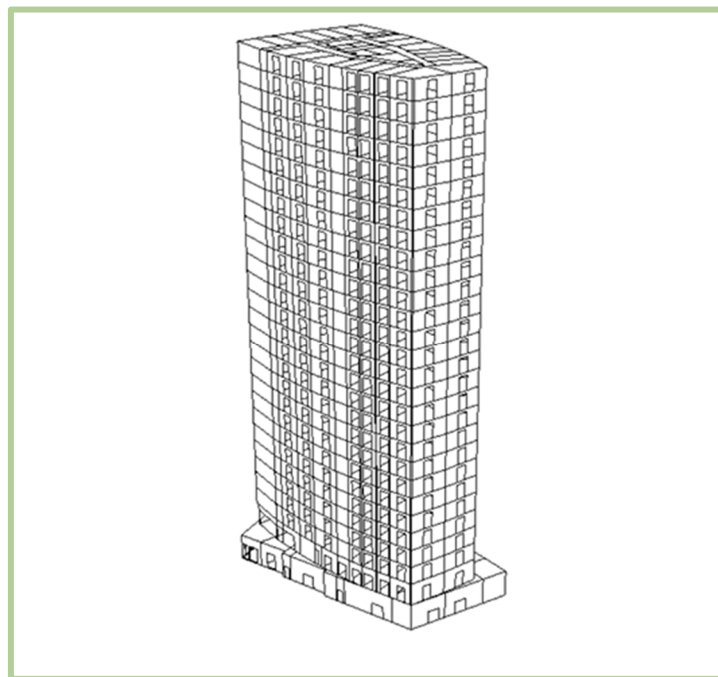


7.1.2 Geometry and Site Details

The SHP drawings used to create the dynamic thermal model are as follows:

- 63088-SHA-ZZ-00-D-A-200101_General Arrangement Plan Level 00_P01_S4
- 63088-SHA-ZZ-01-D-A-200101_General Arrangement Plan Level 01_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200101_General Arrangement Plan Type 01 (Levels 02,08,14)_P02_S3
- 63088-SHA-ZZ-ZZ-D-A-200102_General Arrangement Plan Type 02 (Levels 03,05,07,_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200103_General Arrangement Plan Type 03 (Levels 04,06,10,_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200104_General Arrangement Plan Type 04 (Levels 16,18,20,_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200105_General Arrangement Plan Type 05 (Levels 17,19,21,_P01_S4
- 63088-SHA-ZZ-28-D-A-200101_General Arrangement Plan Level 28 - Roof Plant_P01_S4
- 63088-SHA-ZZ-RF-D-A-200101_General Arrangement Plan Roof Level_P01_S4

Figure 7.1 – Dynamic Thermal Model of First Street, Block C



The energy demand for the student accommodation was calculated in IESVE using the Apache engine. This software allows detailed modelling of building fabric, ventilation, internal gains and heating system performance to produce predictions of regulated energy use.



7.1.3 Data Inputs and Internal Gains

For the purposes of this operational energy assessment, occupancy patterns have been defined to reflect the typical use profile of student accommodation within the UK academic calendar. Occupancy has been assumed to align with standard university term times, with high utilisation expected during teaching periods and reduced occupancy during holiday and break periods. A diversified daily profile has been applied to reflect typical student behaviour, including daytime absences associated with academic activities and higher occupancy during evenings and overnight periods. Allowances have also been made for partial occupation outside of core term times, recognising that a proportion of students may remain in residence year-round.

Small power loads have been derived from equipment schedules provided by the client, with full details contained within the Abacus Consult Limited report included in Appendix A. The resulting load profile reflects both the diversity and intermittency of plug loads, while still allowing for peak usage. This methodology ensures that the small power demand is representative of both expected occupant behaviour and the proposed fit-out specification.

Tables 7.1 and 7.2 present the proposed specifications and data inputs used within the dynamic simulation modelling calculations, which underpin the energy performance results in Table 7.4.

Table 7.1 – Proposed Fabric Specification

Item	Proposed Specification
Unitised Façade (non-vision)	0.73 W/m ² K
Unitised Façade (vision)	0.73 W/m ² K
External Walls	0.16 W/m ² K
Solid Floor	0.18 W/m ² K
Roof	0.18 W/m ² K
Windows	G-value 0.40
Personnel Doors	1.60 W/m ² K
Air Permeability	3.00m ³ /hm ² (@50Pa.)

Table 7.2 – Proposed Mechanical and Electrical Specification

Item	Proposed Specification
Lighting	100% LEDs
Ventilation	Mechanical Ventilation with Heat Recovery Heat Recovery Efficiency 85%
Space Heating	VRF Heat Pump System CoP 5.7 SEER 11.3
Water Heating	Mitsubishi QAHV high temperature CO ₂ ASHP's serving hot water storage vessels CoP 3.3



7.1.4 Results

Table 7.3 details the annual energy consumption by end use for the student accommodation.

Table 7.3 – TM54 Predictive Energy Demand Breakdown

Energy Consumption by end use	Annual Energy Consumption (kWh/m ² /yr)
Space Heating	16.84
Space Cooling	0.37
Auxiliary	5.86
Lighting	4.26
Domestic Hot Water	4.05
Small Power	19.95
Total	51.33

Based on the assessment, the student accommodation has a predicted energy usage intensity of 51.33 kWh/m²/year.

Table 7.4 – PfE Predictive Energy Demand Benchmarks

	Student Accommodation (kWh/m ² /year)	Places for Everyone Target (kWh/m ² /year)
Space Heating Demand	16.84	15
Space Cooling Demand	0.37	15
Combined Heating & Cooling	17.21	30

Although the space heating demand marginally exceeds the 15 kWh/m²/year target, the space cooling demand is substantially below target. Overall, the combined heating and cooling demand remains below 30 kWh/m²/year, demonstrating broad alignment with the Places for Everyone energy performance objectives, given that the scheme was designed prior to the introduction of the updated requirements.

7.2 Part L Calculations

Abacus Consult Limited have carried out a RIBA Stage 3 Simplified Building Energy Model (SBEM) assessment using IES Virtual Environment software. The Part L report from Abacus Consult Limited can be found in Appendix C.

SBEM software calculates the regulated energy demand and associated carbon dioxide emissions in accordance with the requirements of Building Regulations, Part L, Approved Document Volume 2 (2021), which the development will be constructed in compliance with.



Table 7.5 presents a summary of the results, showing the emission rate and energy demand performance associated with the development.

Table 7.5 – Calculated Regulated Building Emission and Primary Energy Rates

	First Street, Block C
Building Emission Rate - BER (kgCO ₂ /m ² /yr.)	3.06
Target Emission Rate - TER (kgCO ₂ /m ² /yr.)	3.10
AD: Volume 2 (2021) Compliance	Achieved
Building Primary Energy Rate (BPER) (kWh/m ² /yr.)	32.41
Target Primary Energy Rate (TPER) (kWh/m ² /yr.)	33.04
AD: Volume 2 (2021) Compliance	Achieved

Analysis of the INP file from Abacus' Stage 3 BRUKL report shows that 5 credits were achieved under Ene 01, meeting the minimum requirement for an 'Excellent' BREEAM rating, as per Table 7.6.

The same methodology will be applied at Stage 4, with results reported upon completion. This provides a clear indication that the project is on track to meet the minimum 'Excellent' standard for energy credits.

Table 7.6 – Ene 01 EPR_{NC} Benchmark Scale

BREEAM Credits	EPR _{NC}	Minimum Standards	
		Rating	Minimum Requirements
1	0.1	Very Good	Requires a performance improvement better than the relevant national building regulations compliant standard
2	0.2		
3	0.3		
4	0.4	Excellent	Requires 4 credits to be achieved (equivalent to an EPR _{NC} of at least 0.4) or 4 credits for prediction of operational energy consumption (where operational energy performance has been substantially improved).
5	0.5		
6	0.6		
7	0.7	Outstanding	Requires 6 credits to be achieved (equivalent to an EPR _{NC} of at least 0.6) and 4 credits for prediction of operational energy consumption.
8	0.8		
9	0.9 AND zero net regulated CO ₂ -eq emissions		



7.3 Building Fabric and Ventilation

The standard measurement of heat transfer through a given building material or construction type is the U-value ($\text{W/m}^2\text{K}$). The lower the U-value, the more slowly heat transfers and is lost out of a building. In buildings, heat loss generally occurs through the following main areas and elements of the construction:

- Ground floor;
- External walls;
- Roofs;
- Doors and windows;
- Thermal bridging; and,
- Uncontrolled ventilation

This development will benefit from a material and design specification that is aligned with Building Regulation standards and will include numerous efficiency measures designed to reduce heat losses and minimise energy demand in accordance with the first principle of the energy hierarchy, including:

- ✓ High performance U - values;
- ✓ Reduced thermal bridge heat losses;
- ✓ Efficient form of construction; and,
- ✓ Low design air permeability target.

This 'fabric led' approach to minimising energy demand and associated carbon dioxide emissions through the performance of the thermal envelope is aligned with the first principle of the energy hierarchy, which states that reduction in energy demand should be achieved initially by energy efficiency.

7.3.1 Building Form and Heat Loss Envelope

The form of the student accommodation is as follows:

- Communal amenity and office areas on the ground and first floor levels; and,
- The remainder of the building consists of, mid and top floor studios and clusters.

The calculated form factor for the development has been calculated, as follows:

- Student Accommodation: 0.5

7.3.2 Elevation Design and Window Proportions

The dwellings are of bespoke architectural design with a range of high specification design features and materials palette, allied to generous proportions and detailing.

7.3.3 Heated Spaces

The student accommodation includes several unheated ground-floor spaces, including plant and refuse rooms. The walls and exposed floors adjoining these areas will be well insulated to minimise heat loss.

7.3.4 Building Fabric Specifications and Air Permeability

The proposed material specification that will be incorporated within the building to limit heat loss and ensure efficient operation are presented in Table 7.2 above.



7.3.5 Ventilation System

The student accommodation will benefit from mechanical ventilation with heat recovery systems to the amenity areas and communal habitable spaces. All student accommodation clusters and studios will be supplied from a local supply and extract MVHR system. These systems will maintain a healthy living environment and further reduce the heat losses and energy demand of the dwellings.

MVHR systems can recover up to 90% of heat from the extracted stale air from the dwelling by using a counter flow heat exchanger which 'pre-heats' cool incoming, fresh air. The outgoing and incoming air pass next to each other, but do not mix.

7.3.6 Space Heating Demand

To demonstrate the environmental performance, a CIBSE TM54 assessment has been undertaken for the student accommodation. The predicted space heating and cooling demands are as follows:

- Space heating demand = **16.84 kWh/m²/year**
- Space cooling demand = **0.37 kWh/m²/year**

For non-residential developments, the current space heating and cooling demand target is 15 kWh/m²/year. The student accommodation has a modelled space heating demand of 16.84 kWh/m²/year and a space cooling demand of 0.37 kWh/m²/year. Although the heating demand is slightly above the target, the performance is very close, particularly considering that the scheme was designed prior to the introduction of the updated Places for Everyone requirements. This demonstrates that the development is largely aligned with the current energy performance expectations.

7.4 Maximise Energy Efficiency

7.4.1 Energy Use Intensity

The energy use intensity (EUI) of a home or building is the total amount of energy (regulated and unregulated) it uses for all purposes in kWh/year, divided by the gross internal floor area (GIA) in m². The EUI has been calculated prior to the inclusion of the PV array.

Both regulated plus unregulated energy demand have been calculated for the purposes of the Energy Use Intensity (EUI) calculation. The EUI for the student accommodation has been calculated, as follows:

- Regulated energy consumption = **31.38 kWh/m²/year**
- Unregulated energy consumption = **19.95 kWh/m²/year**
- Total energy usage intensity = **51.33 kWh/m²/year**

Whilst there are no specific energy use intensity targets for non-residential developments, there is an expectation to achieve a BREEAM 'Excellent' rating for energy performance.

Analysis of the Stage 3 BRUKL report indicates that **5 credits were achieved, meeting the minimum requirement for 'Excellent'**, as shown in Table 7.7 above. The same methodology will be applied at Stage 4, with results reported upon completion, providing a strong indication that the project is on track to meet the required standard for energy credits.



7.4.2 Efforts to Reduce Energy Use of Equipment

In order to limit energy demand and carbon dioxide (CO₂) emissions from the operation of the building, a number of design features will be integrated that will collectively contribute towards emission reductions for the scheme.

The energy strategy for the student accommodation focuses on a holistic approach to improving the buildings' performance by applying a fabric-led strategy, allied to renewable and low carbon technology.

The reduction in energy demand to meet the carbon reduction targets will be achieved through the following design measures and low carbon technology:

- High performance thermal insulation;
- Low air permeability;
- Hot Water Heat Pumps;
- Mechanical Ventilation with Heat Recovery;
- Solar photovoltaic array;
- Sophisticated heating controls;
- Appliances and white goods specified will be highly energy efficient; and,

The proposed specification demonstrates broad alignment with the performance metrics and key indicators set out within the Greater Manchester Combined Authority's Places for Everyone guidance, noting that the scheme was developed prior to the introduction of these requirements.

7.5 Renewable Energy Generation

The operational efficiency of the development will be optimised via the use efficient mechanical and electrical (M&E) systems allied to low carbon and renewable energy generation.

The proposed building services that will be incorporated in the development to ensure efficient servicing is presented in Table 7.7.

Table 7.7 – Proposed Mechanical and Electrical Specification

Item	Proposed Specification
Lighting	100% LEDs
Ventilation	Mechanical Ventilation with Heat Recovery Heat Recovery Efficiency 85%
Space Heating	VRF Heat Pump System CoP 5.7 SEER 11.3
Water Heating	Mitsubishi QAHV high temperature CO ₂ ASHP's serving hot water storage vessels CoP 3.3
Renewables	Photovoltaic Array



7.5.1 Proposed Renewable Energy Generation System

Photovoltaic Array

Photovoltaic (PV) arrays have been selected as an appropriate renewable energy technology to contribute to the CO₂ emission reduction target for the development and to support the requirements stipulated within Places for Everyone. PV arrays are relatively straightforward to install, benefit from low maintenance costs and will reduce the operational cost of the building. The use of PV in general at this site would provide the following benefits:

- Reducing the buildings electrical energy grid load;
- Simple installation and commissioning;
- Low maintenance; and,
- Reliable, proven technology.

Proposed System Details –

- It is proposed that PV panels will be mounted on the roof.

Figure 7.2 – Proposed PV Layout

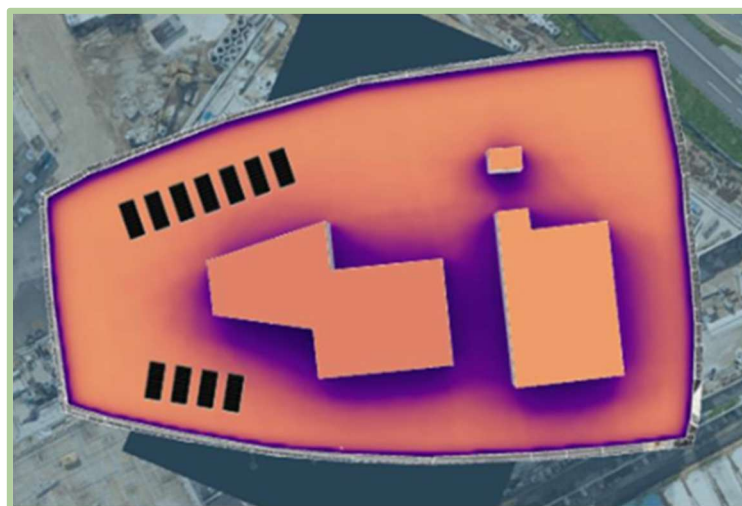


Table 7.8 – Proposed PV Area

	Solar PV
Ground Floor Area (m ²)	926
Proposed PV Area (m ²)	28.4
PV Footprint area (% of ground floor area)	3%

Land Use –

- There are no land use issues associated with PV technology at this site;
- The development has sufficient roof area to accommodate the PV arrays; and,
- The PV arrays can be installed as part of the roof system in order to minimise the visual impact.



Local Planning Issues –

- There are no planning policy issues associated with this technology and this type of technology is favoured under the PfE requirements.

Noise Issues –

- PV is silent in operation.

Whole life cost and lifecycle impact –

- Current installed costs for PV are approximately £1,500 / kWp installed.
- Additional costs throughout the system's thirty-year lifecycle are limited to:
 - Cleaning of the arrays; and,
 - Replacement of the DC / AC inverter unit which typically have a lifespan of around ten years.

Air Source Heat Pumps

The student accommodation will be served by heat pump technology for both space heating and domestic hot water. Space heating and cooling will be provided through a Variable Refrigerant Flow (VRF) system, offering efficient temperature control throughout the building. Domestic hot water demand will be met by Mitsubishi QAHV high-temperature CO₂ air source heat pumps, supplying hot water storage vessels. These systems are designed to operate highly efficiently, reducing energy demand and supporting the building's overall sustainability objectives. Further benefits are as follows:

- Highly energy-efficient system, thus limiting electrical energy demand and associated carbon dioxide (CO₂) emissions;
- This technology benefits from a low 'carbon footprint' due to the inherent efficiency of the heat pump process. It is a well-established technology with an anticipated long lifespan - with proper care they can be operational for up to twenty years;
- Omission of fossil fuel connection from the proposed scheme will enable the development to track the decarbonisation of the UK electricity grid over time and reduce operational carbon emissions as a consequence; and,
- ASHPs primarily consume grid mix electricity which is, in part (albeit diminishing) sourced from a mix of fossil fuels / LZC and nuclear.

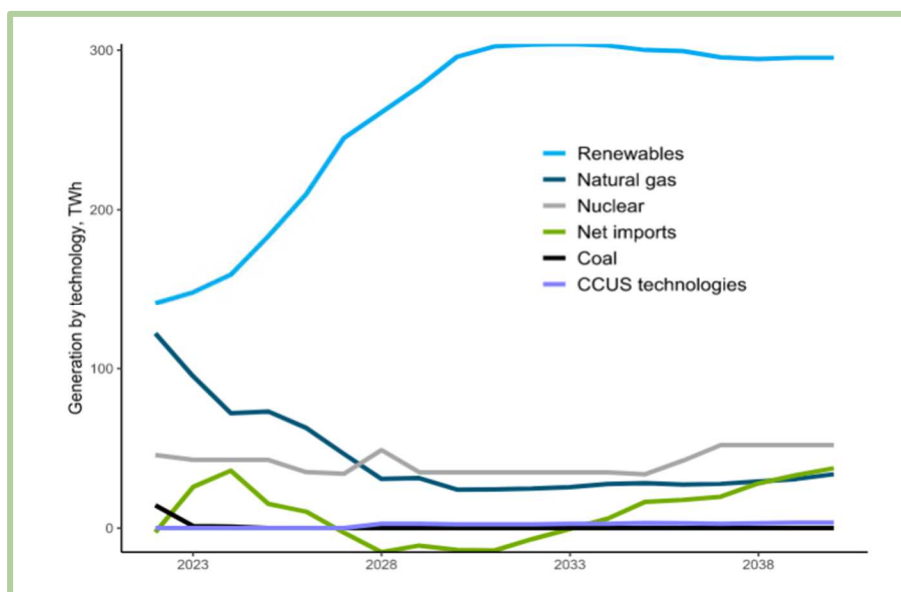
7.6 Low Carbon Heating

7.6.1 Fossil Fuel Free

The scheme will be fossil fuel free. As the UK electricity grid's CO₂ footprint continues to improve, so too would the carbon dioxide emissions associated with the operational phase of the proposed scheme, which benefits from highly efficient systems.



Figure 7.2 - Electricity Generation by Fuel Source, TWh



Source – BEIS, Energy and Emissions Projections (2022)

UK grid mix electricity carbon emissions will decrease significantly by 2035, with the carbon intensity of electricity generation falling by 93% between 2020 and 2035. This is due to the progressive shift away from fossil fuels as demonstrated in Figure 7.2.

The energy strategy for the scheme uses a combination of air source heat pumps and photovoltaics. The air source heat pumps are highly efficient systems that utilise grid electricity to provide space heating and domestic hot water. The use of heat pumps will ensure that fossil fuels converted and distributed through the National Grid as electrical energy will be consumed cleanly and efficiently.

Therefore, this will further support the schemes move towards operational net zero carbon in accordance with the Places for Everyone requirements.

7.6.2 Proposed Heating and Hot Water System

Domestic hot water will be served by Mitsubishi QAHV high-temperature CO₂ air source heat pumps, supplying hot water storage vessels. This system operates with a COP of 3.3. Space heating Variable Refrigerant Flow (VRF) system which operates with a SCOP of 5.7.

7.6.3 Proposed Cooling System

Space cooling can be provided by the VRF system, which operates with a SEER of 11.3.

However, **compliance with Building Regulations Approved Document O: Overheating and CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes** has been **demonstrated without the need for active cooling**. Overheating mitigation is achieved through passive measures, including purge ventilation via rapid ventilation panels and the provision of mechanical ventilation supplying fresh air to the rooms.



8. LOW CARBON HEAT APPRAISAL

This Low-Carbon Heat Appraisal has been prepared to support the planning application for the development at First Street, Block C.

It assesses the predicted performance of the proposed heating system, against the required Key Performance Indicators (KPIs) for major scale developments such as this.

The development falls under Places for Everyone **Location Case 1**, which applies to sites located within 500m of an existing low carbon heat network. This development is located within 500m of The Manchester Civic Quarter Heat Network, which is a gas fired CHP system.

As this scheme has a GIA over 1000m² it is considered a Major application. This triggers the need for a Low Carbon Heat Appraisal comparing a set of Key Performance Indicators (KPIs) against the proposed system. This can be seen in Table 8.1.

For Major applications, the energy carbon requirements, are as follows:

1. Non fossil fuel based system proposed
2. The carbon content of heat (delivered) is less than 100gCO₂/kWh

Policy JP-S3 states that all major applications falling under cases 1, 2, or 3 will be required to include a comparison of the proposed heating system against selected alternatives, including a low-carbon heat network and an on-site communal heating system.

- **Case 1:** The site is within 500m of an existing low carbon heat network
- **Case 2:** The site is within 500mm of a planned low carbon heat network
- **Case 3:** The site is within a low carbon heat network opportunity area
- **Case 4:** Any other location

Furthermore, there is an expectation that connection to a low carbon heat network is proposed 'unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is not practicable or financially viable'.

There are four key grounds for exemption, these are as follows:

1. **Carbon Grounds:** An alternative on-site heating system would be lower carbon than the carbon content of heat (delivered) of the low carbon heat network.
2. **Heating costs grounds:** Connection to the low carbon heat network would lead to heating costs for the residents which are more than 10% higher than an on-site heating system with an equal or lower carbon content of heat.
3. **Cost effectiveness grounds:** Connection to the low carbon heat network (and the installation of on-site interim heating plant if needed) would not be as cost effective as installing an on-site heating system with an equal or lower carbon content of heat.
4. **Technical/practical grounds:** There are significant technical/practical reasons why the development cannot connect.

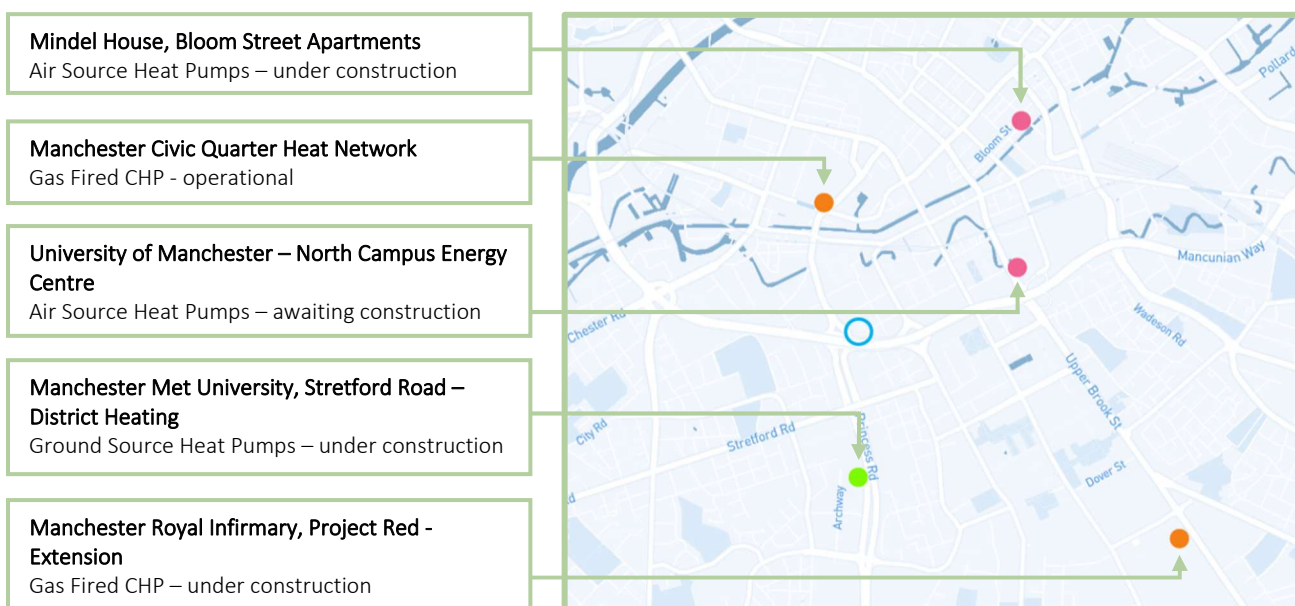


A review was undertaken to determine whether the site lies within a District Heat Network zone, in accordance with the Places for Everyone guidance for Manchester. It was determined that the site is located within an existing gas fired CHP heat network and is therefore **classified as Case 1**, as noted above.

8.1 District Heat Network Review

Figure 8.1 – Map of Heat and Energy Network Opportunity Areas

Figure 8.1 below shows a snippet of the Greater Manchester Heat Networks Planning database, the area circled in blue is the Block C site location.



8.1.1 Operational Heat Networks

The Manchester Civic Quarter Heat Network is currently operational. However, the network is served by gas-fired CHP and is therefore not considered a low-carbon heat source. While the carbon intensity of the network is understood to perform marginally better than a conventional gas-fired system, the development is already specified with highly efficient all-electric systems which are expected to achieve significantly lower operational carbon emissions.

8.1.2 Proposed Heat Networks

The University of Manchester – North Campus Energy Centre, Manchester Metropolitan University Stretford Road District Heating network, and Manchester Royal Infirmary Project Red Extension are all either under construction or awaiting construction and are therefore not currently available to serve the development. However, as the student accommodation has been designed with a ‘wet system’ serving the domestic hot water, allowing for a potential connection to a low carbon district heat network in the future.



8.2 KPI Assessment Summary

As the student accommodation was designed and specified prior to the introduction of the new Places for Everyone (PfE) guidance, the building systems and servicing strategy had already been established.

The development was therefore designed in accordance with the applicable standards and policy requirements in place at the time and achieved the relevant carbon and energy performance targets during the design stage.

However, the development still performs strongly against the requirements of the new PfE guidance, with the systems in place being highly efficient. As a result, a comparison against alternative systems has been deemed unnecessary, and the applicable KPIs have therefore been addressed within Table 8.2.

Table 8.1 – Proposed and Alternative Systems

	Specified System
Space Heating	VRF Heat Pump System CoP 5.7 SEER 11.3
Domestic Hot Water	Mitsubishi QAHV high temperature CO ₂ ASHP's serving hot water storage vessels CoP 3.3
Ventilation	MVHR

Table 8.2 – KPI Performance Assessment

	Key Performance Indicators	Specified System
Environmental Performance	Fossil Fuel	No
	Carbon Content of Heat (gCO ₂ /kWh)	35
	Local Pollution	None, system is 'full electric'
Impact on users	Estimated Running Costs for heating & Hot water (£/yr/building)	£101,688
Infrastructure development	Connection to low carbon Heat network	Potential future connection
	Scale of application GIA m ²	18,438 m ²



8.2.1 Running Costs

The estimated running cost is based on the average space heating and hot water demand derived from the representative CIBSE TM54 predictive energy calculations, multiplied by the average electricity prices for July to September 2025 as published by the House of Commons Library. These figures can be seen below:

- Average Standing charge: £0.5368/day
- Average Day rate: £0.2635/kWh

Table 8.2 – Estimated Running Cost²

Estimated heating demand (Space & Water) kWh/year	Standing Charge £/year	Day rate cost £/year	Estimated running Cost £/year/building
385,169	195.93	101,492	101,688

8.2.2 Carbon Emissions

This option is considered fossil-fuel-free as it is fully electric, resulting in no local pollution at the point of use. Unlike gas boilers, which burn fossil fuels within the dwelling, producing local emissions. Furthermore, as the UK electricity grid's CO₂ footprint continues to improve, so too would the carbon dioxide emissions associated with the operational phase of the proposed scheme, which benefits from highly efficient systems.

The carbon content³ of the proposed heating strategy is specified below:

Variable Refrigerant Flow Heat Pump System:

- Efficiency of system: SCOP of 5.70
- Carbon content of delivered heat: 31 gCO₂/kWh

Mitsubishi QAHV high temperature CO₂ ASHP's:

- Efficiency of system: SCOP of 3.30
- Carbon content of delivered heat: 54 gCO₂/kWh

Weighted average of Carbon content:

- Space heating is 82% of heating demand
- Water heating is 18% of heating demand
- Carbon content of the proposed system is 35 gCO₂/kWh

Furthermore, the refrigerant used in the Mitsubishi QAHV high temperature CO₂ heat pump system is R744, which has a global warming potential (GWP) of 1, classed as a very low-impact refrigerant under the F-gas Regulation.

² The estimated running cost is based on the average space heating and hot water demand derived from the representative CIBSE TM54 predictive energy calculations, multiplied by the average electricity prices for July to September 2025 as published by the House of Commons Library. These figures can be seen below:

- Average Standing charge: £0.5368/day
- Average Day rate: £0.2635/kWh

³ According to the 2025 Government Greenhouse Gas (GHG) Conversion Factors published by DESNZ, the carbon content of grid electricity is 0.177 kgCO₂ per kWh. This emission factor has been used to estimate the operational carbon performance of the proposed full electric heating system.



9. OVERHEATING RISK

9.1 Overheating Risk Assessment

An overheating analysis has been undertaken by Abacus Consult Limited for the five-hundred and fifty-five room purpose-built student accommodation in accordance with Building Regulations Approved Document O: Overheating and CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes. The Abacus Consult Limited report is included within Appendix B. The dynamic thermal modelling method for demonstrating compliance with requirement O1 has been followed as stipulated within the Places for Everyone guidance and Approved Document O.

The CIBSE TM59 calculations have been carried out using IESVE. IESVE is a dynamic simulation software that is fully compliant with CIBSE AM11. IESVE uses the 'SunCast' solar shading module to model the sun path and solar shading effect for the proposed building. The 'MacroFlo' module has been used to simulate the natural ventilation openings using a selection of appropriate control profiles.

9.2 Data Inputs and Building Model

Table 9.1 below summarises the building fabric specification which has been applied to the thermal simulation model for the dwellings.

Table 9.1 – Thermal Fabric Performance Levels

Building Element	U-Value (W/m ² K)
External Walls	0.73
Exposed Floors	0.18
Flat Roof	0.18
Glazing	0.73 (g-value of 0.40)
Personnel Doors	1.60
Air Permeability m ³ /hm ² (@50Pa.)	3.00

9.2.1 Weather Data

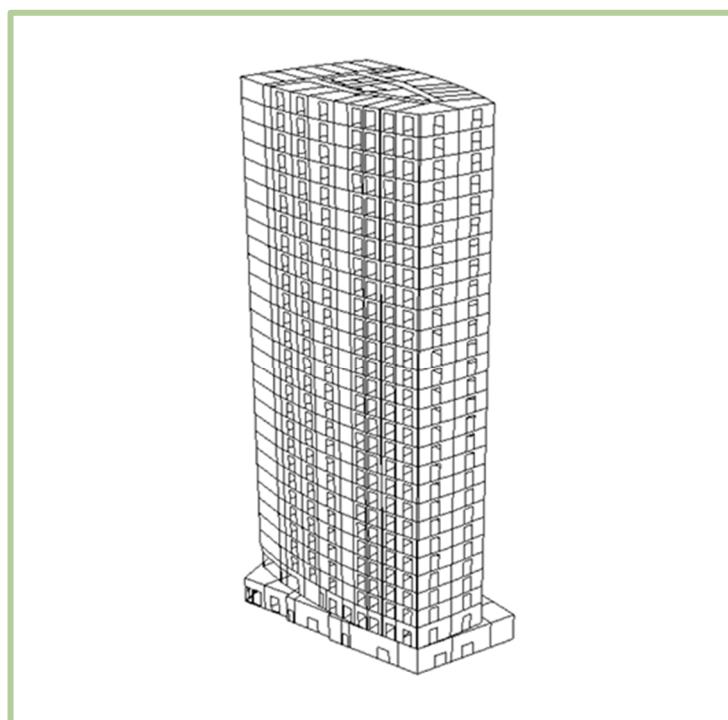
The weather data used in this study is the CIBSE DSY1 2020's, high emissions 50th percentile for Manchester as this is the most applicable to the site.

9.2.2 Internal Gains

The internal gains and profiles that have been used for the internal temperature analysis model have been taken from CIBSE TM59 and the full tables for reference can be found in Appendix A. Single occupancy has been assigned to all the bedrooms because they are single occupancy rooms, let on a single occupancy basis.



Figure 9.1 – Dynamic thermal model of First Street, Block C



9.3 Ventilation Strategy

9.3.1 Mechanical Ventilation

Mechanical ventilation with heat recovery is included in the analysis based on the results of the Part L modelling. Ventilation extract rates have been set up in the model in accordance with the flow rates listed below. Ventilation flow rates for the kitchen/living spaces have been increased to 30 l/s from the minimum Part F boost rate of 13 l/s to mitigate overheating in these spaces. For the avoidance of doubt, Part F purge vent is not assessed in this thermal comfort analysis. Part F purge vent and any requirement for additional mechanical ventilation to meet Part F purge vent is assessed separately.

Table 9.2 – MVHR flow rates included in the TM59 model

Reference	Flow Rate
Cluster Bathroom	8 l/s
Kitchen/living (not air conditioned)	30 l/s
Kitchen/living (air conditioned)	13 l/s
Studio	21 l/s

9.3.2 Acoustic Restrictions

For acoustic break in reasons, the opening hours of the rapid vents are limited for the purposes of this analysis. Vents should remain closed overnight between the hours of 23:00 and 07:00.



9.3.3 Air Quality Restrictions

Levels 01–04 have a sealed façade due to air quality constraints and are therefore provided with VRV heating and cooling systems to mitigate the risk of overheating. The levels above can rely on opening rapid vents for natural ventilation and have been assessed through TM59 overheating analysis. The top four floors are also equipped with VRV heating and cooling systems; however, these are not required for overheating mitigation and are instead provided to satisfy Part L compliance requirements.

9.4 TM59 Results

This assessment has determined the thermal comfort performance of occupied areas against the performance requirements of CIBSE TM59 for predominantly naturally ventilated homes.

It can be seen from the results Table 9.3 that the proposals as described in this document, fully comply with the requirements of CIBSE TM59. All rooms passed initial simulation under the Manchester DSY1 weather file. The TM59 analysis does not include the use of blinds in line with Part O. The analysis as described in this report therefore complies with CIBSE TM59 when mechanical extract ventilation rates are set to the requirements stated in Table 9.2.

Table 9.3 – Manchester DSY1 TM59 Results for a typical floor

Room Name	Room ID	Criterion A (%)	Criterion B (hr)	Pass/Fail
5 Bed Cluster Bedroom 1	LV00000B	0.30	11	Pass
Studio 1	ST000000	0.00	1	Pass
Studio 2	ST000006	0.10	2	Pass
Studio 3	ST000005	0.10	3	Pass
Studio 4	ST000004	0.10	3	Pass
Studio 5	ST000003	0.20	3	Pass
Studio 6	ST000002	0.20	3	Pass
Studio 7	ST000001	0.20	3	Pass
Studio 8	LV000010	1.10	12	Pass
Studio 9	LV00000F	2.60	20	Pass
Studio 11	LV000006	0.00	0	Pass
Studio 12	LV00000C	0.10	4	Pass
4 Bed Cluster Bedroom 1	LV00000D	0.20	4	Pass
4 Bed Cluster Bedroom 2	LV000011	0.10	1	Pass
4 Bed Cluster Bedroom 3	LV000012	0.10	1	Pass
4 Bed Cluster Bedroom 4	LV000013	0.30	5	Pass
4 Bed Cluster KLD	LV000004	0.10	1	Pass
5 Bed Cluster Bedroom 2	LV000007	0.10	2	Pass
5 Bed Cluster Bedroom 3	LV000008	0.00	0	Pass
5 Bed Cluster Bedroom 4	LV000001	0.00	0	Pass
5 Bed Cluster Bedroom 5	LV00000A	0.00	0	Pass
5 Bed Cluster KLD	LV000009	0.00	1	Pass
Studio 10	LV00000E	0.20	3	Pass
4 Bed Cluster Bedroom 1	LV00000D	0.20	3	Pass



9.4.1 Design for projected climate change

For the purposes of BREEAM Hea04 the student accommodation has also been simulated against the Manchester DSY2 2050s high emissions 50th percentile and DSY3 2080s high emissions 50th percentile weather files to simulate future climate conditions and assess the adaptability for climate change. The future weather file simulations proved the following:

- Thermal modelling demonstrates compliance with CIBSE AM11 Building Energy and Environmental Modelling criteria.
- The TM59 calculation still achieves a pass through the use of opening the rapid vent panels to overcome overheating issues.
- Modelling of the air conditioned/mechanically ventilated building spaces demonstrates that during occupied hours the temperature range meets CIBSE Guide A Environmental Design criteria.



10. MATERIALS

10.1 Whole Life Cycle Assessment & Upfront Embodied Carbon

An LCA was prepared by Ramboll prior to the introduction of Greater Manchester Combined Authority 'Places for Everyone' (PfE) Design Guidance for Net Zero requirements. However, this assessment aligns with what is required for the net zero design and carbon reporting requirements set out in the 2025 Places for Everyone guidance.

The purpose of this assessment is to assess the whole life carbon impact of the proposed scheme, in line with the Royal Institute of Chartered Surveyors (RICS) Professional Statement 2nd Edition (incorporating all life cycle modules), and to separately report on the upfront embodied carbon (lifecyle modules A1–A5), whole life cycle carbon (lifecyle modules A-C, excluding B6, B7 and D), and life cycle module D.

The Places for Everyone guidance outlines various metrics and key performance indicators (KPIs). These are used to measure success of Net Zero Carbon design and construction to provide an indication of how design decisions have influenced the carbon performance of the building.

Below are the upfront embodied carbon ($\text{kgCO}_2\text{e/m}^2$) targets outlined for non-residential developments in section 2: Energy and Carbon requirements of the Design Guidance for Net Zero, Places for Everyone policies.

Table 10.1 – Places for Everyone, Upfront Embodied Carbon Targets

	Minor development		Major development	
	Small minor <100m ²	Minor 100-999m ²	Major 1,000-4,999m ²	Large major +5,000m ²
Upfront embodied carbon ($\text{kgCO}_2\text{e/m}^2_{\text{GIA}}$) Minimise embodied carbon				

As the First Street, Block C scheme exceeds 5,000 m², it is classified as a 'Large Major' development under PfE guidance. Therefore, the upfront embodied carbon has been measured in $\text{kgCO}_2\text{e/m}^2$, as shown in Table 10.1.

For this scheme, the student accommodation achieves an upfront embodied carbon value of 707 $\text{kgCO}_2\text{e/m}^2$.

The purpose of the Life Cycle Assessment is to quantify the environmental impacts of the First Street, Block C scheme in accordance with the methodology expressed within the RICS Professional Statement – 2nd Edition (2021).



The total global warming potential for the scheme has been calculated as follows:

Table 10.2 – Results Summary

	Tonnes CO ₂ e	kgCO ₂ e/m ²
Upfront Carbon	13,463	707
Whole Life Carbon Assessment	19,437	1021

	First Street, Block C - kgCO ₂ e/m ²
Upfront	707
Whole life	1021

Table 10.3 shows the top three materials with the highest upfront embodied carbon emissions (kgCO₂e/m²GIA).

Table 10.3– Top Three Materials with Highest Embodied Carbon

	Upfront embodied carbon (kgCO ₂ e/m ² GIA)	
Minimise embodied carbon	Material 1: Ready-mix concrete for external walls & floors	67.9 kg CO ₂ e/m ²
	Material 2: Glass façades and glazing	54.6 kg CO ₂ e/m ²
	Material 3: HVAC components and equipment	46.1 kg CO ₂ e/m ²

10.2 Efforts Made to Minimise Embodied Carbon

The proposals will contribute towards making more efficient use of non-renewable materials resources, and to reducing the lifecycle impact of materials used in construction. This is demonstrated by:

- A key consideration in materials selection will their environmental performance, alongside commercial and aesthetics. Indirect carbon emissions will therefore be taken into account, including those involved in the extraction/cultivation, manufacture and handling processes; and subsequent, in-life emissions resulting from the use of those materials in development;
- Materials with a low environmental impact throughout their life cycle will be prioritised within the new buildings. Plus, materials with associated Environmental Performance Declarations (EPD's) will be favoured;
- Responsibly sourced materials from suppliers operating an Environmental Management System and procuring timber verified by either the Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification standard (PEFC) will be prioritised;
- Material selection will be carefully considered to avoid the use of toxic materials, such as Volatile Organic Compounds (VOCs) and contribute towards creating a healthy indoor environment; and,
- Local sourcing of construction materials where feasible and viable will minimise the impact of carbon dioxide emissions associated with the transportation of materials.



Appendix A – First Street South Block C, Manchester

TM54 Report



First Street South Block C, Manchester

TM54 Report



Project Number:	L1513-XX-XX-RP-M-50001
Document Ref:	TM54 Report
Engineer:	P.Abel
Revision:	WIP
Issue Date:	24-04-2026

Abacus Consult Limited

First Street South Block C, TM54 Report

Project: First Street South Block C

Subject: TM54 Report

Prepared for: Downing Living Manchester South Ltd Partnership Incorporated

Revision	Issue/Revision Description	Prepared By	Approved By	Issue Date
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1.0 Introduction

This assessment has been carried out at RIBA Stage 3. At this point, the building geometry, fabric specification, and primary building services strategies are sufficiently defined to enable detailed energy modelling. However, certain elements such as final control strategies, equipment selections and operational procedures remain subject to further development. As such, the results presented should be considered indicative of the design intent at this stage and may be refined as the project progresses.

1.01 Purpose of the TM54 Assessment

The purpose of this assessment is to evaluate the predicted operational energy performance of the proposed development using the methodology set out in CIBSE TM54. Unlike compliance based assessments, this analysis aims to provide a more realistic estimate of actual in-use energy consumption by incorporating detailed operational assumptions, system performance characteristics and end-user behaviours. The study is intended to identify key drivers of energy use and highlight potential performance gaps to inform design decisions to improve the building's operational efficiency and performance.

1.02 Scope of Analysis

The scope of this assessment includes a dynamic simulation of the building's annual energy consumption, covering both regulated and unregulated energy uses. The analysis considers all major end uses, including heating, cooling, ventilation, lighting, domestic hot water and small power loads. The model reflects the proposed architectural and building services design at the current project stage and incorporates realistic occupancy patterns, internal gains, and control strategies.

2.0 Building Description

2.01 Site Location

Building C is on the First Street South campus, bound by Hulme Street to the north and Medlock Street to the west. It is a 28 storey building with plant, switch rooms, main entrance and management suite on level 00, amenity areas on levels 00 and 01 and student accommodation areas on levels 1 to 27. The proposals will deliver a residential building comprising 555 bed spaces.



Figure 1 – Indicative site map from Google Maps

2.02 Fabric specification

The fabric specification is set out in the table below. The specification is the same as that set out in the proposed Part L and Part O reports.

Elements	U Value	Notes
Opaque façade panels	0.73 w/m ² /K	
Opaque stick façade	0.73 w/m ² /K	
External walls	0.16 w/m ² /K	
Exposed floors	0.18 w/m ² /K	
Flat roofs	0.18 w/m ² /K	
Vision façade panels	0.73 w/m ² /K	
Vision stick façade	0.73 w/m ² /K	
Windows	1.2 w/m ² /K	
Personnel doors	1.6 w/m ² /K	
Air permeability – 3 m ³ / (h.m ²) at 50Pa		

Thermal bridging values for the building have been left as default throughout except for opaque and vision façade panels which have been reduced to 0. This is due to the thermal bridging being included within the area weighted u value calculations provided by Focchi.

2.03 Building Services Strategy

- Lighting Gains are based on Stage 3 calculations and will be finalised upon completion of Stage 4 calculations.
- Air Permeability is based on maximum 3.0 m³/m².Hr at 50Pa.
- Ventilation is via MVHR systems as detailed in Abacus Consult Ventilation Strategy. Fan SFP's are currently based on worst case and will be finalised at as-built stage.
- Mechanical heating and cooling via VRF heat pump systems to management suites, amenity areas, limited clusters and studios on levels 01-04 and 24-27.
- Domestic hot water production via Mitsubishi Qton high temperature CO₂ air source heat pumps serving hot water storage vessels.

2.04 Operational Assumptions

For the purposes of this operational energy assessment, occupancy patterns have been defined to reflect the typical use profile of student accommodation within the UK academic calendar. Occupancy has been assumed to align with standard university term times, with high utilisation expected during teaching periods and reduced occupancy during holiday and break periods. A diversified daily profile has been applied to reflect typical student behaviour, including daytime absences associated with academic activities and higher occupancy during evenings and overnight periods. Allowances have also been made for partial occupation outside of core term times, recognising that a proportion of students may remain in residence year-round.

Small power loads have been derived using equipment schedules provided by the client as attached in appendix 1. The resulting load profile reflects both the diversity and intermittency of plug loads, while still allowing for peak usage. This methodology ensures that the small power demand is representative of both expected occupant behaviour and the proposed fit-out specification.

4.0 Modelling Methodology

4.01 Software Platform

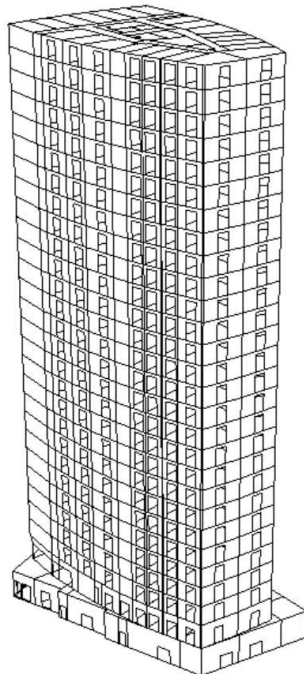
Dynamic thermal modelling has been undertaken using the Apache engine in IESVE, which is recognised under CIBSE AM11 as an approved simulation tool for detailed building performance analysis.

The model has been developed to represent:

- Building geometry and zoning in detail
- Fabric thermal properties in accordance with design specifications
- Integrated building services systems, including HVAC, lighting and hot water

4.02 Weather Data

Simulations have been carried out using CIBSE weather files for Manchester.



4.03 Architectural layouts

The SHP drawings that have been used to create the model are as follows:

- 63088-SHA-ZZ-00-D-A-200101_General Arrangement Plan Level 00_P01_S4

- 63088-SHA-ZZ-01-D-A-200101_General Arrangement Plan Level 01_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200101_General Arrangement Plan Type 01 (Levels 02,08,14)_P02_S3
- 63088-SHA-ZZ-ZZ-D-A-200102_General Arrangement Plan Type 02 (Levels 03,05,07)_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200103_General Arrangement Plan Type 03 (Levels 04,06,10)_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200104_General Arrangement Plan Type 04 (Levels 16,18,20)_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200105_General Arrangement Plan Type 05 (Levels 17,19,21)_P01_S4
- 63088-SHA-ZZ-28-D-A-200101_General Arrangement Plan Level 28 - Roof Plant_P01_S4
- 63088-SHA-ZZ-RF-D-A-200101_General Arrangement Plan Roof Level_P01_S4

5.0 Energy Breakdown

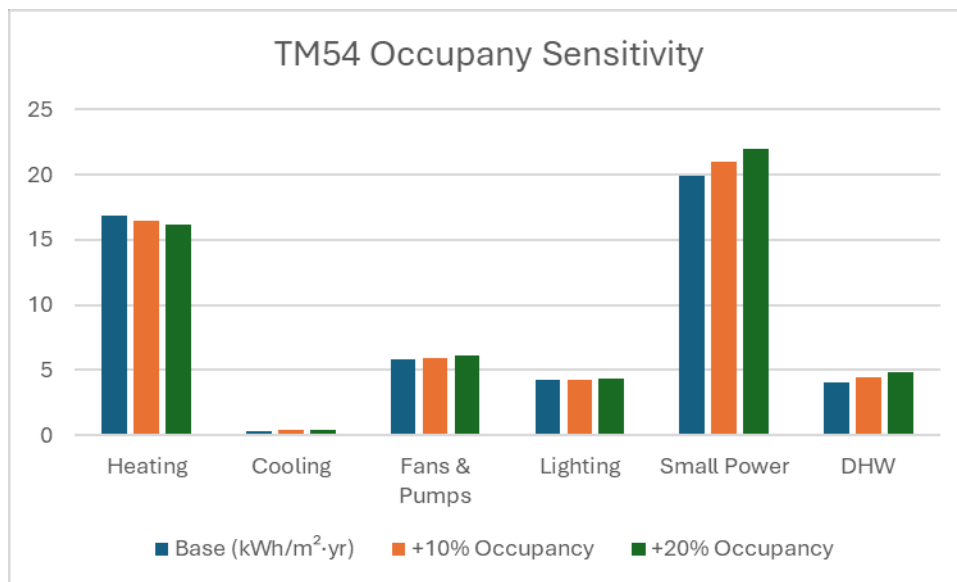
The TM54 assessment indicates a total annual regulated energy consumption of 31.38 kWh/m²·yr. Space heating accounts for 16.84 kWh/m²·yr, representing a significant proportion of the regulated load, while cooling demand is minimal at 0.37 kWh/m²·yr reflecting the limited reliance on mechanical cooling. Energy associated with fans and pumps contributes 5.86 kWh/m²·yr, lighting demand is 4.26 kWh/m²·yr and domestic hot water consumption is calculated at 4.05 kWh/m²·yr. Small power represents the largest single end use at 19.95 kWh/m²·yr, forming most of the unregulated load and highlighting the impact of occupant-related energy use. It should be noted that, as this assessment has been undertaken at RIBA Stage 3, the results are subject to a degree of uncertainty due to the developing nature of the design and associated assumptions.

5.01 Comparison with Benchmarks

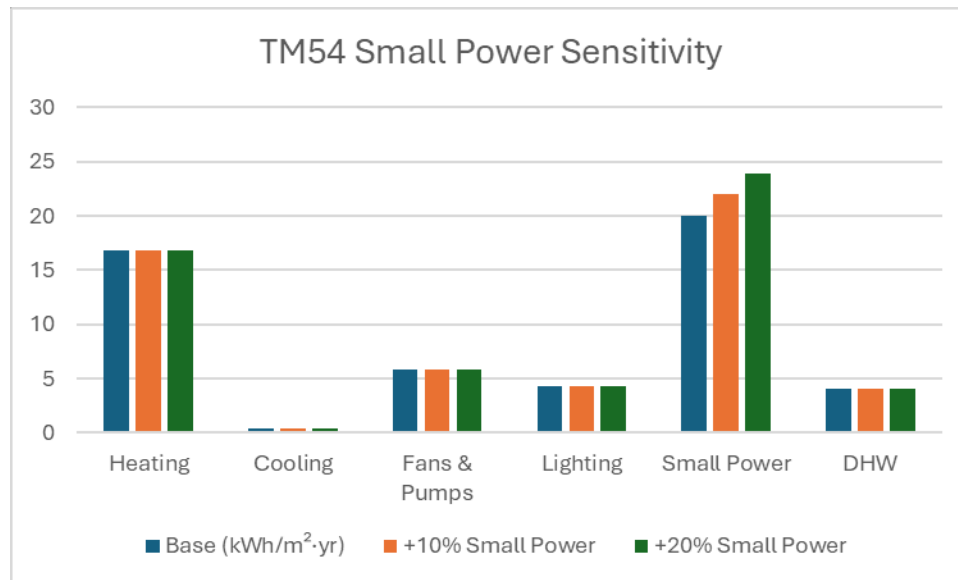
When compared against the benchmarks set out in CIBSE Guide F, the predicted energy performance of the proposed student accommodation appears to be significantly better than typical good practice values. Guide F indicates a benchmark of approximately 85 kWh/m²·yr (noting this is often expressed as an energy intensity rather than W/m² in annual terms) for buildings of this type, whereas the TM54 assessment predicts a total regulated energy consumption of 31.38 kWh/m²·yr and 51.33 kWh/m²·yr when including unregulated small power loads. This represents a substantial reduction relative to the benchmark, indicating a highly energy-efficient design.

7.0 Sensitivity Analysis

Increasing occupancy above the standard student accommodation assumptions would be expected to drive a corresponding increase in domestic hot water demand and a moderate increase in small power consumption and smaller increases in lighting and auxiliary energy. Space heating demand may reduce slightly due to increased internal gains from occupants and equipment but there may be a small rise in cooling demand where higher occupancy contributes to overheating risk. The expected differences in energy usage for each system at 10% and 20% increased occupancy can be seen in the charts below.



Less efficient small power equipment would be expected to affect overall energy consumption more directly, as plug loads are unregulated and form a substantial proportion of the total operational energy in buildings. The significant effect of a 10% and 20% increase in small power loads can be seen in the table below.



The tables above provide a useful sensitivity check against the TM54 outputs and can be used to compare how the simulation responds to changes in occupancy and occupant-related equipment loads.

8.0 Conclusion

This TM54 assessment has been undertaken at RIBA Stage 3 to provide an estimate of the likely operational energy performance of the proposed development based on the current design information. The analysis indicates a total predicted operational energy intensity of 51.33 kWh/m²·yr including both regulated and unregulated energy uses and regulated energy accounting for 31.38 kWh/m²·yr.

In comparison with benchmarks presented in CIBSE Guide F, the proposed development demonstrates a level of performance that is better than typical good practice for buildings of this type. This reflects the adoption of a building services strategy incorporating mechanical ventilation with heat recovery, heat pump-based domestic hot water generation, and a thermally efficient building fabric.

It should be noted that as the assessment is based on Stage 3 design information a number of inputs remain subject to further development. These include system efficiencies, control strategies and aspects of the detailed building fabric. As such, the results presented should be considered indicative of the current design intent rather than a definitive prediction of in-use performance.

The analysis identifies that small power forms a significant proportion of the total energy consumption. This highlights the importance of occupant behaviour and equipment specification in determining actual operational performance. Sensitivity testing also demonstrates that variations in occupancy and small power loads can have a noticeable impact on overall energy use.

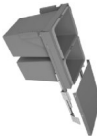
While the modelling has been developed in accordance with TM54 methodology and incorporates realistic operational assumptions, there remains an uncertainty associated with predicting in-use energy consumption at this stage. The potential for variation between predicted and actual performance will be influenced by factors including user behaviour, system operation and ongoing maintenance.

9.0 Appendix 1 Small Power Equipment Schedules

Typical Kitchen / Lounge
finishes schedule

D6	Television with ONMD & Control	Philips Professional LED TV, 43" EasySuite Plus matching bracket.	Awave	All equal and approved	
D7	Window Sheers (upgrade option for those with overbooked silas)	Full Length Sheers Pencil Pleat Unlined Skopos Design Linear Stripe Refer to Skopos Quote for Full Product Description	Skopos	All equal and approved	
D8	Window Curtains (upgrade option for dense overbooked silas)	Full Length Blackout Curtains Pencil Pleat Unlined Skopos Design Linear Gunmetal Refer to Skopos Quote for Full Product Description	Skopos	All equal and approved	
D - ACCESSORIES & WINDOW COVERINGS					
E1	Oven	CDA Integrated Black Multifunction Oven Code: SL30BL Dimensions: W: 595mm D: 550mm H: 595mm	Kitchen subcontractor	All equal and approved	
E2	Comb Microwave	CDA Built-in Black Microwave, Oven & Grill Code: HCR19 Dimensions: W: 595mm D: 390mm H: 385mm	Kitchen subcontractor	All equal and approved	
E3	Hob	CDA 4 Ring ceramic Hob Code: HC62TFR Dimensions: W: 570mm D: 570mm H: 65mm	Kitchen subcontractor	All equal and approved	
E4	Tall Fridge	CDA Integrated Tall Fridge Code: CR1621 Dimensions: W: 540mm D: 545mm H: 1770mm	Kitchen subcontractor	All equal and approved	
E5	Tall Freezer	CDA Integrated Tall Freezer Code: CR1621 Dimensions: W: 540mm D: 545mm H: 1770mm	Kitchen subcontractor	All equal and approved	
E6	America Style F/F	HI Sense American Fridge / Freezer 700W Code: RQ78NMSAYSE Dimensions: W: 912mm D: 726mm H: 1785mm	Kitchen subcontractor	All equal and approved	
E7	Tap	Chrome Mixer Tap Fixed To The Sink Tap Hole With All Necessary Accessories And Plumbing	Kitchen subcontractor	All equal and approved	
E8	Sink	Pier 111 Sink 2 No. 32 Litre Stainless Steel Sink With Tap Hole And Overflow For In Base Cabinet Dimensions: W: 500mm D: 760mm H: 200mm	Kitchen subcontractor	All equal and approved	
E9	Pull-out Bin	Vaith-Sagel VS ENV Space XX Pro S Lava Grey 2 No. 32 Litre Bin Inserts 1 No. 21 Litre Bin Insert	Kitchen subcontractor	All equal and approved	
E10	Cooker Hood	Vent-Axia Aluminium Pull-Out System Hood To Fit in 600mm Wide Aperture With 2 No. Low Energy 9W Lamps Stock Ref: 474791	Kitchen subcontractor	All equal and approved	
E11	Strip LED to wall units	Submit proposals to kitchen wall units	Kitchen subcontractor	All equal and approved	

C - LOOSE FURNITURE					
C1	Desk Chair	Desk Chair Product Code: TBC Upholstery: TBC Base Finish: TBC	TBC	Site specific colour selection	
C2	Lounge Chair (Optional / upgrade)	Lounge Chair Product Code: TBC Upholstery: TBC Base Finish: TBC	TBC	Site specific colour selection	
C3	Mattress	Standard UK Double Neolux mattress as baseline Dimensions: 1900L X 1350V	TBC		
C4	Mirror	Muto Large Framed Mirror, Clear Glass Powder Coated Steel Frame Colour: Taupe Dimensions: H:118 X W:44.5 X D:4CM	Muto	All equal and approved	
D - ACCESSORIES & WINDOW COVERINGS					
D1	Window Blinds	Blackout Roller Blind 100% Polyester, Flame Retardant, Manually Operated With Black Aluminium Bottom Bar Frame Extent to be Extended Beyond Bottom Rail.	Shops	All equal and approved. Blind window / facade interface to be detailed as RIBA Stage 3 deliverable	
D2	Furniture Hinges And Drawer Packs Wardrobe / Drawers	To Be Commercial Quality and Durable Fixings. Where Required 180° Hinges To Be Fixed.	TBC By Casework Supplier	All equal and approved	
D3	Ironmongery Wardrobe	Black Powder Coated Steel Handles To Match RAL 9004 Signal Black. Widthin x H650mm.	TBC By Casework Supplier	All equal and approved	
D4	Coat Hooks	Muto Coil Coat Hook Finish: Dark Green, Anodized Aluminium Dimensions: H95 X D65 X W:100MM	Muto / Casework Supplier	All equal and approved	
D5	Wall Light	Astro Enna Square Switched LED Wall Light Finish: Matt Black Code: 1058024 Dimensions: H110 X W110 X D130MM	Astro Lighting	All equal and approved	
D6	Television with CMD & Control	Philips Professional LED TV, 43" EasySuite Plus matching bracket.	Amwave	All equal and approved	

E • KITCHENETTE FIXTURES AND FITTINGS					
E1	Comb Microwave	CDA Built-In Black Microwave, Grill & Convection Oven Code: VM452SS Dimensions: W: 594mm D: 450mm H: 389mm	Kitchen subcontractor	All equal and approved	
E2	Hob	CDA 2 Ring Ceramic Hob Code: HC3616FR Dimensions: W: 500mm D: 520mm H: 48mm	Kitchen subcontractor	All equal and approved	
E3	Fridge With Ice Box	CDA Integrated Undercounter Fridge With Ice Box Code: CR155 Dimensions: W: 595mm D: 548mm H: 812-892mm	Kitchen subcontractor	All equal and approved	
E4	Tap	Chrome Mixer Tap Fixed To The Sink Tap Hole With All Necessary Accessories And Plumbing	Kitchen subcontractor	All equal and approved	
E5	Sink	Johnson 110 Sink Black Composite To Go Black Stainless Steel Sink With Tap Hole And Drain To Fit In Base Cupboard Dimensions: W: 500mm D: 470mm H: 185mm	Kitchen subcontractor	All equal and approved	
E6	Pull-out Bin	Titan Bin 84300 Pull-out Bin Grey Dimensions: W: 342mm D: 480mm H: 351mm	Kitchen subcontractor	All equal and approved	
E7	Cooker Hood	Vert-A-Vue Pull-Out System Hood To Fit In 600mm Wide Aperture With 2 No. Low Energy 9W Lamps Stock Ref: 47791	Kitchen subcontractor	All equal and approved	
E8	Strip LED	Submit proposals to kitchen wall units	Kitchen subcontractor	All equal and approved	

Appendix B – First Street South Block C, Manchester

Part O Overheating Report



First Street South Block C, Manchester

Part O Overheating Report



Project Number:	L1513-XX-XX-RP-M-50001
Document Ref:	Part O Overheating Report
Engineer:	C.Abel
Revision:	P02
Issue Date:	23-02-2026

Abacus Consult Limited

First Street South Block C, Part O Overheating Report

Project: First Street South Block C

Subject: Part O Overheating Report

Prepared for: Downing Living Manchester South Ltd Partnership Incorporated

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1.0 Introduction

Abacus Consult Ltd have been commissioned to test the overheating risk of the proposed First Street South Block C student accommodation in Manchester against the requirements of Approved Document O. A CIBSE TM59 dynamic thermal simulation has been undertaken to predict the summertime temperatures for the bedrooms and living kitchen spaces. The TM59 criteria provides a basis for assessing the risk of perceived overheating. The results contained within this report are estimates of the temperatures that may be experienced in a typical year based on the CIBSE DSY weather files. Actual occupancies, internal gains and external weather conditions can vary from the predicted scenario, and therefore the actual internal room condition can be different as a result. This document in no way attempts to assess the scheme for compliance with the purge ventilation requirements of Approved Document F. This assessment aims to identify whether the proposals meet the requirements of Approved Document O using the CIBSE TM59 methodology.

1.01 Approved Document O

Approved Document Part O of the Building Regulations aims to reduce the risk of overheating in new residential buildings by setting limits on solar gains and requiring adequate means of removing excess heat. It provides guidance on both simplified and dynamic thermal modelling approaches to demonstrate compliance. The regulation ensures that dwellings are designed to maintain comfortable internal conditions during summer months without excessive reliance on active cooling systems, promoting occupant health and energy efficiency.

1.02 Building information

Building C is on the First Street South campus, bound by Hulme Street to the north and Medlock Street to the west. It is a 28 storey building with plant, switch rooms, main entrance and management suite on level 00, amenity areas on levels 00 and 01 and student accommodation areas on levels 1 to 27. The proposals will deliver a residential building comprising 555 bed spaces.



Figure 1 – Indicative site map from Google Maps

2.0 TM59 Assessment Methodology

The TM59 methodology is a standardised approach to predicting overheating risk for residential building designs using dynamic thermal analysis. The testing of the methodology has focused on flats as they tend to represent a higher overheating risk than houses. The aim is to produce a test that encourages good design that is comfortable within sensible limits, without being so stringent that it over promotes the use of mechanical cooling. CIBSE TM59 also sets out profiles that represent reasonable usage patterns for a home suitable for evaluating overheating risk. The profiles are developed to test a design and do not cover all usage modes. The Methodology is intended for use by designers to influence building design for the better. It can be used at planning stage to assess risk, as well as at later design stages.

The TM59 methodology will:

- Allow different designs to be compared based on reasonable assumptions
- Support design decisions that improve comfort without cooling
- Provide consistency across the industry for overheating risk prediction

The TM59 methodology will not:

- Guarantee that people will always be comfortable in compliant spaces, however they act
- Take into account unusual use

The basis of the design comfort criteria for CIBSE TM59 is:

- CIBSE TM52: Limits of thermal comfort: avoiding overheating (2013) – Provides the principles of thermal comfort
- CIBSE Guide A: Environmental design (2015) – Includes advice regarding sleep quality

The methodology is prescriptive so as to be consistently applied. It uses thermal modelling tools, defined internal gains profiles and specific weather files with a clearly defined thresholds to provide a clear pass/fail result.

CIBSE TM59 sets out two different overheating criteria for different design strategies. The two strategies are:

- Buildings that are predominantly naturally ventilated
- Buildings that are predominantly mechanically ventilated

For homes that are predominantly naturally ventilated, two criteria apply. These are:

1. Living Rooms, Kitchens and Bedrooms – Hours of exceedance

The number of hours during which ΔT is greater than or equal to one degree ($^{\circ}K$) during the period May to September inclusive shall not be more than 3% of occupied hours. ΔT is defined as operative temperature less the maximum acceptable temperature. ΔT is rounded to the nearest whole degree

2. Bedrooms Only – Sleeping Conditions

During the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed $26^{\circ}C$ for more than 1% of annual hours. This has been determined as being 32 hours a year.

TM59 compliance criteria for predominantly naturally ventilated buildings		
	Criterion 1 $\Delta T \geq 1K$ (Max 3%)	Criterion 2 Average hours above $26^{\circ}C$ (Max 1%)
Bedrooms	≤ 110 (3% occupied hours)	≤ 32 (1% occupied hours)
Kitchen/living	≤ 68 (3% occupied hours)	n/a

Table 1 – TM59 compliance criteria

The TM59 criteria set out above provides a basis for assessing the risk of perceived overheating. The criteria above and results contained within this report are estimates of the temperatures that may be experienced in a typical year based on the CIBSE weather files. Actual occupancies, internal gains and external weather conditions will vary, and internal room condition may be different as a result.

2.01 Heat gains

For the purposes of the assessment, lighting energy is assumed to be proportional to floor area, and lighting loads are measured in W/m^2 . From 6 pm to 11 pm, 2 W/m^2 should be assumed as the default for efficient new buildings. This assumes that good daylight levels are available (also noting that only May to September is assessed within CIBSE TM52). For existing buildings, or specialist lighting designs, a calculated higher value should be used. For communal corridors, use 2 W/m^2 ; this may be assumed as zero if passive infrared (PIR) sensors are present.

2.02 Communal Corridors

Extract from TM59: 2017 Section 3.9

'Communal corridor heat gains should be modelled based on calculated losses from pipework.'

Extract from TM59: 2017 Section 5.2

'For communal corridors, use 2 W/m^2 ; this may be assumed as zero if passive infrared (PIR) sensors are present.'

3.0 Thermal model input criteria

3.01 Software

The CIBSE TM59 calculations have been carried out using IESVE. IESVE is a dynamic simulation software that is fully compliant with CIBSE AM11. IESVE uses the 'SunCast' solar shading module to model the sun path and solar shading effect for the proposed building. The 'MacroFlo' module has been used to simulate the natural ventilation openings using a selection of appropriate control profiles.

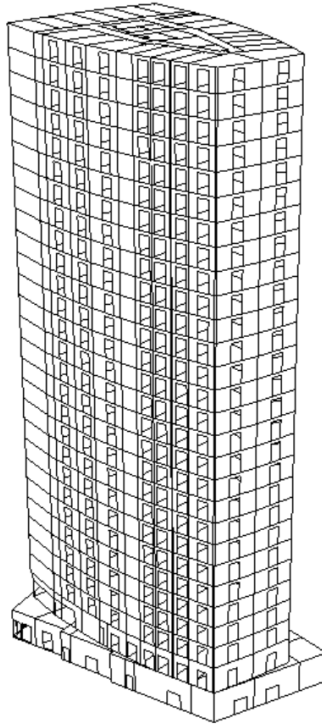


Figure 2 – Dynamic thermal model of the First Street South Block C building.

3.02 Architectural layouts

The SHP drawings that have been used to create the model are as follows:

- 63088-SHA-ZZ-00-D-A-200101_General Arrangement Plan Level 00_P01_S4
- 63088-SHA-ZZ-01-D-A-200101_General Arrangement Plan Level 01_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200101_General Arrangement Plan Type 01 (Levels 02,08,14)_P02_S3
- 63088-SHA-ZZ-ZZ-D-A-200102_General Arrangement Plan Type 02 (Levels 03,05,07,_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200103_General Arrangement Plan Type 03 (Levels 04,06,10,_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200104_General Arrangement Plan Type 04 (Levels 16,18,20,_P01_S4
- 63088-SHA-ZZ-ZZ-D-A-200105_General Arrangement Plan Type 05 (Levels 17,19,21,_P01_S4
- 63088-SHA-ZZ-28-D-A-200101_General Arrangement Plan Level 28 - Roof Plant_P01_S4
- 63088-SHA-ZZ-RF-D-A-200101_General Arrangement Plan Roof Level_P01_S4

3.04 Rapid ventilation panels

Denoted on the plans as being an inward openable door, able to open to 90° with a minimum free area of 0.6m². Each studio, cluster bedroom and cluster kitchen has been assigned at least one rapid ventilation panel as indicated on the SHP architectural layouts. The TM59 assessment will consider the building as being predominantly naturally ventilated due to the inclusion of rapid ventilation panels.

3.05 Fabric specification

The fabric specification is set out in Table 2 below. The specification is the same as that set out in the proposed BRUKL report.

Elements	U Value	Notes
External walls	0.73 w/m ² /K	
Exposed floors	0.18 w/m ² /K	
Flat roofs	0.18 w/m ² /K	
Windows	0.73 w/m ² /K	
Personnel doors	1.6 w/m ² /K	
Air permeability – 3 m ³ / (h.m ²) at 50Pa		

Table 2 – Proposed fabric specification

3.06 Mechanical ventilation

Mechanical ventilation with heat recovery is included in the analysis based on the results of the Part L modelling. Ventilation extract rates have been set up in the model in accordance with the flow rates listed below. Ventilation flow rates for the kitchen/living spaces have been increased to 30l/s from the minimum Part F boost rate of 13l/s to mitigate overheating in these spaces. For the avoidance of doubt, Part F purge vent is not assessed in this thermal comfort analysis. Part F purge vent and any requirement for additional mechanical ventilation to meet Part F purge vent is assessed separately.

	Flow rate
Cluster bathroom	8 l/s
Kitchen/living (not air conditioned)	30 l/s
Kitchen/living (air conditioned)	13l/s
Studio	21 l/s

Table 3 – MVHR flow rates included in the TM59 model

3.07 Weather files

The Manchester DSY1 2020 High 50 weather files has been used as directed by the TM59 methodology, as it is the closest DSY weather file to the site.

3.08 Internal Gains

The internal gains and profiles that have been used for the internal temperature analysis model have been taken from CIBSE TM59 and the full tables for reference can be found in Appendix A. Single occupancy has been assigned to all the bedrooms because they are single occupancy rooms, let on a single occupancy basis.

3.09 Acoustic restrictions

For acoustic break in reasons, the opening hours of the rapid vents limited for the purposes of this analysis. Vents should remain closed overnight between the hours of 23:00 and 07:00.

4.0 Results and Conclusions

4.01 TM59 overheating assessment results

It can be seen from the results table Appendix B that the proposals as described in this document, fully comply with the requirements of CIBSE TM59. All rooms passed initial simulation under the Manchester DSY1 weather file. The TM59 analysis does not include the use of blinds in line with Part O. The analysis as described in this report therefore complies with CIBSE TM59 when mechanical extract ventilation rates are set to the requirements stated in section 3.06. The full results from the simulation can be found in Appendix B.

4.02 Results for PMV and PPD

Thermal modelling has also been undertaken to establish the predicted mean vote (PMV) and the Predicted Percentage of Dissatisfied (PPD) indices for each air conditioned space. This demonstrates compliance with BREEAM Hea04 criteria as the number of hours outside of the recommended range is under 3% of the total occupied hours and therefore meet CIBSE Guide A standards. Results showing the PMV/PPD indices for the occupied spaces within the proposed First Street Block C using the Manchester DSY 1 2020's high emissions 50th percentile range weather file can be found below.

4.03 Design for a projected climate change environment

For the purposes of BREEAM Hea04 the proposed building has also been simulated against the Manchester DSY2 2050s high emissions 50th percentile and DSY3 2080s high emissions 50th percentile weather files to simulate future climate conditions and assess the adaptability for climate change. The future weather file simulations proved the following:

- Thermal modelling demonstrates compliance with CIBSE AM11 Building Energy and Environmental Modelling criteria.
- The TM59 calculation still achieves a pass through the use of opening the rapid vent panels to overcome overheating issues.
- Modelling of the air conditioned/mechanically ventilated building spaces demonstrates that during occupied hours the temperature range meets CIBSE Guide A Environmental Design criteria.

4.04 Limitations of the TM59 assessment criteria

The TM59 criteria provides a basis for assessing the risk of perceived overheating. The results contained within this report are estimates of the temperatures that may be experienced in a typical year based on the CIBSE DSY weather files. Actual occupancies, internal gains and external weather conditions can vary from the predicted scenario, and therefore the actual internal room condition can be different as a result. This document in no way attempts to assess the scheme for compliance with the purge ventilation requirements of Approved Document F.

Appendix A – TM59 gains and occupancy profiles

Unit/ room type	Occupancy	Equipment load
Studio	2 people at 70% gains from 11 pm to 8 am 2 people at 100% gains from 8 am to 11 pm	Peak load of 450 W from 6 pm to 8 pm*. 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room	1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
1-bedroom apartment: kitchen	1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
2-bedroom apartment: kitchen	2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
3-bedroom apartment: living room/kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-bedroom apartment: living room	3 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
3-bedroom apartment: kitchen	3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm base load of 50 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gains in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom (too small to accommodate double bed)	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
Communal corridors	Assumed to be zero	Pipework heat loss only; see section 3.1 above

* All times in GMT

Extract from TM59: 2017 Section 6

First Street South Block C, Part O Overheating Report

Number of people	Description	Peak load (W)		Period																							
		Sensible	Latent	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
				Hour-ending																							
				1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single bedroom occupancy	75	55	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double bedroom occupancy	150	110	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio occupancy	150	110	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1-bed: living/kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
1	1-bed: living occupancy	75	55	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0
1	1-bed: kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0
2	2-bed: living/kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
2	2-bed: living occupancy	150	110	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0
2	2-bed: kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0
3	3-bed: living/kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
3	3-bed: living occupancy	225	165	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0
3	3-bed: kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0
	Single bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Double bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Studio equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living/kitchen equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living equipment	150		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	1	1	1	0.4	0.4
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17
	Lighting profile	2 (W/m2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0

Extract from TM59: 2017 Section 6

Appendix B – Manchester DSY1 TM59 results for a typical floor

Room Name	Room ID	Criterion 1 $\Delta T \geq 1K$ (Max 3%)	Criterion 2 Average hours above 26°C (Max 32)	Complies with TM59?
5BED CLUSTER BEDROOM 1	LV00000B	0.3	11	✓
STUDIO 1	ST000000	0	1	✓
STUDIO 2	ST000006	0.1	2	✓
STUDIO 3	ST000005	0.1	3	✓
STUDIO 4	ST000004	0.1	3	✓
STUDIO 5	ST000003	0.2	3	✓
STUDIO 6	ST000002	0.2	3	✓
STUDIO 7	ST000001	0.2	3	✓
STUDIO 8	LV000010	1.1	12	✓
STUDIO 9	LV00000F	2.6	20	✓
STUDIO 11	LV000006	0	0	✓
STUDIO 12	LV00000C	0.1	4	✓
4BED CLUSTER BEDROOM 1	LV00000D	0.2	4	✓
4BED CLUSTER BEDROOM 2	LV000011	0.1	1	✓
4BED CLUSTER BEDROOM 3	LV000012	0.1	1	✓
4BED CLUSTER BEDROOM 4	LV000013	0.3	5	✓
4BED CLUSTER KLD	LV000004	0.1	1	✓
5BED CLUSTER BEDROOM 2	LV000007	0.1	2	✓
5BED CLUSTER BEDROOM 3	LV000008	0	0	✓
5BED CLUSTER BEDROOM 4	LV000001	0	0	✓
5BED CLUSTER BEDROOM 5	LV00000A	0	0	✓
5BED CLUSTER KLD	LV000009	0	1	✓
STUDIO 10	LV00000E	0.2	3	✓
4BED CLUSTER BEDROOM 1	LV00000D	0.2	3	✓

Appendix C – First Street South Block C,
Mechanical & Electrical Services: AD Part L Report



First Street South, Block C

Mechanical & Electrical Services

AD Part L Report – RIBA Stage 3



Project Number:	L1513
Document Ref:	FSS-ABA-ZC-ZZ-RP-M-50001
Engineer:	P.Abel/ S. Boswarva
Revision:	T04
Issue Date:	25-02-2026

Abacus Consult Limited

Project: First Street South, Block C, Student Accommodation, Manchester

Subject: Stage 3 Developed Design – AD Part L Report

Prepared for: Downing Living (Manchester South) Ltd Partnership Incorporated

Revision	Issue/Revision Description	Prepared By	Approved By	Issue Date
T01	For Contract/Tender	P. Abel	P. Abel S. Boswarva	20/09/2024
T02	Revised to reduce AC installation	P. Abel	P. Abel S. Boswarva	06/02/2026
T03	Revised to 3.0 air permeability	P. Abel	P. Abel S. Boswarva	12/02/2026
T04	Level 00 non unitised façade details clarified (in red)	P. Abel	P. Abel S. Boswarva	25/02/2026

CONTENTS

- 1.0 Introduction & Input Data
- 2.0 Results
- 3.0 Block C As Designed BRUKL

1.0 Introduction & Input Data

This report forms part of the full planning application for First Street Block C Student Accommodation development in Manchester City Centre. The report is intended to set out the principles of the building services systems in accordance with Building Regulations and Manchester City Council Plan Policy EN6.

Downing intend to submit planning for the erection of 1no. student accommodation block 28 storeys with associated amenity areas. The total number of beds will be 555, 56% of which will be studios with the remaining 44% cluster bedrooms.

This executive summary details the input data used and the results of the dynamic simulation and Part L2 calculations. These figures are used for assessment during RIBA Stage 3 and shall be updated by the mechanical sub-contractor during RIBA Stage 4 to account for the actual data issued by the Stage 4 designers. The key points are highlighted in the summary below: -

- The following U-Values have been used in the simulation/calculations: -

Unitised Façade (non-vision)	=	0.73 W/m ² K
Unitised Façade (vision)	=	0.73 W/m ² K
Solid Floor	=	0.18 W/m ² K
Roof	=	0.18 W/m ² K
Level 00 wall	=	0.16 W/m ² K
Level 00 windows	=	1.2 W/m ² K

Window Frames assumed 50mm

- Windows

G Value	=	0.4
Light Transmittance	=	0.7 (Part L default)

- Weather data file used for calculations is CIBSE DSY1 2020s, high emissions 50th percentile for Manchester.
- Lighting Gains are based on Stage 3 calculations and will be finalised upon completion of Stage 4 calculations.
- Air Permeability is based on maximum 3.0 m³/m².Hr at 50Pa.
- Ventilation is via MVHR systems as detailed in Abacus Consult Ventilation Strategy. Fan SFP's are currently based on worst case and will be finalised at as-built stage.
- Mechanical heating and cooling via VRF heat pump systems to management suites, amenity areas, limited clusters and studios on levels 01-04 and 24-27.
- Domestic hot water production via Mitsubishi Qton high temperature CO₂ air source heat pumps serving hot water storage vessels.
- Detailed dynamic simulation overheating analysis provides compliance to rooms shown to exceed solar gain in the BRUKL.

2.0 Results

The development meets the Manchester City Council's Plan (MCCP) requirement for at least 15% reduction in Part L 2010 carbon emissions from renewable and or low carbon technologies, as demonstrated below.

- Part L2 2021 CO₂ target emissions (TER) and predicted building emissions (BER) are as follows: -

Block C 18,438 m²

Target Emissions Rate	=	3.1 kgCO ₂ /m ² /yr
Building Emissions Rate	=	3.06 kgCO ₂ /m ² /yr
Project Carbon Reduction	=	1.3 %

Part L 2021 (Volume 2 for non-domestic buildings) requires an average 35–40% reduction in carbon emissions compared to Part L 2010, depending on the specific building type.

Therefore, by passing Part L 2021, the building exceeds the MCCP requirement for at least 15% reduction in Part L 2010 carbon emissions

Energy Consumption Relative to Occupancy

Energy consumption is detailed below

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.84	6.76
Cooling	0.83	1.07
Auxiliary	4.02	2.5
Lighting	4.32	6.89
Hot water	4.39	5.56
Equipment*	25.84	25.84
TOTAL**	21.4	22.77

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Occupancy for the building is set at 555people.

Therefore, energy consumption relative to occupancy is:

21.4 kWh/m² divide by 555people = 0.039 kWh/person/m²/annum

3.0 Block C 'As Designed' 2021 BRUKL

Project name

First Street Block C

As designed

Date: Mon Jan 05 16:00:30 2026

Administrative information

Building Details

Address: Manchester,

Certifier details

Name: Callan Abel

Telephone number: 0151 480 6161

Address: Unit 4 Paramount Business Park Wilson Road,
Liverpool, L36 6AW

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 658.51The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	3.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	3.06
Target primary energy rate (TPER), kWh _{PE} /m ² .annum	33.04
Building primary energy rate (BPER), kWh _{PE} /m ² .annum	32.41
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.16	0.16	LV0003FB:Surf[9]
Floors	0.18	0.18	0.18	LV0003FB:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	LV0003FB:Surf[1]
Windows** and roof windows	1.6	0.74	1.2	LV0003FB:Surf[2]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	LV0003F4:Surf[3]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- VRF MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.7	11.3	0	-	0.85
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- Panel Heaters MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- VRF MVHR (Heating Only)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.7	11.3	0	-	0.85
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

4- Panel Heaters MVHR (FH)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	-	0.9
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- Mitsubishi QAHV DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.3	0.001
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Level00_Amenity		-	-	-	2	-	-	-	-	-	-	N/A
Level00_BinStore		-	-	0.4	-	-	-	-	-	-	-	N/A
Level00_Gym		-	-	-	2	-	-	-	-	-	-	N/A
Level00_MeetingRoom		-	-	-	2	-	-	-	-	-	-	N/A
Level00_Office		-	-	-	2	-	-	-	-	-	-	N/A
Level00_ParcelRoom		-	-	-	2	-	-	-	-	-	-	N/A
Level00_PostRoom		-	-	-	2	-	-	-	-	-	-	N/A
Level00_Reception		-	-	-	2	-	-	-	-	-	-	N/A
Level00_Shower		-	-	0.4	-	-	-	-	-	-	-	N/A
Level00_StaffKitchen		-	-	-	2	-	-	-	-	-	-	N/A
Level00_StaffWC		-	-	0.4	-	-	-	-	-	-	-	N/A
Level00_WC		-	-	0.4	-	-	-	-	-	-	-	N/A
Level01_Amenity		-	-	-	2	-	-	-	-	-	-	N/A
Level01_Amenity		-	-	-	2	-	-	-	-	-	-	N/A
Level01_Amenity		-	-	-	2	-	-	-	-	-	-	N/A
Level01_Amenity		-	-	-	2	-	-	-	-	-	-	N/A
Level01_Amenity		-	-	-	2	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_KLD		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_KLD		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_Studio		-	-	-	0.7	-	-	-	-	-	-	N/A
Level01_Studio		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (1)		-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (1)		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (1)		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (1)		-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (1)		-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (1)		-	-	-	0.6	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Level02_ClusterBedroom (6)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (6)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (6)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (6)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (6)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (7)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (8)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (9)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (10)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (11)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (11)	-	-	-	0.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Level02_ClusterBedroom (16)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (17)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (18)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (19)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Level02_ClusterBedroom (20)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (20)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (21)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (22)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (23)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (24)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (25)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (25)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (25)	-	-	-	0.6	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (25)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_ClusterBedroom (25)	-	-	-	0.7	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard	
Level02_ClusterBedroom (25)	-	-	-	0.6	-	-	-	-	-	-	N/A	
Level02_ClusterBedroom (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_ClusterBedroom (25)	-	-	-	0.6	-	-	-	-	-	-	N/A	
Level02_ClusterBedroom (25)	-	-	-	0.6	-	-	-	-	-	-	N/A	
Level02_KLD	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (1)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (1)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (2)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (2)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (3)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (3)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (4)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (4)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (5)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (5)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (6)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (6)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (7)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (7)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (8)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (8)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (9)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (9)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (10)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (10)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (11)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (11)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (12)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (12)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (13)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (13)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (14)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (14)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (15)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (15)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (16)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (16)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (17)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (17)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (18)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (18)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_KLD (19)	-	-	-	0.7	-	-	-	-	-	-	N/A	

[illegible]

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Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (13)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (14)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (15)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A
Level02_Studio (16)	-	-	-	0.7	-	-	-	-	-	-	N/A

[illegible]

[illegible]

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (24)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	
Level02_Studio (25)	-	-	-	0.7	-	-	-	-	-	-	N/A	

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level00_Amenity		95	-	-
Level00_BikeStore		95	-	-
Level00_BinStore		95	-	-
Level00_Comms		95	-	-
Level00_Corridor		95	-	-
Level00_Entrance		95	-	-
Level00_EscapeCorridor		95	-	-
Level00_EscapeCorridor		95	-	-
Level00_Generator		95	-	-
Level00_Gym		95	-	-
Level00_Laundry		95	-	-
Level00_Lobby		95	-	-
Level00_Lobby		95	-	-
Level00_Lobby		95	-	-
Level00_LV		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level00_MeetingRoom		95	-	-
Level00_Office		95	-	-
Level00_ParcelRoom		95	-	-
Level00_Plant		95	-	-
Level00_Plant		95	-	-
Level00_PostRoom		95	-	-
Level00_Reception		95	-	-
Level00_Shower		95	-	-
Level00_StaffKitchen		95	-	-
Level00_StaffWC		95	-	-
Level00_Stair		95	-	-
Level00_Stair		95	-	-
Level00_SubStation		95	-	-
Level00_WC		95	-	-
Level01_Amenity		95	-	-
Level01_Amenity		95	-	-
Level01_Amenity		95	-	-
Level01_Amenity		95	-	-
Level01_Amenity		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterBedroom		95	-	-
Level01_ClusterCorridor		95	-	-
Level01_ClusterCorridor		95	-	-
Level01_Corridor		95	-	-
Level01_KLD		95	-	-
Level01_KLD		95	-	-
Level01_Lobby		95	-	-
Level01_Lobby		95	-	-
Level01_Lobby		95	-	-
Level01_Lobby		95	-	-
Level01_Stair		95	-	-
Level01_Stair		95	-	-
Level01_Studio		95	-	-
Level01_Studio		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (1)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (2)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (3)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (4)		95	-	-
Level02_ClusterBedroom (5)		95	-	-
Level02_ClusterBedroom (5)		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (10)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (11)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (12)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (13)		95	-	-
Level02_ClusterBedroom (14)		95	-	-
Level02_ClusterBedroom (14)		95	-	-
Level02_ClusterBedroom (14)		95	-	-
Level02_ClusterBedroom (14)		95	-	-
Level02_ClusterBedroom (14)		95	-	-
Level02_ClusterBedroom (14)		95	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Level02_ClusterBedroom (14)	95	-	-
Level02_ClusterBedroom (14)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (15)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (16)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (17)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (18)	95	-	-
Level02_ClusterBedroom (19)	95	-	-
Level02_ClusterBedroom (19)	95	-	-
Level02_ClusterBedroom (19)	95	-	-
Level02_ClusterBedroom (19)	95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_ClusterBedroom (24)		95	-	-
Level02_ClusterBedroom (24)		95	-	-
Level02_ClusterBedroom (24)		95	-	-
Level02_ClusterBedroom (24)		95	-	-
Level02_ClusterBedroom (24)		95	-	-
Level02_ClusterBedroom (24)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterBedroom (25)		95	-	-
Level02_ClusterCorridor		95	-	-
Level02_ClusterCorridor		95	-	-
Level02_ClusterCorridor (1)		95	-	-
Level02_ClusterCorridor (1)		95	-	-
Level02_ClusterCorridor (2)		95	-	-
Level02_ClusterCorridor (2)		95	-	-
Level02_ClusterCorridor (3)		95	-	-
Level02_ClusterCorridor (3)		95	-	-
Level02_ClusterCorridor (4)		95	-	-
Level02_ClusterCorridor (4)		95	-	-
Level02_ClusterCorridor (5)		95	-	-
Level02_ClusterCorridor (5)		95	-	-
Level02_ClusterCorridor (6)		95	-	-
Level02_ClusterCorridor (6)		95	-	-
Level02_ClusterCorridor (7)		95	-	-
Level02_ClusterCorridor (7)		95	-	-
Level02_ClusterCorridor (8)		95	-	-
Level02_ClusterCorridor (8)		95	-	-
Level02_ClusterCorridor (9)		95	-	-
Level02_ClusterCorridor (9)		95	-	-
Level02_ClusterCorridor (10)		95	-	-
Level02_ClusterCorridor (10)		95	-	-
Level02_ClusterCorridor (11)		95	-	-
Level02_ClusterCorridor (11)		95	-	-
Level02_ClusterCorridor (12)		95	-	-
Level02_ClusterCorridor (12)		95	-	-
Level02_ClusterCorridor (13)		95	-	-
Level02_ClusterCorridor (13)		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_ClusterCorridor (14)		95	-	-
Level02_ClusterCorridor (14)		95	-	-
Level02_ClusterCorridor (15)		95	-	-
Level02_ClusterCorridor (15)		95	-	-
Level02_ClusterCorridor (16)		95	-	-
Level02_ClusterCorridor (16)		95	-	-
Level02_ClusterCorridor (17)		95	-	-
Level02_ClusterCorridor (17)		95	-	-
Level02_ClusterCorridor (18)		95	-	-
Level02_ClusterCorridor (18)		95	-	-
Level02_ClusterCorridor (19)		95	-	-
Level02_ClusterCorridor (19)		95	-	-
Level02_ClusterCorridor (20)		95	-	-
Level02_ClusterCorridor (20)		95	-	-
Level02_ClusterCorridor (21)		95	-	-
Level02_ClusterCorridor (21)		95	-	-
Level02_ClusterCorridor (22)		95	-	-
Level02_ClusterCorridor (22)		95	-	-
Level02_ClusterCorridor (23)		95	-	-
Level02_ClusterCorridor (23)		95	-	-
Level02_ClusterCorridor (24)		95	-	-
Level02_ClusterCorridor (24)		95	-	-
Level02_ClusterCorridor (25)		95	-	-
Level02_ClusterCorridor (25)		95	-	-
Level02_Corridor		95	-	-
Level02_Corridor		95	-	-
Level02_Corridor (1)		95	-	-
Level02_Corridor (1)		95	-	-
Level02_Corridor (2)		95	-	-
Level02_Corridor (2)		95	-	-
Level02_Corridor (3)		95	-	-
Level02_Corridor (3)		95	-	-
Level02_Corridor (4)		95	-	-
Level02_Corridor (4)		95	-	-
Level02_Corridor (5)		95	-	-
Level02_Corridor (5)		95	-	-
Level02_Corridor (6)		95	-	-
Level02_Corridor (6)		95	-	-
Level02_Corridor (7)		95	-	-
Level02_Corridor (7)		95	-	-
Level02_Corridor (8)		95	-	-
Level02_Corridor (8)		95	-	-
Level02_Corridor (9)		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_Corridor (9)		95	-	-
Level02_Corridor (10)		95	-	-
Level02_Corridor (10)		95	-	-
Level02_Corridor (11)		95	-	-
Level02_Corridor (11)		95	-	-
Level02_Corridor (12)		95	-	-
Level02_Corridor (12)		95	-	-
Level02_Corridor (13)		95	-	-
Level02_Corridor (13)		95	-	-
Level02_Corridor (14)		95	-	-
Level02_Corridor (14)		95	-	-
Level02_Corridor (15)		95	-	-
Level02_Corridor (15)		95	-	-
Level02_Corridor (16)		95	-	-
Level02_Corridor (16)		95	-	-
Level02_Corridor (17)		95	-	-
Level02_Corridor (17)		95	-	-
Level02_Corridor (18)		95	-	-
Level02_Corridor (18)		95	-	-
Level02_Corridor (19)		95	-	-
Level02_Corridor (19)		95	-	-
Level02_Corridor (20)		95	-	-
Level02_Corridor (20)		95	-	-
Level02_Corridor (21)		95	-	-
Level02_Corridor (21)		95	-	-
Level02_Corridor (22)		95	-	-
Level02_Corridor (22)		95	-	-
Level02_Corridor (23)		95	-	-
Level02_Corridor (23)		95	-	-
Level02_Corridor (24)		95	-	-
Level02_Corridor (24)		95	-	-
Level02_Corridor (25)		95	-	-
Level02_Corridor (25)		95	-	-
Level02_KLD		95	-	-
Level02_KLD		95	-	-
Level02_KLD (1)		95	-	-
Level02_KLD (1)		95	-	-
Level02_KLD (2)		95	-	-
Level02_KLD (2)		95	-	-
Level02_KLD (3)		95	-	-
Level02_KLD (3)		95	-	-
Level02_KLD (4)		95	-	-
Level02_KLD (4)		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_KLD (5)		95	-	-
Level02_KLD (5)		95	-	-
Level02_KLD (6)		95	-	-
Level02_KLD (6)		95	-	-
Level02_KLD (7)		95	-	-
Level02_KLD (7)		95	-	-
Level02_KLD (8)		95	-	-
Level02_KLD (8)		95	-	-
Level02_KLD (9)		95	-	-
Level02_KLD (9)		95	-	-
Level02_KLD (10)		95	-	-
Level02_KLD (10)		95	-	-
Level02_KLD (11)		95	-	-
Level02_KLD (11)		95	-	-
Level02_KLD (12)		95	-	-
Level02_KLD (12)		95	-	-
Level02_KLD (13)		95	-	-
Level02_KLD (13)		95	-	-
Level02_KLD (14)		95	-	-
Level02_KLD (14)		95	-	-
Level02_KLD (15)		95	-	-
Level02_KLD (15)		95	-	-
Level02_KLD (16)		95	-	-
Level02_KLD (16)		95	-	-
Level02_KLD (17)		95	-	-
Level02_KLD (17)		95	-	-
Level02_KLD (18)		95	-	-
Level02_KLD (18)		95	-	-
Level02_KLD (19)		95	-	-
Level02_KLD (19)		95	-	-
Level02_KLD (20)		95	-	-
Level02_KLD (20)		95	-	-
Level02_KLD (21)		95	-	-
Level02_KLD (21)		95	-	-
Level02_KLD (22)		95	-	-
Level02_KLD (22)		95	-	-
Level02_KLD (23)		95	-	-
Level02_KLD (23)		95	-	-
Level02_KLD (24)		95	-	-
Level02_KLD (24)		95	-	-
Level02_KLD (25)		95	-	-
Level02_KLD (25)		95	-	-
Level02_Lobby		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_Lobby		95	-	-
Level02_Lobby (1)		95	-	-
Level02_Lobby (1)		95	-	-
Level02_Lobby (2)		95	-	-
Level02_Lobby (2)		95	-	-
Level02_Lobby (3)		95	-	-
Level02_Lobby (3)		95	-	-
Level02_Lobby (4)		95	-	-
Level02_Lobby (4)		95	-	-
Level02_Lobby (5)		95	-	-
Level02_Lobby (5)		95	-	-
Level02_Lobby (6)		95	-	-
Level02_Lobby (6)		95	-	-
Level02_Lobby (7)		95	-	-
Level02_Lobby (7)		95	-	-
Level02_Lobby (8)		95	-	-
Level02_Lobby (8)		95	-	-
Level02_Lobby (9)		95	-	-
Level02_Lobby (9)		95	-	-
Level02_Lobby (10)		95	-	-
Level02_Lobby (10)		95	-	-
Level02_Lobby (11)		95	-	-
Level02_Lobby (11)		95	-	-
Level02_Lobby (12)		95	-	-
Level02_Lobby (12)		95	-	-
Level02_Lobby (13)		95	-	-
Level02_Lobby (13)		95	-	-
Level02_Lobby (14)		95	-	-
Level02_Lobby (14)		95	-	-
Level02_Lobby (15)		95	-	-
Level02_Lobby (15)		95	-	-
Level02_Lobby (16)		95	-	-
Level02_Lobby (16)		95	-	-
Level02_Lobby (17)		95	-	-
Level02_Lobby (17)		95	-	-
Level02_Lobby (18)		95	-	-
Level02_Lobby (18)		95	-	-
Level02_Lobby (19)		95	-	-
Level02_Lobby (19)		95	-	-
Level02_Lobby (20)		95	-	-
Level02_Lobby (20)		95	-	-
Level02_Lobby (21)		95	-	-
Level02_Lobby (21)		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_Lobby (22)		95	-	-
Level02_Lobby (22)		95	-	-
Level02_Lobby (23)		95	-	-
Level02_Lobby (23)		95	-	-
Level02_Lobby (24)		95	-	-
Level02_Lobby (24)		95	-	-
Level02_Lobby (25)		95	-	-
Level02_Lobby (25)		95	-	-
Level02_Stair		95	-	-
Level02_Stair		95	-	-
Level02_Stair (1)		95	-	-
Level02_Stair (1)		95	-	-
Level02_Stair (2)		95	-	-
Level02_Stair (2)		95	-	-
Level02_Stair (3)		95	-	-
Level02_Stair (3)		95	-	-
Level02_Stair (4)		95	-	-
Level02_Stair (4)		95	-	-
Level02_Stair (5)		95	-	-
Level02_Stair (5)		95	-	-
Level02_Stair (6)		95	-	-
Level02_Stair (6)		95	-	-
Level02_Stair (7)		95	-	-
Level02_Stair (7)		95	-	-
Level02_Stair (8)		95	-	-
Level02_Stair (8)		95	-	-
Level02_Stair (9)		95	-	-
Level02_Stair (9)		95	-	-
Level02_Stair (10)		95	-	-
Level02_Stair (10)		95	-	-
Level02_Stair (11)		95	-	-
Level02_Stair (11)		95	-	-
Level02_Stair (12)		95	-	-
Level02_Stair (12)		95	-	-
Level02_Stair (13)		95	-	-
Level02_Stair (13)		95	-	-
Level02_Stair (14)		95	-	-
Level02_Stair (14)		95	-	-
Level02_Stair (15)		95	-	-
Level02_Stair (15)		95	-	-
Level02_Stair (16)		95	-	-
Level02_Stair (16)		95	-	-
Level02_Stair (17)		95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (2)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (3)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (4)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-
Level02_Studio (5)		95	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Level02_Studio (5)	95	-	-
Level02_Studio (5)	95	-	-
Level02_Studio (5)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (6)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (7)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (8)	95	-	-
Level02_Studio (9)	95	-	-
Level02_Studio (9)	95	-	-
Level02_Studio (9)	95	-	-
Level02_Studio (9)	95	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Level02_Studio (16)		95	-	-
Level02_Studio (16)		95	-	-
Level02_Studio (16)		95	-	-
Level02_Studio (16)		95	-	-
Level02_Studio (16)		95	-	-
Level02_Studio (16)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (17)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (18)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (19)		95	-	-
Level02_Studio (20)		95	-	-

[illegible]

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level00_Amenity	YES (+43.7%)	NO
Level00_Comms	N/A	N/A
Level00_Gym	YES (+53.5%)	NO
Level00_MeetingRoom	NO (-100%)	NO
Level00_Office	NO (-61.4%)	NO
Level00_ParcelRoom	NO (-32.5%)	NO
Level00_PostRoom	YES (+97.6%)	NO
Level00_Reception	NO (-99.6%)	NO
Level00_StaffKitchen	NO (-48.9%)	NO
Level01_Amenity	NO (-20.9%)	NO
Level01_Amenity	NO (-23.9%)	NO
Level01_Amenity	YES (+18.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level01_Amenity	YES (+46.7%)	NO
Level01_Amenity	YES (+44.2%)	NO
Level01_ClusterBedroom	YES (+30.5%)	NO
Level01_ClusterBedroom	YES (+27.2%)	NO
Level01_ClusterBedroom	YES (+28%)	NO
Level01_ClusterBedroom	YES (+16.4%)	NO
Level01_ClusterBedroom	YES (+14.2%)	NO
Level01_ClusterBedroom	YES (+10.6%)	NO
Level01_ClusterBedroom	YES (+9.7%)	NO
Level01_KLD	NO (-35%)	NO
Level01_KLD	NO (-38.4%)	NO
Level01_Studio	YES (+11.5%)	NO
Level01_Studio	NO (-44.9%)	NO
Level02_ClusterBedroom	YES (+10.7%)	NO
Level02_ClusterBedroom	YES (+14.2%)	NO
Level02_ClusterBedroom	YES (+30.9%)	NO
Level02_ClusterBedroom	YES (+27.7%)	NO
Level02_ClusterBedroom	YES (+9.4%)	NO
Level02_ClusterBedroom	YES (+16.2%)	NO
Level02_ClusterBedroom	N/A	N/A
Level02_ClusterBedroom	YES (+27%)	NO
Level02_ClusterBedroom	NO (-45%)	NO
Level02_ClusterBedroom (1)	YES (+27.7%)	NO
Level02_ClusterBedroom (1)	NO (-46.2%)	NO
Level02_ClusterBedroom (1)	YES (+9.2%)	NO
Level02_ClusterBedroom (1)	YES (+10.7%)	NO
Level02_ClusterBedroom (1)	N/A	N/A
Level02_ClusterBedroom (1)	YES (+27%)	NO
Level02_ClusterBedroom (1)	YES (+16.2%)	NO
Level02_ClusterBedroom (1)	YES (+30.9%)	NO
Level02_ClusterBedroom (1)	YES (+14%)	NO
Level02_ClusterBedroom (2)	YES (+27.7%)	NO
Level02_ClusterBedroom (2)	YES (+16.2%)	NO
Level02_ClusterBedroom (2)	YES (+27%)	NO
Level02_ClusterBedroom (2)	N/A	N/A
Level02_ClusterBedroom (2)	YES (+30.9%)	NO
Level02_ClusterBedroom (2)	YES (+9.2%)	NO
Level02_ClusterBedroom (2)	YES (+10.7%)	NO
Level02_ClusterBedroom (2)	YES (+14%)	NO
Level02_ClusterBedroom (2)	NO (-45%)	NO
Level02_ClusterBedroom (3)	YES (+16.2%)	NO
Level02_ClusterBedroom (3)	NO (-45.9%)	NO
Level02_ClusterBedroom (3)	YES (+27%)	NO
Level02_ClusterBedroom (3)	YES (+10.7%)	NO
Level02_ClusterBedroom (3)	YES (+27.7%)	NO
Level02_ClusterBedroom (3)	YES (+30.9%)	NO
Level02_ClusterBedroom (3)	N/A	N/A
Level02_ClusterBedroom (3)	YES (+14%)	NO
Level02_ClusterBedroom (3)	YES (+9.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_ClusterBedroom (4)	YES (+14%)	NO
Level02_ClusterBedroom (4)	YES (+16.2%)	NO
Level02_ClusterBedroom (4)	NO (-45.6%)	NO
Level02_ClusterBedroom (4)	YES (+27%)	NO
Level02_ClusterBedroom (4)	YES (+10.7%)	NO
Level02_ClusterBedroom (4)	N/A	N/A
Level02_ClusterBedroom (4)	YES (+9.8%)	NO
Level02_ClusterBedroom (4)	YES (+27.7%)	NO
Level02_ClusterBedroom (4)	YES (+30.9%)	NO
Level02_ClusterBedroom (5)	YES (+9%)	NO
Level02_ClusterBedroom (5)	N/A	N/A
Level02_ClusterBedroom (5)	NO (-45.9%)	NO
Level02_ClusterBedroom (5)	YES (+10.7%)	NO
Level02_ClusterBedroom (5)	YES (+16.2%)	NO
Level02_ClusterBedroom (5)	YES (+30.9%)	NO
Level02_ClusterBedroom (5)	YES (+27%)	NO
Level02_ClusterBedroom (5)	YES (+14%)	NO
Level02_ClusterBedroom (5)	YES (+27.7%)	NO
Level02_ClusterBedroom (6)	NO (-46.2%)	NO
Level02_ClusterBedroom (6)	YES (+14%)	NO
Level02_ClusterBedroom (6)	YES (+10.7%)	NO
Level02_ClusterBedroom (6)	YES (+9.6%)	NO
Level02_ClusterBedroom (6)	YES (+27.7%)	NO
Level02_ClusterBedroom (6)	YES (+16.2%)	NO
Level02_ClusterBedroom (6)	YES (+30.9%)	NO
Level02_ClusterBedroom (6)	N/A	N/A
Level02_ClusterBedroom (6)	YES (+27%)	NO
Level02_ClusterBedroom (7)	NO (-46.2%)	NO
Level02_ClusterBedroom (7)	YES (+9.2%)	NO
Level02_ClusterBedroom (7)	YES (+27.7%)	NO
Level02_ClusterBedroom (7)	YES (+14%)	NO
Level02_ClusterBedroom (7)	YES (+10.7%)	NO
Level02_ClusterBedroom (7)	YES (+16.2%)	NO
Level02_ClusterBedroom (7)	YES (+27%)	NO
Level02_ClusterBedroom (7)	YES (+30.9%)	NO
Level02_ClusterBedroom (7)	N/A	N/A
Level02_ClusterBedroom (8)	YES (+16.2%)	NO
Level02_ClusterBedroom (8)	N/A	N/A
Level02_ClusterBedroom (8)	YES (+9.2%)	NO
Level02_ClusterBedroom (8)	YES (+14%)	NO
Level02_ClusterBedroom (8)	YES (+27.7%)	NO
Level02_ClusterBedroom (8)	YES (+10.7%)	NO
Level02_ClusterBedroom (8)	YES (+30.9%)	NO
Level02_ClusterBedroom (8)	YES (+27%)	NO
Level02_ClusterBedroom (8)	NO (-45%)	NO
Level02_ClusterBedroom (9)	YES (+30.9%)	NO
Level02_ClusterBedroom (9)	YES (+27.7%)	NO
Level02_ClusterBedroom (9)	YES (+9%)	NO
Level02_ClusterBedroom (9)	YES (+16.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_ClusterBedroom (9)	N/A	N/A
Level02_ClusterBedroom (9)	YES (+14%)	NO
Level02_ClusterBedroom (9)	NO (-45.3%)	NO
Level02_ClusterBedroom (9)	YES (+10.7%)	NO
Level02_ClusterBedroom (9)	YES (+27%)	NO
Level02_ClusterBedroom (10)	YES (+9%)	NO
Level02_ClusterBedroom (10)	YES (+16.2%)	NO
Level02_ClusterBedroom (10)	YES (+27.7%)	NO
Level02_ClusterBedroom (10)	YES (+30.9%)	NO
Level02_ClusterBedroom (10)	NO (-45.6%)	NO
Level02_ClusterBedroom (10)	YES (+27%)	NO
Level02_ClusterBedroom (10)	N/A	N/A
Level02_ClusterBedroom (10)	YES (+10.7%)	NO
Level02_ClusterBedroom (10)	YES (+14%)	NO
Level02_ClusterBedroom (11)	YES (+9%)	NO
Level02_ClusterBedroom (11)	YES (+16.2%)	NO
Level02_ClusterBedroom (11)	YES (+27%)	NO
Level02_ClusterBedroom (11)	YES (+27.7%)	NO
Level02_ClusterBedroom (11)	YES (+14%)	NO
Level02_ClusterBedroom (11)	YES (+10.7%)	NO
Level02_ClusterBedroom (11)	NO (-45%)	NO
Level02_ClusterBedroom (11)	YES (+30.9%)	NO
Level02_ClusterBedroom (11)	N/A	N/A
Level02_ClusterBedroom (12)	N/A	N/A
Level02_ClusterBedroom (12)	YES (+10.7%)	NO
Level02_ClusterBedroom (12)	YES (+9.2%)	NO
Level02_ClusterBedroom (12)	YES (+30.9%)	NO
Level02_ClusterBedroom (12)	YES (+16.2%)	NO
Level02_ClusterBedroom (12)	YES (+27.7%)	NO
Level02_ClusterBedroom (12)	YES (+27%)	NO
Level02_ClusterBedroom (12)	NO (-45.3%)	NO
Level02_ClusterBedroom (12)	YES (+14%)	NO
Level02_ClusterBedroom (13)	YES (+27.7%)	NO
Level02_ClusterBedroom (13)	YES (+30.9%)	NO
Level02_ClusterBedroom (13)	YES (+14%)	NO
Level02_ClusterBedroom (13)	YES (+10.7%)	NO
Level02_ClusterBedroom (13)	N/A	N/A
Level02_ClusterBedroom (13)	YES (+27%)	NO
Level02_ClusterBedroom (13)	NO (-45.6%)	NO
Level02_ClusterBedroom (13)	YES (+9.6%)	NO
Level02_ClusterBedroom (13)	YES (+16.2%)	NO
Level02_ClusterBedroom (14)	YES (+14%)	NO
Level02_ClusterBedroom (14)	YES (+10.7%)	NO
Level02_ClusterBedroom (14)	YES (+27.7%)	NO
Level02_ClusterBedroom (14)	YES (+30.9%)	NO
Level02_ClusterBedroom (14)	YES (+27%)	NO
Level02_ClusterBedroom (14)	YES (+9.4%)	NO
Level02_ClusterBedroom (14)	N/A	N/A
Level02_ClusterBedroom (14)	YES (+16.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_ClusterBedroom (14)	NO (-45%)	NO
Level02_ClusterBedroom (15)	YES (+9%)	NO
Level02_ClusterBedroom (15)	YES (+14%)	NO
Level02_ClusterBedroom (15)	YES (+30.9%)	NO
Level02_ClusterBedroom (15)	YES (+27%)	NO
Level02_ClusterBedroom (15)	YES (+16.2%)	NO
Level02_ClusterBedroom (15)	YES (+10.7%)	NO
Level02_ClusterBedroom (15)	YES (+27.7%)	NO
Level02_ClusterBedroom (15)	NO (-45%)	NO
Level02_ClusterBedroom (15)	N/A	N/A
Level02_ClusterBedroom (16)	YES (+27%)	NO
Level02_ClusterBedroom (16)	N/A	N/A
Level02_ClusterBedroom (16)	NO (-46.2%)	NO
Level02_ClusterBedroom (16)	YES (+27.7%)	NO
Level02_ClusterBedroom (16)	YES (+16.2%)	NO
Level02_ClusterBedroom (16)	YES (+9.4%)	NO
Level02_ClusterBedroom (16)	YES (+10.7%)	NO
Level02_ClusterBedroom (16)	YES (+30.9%)	NO
Level02_ClusterBedroom (16)	YES (+14%)	NO
Level02_ClusterBedroom (17)	YES (+14%)	NO
Level02_ClusterBedroom (17)	NO (-45.9%)	NO
Level02_ClusterBedroom (17)	YES (+30.9%)	NO
Level02_ClusterBedroom (17)	YES (+27.7%)	NO
Level02_ClusterBedroom (17)	YES (+27%)	NO
Level02_ClusterBedroom (17)	YES (+16.2%)	NO
Level02_ClusterBedroom (17)	N/A	N/A
Level02_ClusterBedroom (17)	YES (+10.7%)	NO
Level02_ClusterBedroom (17)	YES (+9.8%)	NO
Level02_ClusterBedroom (18)	YES (+30.9%)	NO
Level02_ClusterBedroom (18)	YES (+14%)	NO
Level02_ClusterBedroom (18)	YES (+9.2%)	NO
Level02_ClusterBedroom (18)	YES (+10.7%)	NO
Level02_ClusterBedroom (18)	N/A	N/A
Level02_ClusterBedroom (18)	YES (+27.7%)	NO
Level02_ClusterBedroom (18)	YES (+16.2%)	NO
Level02_ClusterBedroom (18)	NO (-45%)	NO
Level02_ClusterBedroom (18)	YES (+27%)	NO
Level02_ClusterBedroom (19)	YES (+27.7%)	NO
Level02_ClusterBedroom (19)	YES (+30.9%)	NO
Level02_ClusterBedroom (19)	YES (+10.7%)	NO
Level02_ClusterBedroom (19)	YES (+14%)	NO
Level02_ClusterBedroom (19)	YES (+9.4%)	NO
Level02_ClusterBedroom (19)	NO (-45.3%)	NO
Level02_ClusterBedroom (19)	N/A	N/A
Level02_ClusterBedroom (19)	YES (+27%)	NO
Level02_ClusterBedroom (19)	YES (+16.2%)	NO
Level02_ClusterBedroom (20)	YES (+30.9%)	NO
Level02_ClusterBedroom (20)	YES (+27%)	NO
Level02_ClusterBedroom (20)	YES (+10.7%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_ClusterBedroom (20)	N/A	N/A
Level02_ClusterBedroom (20)	YES (+16.2%)	NO
Level02_ClusterBedroom (20)	YES (+9.4%)	NO
Level02_ClusterBedroom (20)	NO (-45.3%)	NO
Level02_ClusterBedroom (20)	YES (+14%)	NO
Level02_ClusterBedroom (20)	YES (+27.7%)	NO
Level02_ClusterBedroom (21)	YES (+27.7%)	NO
Level02_ClusterBedroom (21)	YES (+9%)	NO
Level02_ClusterBedroom (21)	YES (+14%)	NO
Level02_ClusterBedroom (21)	YES (+30.9%)	NO
Level02_ClusterBedroom (21)	NO (-45.6%)	NO
Level02_ClusterBedroom (21)	YES (+27%)	NO
Level02_ClusterBedroom (21)	N/A	N/A
Level02_ClusterBedroom (21)	YES (+16.2%)	NO
Level02_ClusterBedroom (21)	YES (+10.7%)	NO
Level02_ClusterBedroom (22)	YES (+16.2%)	NO
Level02_ClusterBedroom (22)	NO (-45.9%)	NO
Level02_ClusterBedroom (22)	YES (+27.7%)	NO
Level02_ClusterBedroom (22)	YES (+14%)	NO
Level02_ClusterBedroom (22)	YES (+9.6%)	NO
Level02_ClusterBedroom (22)	N/A	N/A
Level02_ClusterBedroom (22)	YES (+30.9%)	NO
Level02_ClusterBedroom (22)	YES (+27%)	NO
Level02_ClusterBedroom (22)	YES (+10.7%)	NO
Level02_ClusterBedroom (23)	YES (+10.7%)	NO
Level02_ClusterBedroom (23)	NO (-45.9%)	NO
Level02_ClusterBedroom (23)	YES (+27%)	NO
Level02_ClusterBedroom (23)	N/A	N/A
Level02_ClusterBedroom (23)	YES (+30.9%)	NO
Level02_ClusterBedroom (23)	YES (+16.2%)	NO
Level02_ClusterBedroom (23)	YES (+14%)	NO
Level02_ClusterBedroom (23)	YES (+27.7%)	NO
Level02_ClusterBedroom (23)	YES (+9.8%)	NO
Level02_ClusterBedroom (24)	YES (+27%)	NO
Level02_ClusterBedroom (24)	YES (+16.2%)	NO
Level02_ClusterBedroom (24)	YES (+30.9%)	NO
Level02_ClusterBedroom (24)	N/A	N/A
Level02_ClusterBedroom (24)	YES (+9.2%)	NO
Level02_ClusterBedroom (24)	YES (+14%)	NO
Level02_ClusterBedroom (24)	YES (+10.7%)	NO
Level02_ClusterBedroom (24)	NO (-45%)	NO
Level02_ClusterBedroom (24)	YES (+27.7%)	NO
Level02_ClusterBedroom (25)	NO (-46.2%)	NO
Level02_ClusterBedroom (25)	YES (+9.2%)	NO
Level02_ClusterBedroom (25)	N/A	N/A
Level02_ClusterBedroom (25)	YES (+14%)	NO
Level02_ClusterBedroom (25)	YES (+16.2%)	NO
Level02_ClusterBedroom (25)	YES (+27%)	NO
Level02_ClusterBedroom (25)	YES (+10.7%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_ClusterBedroom (25)	YES (+30.8%)	NO
Level02_ClusterBedroom (25)	YES (+27.7%)	NO
Level02_KLD	NO (-35.3%)	NO
Level02_KLD	NO (-38.6%)	NO
Level02_KLD (1)	NO (-35.3%)	NO
Level02_KLD (1)	NO (-38.5%)	NO
Level02_KLD (2)	NO (-35.3%)	NO
Level02_KLD (2)	NO (-38.5%)	NO
Level02_KLD (3)	NO (-38.5%)	NO
Level02_KLD (3)	NO (-35.3%)	NO
Level02_KLD (4)	NO (-38.5%)	NO
Level02_KLD (4)	NO (-35.3%)	NO
Level02_KLD (5)	NO (-38.5%)	NO
Level02_KLD (5)	NO (-35.3%)	NO
Level02_KLD (6)	NO (-38.5%)	NO
Level02_KLD (6)	NO (-35.3%)	NO
Level02_KLD (7)	NO (-35.3%)	NO
Level02_KLD (7)	NO (-38.5%)	NO
Level02_KLD (8)	NO (-35.3%)	NO
Level02_KLD (8)	NO (-38.5%)	NO
Level02_KLD (9)	NO (-38.5%)	NO
Level02_KLD (9)	NO (-35.3%)	NO
Level02_KLD (10)	NO (-35.3%)	NO
Level02_KLD (10)	NO (-38.5%)	NO
Level02_KLD (11)	NO (-35.3%)	NO
Level02_KLD (11)	NO (-38.5%)	NO
Level02_KLD (12)	NO (-35.3%)	NO
Level02_KLD (12)	NO (-38.5%)	NO
Level02_KLD (13)	NO (-38.5%)	NO
Level02_KLD (13)	NO (-35.3%)	NO
Level02_KLD (14)	NO (-38.5%)	NO
Level02_KLD (14)	NO (-35.3%)	NO
Level02_KLD (15)	NO (-38.5%)	NO
Level02_KLD (15)	NO (-35.3%)	NO
Level02_KLD (16)	NO (-38.5%)	NO
Level02_KLD (16)	NO (-35.3%)	NO
Level02_KLD (17)	NO (-38.5%)	NO
Level02_KLD (17)	NO (-35.3%)	NO
Level02_KLD (18)	NO (-35.3%)	NO
Level02_KLD (18)	NO (-38.5%)	NO
Level02_KLD (19)	NO (-35.3%)	NO
Level02_KLD (19)	NO (-38.5%)	NO
Level02_KLD (20)	NO (-35.3%)	NO
Level02_KLD (20)	NO (-38.5%)	NO
Level02_KLD (21)	NO (-35.3%)	NO
Level02_KLD (21)	NO (-38.5%)	NO
Level02_KLD (22)	NO (-35.3%)	NO
Level02_KLD (22)	NO (-38.5%)	NO
Level02_KLD (23)	NO (-35.3%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_KLD (23)	NO (-38.5%)	NO
Level02_KLD (24)	NO (-38.6%)	NO
Level02_KLD (24)	NO (-35.3%)	NO
Level02_KLD (25)	NO (-38.5%)	NO
Level02_KLD (25)	NO (-35.3%)	NO
Level02_Studio	NO (-25.3%)	NO
Level02_Studio	NO (-22.8%)	NO
Level02_Studio	NO (-32.2%)	NO
Level02_Studio	NO (-75.9%)	NO
Level02_Studio	NO (-24.1%)	NO
Level02_Studio	NO (-24.3%)	NO
Level02_Studio	NO (-27.9%)	NO
Level02_Studio	NO (-77.8%)	NO
Level02_Studio	NO (-24%)	NO
Level02_Studio	NO (-9.3%)	NO
Level02_Studio	NO (-25.4%)	NO
Level02_Studio	NO (-25.5%)	NO
Level02_Studio (1)	NO (-9.3%)	NO
Level02_Studio (1)	NO (-77.8%)	NO
Level02_Studio (1)	NO (-24%)	NO
Level02_Studio (1)	NO (-22.8%)	NO
Level02_Studio (1)	NO (-25.3%)	NO
Level02_Studio (1)	NO (-32.2%)	NO
Level02_Studio (1)	NO (-27.9%)	NO
Level02_Studio (1)	NO (-25.5%)	NO
Level02_Studio (1)	NO (-24.3%)	NO
Level02_Studio (1)	NO (-25.4%)	NO
Level02_Studio (1)	NO (-75.9%)	NO
Level02_Studio (1)	NO (-24.1%)	NO
Level02_Studio (2)	NO (-22.8%)	NO
Level02_Studio (2)	NO (-25.3%)	NO
Level02_Studio (2)	NO (-9.3%)	NO
Level02_Studio (2)	NO (-25.5%)	NO
Level02_Studio (2)	NO (-24.3%)	NO
Level02_Studio (2)	NO (-32.2%)	NO
Level02_Studio (2)	NO (-27.9%)	NO
Level02_Studio (2)	NO (-24.1%)	NO
Level02_Studio (2)	NO (-77.8%)	NO
Level02_Studio (2)	NO (-25.4%)	NO
Level02_Studio (2)	NO (-75.9%)	NO
Level02_Studio (2)	NO (-24%)	NO
Level02_Studio (3)	NO (-25.4%)	NO
Level02_Studio (3)	NO (-25.5%)	NO
Level02_Studio (3)	NO (-32.2%)	NO
Level02_Studio (3)	NO (-77.8%)	NO
Level02_Studio (3)	NO (-24%)	NO
Level02_Studio (3)	NO (-9.3%)	NO
Level02_Studio (3)	NO (-27.9%)	NO
Level02_Studio (3)	NO (-25.3%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_Studio (3)	NO (-75.9%)	NO
Level02_Studio (3)	NO (-24.3%)	NO
Level02_Studio (3)	NO (-24.1%)	NO
Level02_Studio (3)	NO (-22.2%)	NO
Level02_Studio (4)	NO (-75.9%)	NO
Level02_Studio (4)	NO (-32.2%)	NO
Level02_Studio (4)	NO (-9.3%)	NO
Level02_Studio (4)	NO (-77.8%)	NO
Level02_Studio (4)	NO (-25.5%)	NO
Level02_Studio (4)	NO (-25.4%)	NO
Level02_Studio (4)	NO (-27.9%)	NO
Level02_Studio (4)	NO (-22.8%)	NO
Level02_Studio (4)	NO (-24%)	NO
Level02_Studio (4)	NO (-25.3%)	NO
Level02_Studio (4)	NO (-24.1%)	NO
Level02_Studio (4)	NO (-24.3%)	NO
Level02_Studio (5)	NO (-24.3%)	NO
Level02_Studio (5)	NO (-25.3%)	NO
Level02_Studio (5)	NO (-25.4%)	NO
Level02_Studio (5)	NO (-27.9%)	NO
Level02_Studio (5)	NO (-22.8%)	NO
Level02_Studio (5)	NO (-77.8%)	NO
Level02_Studio (5)	NO (-9.3%)	NO
Level02_Studio (5)	NO (-24%)	NO
Level02_Studio (5)	NO (-24.1%)	NO
Level02_Studio (5)	NO (-75.9%)	NO
Level02_Studio (5)	NO (-32.2%)	NO
Level02_Studio (5)	NO (-25.5%)	NO
Level02_Studio (6)	NO (-9.3%)	NO
Level02_Studio (6)	NO (-77.8%)	NO
Level02_Studio (6)	NO (-27.9%)	NO
Level02_Studio (6)	NO (-25.3%)	NO
Level02_Studio (6)	NO (-75.9%)	NO
Level02_Studio (6)	NO (-22.8%)	NO
Level02_Studio (6)	NO (-25.4%)	NO
Level02_Studio (6)	NO (-24%)	NO
Level02_Studio (6)	NO (-25.5%)	NO
Level02_Studio (6)	NO (-24.3%)	NO
Level02_Studio (6)	NO (-32.2%)	NO
Level02_Studio (6)	NO (-24.1%)	NO
Level02_Studio (7)	NO (-24.1%)	NO
Level02_Studio (7)	NO (-32.2%)	NO
Level02_Studio (7)	NO (-9.3%)	NO
Level02_Studio (7)	NO (-24%)	NO
Level02_Studio (7)	NO (-77.8%)	NO
Level02_Studio (7)	NO (-27.9%)	NO
Level02_Studio (7)	NO (-22.2%)	NO
Level02_Studio (7)	NO (-25.5%)	NO
Level02_Studio (7)	NO (-24.3%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_Studio (7)	NO (-25.4%)	NO
Level02_Studio (7)	NO (-75.9%)	NO
Level02_Studio (7)	NO (-25.3%)	NO
Level02_Studio (8)	NO (-32.2%)	NO
Level02_Studio (8)	NO (-24.3%)	NO
Level02_Studio (8)	NO (-25.3%)	NO
Level02_Studio (8)	NO (-9.3%)	NO
Level02_Studio (8)	NO (-27.9%)	NO
Level02_Studio (8)	NO (-25.4%)	NO
Level02_Studio (8)	NO (-24%)	NO
Level02_Studio (8)	NO (-22.8%)	NO
Level02_Studio (8)	NO (-75.9%)	NO
Level02_Studio (8)	NO (-24.1%)	NO
Level02_Studio (8)	NO (-25.5%)	NO
Level02_Studio (8)	NO (-77.8%)	NO
Level02_Studio (9)	NO (-25.4%)	NO
Level02_Studio (9)	NO (-24.3%)	NO
Level02_Studio (9)	NO (-9.3%)	NO
Level02_Studio (9)	NO (-77.8%)	NO
Level02_Studio (9)	NO (-27.9%)	NO
Level02_Studio (9)	NO (-25.3%)	NO
Level02_Studio (9)	NO (-25.5%)	NO
Level02_Studio (9)	NO (-75.9%)	NO
Level02_Studio (9)	NO (-24.1%)	NO
Level02_Studio (9)	NO (-32.2%)	NO
Level02_Studio (9)	NO (-22.2%)	NO
Level02_Studio (9)	NO (-24%)	NO
Level02_Studio (10)	NO (-77.8%)	NO
Level02_Studio (10)	NO (-9.3%)	NO
Level02_Studio (10)	NO (-22.8%)	NO
Level02_Studio (10)	NO (-24.3%)	NO
Level02_Studio (10)	NO (-24%)	NO
Level02_Studio (10)	NO (-27.9%)	NO
Level02_Studio (10)	NO (-25.5%)	NO
Level02_Studio (10)	NO (-25.3%)	NO
Level02_Studio (10)	NO (-75.9%)	NO
Level02_Studio (10)	NO (-32.2%)	NO
Level02_Studio (10)	NO (-24.1%)	NO
Level02_Studio (10)	NO (-25.4%)	NO
Level02_Studio (11)	NO (-22.8%)	NO
Level02_Studio (11)	NO (-24.1%)	NO
Level02_Studio (11)	NO (-24%)	NO
Level02_Studio (11)	NO (-25.5%)	NO
Level02_Studio (11)	NO (-27.9%)	NO
Level02_Studio (11)	NO (-75.9%)	NO
Level02_Studio (11)	NO (-24.3%)	NO
Level02_Studio (11)	NO (-77.8%)	NO
Level02_Studio (11)	NO (-25.4%)	NO
Level02_Studio (11)	NO (-32.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_Studio (11)	NO (-25.3%)	NO
Level02_Studio (11)	NO (-9.3%)	NO
Level02_Studio (12)	NO (-24%)	NO
Level02_Studio (12)	NO (-25.3%)	NO
Level02_Studio (12)	NO (-77.8%)	NO
Level02_Studio (12)	NO (-25.4%)	NO
Level02_Studio (12)	NO (-24.3%)	NO
Level02_Studio (12)	NO (-22.8%)	NO
Level02_Studio (12)	NO (-9.3%)	NO
Level02_Studio (12)	NO (-25.5%)	NO
Level02_Studio (12)	NO (-32.2%)	NO
Level02_Studio (12)	NO (-27.9%)	NO
Level02_Studio (12)	NO (-24.1%)	NO
Level02_Studio (12)	NO (-75.9%)	NO
Level02_Studio (13)	NO (-24.1%)	NO
Level02_Studio (13)	NO (-25.5%)	NO
Level02_Studio (13)	NO (-22.2%)	NO
Level02_Studio (13)	NO (-75.9%)	NO
Level02_Studio (13)	NO (-24.3%)	NO
Level02_Studio (13)	NO (-25.3%)	NO
Level02_Studio (13)	NO (-77.8%)	NO
Level02_Studio (13)	NO (-25.4%)	NO
Level02_Studio (13)	NO (-9.3%)	NO
Level02_Studio (13)	NO (-24%)	NO
Level02_Studio (13)	NO (-27.9%)	NO
Level02_Studio (13)	NO (-32.2%)	NO
Level02_Studio (14)	NO (-32.2%)	NO
Level02_Studio (14)	NO (-27.9%)	NO
Level02_Studio (14)	NO (-77.8%)	NO
Level02_Studio (14)	NO (-22.8%)	NO
Level02_Studio (14)	NO (-25.4%)	NO
Level02_Studio (14)	NO (-25.3%)	NO
Level02_Studio (14)	NO (-24.3%)	NO
Level02_Studio (14)	NO (-24%)	NO
Level02_Studio (14)	NO (-9.3%)	NO
Level02_Studio (14)	NO (-24.1%)	NO
Level02_Studio (14)	NO (-25.5%)	NO
Level02_Studio (14)	NO (-75.9%)	NO
Level02_Studio (15)	NO (-27.9%)	NO
Level02_Studio (15)	NO (-77.8%)	NO
Level02_Studio (15)	NO (-9.3%)	NO
Level02_Studio (15)	NO (-32.2%)	NO
Level02_Studio (15)	NO (-25.5%)	NO
Level02_Studio (15)	NO (-24%)	NO
Level02_Studio (15)	NO (-25.4%)	NO
Level02_Studio (15)	NO (-25.3%)	NO
Level02_Studio (15)	NO (-75.9%)	NO
Level02_Studio (15)	NO (-22.8%)	NO
Level02_Studio (15)	NO (-24.1%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_Studio (15)	NO (-24.3%)	NO
Level02_Studio (16)	NO (-24.3%)	NO
Level02_Studio (16)	NO (-77.8%)	NO
Level02_Studio (16)	NO (-24%)	NO
Level02_Studio (16)	NO (-24.1%)	NO
Level02_Studio (16)	NO (-22.2%)	NO
Level02_Studio (16)	NO (-75.9%)	NO
Level02_Studio (16)	NO (-32.2%)	NO
Level02_Studio (16)	NO (-25.3%)	NO
Level02_Studio (16)	NO (-25.5%)	NO
Level02_Studio (16)	NO (-27.9%)	NO
Level02_Studio (16)	NO (-25.4%)	NO
Level02_Studio (16)	NO (-9.3%)	NO
Level02_Studio (17)	NO (-22.8%)	NO
Level02_Studio (17)	NO (-27.9%)	NO
Level02_Studio (17)	NO (-25.3%)	NO
Level02_Studio (17)	NO (-24%)	NO
Level02_Studio (17)	NO (-75.9%)	NO
Level02_Studio (17)	NO (-25.4%)	NO
Level02_Studio (17)	NO (-9.3%)	NO
Level02_Studio (17)	NO (-25.5%)	NO
Level02_Studio (17)	NO (-24.3%)	NO
Level02_Studio (17)	NO (-32.2%)	NO
Level02_Studio (17)	NO (-24.1%)	NO
Level02_Studio (17)	NO (-77.8%)	NO
Level02_Studio (18)	NO (-25.4%)	NO
Level02_Studio (18)	NO (-27.9%)	NO
Level02_Studio (18)	NO (-24.3%)	NO
Level02_Studio (18)	NO (-25.5%)	NO
Level02_Studio (18)	NO (-25.3%)	NO
Level02_Studio (18)	NO (-24%)	NO
Level02_Studio (18)	NO (-24.1%)	NO
Level02_Studio (18)	NO (-32.2%)	NO
Level02_Studio (18)	NO (-77.8%)	NO
Level02_Studio (18)	NO (-22.2%)	NO
Level02_Studio (18)	NO (-9.3%)	NO
Level02_Studio (18)	NO (-75.9%)	NO
Level02_Studio (19)	NO (-27.9%)	NO
Level02_Studio (19)	NO (-25.5%)	NO
Level02_Studio (19)	NO (-77.8%)	NO
Level02_Studio (19)	NO (-32.2%)	NO
Level02_Studio (19)	NO (-9.3%)	NO
Level02_Studio (19)	NO (-24.1%)	NO
Level02_Studio (19)	NO (-25.4%)	NO
Level02_Studio (19)	NO (-22.2%)	NO
Level02_Studio (19)	NO (-24.3%)	NO
Level02_Studio (19)	NO (-25.3%)	NO
Level02_Studio (19)	NO (-75.9%)	NO
Level02_Studio (19)	NO (-24%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_Studio (20)	NO (-27.9%)	NO
Level02_Studio (20)	NO (-25.3%)	NO
Level02_Studio (20)	NO (-24%)	NO
Level02_Studio (20)	NO (-25.4%)	NO
Level02_Studio (20)	NO (-24.3%)	NO
Level02_Studio (20)	NO (-22.8%)	NO
Level02_Studio (20)	NO (-9.3%)	NO
Level02_Studio (20)	NO (-32.2%)	NO
Level02_Studio (20)	NO (-25.5%)	NO
Level02_Studio (20)	NO (-24.1%)	NO
Level02_Studio (20)	NO (-75.9%)	NO
Level02_Studio (20)	NO (-77.8%)	NO
Level02_Studio (21)	NO (-24.1%)	NO
Level02_Studio (21)	NO (-9.3%)	NO
Level02_Studio (21)	NO (-24.3%)	NO
Level02_Studio (21)	NO (-77.8%)	NO
Level02_Studio (21)	NO (-25.3%)	NO
Level02_Studio (21)	NO (-25.5%)	NO
Level02_Studio (21)	NO (-22.2%)	NO
Level02_Studio (21)	NO (-32.2%)	NO
Level02_Studio (21)	NO (-27.9%)	NO
Level02_Studio (21)	NO (-75.9%)	NO
Level02_Studio (21)	NO (-24%)	NO
Level02_Studio (21)	NO (-25.4%)	NO
Level02_Studio (22)	NO (-24.3%)	NO
Level02_Studio (22)	NO (-77.8%)	NO
Level02_Studio (22)	NO (-32.2%)	NO
Level02_Studio (22)	NO (-9.3%)	NO
Level02_Studio (22)	NO (-22.8%)	NO
Level02_Studio (22)	NO (-25.3%)	NO
Level02_Studio (22)	NO (-24.1%)	NO
Level02_Studio (22)	NO (-25.4%)	NO
Level02_Studio (22)	NO (-75.9%)	NO
Level02_Studio (22)	NO (-27.9%)	NO
Level02_Studio (22)	NO (-24%)	NO
Level02_Studio (22)	NO (-25.5%)	NO
Level02_Studio (23)	NO (-24.1%)	NO
Level02_Studio (23)	NO (-9.3%)	NO
Level02_Studio (23)	NO (-25.3%)	NO
Level02_Studio (23)	NO (-27.9%)	NO
Level02_Studio (23)	NO (-24%)	NO
Level02_Studio (23)	NO (-25.5%)	NO
Level02_Studio (23)	NO (-25.4%)	NO
Level02_Studio (23)	NO (-22.2%)	NO
Level02_Studio (23)	NO (-32.2%)	NO
Level02_Studio (23)	NO (-75.9%)	NO
Level02_Studio (23)	NO (-77.8%)	NO
Level02_Studio (23)	NO (-24.3%)	NO
Level02_Studio (24)	NO (-25.5%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level02_Studio (24)	NO (-25.3%)	NO
Level02_Studio (24)	NO (-32.2%)	NO
Level02_Studio (24)	NO (-24.1%)	NO
Level02_Studio (24)	NO (-27.9%)	NO
Level02_Studio (24)	NO (-24.3%)	NO
Level02_Studio (24)	NO (-75.9%)	NO
Level02_Studio (24)	NO (-77.8%)	NO
Level02_Studio (24)	NO (-9.3%)	NO
Level02_Studio (24)	NO (-22.2%)	NO
Level02_Studio (24)	NO (-24%)	NO
Level02_Studio (24)	NO (-25.4%)	NO
Level02_Studio (25)	NO (-24%)	NO
Level02_Studio (25)	NO (-25.3%)	NO
Level02_Studio (25)	NO (-25.5%)	NO
Level02_Studio (25)	NO (-25.4%)	NO
Level02_Studio (25)	NO (-32.2%)	NO
Level02_Studio (25)	NO (-27.9%)	NO
Level02_Studio (25)	NO (-24.1%)	NO
Level02_Studio (25)	NO (-9.3%)	NO
Level02_Studio (25)	NO (-75.9%)	NO
Level02_Studio (25)	NO (-77.8%)	NO
Level02_Studio (25)	NO (-24.3%)	NO
Level02_Studio (25)	NO (-22.2%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	18438.2	18438.2
External area [m ²]	10482.1	10482.1
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	6510.13	5943.17
Average U-value [W/m ² K]	0.62	0.57
Alpha value* [%]	2.24	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels
 Residential Institutions: Hospitals and Care Homes
 Residential Institutions: Residential Schools

100 Residential Institutions: Universities and Colleges

Secure Residential Institutions
 Residential Spaces
 Non-residential Institutions: Community/Day Centre
 Non-residential Institutions: Libraries, Museums, and Galleries
 Non-residential Institutions: Education
 Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.84	6.76
Cooling	0.83	1.07
Auxiliary	4.02	2.5
Lighting	4.32	6.89
Hot water	4.39	5.56
Equipment*	25.84	25.84
TOTAL**	21.4	22.77

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0.08	0.65
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0.08</i>	<i>0.65</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	68.43	61.51
Primary energy [kWh _{PE} /m ²]	32.41	33.04
Total emissions [kg/m ²]	3.06	3.1

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	86.5	0	24	0	0	1	0	1	0
	Notional	85.2	0	16.8	0	0	1.41	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	25.2	37.9	1.2	1.3	6	5.7	8.02	5.7	11.3
	Notional	26.1	26.7	2.6	1.6	3.4	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	96.1	0	26.7	0	0	1	0	1	0
	Notional	94.6	0	18.6	0	0	1.41	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	28.5	23.7	1.4	0.6	4.2	5.7	11.3	5.7	11.3
	Notional	30	17.4	3	1	3.2	2.78	4.63	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Appendix D – First Street Block C, Whole Life Carbon Assessment



Intended for
Downing

Document type
Report

Date
November 2023

FIRST STREET BLOCK C

RIBA STAGE 2 WHOLE LIFE CARBON ASSESSMENT



FIRST STREET BLOCK C

RIBA STAGE 2 WHOLE LIFE CARBON ASSESSMENT

Project name **First Street Block C**
Project no. **1620005201**
Recipient **Downing**
Version **3**
Date **07/11/2023**
Prepared by **Mariami Tkeshelashvili**
Checked by **Robert Cairns**
Approved by **Sarah Ord**
Description **Whole Life-Cycle Carbon Assessment in line with BS EN 15978:2011 and RICS guidance.**

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1. EXECUTIVE SUMMARY

Ramboll have been appointed to undertake the Whole Life Carbon Assessment (WLCA) for the development at Block C, Plot 11, First Street, aiming to provide high end student accommodation.

The proposed development will comprise of a 28-storey building with 19,023 m² (GIA) floorspace. It is intended to be a concrete framed building with full perimeter glazing.

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

Embodied Carbon
707

kgCO₂e/m² GIA
(A1-A5, B2-B4, C1-C4)

Operational Energy

126 kWh/m²/yr

Operational Carbon
(FES)

314

kgCO₂e/m² GIA (B6)

Whole Life Carbon

1,021

kgCO₂e/m² GIA
(A1-A5, B2-B4, B6, C1-C4)

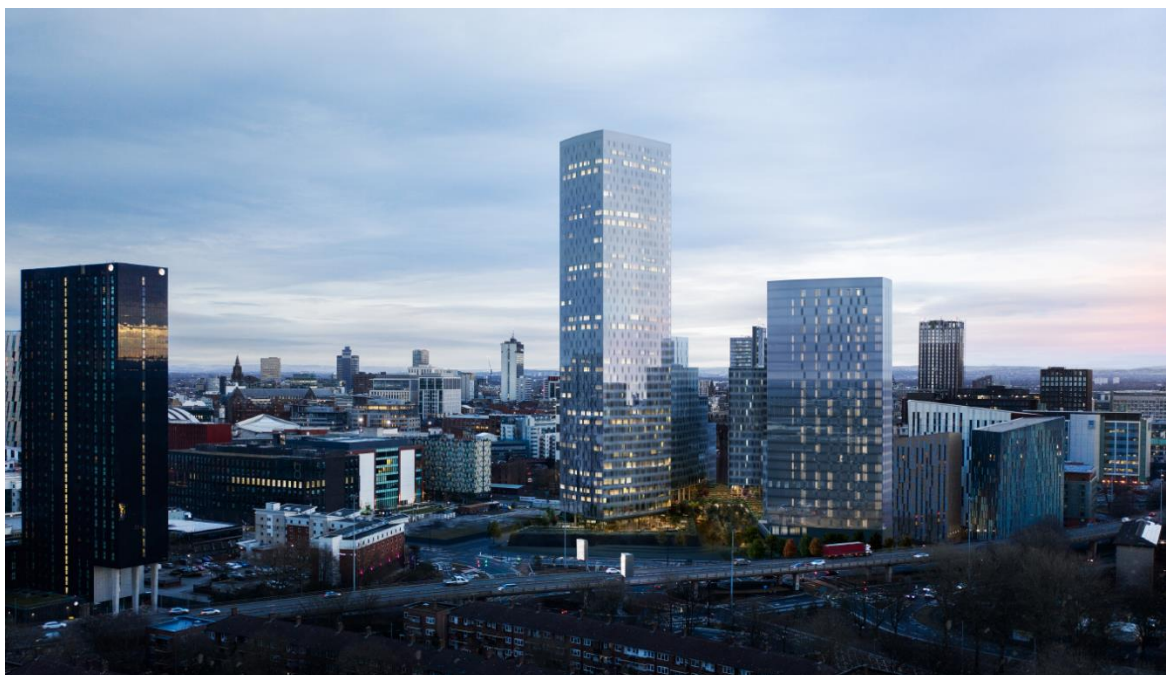


Figure 1: First Street Block C (SimpsonHaugh)

2. INTRODUCTION

Ramboll have been appointed to undertake a Whole Life-cycle Carbon Assessment (WLCA) in line with the requirements for the Block C, Plot 11, First Street South, located in Manchester.

The proposed residential development will comprise up to 28 storeys and up to **19,023 m²** GIA floorspace.

This document presents the WLCA study and 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'.

2.1 The Site

The proposed development include one block - Block C - which is located in the south part of the site, highlighted in blue.

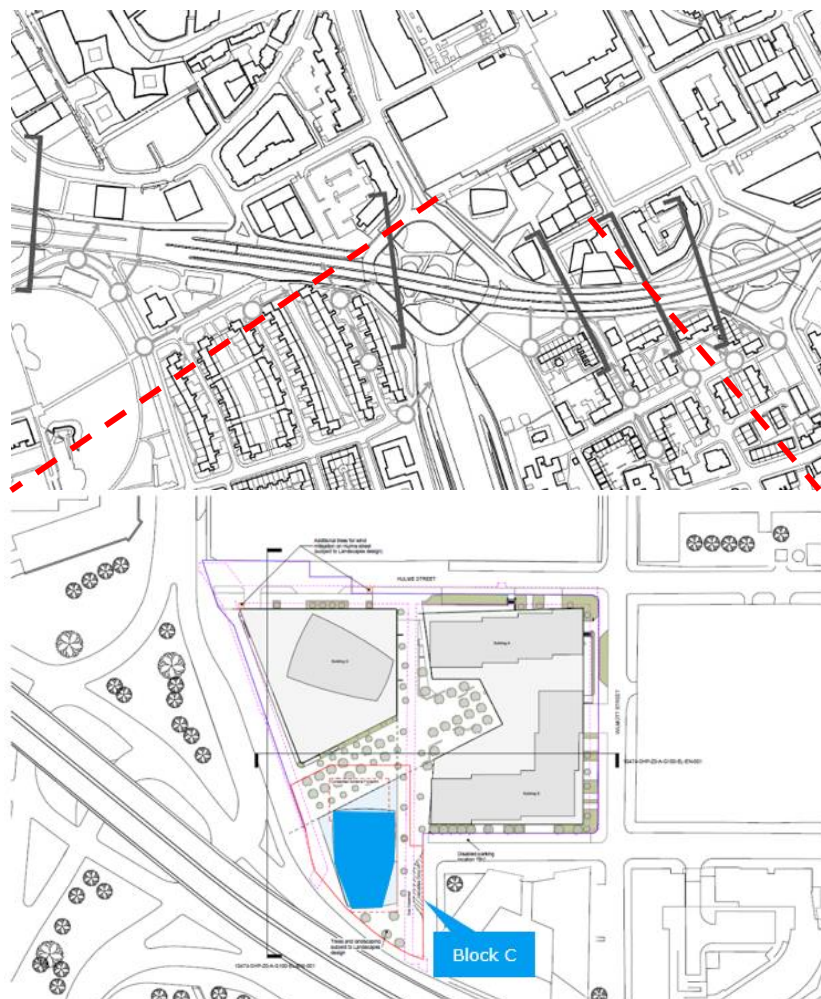


Figure 2: First Street Block C, site location and boundaries (SimpsonHaugh)

Block C is a multistorey development with student accommodation, comprising bedspaces and communal areas (Figure 3). The building will be 28 storeys, and 19,023 m² (GIA) floorspace with an RC frame and double glazed aluminium curtain wall façade (Figure 4).

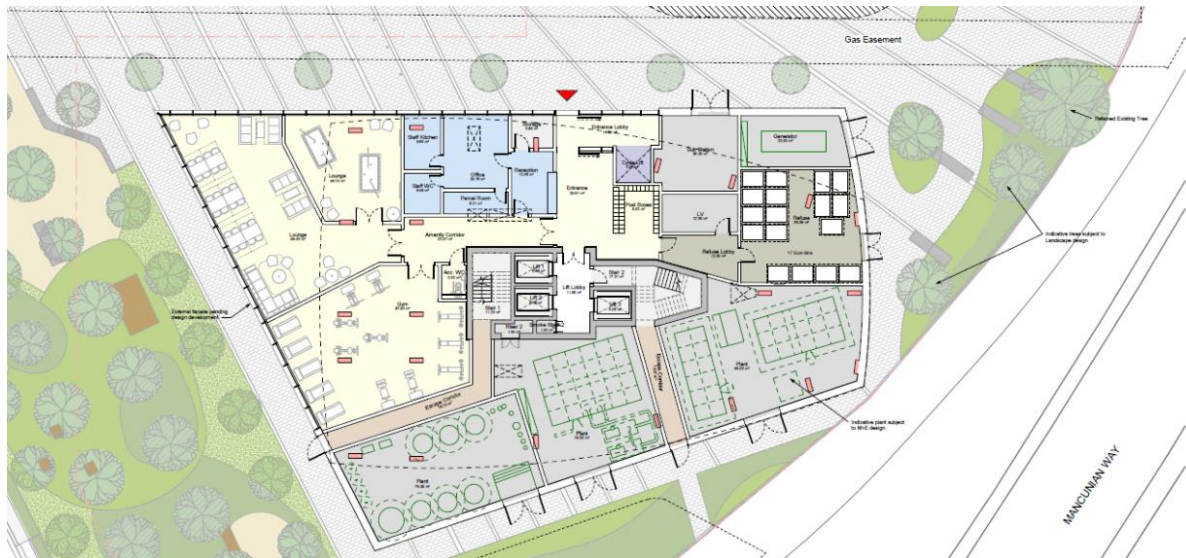


Figure 3: Proposed Ground floor plan (Simpsonhaugh)

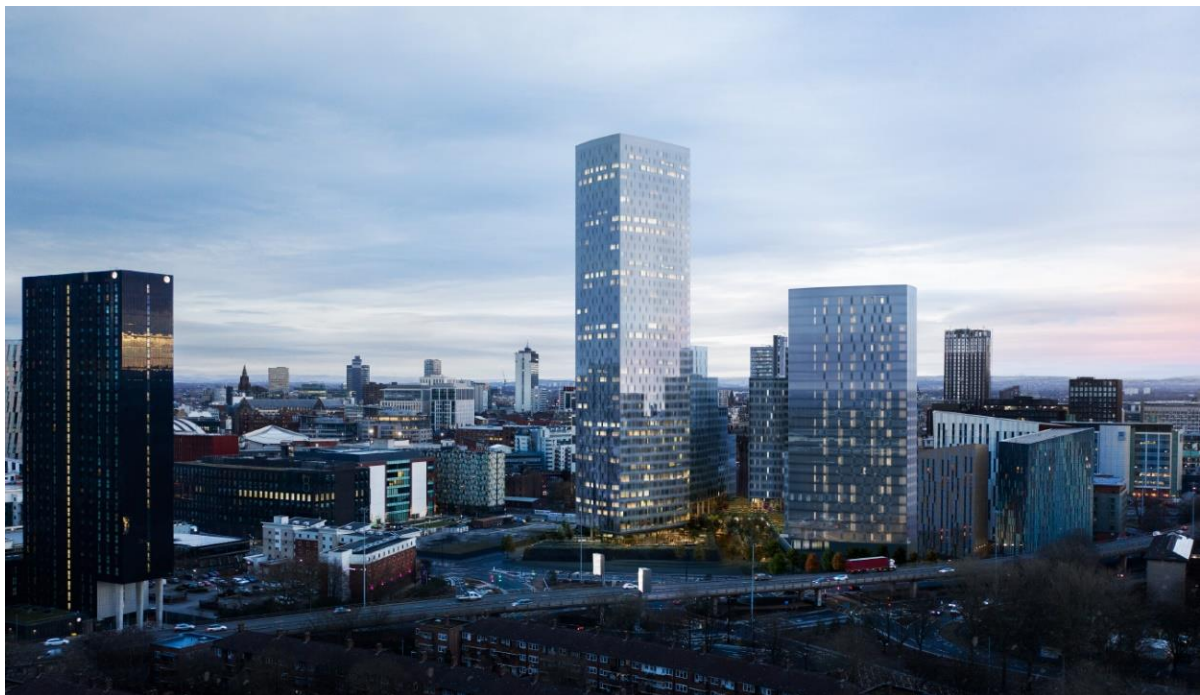


Figure 4: First Street Block C (Simpsonhaugh)

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

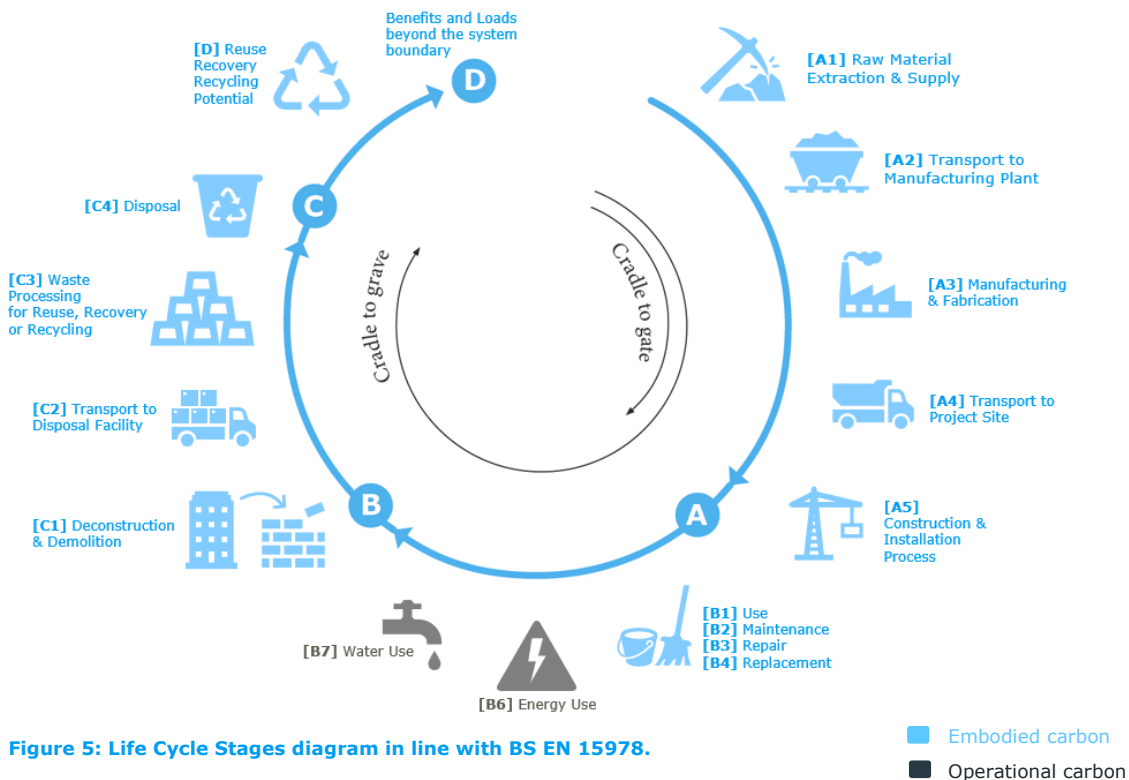


Figure 5: Life Cycle Stages diagram in line with BS EN 15978.

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.

4. WLCA - METHODOLOGY

4.1 Whole Life-Cycle Carbon Assessment Guidance

The RICS Professional Statement: Whole Life Carbon Assessment for the built environment is a useful guide to the practical implementation of the BS EN 15978 principles. In the UK it is considered the current industry best practice for applying the techniques of WLCA to measuring carbon on construction projects. It sets out technical details and calculation requirements as well as indicative values.

4.2 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 CONSTRUCTI ON 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	TRANSPORT TO PROJECT SITE	CONSTRUCTION AND INSTALLATION PROCESS	USE	MAINTENANCE	REPAIR	REPLACEMENT	REFURBISHMENT	DECONSTRUCTION DEMOLITTONNES	TRANSPORT TO DISPOSAL FACILITY	WASTE PROCESSING	DISPOSAL	REUSE, RECOVERY, RECYCLING POTENTIAL				
					B6 – OPERATIONAL ENERGY USE													
					B7 – OPERATIONAL WATER USE													

Embodied carbon – **included** [A1-A5, B2-B4, C1-C4] and **excluded** [B1, B5, B7]

Operational carbon – **included** [B6]

Circularity – **included** [D]

The WLC assessment for the First Street Block C covers all building elements listed in Table 2 that are applicable to the project. The current model captures the shell and core of the building and full fit-out to residential and communal spaces such as reception and lift lobbies, office/study spaces and residential units.

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 (deconstruction and demolition process, RICS)
		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 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 (GLA Benchmark, ~19kgCO2e/m2 GIA))
5	Building services/MEP	5.1, 5.3, 5.4, 5.6, 5.7, 5.8, 5.10, 5.11, 5.12 – Included services 5.2, 5.5, 5.9, 5.13-5.14 – Excluded services	Included as noted 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, 8.5 & 8.6)

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.

4.3 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.

As many elements as possible have been included from the information provided, however, cost was not provided on this project, so no adjustment factor has been applied.

4.4 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.

4.5 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 3 : Sources of design information used for LCA

Design Information	Sender	Received	File name
Structural details	SimpsonHaugh	17/10/23	10474-AJP-ZZ-RF-DR-S-0600_MATERIAL SCHEDULE .pdf
Material quantities for substructure, superstructure, finishes, services, and external works	Downing	18/10/23	FS, BLock C Cost Plan Nr 1 - DRAFT CARBON.xlsx
Façade details	SimpsonHaugh	18/10/23	Information provided via email
Project background information	SimpsonHaugh	20/09/23	First Street south – building C, design team meeting.pdf
Operational energy	Abacus Consult	31/10/2023	Information provided via email

The relevant data was summarised in the Life Cycle Inventory (LCI) spreadsheet developed by Ramboll. 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, meaning B and C stages may change significantly from the time of the assessment over the 60 year WLCA study period.

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

Table 4: Main project data sources and key assumptions.

Life cycle stage	Data sources and assumptions																																		
A1 – A3 Construction materials	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 ' <i>Whole life carbon assessment for the built environment, November 2017</i> ', Table 6 has been used.																																		
A4 Transportation to site	With regards to (A4) emissions, the following assumptions have been made for transport distances in alignment with RICS guidance ' <i>Whole life carbon assessment for the built environment, November 2017</i> ': 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.																																		
A5 Construction and installation process	In the absence of more specific information, average figures have been used to capture the Building Construction Site Emissions (A5) at 13.91 kgCO ₂ e/m ² of GIA 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 5: Material waste rate assumptions, Module A5. <table border="1"> <thead> <tr> <th>Material</th><th>Waste rate (%) assumed</th></tr> </thead> <tbody> <tr><td>Concrete</td><td>5</td></tr> <tr><td>Reinforcement Steel</td><td>5</td></tr> <tr><td>Brick</td><td>5</td></tr> <tr><td>Precast concrete pavers</td><td>5</td></tr> <tr><td>Concrete block</td><td>20</td></tr> <tr><td>Mineral wool</td><td>8</td></tr> <tr><td>Aluminium sheet</td><td>1</td></tr> <tr><td>MDF</td><td>10</td></tr> <tr><td>Membranes</td><td>10</td></tr> <tr><td>Curtain wall</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>Ceramic tiles</td><td>8</td></tr> <tr><td>Vinyl tiles</td><td>5</td></tr> <tr><td>Epoxy</td><td>10</td></tr> <tr><td>Paint</td><td>10</td></tr> </tbody> </table>	Material	Waste rate (%) assumed	Concrete	5	Reinforcement Steel	5	Brick	5	Precast concrete pavers	5	Concrete block	20	Mineral wool	8	Aluminium sheet	1	MDF	10	Membranes	10	Curtain wall	2.5	Aluminium louvres	1	Internal wooden doors	2.5	Ceramic tiles	8	Vinyl tiles	5	Epoxy	10	Paint	10
Material	Waste rate (%) assumed																																		
Concrete	5																																		
Reinforcement Steel	5																																		
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Vinyl tiles	5																																		
Epoxy	10																																		
Paint	10																																		

	Plasterboard	12.5																																																					
	Carpet tiles	5																																																					
	Stainless steel	2.5																																																					
	Mortar	5																																																					
B1 In use emissions	In use emissions (B1) have been omitted from this report due to lack of available data.																																																						
B2-B3 Maintenance and repair emissions	<p>Maintenance (B2) stage emissions have been estimated based on GLA standard assumption of 10 kgCO₂e/m² of gross internal area (GIA) to cover all building element categories (>1% of modules A1-A5: 6.43 kgCO₂e/m² GIA) in the absence of more specific information.</p> <p>Repair (B3) stage emissions, the following assumptions have been made for the repair emissions (B3) in the absence of project specific data (e.g., maintenance strategy reports, O&M manuals etc.)</p> <p>Table 6: Repair rate assumptions, Module B3.</p> <table> <tr> <th>Element</th><th>Percentage of material repaired [%]</th><th>Repair frequency [years]</th><th>Annual repair rate [%]</th></tr> <tr> <td>Aluminium louvres</td><td>1</td><td>15</td><td>0.07</td></tr> <tr> <td>Aluminium curtain wall</td><td>2</td><td>10</td><td>0.2</td></tr> <tr> <td>Steel profiles/sheets</td><td>1</td><td>15</td><td>0.07</td></tr> <tr> <td>External doors</td><td>2</td><td>10</td><td>0.2</td></tr> <tr> <td>Internal doors</td><td>2</td><td>10</td><td>0.2</td></tr> <tr> <td>Plasterboard</td><td>2</td><td>10</td><td>0.2</td></tr> <tr> <td>Paint finish</td><td>2</td><td>10</td><td>0.2</td></tr> <tr> <td>Epoxy floor covering</td><td>2</td><td>10</td><td>0.2</td></tr> <tr> <td>Ceramic tiles</td><td>1</td><td>10</td><td>0.1</td></tr> <tr> <td>Carpet tiles</td><td>1</td><td>5</td><td>0.2</td></tr> <tr> <td>Precast concrete pavers</td><td>1</td><td>5</td><td>0.2</td></tr> <tr> <td>Vinyl tiles</td><td>1</td><td>10</td><td>0.2</td></tr> </table>			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	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	Vinyl tiles	1	10	0.2
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Vinyl tiles	1	10	0.2																																																				

B4 Replacement emissions	Lifespans used (B4) in the assessment are presented below, taken from RICS PS (2017) and OneClick LCA:		
	Table 7: Replacement cycles / Service life assumptions.		
	Material group		Service life (years)
	Substructure		60
	Concrete		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
	Vinyl tiles		15
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 calculations received from Abacus mechanical and electrical consulting engineers, see below:		
	First Street Block C	Regulated [kWh/m²]	Unregulated [kWh/m²]
	Energy Consumption by End use	69.21	57.46
	Conversion factors used for the operational carbon calculations:		
<ul style="list-style-type: none">2023 UK government GHG electricity emissions factor 0.207074 kgCO2e/kWh fixed for 60 years and,Decarbonised grid FES Falling short scenario, average grid electricity emissions factor 0.0413 kgCO2e/kWh.			
Emissions relating to operational water use (B7) have been excluded as no data was provided.			

C1 - C4 End-of-Life (EoL) stages	<p>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.</p> <p>According to RICS PS, in the absence of more specific information, an average rate of (C1) 3.4 kgCO₂e/m² GIA (rate from monitored demolition case studies in central London) based on aggregated data is used.</p> <p>End-of-life scenarios for Stages (C2-C4) for key material groups are presented below.</p> <p>Table 8: End-of-life scenarios for key material groups.</p> <table border="1"> <thead> <tr> <th>Material group</th><th>End-of-Life scenario (C2-C4)</th></tr> </thead> <tbody> <tr><td>Concrete</td><td>Crushed into aggregates</td></tr> <tr><td>Steel</td><td>Recycling</td></tr> <tr><td>Concrete blocks</td><td>Crushed into aggregates</td></tr> <tr><td>Concrete Reinforcement</td><td>Steel recycling</td></tr> <tr><td>Membranes</td><td>Incineration</td></tr> <tr><td>Mineral Wool insulation</td><td>Landfilling</td></tr> <tr><td>Clay Bricks</td><td>Crushed to aggregates</td></tr> <tr><td>Aluminium elements</td><td>Recycling</td></tr> <tr><td>Timber elements</td><td>Incineration</td></tr> <tr><td>Gypsum Plasterboard</td><td>Recycling</td></tr> <tr><td>Glass Panes</td><td>Recycling</td></tr> <tr><td>Mortar (bricklaying)</td><td>Landfilling</td></tr> <tr><td>Paint</td><td>Landfilling</td></tr> <tr><td>Ceramic Tiles</td><td>Crushed to aggregates</td></tr> <tr><td>Carpet Tiles</td><td>Recycling</td></tr> <tr><td>Vinyl tiles</td><td>Incineration</td></tr> </tbody> </table>	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	Vinyl tiles	Incineration
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Paint	Landfilling																																		
Ceramic Tiles	Crushed to aggregates																																		
Carpet Tiles	Recycling																																		
Vinyl tiles	Incineration																																		
D Benefits and loads beyond the system boundary	<p>Module D benefits and loads have been calculated using the above End-of life scenarios (Table 8), which follow the EN 15978 standard.</p>																																		

5. WLCA - RESULTS

Table 9 and Table 10 present the estimated WLC emissions for the development for non-decarbonised and decarbonised electrical grid scenarios.

Table 9: WLCA Results Summary – Non-decarbonised grid (2023 UK Government)

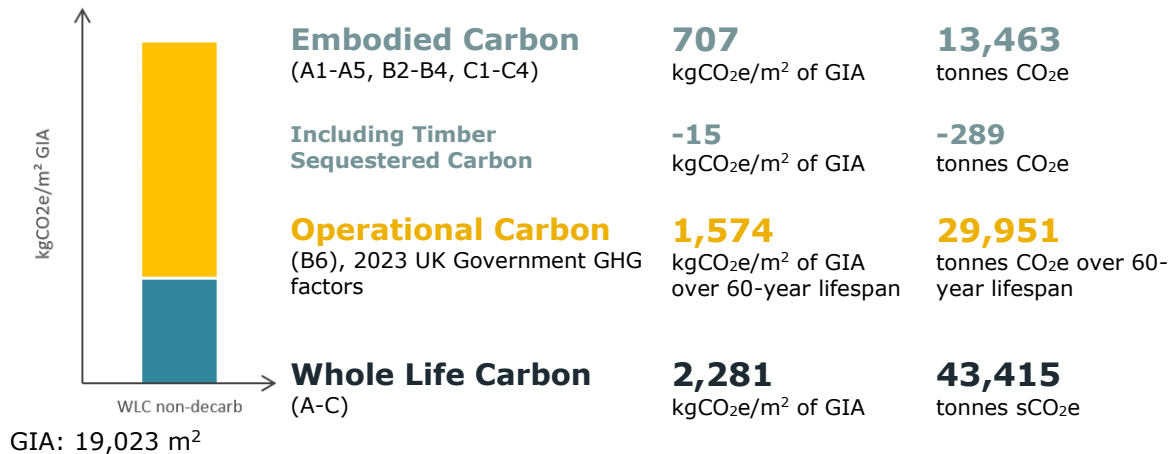
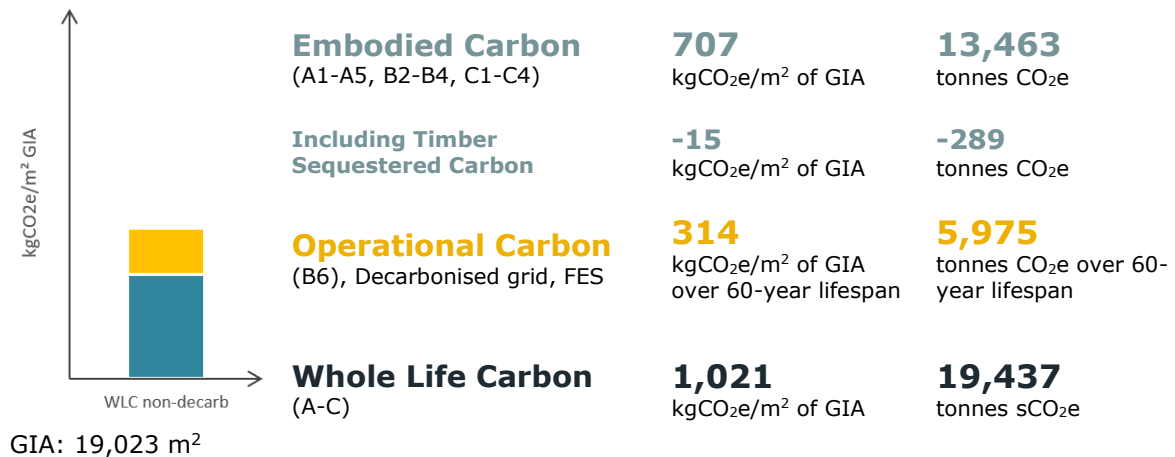


Table 10: WLCA Results Summary – With grid decarbonisation (FES 2022 Falling Short Scenario)



These show that as the UK grid decarbonises, the embodied carbon emissions are significantly higher (~70% of overall emissions) compared to the operational carbon emissions.

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

5.1 Results uncertainty and ranges

While Table 9 and Table 10 present specific embodied and operational carbon figures, in practice there is significant inherent uncertainty in any carbon assessment. Prior to completion of construction the WLCA is a prediction or estimate, and as the project progresses carbon figures could increase or decrease for a variety of reasons, including:

- design development resulting in material quantity or specification change
- supply chain and sourcing impacting products used or manufacturing processes
- revised methodology or change of scope affecting reporting practice
- estimates and imprecision in source carbon data used

To cover for any uncertainties at RIBA Stage 2, a default contingency factor of 15% is applied to all life cycle stages and modules at this early design stage (Table 10, RICS PS, 2023). This is translated to a potential uplift of $\sim 100 \text{ kgCO}_2\text{e/m}^2$ on A-C (excl. B6 & B7) figures at this stage. This factor will change at later stages as more detail and materials are added to the design and construction specifications are provided.

5.2 Whole Life Embodied Carbon [A-C] Benchmarks & Targets

A set of embodied carbon benchmarks for various building types have been developed by Greater London Authority (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 **Residential 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 Residential suggests a *WLC benchmark* of **1,200** $\text{kgCO}_2\text{e/m}^2$ GIA with the *WLC aspirational benchmark* set at **800** $\text{kgCO}_2\text{e/m}^2$ GIA (stages A-C, excl. B6-B7). As shown First Street Block C is a betterment against the GLA Aspirational benchmark (Figure 6).

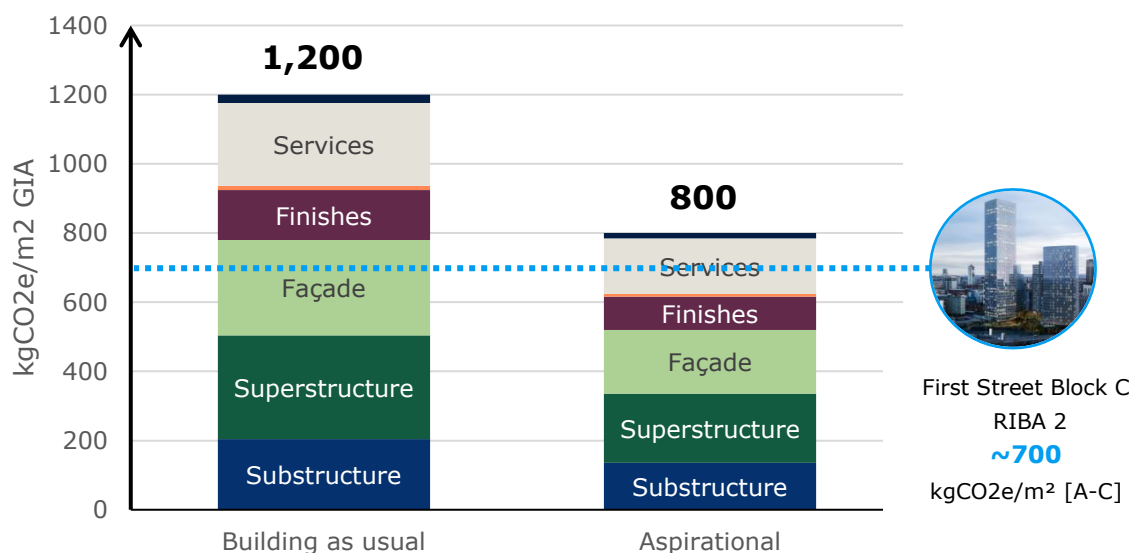


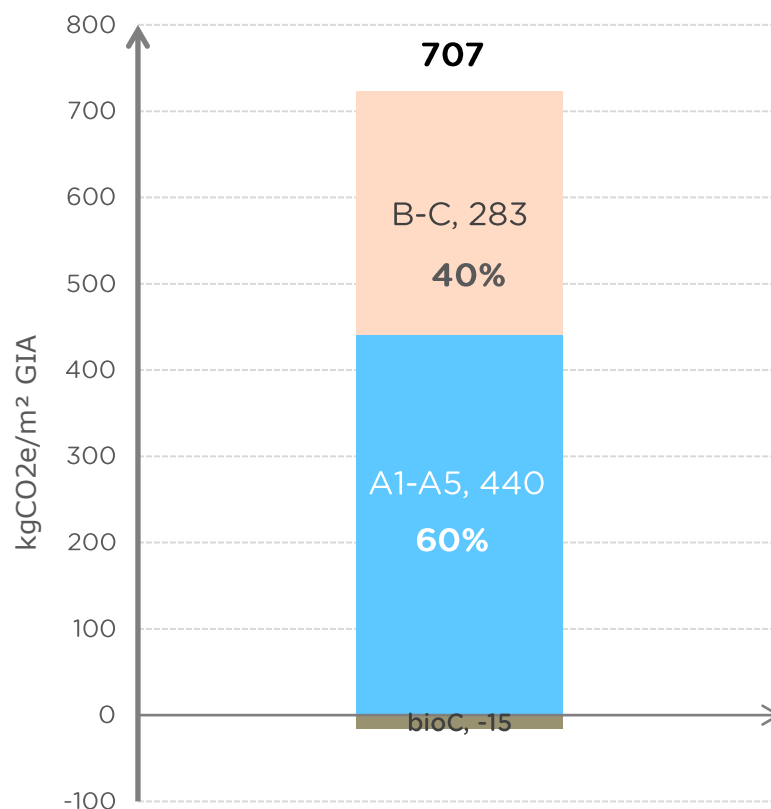
Figure 6: Benchmarks for Residential Buildings, Scope A-C (excluding B6 & B7) vs First Street Block C

5.3 Embodied Carbon

Figure 7 presents the overall embodied carbon emissions broken down by life cycle stages from A to C (excl. B6 & B7). The scope of the assessment covers stages A1-A5, B2-B4 and C1-C4. The overall embodied carbon emissions for Stage 2 have been calculated at $\sim 707 \text{ kgCO}_2/\text{m}^2$ GIA (including carbon sequestration $-15 \text{ kgCO}_2/\text{m}^2$). Module D potential carbon savings for this project as calculated at $-112 \text{ kgCO}_2/\text{m}^2$ using Table 8 End-of-Life scenarios which follow the EN 15978 standard.

These results are likely to change at 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 the lack of industry data availability, approximate rates and benchmarks have been specified for the FF&E, Construction Site Emissions and Services.

Emissions up to practical completion of the project (upfront carbon emissions A1-A5) are significant and account for $\sim 60\%$ of the total embodied carbon emissions. Use stage (B2-B4) emissions associated with in-use, repair, and replacement cycles of materials and End-of-life emissions (C1-C4) approximately 40% . For approximate rates and assumptions regarding the Life Cycle Stages, see Table 4.



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

Figure 7: Embodied Carbon Breakdown of Building Elements (A1-A5, B2-B4, C1-C4)

Figure 8 below 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 (A-C). Among the highest contributors and the top of the list are the services, floor slabs, external works and foundations.

Services is the highest contributor with use stage emissions (Stage B) conservatively responsible for over 21% of the of the total emissions. This due to replacement cycles playing an important role in the life cycle of the building (Stage B4). Replacement periods range from 20 to 60 years depending on the systems used. Services also require refrigerants through the operation of mechanical equipment. This has not been modelled within this report due to lack of available data but is an additional element which contributes significantly to Stage B emissions and should be kept in mind at later stages.

External Walls have similar breakdown between product (A1-A3) and use stage (B4) emissions due to the 30yr lifespan of the external façade elements, allowing for 1nr replacement during the whole life of the building. The embodied carbon value is significant as this allows for the full perimeter glazing on the building.

Upper Floors are next on the list. Floor slabs produce significant emissions due to the large quantities of structural materials (concrete and steel) used in their construction. Almost all these emissions occur during the manufacturing stage (Stages A1-A3), as the materials are energy intensive to produce, but durable and unlikely to be replaced. Concrete with 20% cement replacement that has been used across all structural elements, this assumption should be refined at later stages.

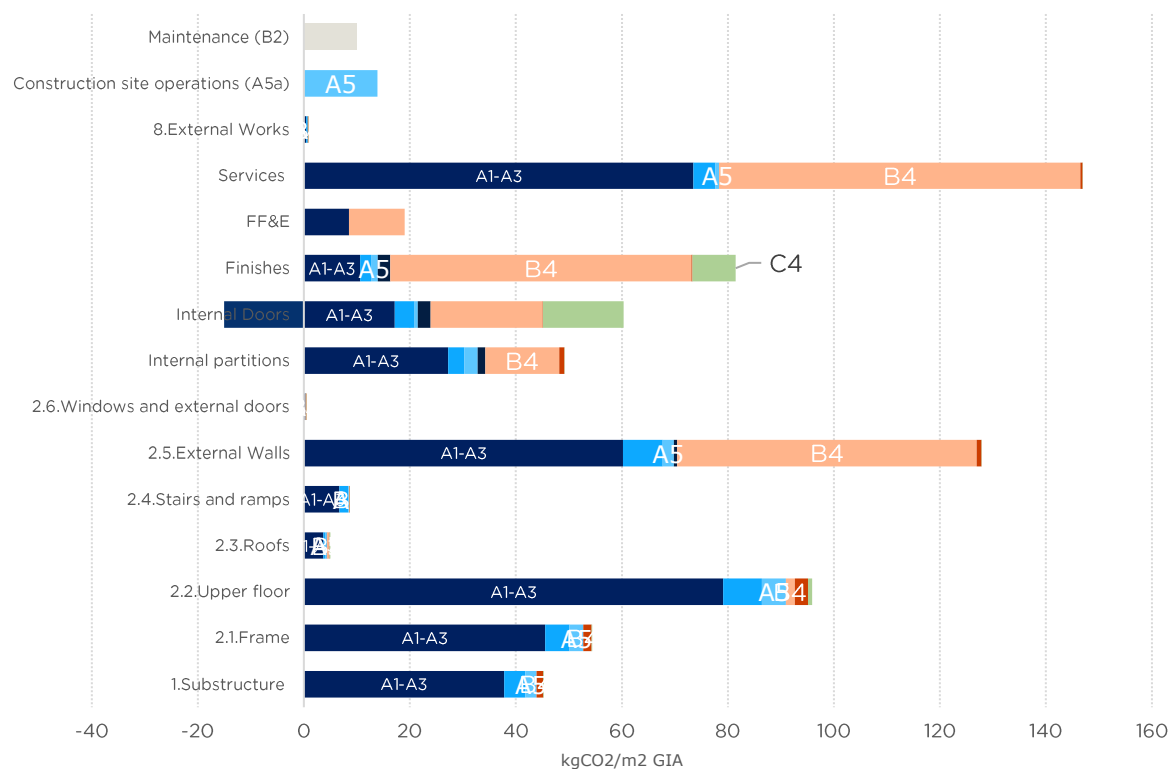


Figure 8: Embodied Carbon Breakdown by Building Elements & LCA Stages (A1-A5, B2-B4, C1-C4)

Figure 9 presents the breakdown by LCA stages, from A to C (excl. B1, B6 & B7). Emissions up to practical completion of the project (upfront carbon emissions A1-A5) are significant and account for **52%** of the total embodied carbon emissions, followed by In-use (B3-B4) emissions associated with repair, and replacement cycles of materials (33%) and End-of-life emissions (C1-C4).

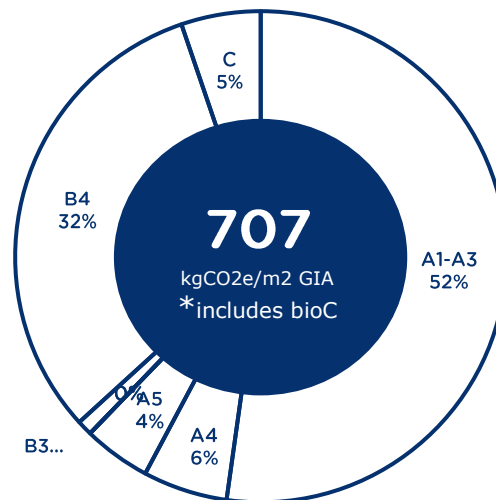


Figure 9 - Upfront [A], in-use [B] and end of life [C] embodied carbon emissions

Figure 10 presents the overall embodied carbon emissions for the development broken down by building elements following RICS New Rules of measurement classification system. Services have the highest percentage of influence around 21%, followed by external walls and internal partitions with 18% and 15% respectively. These results are likely to change on later stages as more detail and materials are added to the design and construction specifications are provided.

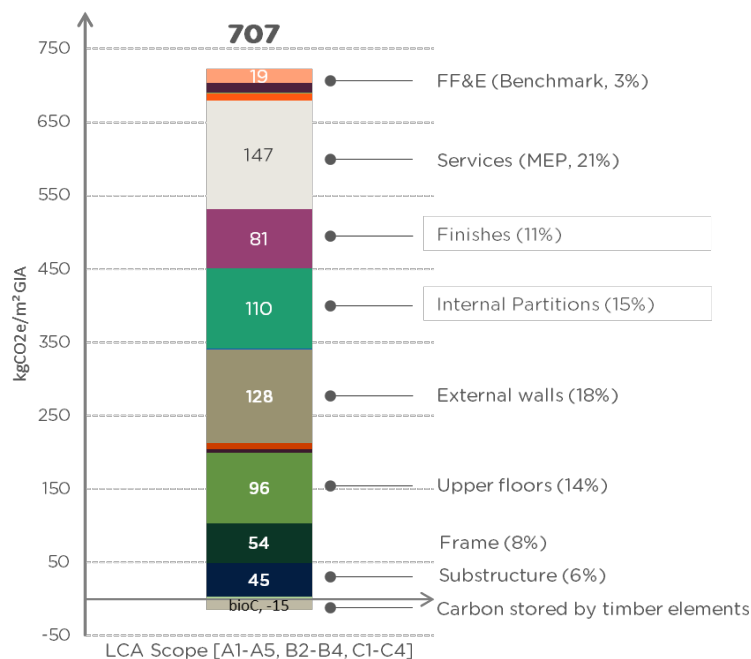


Figure 10: Embodied carbon breakdown by building element.

As shown in Figure 11 below, for A1-A5 upfront carbon emissions, concrete and glass facades and glazing are the two most carbon intensive materials used, followed by HVAC components and equipment, reinforcement and site operations. By comparing these values to the graph below we can see that concrete has large carbon impacts due to the significant quantities of the material required. Despite the lower material usage intensity, HVAC and facades have high carbon intensity, pointing to the highly carbon intensive components of these elements.

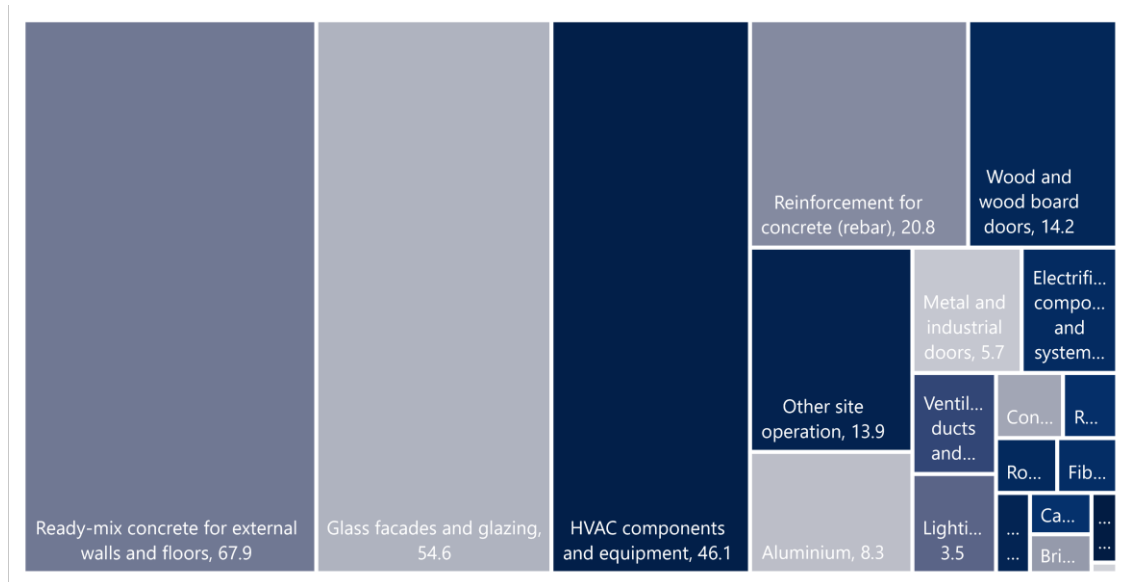


Figure 11: Embodied Carbon Breakdown by Materials (A1-A5), all building elements included.

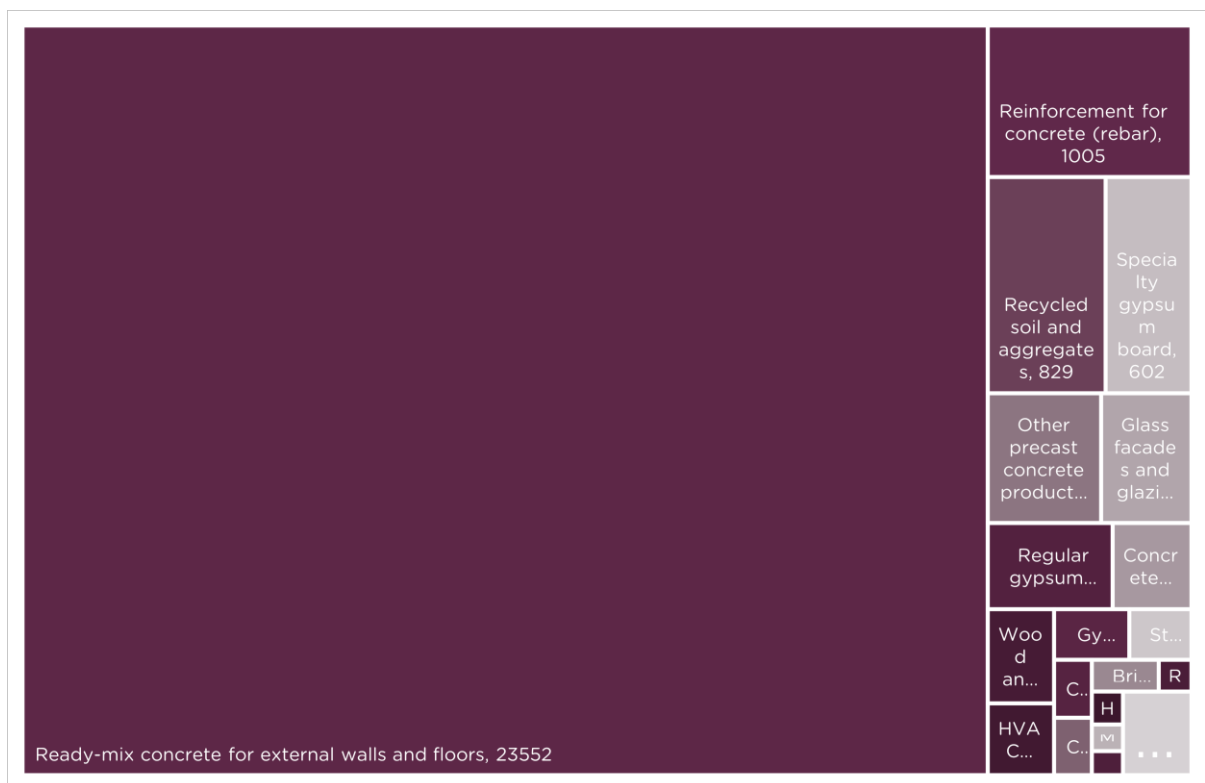


Figure 12: Material massing (tonnes)

5.4 Operational Carbon (B6)

The (B6) emissions associated with running the mechanical and electrical systems in the building have been provided by MEP engineers. The estimated annual energy consumption is 69.21 kWh/m² of GIA for regulated and 57.46 kWh/m² of GIA for unregulated energy use. Regarding the operational carbon emissions two scenarios have been considered:

- **2023 UK government GHG conversion factor** 0.207 kgCO₂e/kWh fixed for 60 years
- **Decarbonised grid FES** Falling short scenario, average grid electricity emissions factor 0.041 kgCO₂e/kWh.

The predicted operational carbon rate (B6) is around ~1,574 kgCO₂e/m² (current grid) over 60 years lifespan and ~314 kgCO₂e/m² (decarbonised grid FES 2022) (Figure 13).

(B6) Predicted
Energy Use

126.7
kWh/m²/yr GIA



Current grid 2023
UK Government:
0.207 kgCO₂e/kWh

1,574
kgCO₂e/m² GIA
over 60 years



Decarbonised grid
FES:
0.041 kgCO₂e/kWh

314
kgCO₂e/m² GIA
over 60 years

Figure 13: Predicted Energy Use & Carbon Scenario

6. OPPORTUNITIES FOR REDUCING WHOLE LIFE CARBON

The core philosophy for minimising embodied carbon emissions is indicated in Figure 14. During RIBA stage 2 a number of opportunities can be considered by the design team to minimise carbon and circularity impacts in the context of cost, programme, quality, and other design considerations.

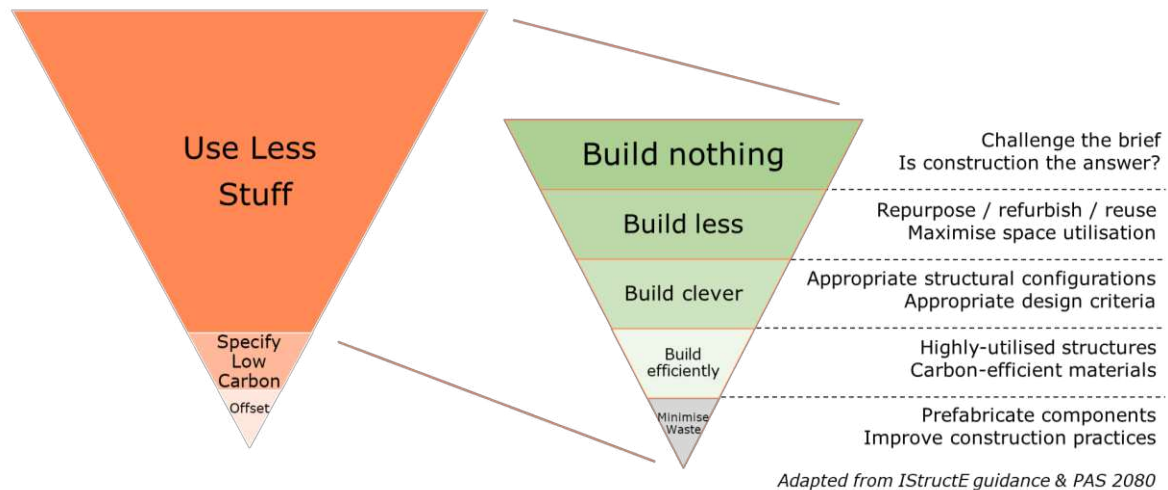


Figure 14: Embodied carbon reduction hierarchy

Based on the findings of the WLCA undertaken at RIBA Stage 2, the following possible mitigation measures have been proposed for the identified carbon hotspots. These should be reviewed and could be incorporated into the Stage 3 design where possible.

- Set a lower carbon concrete mix for the structural elements, particularly upper floors.
- Reduce the amount of glazing on the façade, consider recycled glass/higher recycled content of the aluminium framing components for the curtain walls (currently ~45%).
- Consider timber stud partitions instead of metal studs and SFS.
- Specify carpets with high recycled content to reduce impacts of replacements.
- Selection of durable MEP systems with regular maintenance plans to extend their life.
- Minimise refrigerant charges where possible as leakages result in significant emissions. Offsite specialist refrigerant management and leakage detection systems can further minimise losses.
- Selection of refrigerants with lower environmental impacts.

APPENDIX A – INPUT DATA AND ASSUMPTIONS

LIFE CYCLE INVENTORY

APPENDIX A – INPUT DATA AND ASSUMPTIONS

LIFE CYCLE INVENTORY

Author:	Megan Crossley, Mariami Tkeshelashvili
Checked by:	Robert Cairns
Revision:	01
Date:	01/11/2023

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

Please find attached some minor comments in relation to the WLCA.

Many thanks,
Kelly

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
TM65	Embodied carbon in building services: a calculation methodology, CIBSE TM65: 2021
<p>minor comments in relation to the WLCA.</p> <p>the fact that the floorspace figures included are slightly off. The final GIA figure is: 19,029 sq. m.</p>	
8	
9	
10	

Life-cycle stages, Adapted from EN 15978: 2011

WHOLE LIFE CARBON ASSESSMENT INFORMATION																		
PROJECT LIFE CYCLE INFORMATION													SUPPLEMENTARY INFORMATION					
A1 – A3 PRODUCT STAGE			A4 – A5 CONSTRUCTI ON PROCESS STAGE		B1 – B7 USE STAGE					C1 – C4 END OF LIFE STAGE				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	TRANSPORT TO PROJECT SITE	CONSTRUCTION AND INSTALLATION PROCESS	USE	MAINTENANCE	REPAIR	REPLACEMENT	REFURBISHMENT	DECONSTRUCTION DEMOLITION	TRANSPORT TO DISPOSAL FACILITY	WASTE PROCESSING	DISPOSAL	REUSE, RECOVERY, RECYCLING POTENTIAL				
					B6 – OPERATIONAL ENERGY USE													
					B7 – OPERATIONAL WATER USE													

Table 9.2 Substructure and hard landscaping – In-scope (applicable to criteria 6 and 7)

Level 1 Group element	Level 2 Element	Level 3 Sub-element
1. Substructure	1. Substructure	1. Standard foundations 2. Specialist foundation systems 3. Lowest floor construction 4. Basement excavation 5. Basement retaining walls
8. External works*	2. Roads, paths and pavings	1. Roads, paths and pavings 2. Special surfacings and pavings
<p>*Include hard landscaping that is installed as part of the project under assessment and:</p> <ul style="list-style-type: none">• Is within a defined curtilage of the building• Or is clearly more associated with it (for example, an access road or car park that is intended to serve only the building under assessment or the building and, to a lesser extent, other buildings). <p>Hard landscaping with no such distinction shall be excluded.</p>		

CONSTRUCTION SITE OPERATIONS											
Category	Construction Site Operations Description (Comment)	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	19,029	M2	Ramboll	Average Site impacts	Construction emissions (temperate & southern)	Average production of construction waste	OC	Average construction site impacts, scenario for temperate and southern climate, EU	OC	0
2.Deconstruction/de molition scenarios (C1)	Assumption for Demolition C1 emissions	19,029	M2	Ramboll	Average Site impacts	Deconstruction & Demolition	Deconstruction and Demolition activities	OC	Average deconstruction and demolition process (per GIA)	OC	
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	
Select			Select	Select	Select	Select	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
TM65	Embodied carbon in building services: a calculation methodology, CIBSE TM65: 2021
1	Cost Plan - updated 18.10.2023
2	Structural Engineering Drawings
3	Simpsonhaugh - façade details, email received on 23/10/23
4	Danny Sinclair - Option 1, email received 17/10/2023
5	
6	
7	
8	
9	

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
5.1.Sanitary installations	Sanitary installations	19,029	M2	1	Services	Sanitary installations	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Sanitary elements and valves per GFA, Apartment Buildings, Sub-lot 9.1 (RE2020)	OC	0
5.3.Disposal installations	Sewage water drainage piping network	19,029	M2	1	Services	Sewage water piping network - Residential buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Sewage water drainage piping network, per m2 GIFA (residential buildings)	OC	0
5.4.Water installations	Drinking water supply piping network	19,029	M2	1	Services	Drinking water piping network - Residential buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Drinking water supply piping network, per m2 GIFA (residential buildings)	OC	0
5.6.Space heating and Airconditioning	Heat distribution system	19,029	M2	1	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	19,029	M2	1	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	Lighting and power system	19,029	M2	1	Services	Commercial lighting and power system	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Commercial lighting and power system for large size building, high performance per m2	OC	0
5.10.1.Lift and enclosed hoists	Passenger lift, 13 persons, going 27 stops.	81	UNIT	1	Services	Elevator/Lift	Max. transported gross weight 630kg	Ramboll	Electric elevator elements dependent of the number of floors (cabin and others), max. transported gross weight 630kg, DONNEE PAR DEFAULT (DED)	EPD	Electric elevator elements dependent of the number of floors
5.10.1.Lift and enclosed hoists	Cyclist lift	2	UNIT	1	Services	Elevator/Lift	Max. transported gross weight 630kg	Ramboll	Electric elevator elements dependent of the number of floors (cabin and others), max. transported gross weight 630kg, DONNEE PAR DEFAULT (DED)	EPD	Electric elevator elements dependent of the number of floors
5.11.Fire and lightning protection	Fire alarm system	19,029	M2	1	Services	Fire alarm systems - Office buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Fire detection and alarm system for office buildings per m2	OC	0
5.12.Communication, Security and Control Systems	CCTV	19,029	M2	1	Services	CCTV - Office buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	CCTV system for office buildings per m2	OC	0
5.12.Communication, Security and Control Systems	Access control/intercom system	19,029	M2	1	Services	Access control system - Office buildings	Approximate rates for services estimated from OneClickLCA benchmark data	OC	Access control system for office buildings per m2	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

1.SUBSTRUCTURE											
RICS category ▼	Material Description @	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
1.1.2.Specialist foundations	Piling platform; 6f2 hardcore; ne 600 deep	542	M3	1	Aggregate	Recycled stone aggregates	Assuming recycled aggregates from concrete, asphalt a Ramboll		Recycled stone aggregates, from concrete, asphalt and masonry units, 1530 kg/m3, GP recycled 4/x* mm (ASGB)	EPD	Assuming 1530kg/m3
1.1.2.Specialist foundations	Allow for Geotex base.	904	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
1.1.3.Lowest floor construction	Insitu concrete ground bearing slab 350 thick.	316	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strengtn, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.3.Lowest floor construction	Insitu concrete ground bearing slab 350 thick ; Reinforcement 95kg/m3 reinforcement quantities used for slabs	30058	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.2.Specialist foundations	Pile Caps	661	M3	2	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.2.Specialist foundations	Pile Caps ; Reinforcement 115kg/m3 reinforcement quantities used	76045	KG	2	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.1.Standard foundations	Concrete core foundations - TBC	312	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.1.Standard foundations	Concrete core foundations - TBC ; Reinforcement 80kg/m3 reinforcement quantities used RC pad foundations	24960	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.1.Standard foundations	Capping Beam say 1200 x 1200 mm deep - 1.2m x 1.2m x 133m	192	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.1.Standard foundations	Capping beam say 1200 x 1200 mm deep ; Reinforcement Assumptions as above. Additionally, 230kg/m3 reinforcement quantities used for	44050	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.1.Standard foundations	Ground beams - internal ;250 x 450 dp	117	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.1.Standard foundations	Ground beams - internal ;250 x 450 dp ; Reinforcement Additionally, 230kg/m3 reinforcement quantities used for ground beams	26910	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.1.Standard foundations	Ground beams - perimeter;1200*600 dp (deep) Assuming these are in mm. 1.2m x 0.6 x 133m	96	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.1.Standard foundations	Ground beams - perimeter;1200*600 dp (deep) ; Reinforcement 230kg/m3 reinforcement quantities used for ground beams	22025	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.3.Lowest floor construction	Allowance for slab thickening to plant room - typical concrete thickness is assumed to be 0.15m	44	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.3.Lowest floor construction	Allowance for slab thickening to plant room ; Reinforcement 95 kg/m3 reinforcement quantities	4175	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.2.Specialist foundations	Piling to cores; 12 m long - 450mm diameter (pile). P1 x R=0.25m(squared). x 12m x no. of piles	95	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.2.Specialist foundations	Piling to cores; 12 m long ; Reinforcement @1%	1	M3	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.2.Specialist foundations	Piling - no detail; say 12 m long - 450mm diameter (pile). P1 x R=0.25m(squared). x 12m x no. of piles	149	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.2.Specialist foundations	Piling - no detail; say 12 m long ; Reinforcement	1.49	M3	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.3.Lowest floor construction	Lift Pits/Pumps - A 6 person lift shaft is typically 1500mm (1.5m) width and 1650mm (1.65m) depth. The typical thickness for a concrete slab is 25cm (0.25m). The lift pit will have 5 slabs. 4 walls, one bottom slab. There are 3 lifts.	9.28	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specil	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
1.1.3.Lowest floor construction	Lift Pits/Pumps ; Reinforcement 95kg/m3 reinforcement quantities used for concrete slabs	881.7187500	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	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
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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QA	2.1 FRAME											
	RICS category ▼	Material Description 🔗	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
	2.1.1.Steel frames	Fire Protection & fire stopping						0	0	0	0	0
	2.1.4.Concrete frames	Parapet Wall - Podium - typical height is 1m, minimum thickness of 230mm	31	M3	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specification	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
	2.1.4.Concrete frames	Parapet Wall - Podium - ; Reinforcement @ 65kg/m3	2,033	kg	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
	2.1.4.Concrete frames	Parapet Wall - Roof - typical height is 1m, minimum thickness of 230mm	241	M2	1	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specification	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
	2.1.4.Concrete frames	Parapet Wall - Roof - ; Reinforcement ; 65kg/m3	15,655	kg	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
	2.1.4.Concrete frames	Concrete Columns	579	M3	2	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specification	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
	2.1.4.Concrete frames	Concrete Columns ; Reinforcement - estimated 200kg/m3 reinforcement quantities for columns	115,754	KG	2	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
	2.1.4.Concrete frames	Concrete Walls	2070	M3	2	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specification	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
	2.1.4.Concrete frames	Concrete Walls ; Reinforcement 65 kg/m3 reinforcement quantities for walls	134572	KG	2	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
	2.1.4.Concrete frames	Concrete Beams	8	M3	2	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specification	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
	2.1.4.Concrete frames	Concrete Beams ; Reinforcement 230 kg/m3 reinforcement quantities for ground beams	1,917	KG	2	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3

2.2 UPPER FLOORS												
	RICS category ▼	Material Description 🔗	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
	2.2.1.Floors	Insulation to underside of slab (plantroom, etc)(PROV) - average thickness of 50mm assumed	17	M3	1	Insulation	Roof - 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
	2.2.1.Floors	Insulation to underside of slab (cycle store)(PROV) - - average thickness of 50mm assumed	3	M3	1	Insulation	Roof - 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
	2.2.1.Floors	Insulation to underside of slab to prevent cold bridging (Podium) - average thickness of 50mm assumed	12	M3	1	Insulation	Roof - 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
	2.2.1.Floors	Riser flooring (incl Smoke shafts) - 30mm grating assumed	246	M2	1	Plastic	Precast Glass Fibre reinforced concrete	GRP Floor Grating, 30mm thickness	Ramboll	Polyester grating for outdoor use, 17 kg/m2, Caillebotis en polyester pour utilisation extérieure (mailles de 38mm*38mm, hauteur porteur : 30 mm) (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAULT)	EPD	
	2.2.Upper floor	Concrete upper floors	4419	M3	2	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Specification	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	Provide m3
	2.2.Upper floor	Concrete upper floors ; Reinforcement 95kg/m3 reinforcement quantities for slabs	419786	KG	2	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3

2.3 ROOFS												
	RICS category ▼	Material Description 🔗	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
	2.3.2.Roof coverings	Single ply roof coverings -	607	M2	1	Membrane	Single ply roofing membrane	Assumed Synthetic roofing membrane	Ramboll	Synthetic roofing membrane from FPO - PP, 1.934 kg/m2, BauderTHERMOFIN (Paul Bauder)	EPD	Provide area in m2
	2.3.2.Roof coverings	Single ply roof coverings - Podium area	242	M2	1	Membrane	Single ply roofing membrane	Assumed Synthetic roofing membrane	Ramboll	Synthetic roofing membrane from FPO - PP, 1.934 kg/m2, BauderTHERMOFIN (Paul Bauder)	EPD	Provide area in m2
	2.3.1.Roof structure	Roof slab	199	M3	2	Concrete	Superstructure C35/45, 20% GGBS (BREEAM/LEED)	Assumed C35/45, 20% Cement Replacement	Project Spec	Ready-mix concrete, normal strength, generic, C35/45 (5000/6500 PSI) with CEM II/B-V, 20% fly ash content (340 kg/m3; 21.2 lbs/ft3 total cement)	OC	
	2.3.1.Roof structure	Reinforcment to roof slab	18876.12	KG	2	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	
	2.3.1.Roof structure	Capping to parapet - Podium - assumed solid concrete coping stones, 50mm x 500mm	3.40	M3	1	Concrete	Precast Concrete - C40/50, 0% GGBS (ICE), Average UK cement mix	Assumed C40/50, 0% Cement Replacement	IstructE	Ready-mix concrete, RC 40/50 (40/50 MPa), with CEM I	ICE	Provide m3
	2.3.1.Roof structure	Capping to parapet - Roof - assumed solid concrete coping stones, 50mm x 500mm	2.71	M3	1	Concrete	Precast Concrete - C40/50, 0% GGBS (ICE), Average UK cement mix	Assumed C40/50, 0% Cement Replacement	IstructE	Ready-mix concrete, RC 40/50 (40/50 MPa), with CEM I	ICE	Provide m3
	2.3.1.Roof structure	Roof Level Plantroom - Roof Assume lightweight profiled roof deck	55	M2	1	Steel	Profiled sheet for decking	Assumed profiled steel decking part of composite floc	IstructE	Profiled steel decking for composite floor slabs/decking, 0.9mm sheet thickness, 11.35kg/m2, ComFlor 80 0.9mm steel structural floor deck (Tata Steel)	EPD	Provide m2/kg/m3
	2.3.2.Roof coverings	Paving to Plant - assumes 72 kg/m2	5400	KG	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)

2.4 STAIRS AND RAMPS												

	RICS category ▼	Material Description ?	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
	2.4.1.Stair and ramp structure	Precast concrete stair going 28 levels (to Roof) - a flight of stairs is approximately 3m, assume 2 flights per level	168	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 10 steps, width. 140cm, 1422.6kg/m, CEM III/A, VD (SORIBA)		EPD	Provide length (m)
	2.4.1.Stair and ramp structure	Precast concrete stair going 22 levels - a flight of stairs is approximately 3m, assume 2 flights per level	162	M	1	Concrete	Staircase - 140cm wide	Assumed Precast concrete	Ramboll	Precast concrete staircase, 10 steps, width. 140cm, 1422.6kg/m, CEM III/A, VD (SORIBA)		EPD	Provide length (m)
	2.4.3.Stair and ramp balustrades and handrails	Painted Mild Steel balustrades and ancilleries	440	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)		EPD	Provide length (m)
	2.4.3.Stair and ramp balustrades and handrails	Painted Mild Steel handrails and ancilleries - includes landing	715	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)		EPD	Provide length (m)
	2.4.1.Stair and ramp structure	Stringers - 1.5m wide x 440mm	216	M2	1	Steel	Steel Staircase straight	Galvanised steel straight staircase	Ramboll	Galvanized steel staircase, straight, 207.21 kg/m2		EPD	Provide area in m2
	2.4.3.Stair and ramp balustrades and handrails	Handrail to Plant rooms	13	M	1	Steel	Handrail	Assumed stainless steel	Ramboll	Stainless steel handrail, diam. 45mm, Donnee par default (MDEGD)		EPD	Provide length (m)
	2.4.1.Stair and ramp structure	Plant room steps - assume 1.5m x 3m	5	M2	1	Steel	Steel Staircase straight	Galvanised steel straight staircase	Ramboll	Galvanized steel staircase, straight, 207.21 kg/m2		EPD	Provide area in m2

2.5 EXTERNAL WALLS													
	RICS category ▼	Material Description ?	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
	2.5.External walls	Ground floor - Brickwork, area 435m², single brick cladding, 102.5mm thick	44.5875	M3	3	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.External walls	Ground floor - Brickwork, mortar, area 435m², assuming double brick, 205mm thick	6.688125	KG	Select	Mortar	Masonry/Bricklaying Mortar (BREEAM/LEED)	Cement based mortar for bricklaying	Ramboll	Masonry mortars (CPI Mortars Ltd)		EPD	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)
	2.5.External walls	Ground floor - 140mm block substrate, area 435m²	60.9	M3	3	Concrete	Concrete block wall - Lightweight - 140mm (BREEAM/LEED)	Assumed lightweight concrete blocks	Ramboll	Lightweight concrete block, 13N, 0.35 W/mK, 1183.93 kg/m3, Thermal Liteblock (Roadstone)		EPD	Provide m3
	2.5.External walls	Ground floor - Curtain walling	177	M2	3	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
	Select			Select	Select	Select		N/A	N/A	N/A		N/A	N/A
	2.5.External walls	UCW - Glass fronted, double alu frame, except aluminium rapid vents (~18%) with independent drywall liner and 152mm rockwool insulation (~60%), area 8560m²	7019.2	M2	3	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.External walls	UCW - Glass fronted, double alu frame, except aluminium rapid vents (~18%) with independent drywall liner and 152mm rockwool insulation (~60%), area 8560m²	22341.6	KG	3	Aluminium	Louvres (BREEAM/LEED)	European Average, 20% recycled content	Ramboll	Aluminium sheet, generic, 20% recycled content, average European technology (One Click LCA 2022)		OC	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
	2.5.External walls	UCW - Glass fronted, double alu frame, except aluminium rapid vents (~18%) with independent drywall liner 2x12.5mm Wallboard, 48/50 'I' stud gypframe and 152mm rockwool insulation (~60%), area 8560m²	86284.8	KG	3	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)
	2.5.External walls	UCW - Glass fronted, double alu frame, except aluminium rapid vents (~18%) with independent drywall liner 2x12.5mm Wallboard, 48/50 'I' stud gypframe and 152mm rockwool insulation (~60%), area 8560m²	6163.2	KG	3	Steel	Metal framing components - Gypframe 48 S 50 'C' 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® 48 S 50 'C' Stud 1.2kg/m2 @600mm centres (0.52kg/linear meter)
	2.5.External walls	UCW - Glass fronted, double alu frame, except aluminium rapid vents (~18%) with independent drywall liner, 152mm rockwool insulation (~60%), area 8560m²	780.672	M3	3	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
	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
	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
	2.6.2.External doors	Single door - Automated - assume 0.85m x 2.1m	5.36	M2	1	Aluminium	Glazed Doors	Assumed Aluminium frame double glazing	Ramboll	Aluminium framed glazed doors, double glazed, per sq. meter, 83% glass, 12% aluminium, 3% steel, 40.79, AXILE Family, EDGE Family, KINETIC Family, ELITE Aero (Optima)		OC	Provide area in m2

	2.6.2.External doors	Double door - Automated - Assume 1.2m x 2.1m	2,520	M2	1	Aluminium	Glazed Doors	Assumed Aluminium frame double glazing	Ramboll	Aluminium framed glazed doors, double glazed, per sq. meter, 83% glass, 12% aluminium, 3% steel, 40.79, AXILE Family, EDGE Family, KINETIC Family, ELITE Aero (Optima)	OC	Provide area in m2
	Select	Plenum boxes	609	UNIT								
	2.6.2.External doors	Single Doors - LV - assume 0.85m x 2.1m	1.8	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Leqnica)	EPD	Provide area in m2
	2.6.2.External doors	Double Doors - Plant Room, Binstore - assume 1.2m x 2.1m	13	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Leqnica)	EPD	Provide area in m2
	2.6.2.External doors	Single Escape External Doors - assume 0.85m x 2.1m	3	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Leqnica)	EPD	Provide area in m2
	2.6.1.External Windows	Louvres (rear plinth) -assumes 14.5kg/m2	290	KG	1	Aluminium	Louvres (BREEAM/LEED)	European Average, 20% recycled content	Ramboll	Aluminium sheet, generic, 20% recycled content, average European technology (One Click LCA 2022)	OC	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
	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	
	2.7.1.Walls and Partitions	Stud partitions; Corridor/ cluster bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - SFS 100mm @ 600mm crs	10147.90	KG	1	Steel	SFS - 100.50.12 @ 600mm centres	Assumed Galvanised steel, 20% Recycled Content	RICS	Steel sheets, generic, 20% recycled content, S235, S275 and S355	OC	Assuming 4.75 kg/m2 of elevation (including vertical and horizontal studs)
	2.7.1.Walls and Partitions	Stud partitions; Corridor/ cluster bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 50mm APR Insulation assumed	1922.76	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)
	2.7.1.Walls and Partitions	Stud partitions; Corridor/ cluster bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 12.5mm plasterboard	35891.52	KG	1	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)
	2.7.1.Walls and Partitions	Stud partitions; Corridor/ cluster bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 3mm skim	8545.60	KG	1	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on site)	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
	2.7.1.Walls and Partitions	Stud partitions; Bed/bed100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - SFS 100mm @ 600mm crs	16758.00	KG	1	Steel	SFS - 100.50.12 @ 600mm centres	Assumed Galvanised steel, 20% Recycled Content	RICS	Steel sheets, generic, 20% recycled content, S235, S275 and S355	OC	Assuming 4.75 kg/m2 of elevation (including vertical and horizontal studs)
	2.7.1.Walls and Partitions	Stud partitions; Bed/bed bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 50mm APR Insulation assumed	3175.20	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)
	2.7.1.Walls and Partitions	Stud partitions; Bed/bed bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 12.5mm plasterboard	59270.40	KG	1	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)
	2.7.1.Walls and Partitions	Stud partitions; Bed/bed 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 3mm skim	14112.00	KG	1	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on site)	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
	2.7.1.Walls and Partitions	Stud partitions; Studios (FD60) 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - SFS 100mm @ 600mm crs	54987.19	KG	1	Steel	SFS - 100.50.12 @ 600mm centres	Assumed Galvanised steel, 20% Recycled Content	RICS	Steel sheets, generic, 20% recycled content, S235, S275 and S355	OC	Assuming 4.75 kg/m2 of elevation (including vertical and horizontal studs)
	2.7.1.Walls and Partitions	Stud partitions; Studios (FD60) 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 50mm APR Insulation assumed	10418.63	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)
	2.7.1.Walls and Partitions	Stud partitions; Studios (FD60) 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 12.5mm plasterboard	194481.00	KG	1	Plasterboard	Int.Walls - Gyproc FireLine	Gypsum board A2 fire class	Ramboll	Gypsum plasterboard, fire resistant, 12.5/15 mm, 843 kg/m3, A2 fire class, 10µ water vapour resistance, Gyproc FireLine (British Gypsum (2019))	EPD	Assuming 10.55kg/m² (12.5mm thick)
	2.7.1.Walls and Partitions	Stud partitions; Studios (FD60) 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 3mm skim	46305.00	KG	1	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on site)	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
	2.7.1.Walls and Partitions	Stud partitions to Amenity Space; Assume 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - SFS 100m @ 600mm crs	2234.40	KG	1	Steel	SFS - 100.50.12 @ 600mm centres	Assumed Galvanised steel, 20% Recycled Content	RICS	Steel sheets, generic, 20% recycled content, S235, S275 and S355	OC	Assuming 4.75 kg/m2 of elevation (including vertical and horizontal studs)
	2.7.1.Walls and Partitions	Stud partitions to Amenity Space; Assume 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 50mm APR	423.36	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)
	2.7.1.Walls and Partitions	Stud partitions to Amenity Space; Assume 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 12.5mm plasterboard	7902.72	KG	1	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)
	2.7.1.Walls and Partitions	Stud partitions to Amenity Space; Assume 100 thick; 2450 high; 12.5mm plasterboard, 3mm skim - 2 x 3mm skim	1881.60	KG	1	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on site)	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
	2.7.1.Walls and Partitions	Plasterboard to external walls 1hr fire rating; 2nr layers 12.5mm Knauf Fire Panel one side on 100mm SFS (SFS framing measured elsewhere) at 600mm centres with 100mm Rockwool RWA45 between studs; skim. Assumes 0.9kg/m2	62126	KG	1	Plasterboard	Int.Walls - Gyproc FireLine	Gypsum board A2 fire class	Ramboll	Gypsum plasterboard, fire resistant, 12.5/15 mm, 843 kg/m3, A2 fire class, 10µ water vapour resistance, Gyproc FireLine (British Gypsum (2019))	EPD	Assuming 10.55kg/m² (12.5mm thick)
	2.7.1.Walls and Partitions	Plasterboard to external walls 1hr fire rating; 2nr layers 12.5mm Knauf Fire Panel one side on 100mm SFS (SFS framing measured elsewhere) at 600mm centres with 100mm Rockwool RWA45 between studs; skim. Assumes 4.75kg/m2	14437	KG	1	Steel	SFS - 100.50.12 @ 600mm centres	Assumed Galvanised steel, 20% Recycled Content	RICS	Steel sheets, generic, 20% recycled content, S235, S275 and S355	OC	Assuming 4.75 kg/m2 of elevation (including vertical and horizontal studs)

	2.7.1.Walls and Partitions	Plasterboard to external walls 1hr fire rating; 2nr layers 12.5mm Knauf Fire Panel one side on 100mm SFS (SFS framing measured elsewhere) at 600mm centres with 100mm Rockwool RWA45 between studs; skim.	304	M3	1	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
	2.7.1.Walls and Partitions	Plasterboard to external walls 1hr fire rating; 2nr layers 12.5mm Knauf Fire Panel one side on 100mm SFS (SFS framing measured elsewhere) at 600mm centres with 100mm Rockwool RWA45 between studs; skim. Assumes 1 x 3mm as it's only on one side of the wall - assumes 2kg/m2	6079	KG	1	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on s	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
assume this is included in FFE allowance	2.7.1.Walls and Partitions	Ditto in Wdw Reveals - Assume 200mm width for window surrounds, 2No. Layers of fire rated	29513	KG	1	Plasterboard	Int.Walls - Gyproc FireLine	Gypsum board A2 fire class	Ramboll	Gypsum plasterboard, fire resistant, 12.5/15 mm, 843 kg/m3, A2 fire class, 10µ water vapour resistance, Gyproc FireLine (British Gypsum (2019))	EPD	Assuming 10.55k/m² (12.5mm thick)
	2.7.1.Walls and Partitions	Shaft wall; 2 hour FR; Lining to external wall (Spread of flame) - Assumed build up: gypframe 60 I70 @ 600mm crs, grproc coreboard 19mm between studs, 2 layers 12.5mm Fireline to non shaft side	2658.25	KG	1	Steel	Metal framing components - Gypframe 70 S 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® 70 S 50 AcouStud 1.4kg/m2 @600mm centres (0.61kg/linear meter)
	2.7.1.Walls and Partitions	Shaft wall; 2 hour FR; Lining to external wall (Spread of flame) - Assumed build up: gypframe 60 I70 @ 600mm crs, grproc coreboard 19mm between studs, 2 layers 12.5mm Fireline to non shaft side	36.08	M3	1	Plasterboard	Partitioning/ Ceiling - Gyproc Wallboard	Gyproc Coreboard	Ramboll	Gypsum plasterboard, fire resistant, moisture resistant, 19 mm, 16.13 kg/m2, 849 kg/m3, fire resistance class A2-s1, d0, CoreBoard (Saint-Gobain Gyproc, Kingscourt plant)	EPD	
	2.7.1.Walls and Partitions	Shaft wall; 2 hour FR; Lining to external wall (Spread of flame) - Assumed build up: gypframe 60 I70 @ 600mm crs, grproc coreboard 19mm between studs, 2 layers 12.5mm Fireline to non shaft side	40063.63	KG	1	Plasterboard	Int.Walls - Gyproc FireLine	Gypsum board A2 fire class	Ramboll	Gypsum plasterboard, fire resistant, 12.5/15 mm, 843 kg/m3, A2 fire class, 10µ water vapour resistance, Gyproc FireLine (British Gypsum (2019))	EPD	Assuming 10.55k/m² (12.5mm thick)
	2.7.1.Walls and Partitions	300 mm Blockwork walls; plastered one sides - assumes the thickness of a concrete wall is 8 inches (0.2032 meters)	94	M3	1	Concrete	Concrete block wall - Lightweight - 140mm (BREEAM/LEED)	Assumed lightweight concrete blocks	Ramboll	Lightweight concrete block, 13N, 0.35 W/mK, 1183.93 kg/m3, Thermal Liteblock (Roadstone)	EPD	Provide m3
	2.7.1.Walls and Partitions	300 mm Blockwork walls; plastered one sides - plasterd one side	629.00	KG	1	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on s	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
	2.7.1.Walls and Partitions	Dry lining to pods - assumes 10kg/m2	46620	KG	1	Plasterboard	Plasterboard/Tileboard	Specialty gypsum board for tiling surface	Ramboll	Gypsum plasterboard, reinforced, water resistant, with square edges, 1200x900x6/12.5 mm, 800 kg/m3, 10µ water resistance, Glasroc H TILEBACKER (British Gypsum)	EPD	Assuming 10kg/m2 (12.5mm thick)
	2.7.1.Walls and Partitions	Dry lining/ Plaster to Core Walls (including cleaners cupboard)) - assumes 10kg/m2	101745	KG	1	Plasterboard	Plasterboard/Tileboard	Specialty gypsum board for tiling surface	Ramboll	Gypsum plasterboard, reinforced, water resistant, with square edges, 1200x900x6/12.5 mm, 800 kg	EPD	Assuming 10kg/m2 (12.5mm thick)
	2.7.1.Walls and Partitions	Stud Patytion to management area - 2No. 12.5mm plasterboard, 70mm stud @ 600mm crs, 3mm plaster skim both sides	391	KG	1	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)
	2.7.1.Walls and Partitions	Stud Patytion to management area - 2No. 12.5mm plasterboard, 70mm stud @ 600mm crs, 3mm plaster skim both sides	65	KG	2	Steel	Metal framing components - Gypframe 70 S 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® 70 S 50 AcouStud 1.4kg/m2 @600mm centres (0.61kg/linear meter)
	2.7.1.Walls and Partitions	Stud Patytion to management area - 2No. 12.5mm plasterboard, 70mm stud @ 600mm crs, 3mm plaster skim both sides	93	KG	3	Clay/Lime Plaster	Natural Mineral Plaster - Internal application	Natural clay lime plaster (powdered form, mixed on s	Ramboll	Natural clay lime plaster, Clime (Armourcoat)	EPD	2-3kg/m2 of 2 coats applied
	2.7.1.Walls and Partitions	Rockwool to pods - 50mm of rockwool	83	M3	1	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
	2.7.1.Walls and Partitions	Cluster Cupboards - assumes 900mm x 600mm x 600mm, assumes density 500kg/m3										
	2.7.1.Walls and Partitions	Fire resistant to pod riser and void above		UNIT	1	Select	Select					
	2.7.1.Walls and Partitions	Glazed screen to stairs/reception at Ground Floor (Provisional)	12	M2	1	Aluminium	Glazed Partitions	Assumed double-glazed aluminium frame partitions	Ramboll	Aluminium framed glazed partition systems, double glazed, per m2, 90% glass, 9% aluminium, width 3.0m; height 2.70m, glazing thickness 12mm, Optima 117, 217, Revolution 54,100, Kinetic, Technishield (Optima)	EPD	Provide area in m2
	2.7.1.Walls and Partitions	EO for single doors - glazed, sliding automatic, access control	36	M2	1	Aluminium	Glazed Sliding Doors	Assumed Aluminium frame double glazing	Ramboll	Aluminum frame sliding door, size: 1.23 x 2.18m, double glazing, 27.87 kg/m2, SlimLine 38 Door (Reynaers)	OC	Provide area in m2
To ask about the RICS guidance for these - to exclude, contingency factor at the end	Select	Pattressing to entrance doors (PAS 24)- 18mm Selex ply to surround of door opening		UNIT	1	Timber	Select					
	Select	3 sided letterbox to head of entrances		UNIT	1	Timber	Select					
	Select	Boxing in detail - cill		M	1	Timber	Select					
	Select	Blind boxes		M	1	Plasterboard	Select					
	Select	Plenum boxes		UNIT	1	Steel	Galvanised profiled sheet					
	Select			Select	Select	Select	Select					

2.8 INTERNAL DOORS												
RICS category ▼	Material Description	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
2.8.Internal Doors	Single Doorset - cluster bedroom; pre-finished laminate doors including all ironmongery; acoustic seal - assume 0.85m x 2.1m, 241No.	430	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
2.8.Internal Doors	EO for accessible bedroom door ironmongery, allow 0.2kg/doorset	5	KG	1	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
2.8.Internal Doors	Single Doorset - cluster Entrance; pre-finished laminate oors including all ironmongery - assume 0.85 x 2.1m, 53No.	95	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

Less than 1% of the cost of that element category, then it would be okay to excl. negli	2.8.Internal Doors	EO for accessible cluster entrance door ironmongery, allow 0.2kg/doorset	5	KG	1	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
	2.8.Internal Doors	Single Doorset - to cluster kitchen/living room; pre-finished laminate doors including all ironmongery - assume 0.85 x 2.1m, 53No.	95	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
	2.8.Internal Doors	Single Doorset - to studio entrance; pre-finished laminate doors including all ironmongery; acoustic seal - assume 0.85 x 2.1m, 314No.	560	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
	2.8.Internal Doors	EO for accessible cluster entrance door ironmongery, allow 0.2kg/doorset	5	KG	1	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
	2.8.Internal Doors	Pod Doors including threshold - assume 0.85 x 2.1m, 503No	898	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
	2.8.Internal Doors	Pod Doors Accessible including threshold - assume 0.85 x 2.1m, 52No.	93	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
	2.8.Internal Doors	Single door - to student circulation; pre-finished; staircase FD 60 - assume 0.85 x 2.1m, 162No.	289	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
	2.8.Internal Doors	Double door - to student circulation; pre-finished; staircase FD 60 - assume 1.2m x 2.1m	3	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
	2.8.Internal Doors	Single door - to student circulation; pre-finished : offices,laundry, common room (PROVISIONAL) - assume 0.85 x 2.1m, 6No.	11	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
	2.8.Internal Doors	Double door - to student circulation; pre-finished - Assume 1.2m x 2.1m	3	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
	2.8.Internal Doors	Single door - BOH; pre-finished - assume 0.85 x 2.1m, 9No.	16	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
	2.8.Internal Doors	Double door - BOH; pre-finished - Assume 1.2m x 2.1m, 7No.	35	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
	2.8.Internal Doors	Single door - to cleaners/comms; pre-finished - assume 0.85 x 2.1m, 55No.	98	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
	2.8.Internal Doors	Accessible WC Door - to student area; pre-finished veneer doors including all ironmongery - assume 2.1m, and the standard accessible width is 950mm. 1.98m and 0.95m	2	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
	2.8.Internal Doors	Single Duct Access Door; paint grade (Pods) - assume 600x600m	200	M2	1	Steel	Hatch door	Assumed Coated steel hatch door	Ramboll	Coated steel hatch door, 11.67kg/m2, DONNEE PAR DEFAULT (DED)	EPD	Provide area in m2
	2.8.Internal Doors	Riser doors - Single - assume 0.85 x 2.1m	48	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Leqnica)	EPD	Provide area in m2
	2.8.Internal Doors	Riser doors - Double - Assume 1.2m x 2.1m	680	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Leqnica)	EPD	Provide area in m2
	2.8.Internal Doors	Cluster Cupboard door	95	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
	2.8.Internal Doors	Smoke Vent Doors; FD 60 - assume 0.85 x 2.1m FD60 doors	100	M2	1	Steel	Door	Assumed steel door	Ramboll	Steel doors, 28.3 kg/m2, ET 500 (Kipptor), SP 500 (Sporthallentore), N 500 (Schwingtor) (Hörmann Leqnica)	EPD	Provide area in m2
	2.8.Internal Doors	EO Entrabce Doors for PAS 24 (Provisional)										
	2.8.Internal Doors	Window boards - assumes 219mm wide and thickness of 30mm.	2979	KG	1	Timber	Skirting boards	Assumed MDF generic	Ramboll	Timber, MDF	ICE	Provide kg (density 500kq/m3)
	2.8.Internal Doors	Skirtings - assumes 18mm thickness, 121mm width	17527	KG	1	Timber	Skirting boards	Assumed MDF generic	Ramboll	Timber, MDF	ICE	Provide kg (density 500kq/m3)
	2.8.Internal Doors	SAA corner protection 25 x 25 x 1150 - assumes 2.7kg/m2, 150Nr	23	KG	1	Aluminium	Sheets	General European mix - ICE	IstructE	Aluminium sheet, European Mix, Inc Imports	ICE	Assuming 1.90kg/m2 for 0.7mm thick profile, 2.7kg/m2 for 1mm thick profile
	2.8.Internal Doors	VING - Entrance and Bedroom Doors										
	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
Included based on area of partitions	3.1.Wall finishes	Tiling to kitchen areas - 4 m2 per kitchen; brick pattern	212	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
	3.1.Wall finishes	Painting and decorating - as RHSC -	2795.00165	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)
	3.1.Wall finishes	2 coat Plaster; staircases 2.4-2.7m hi - 3.5 floors - assuming 3mm thick	2548	KG	1	Plaster Gypsum	Interior Applications	Gypsum Plaster	Ramboll	Gypsum-based plaster, for most internal backgrounds, 94.6% gypsum, 5.4% additives, 861.5 kg/m3, Thistle Universal OneCoat (British Gypsum Saint Gobain)	EPD	2.6 kg for 3mm thick coat, 4.3kg/m2 for 5mm thick coat, 8.6kg/m2 for 10mm thick coat
	3.2.Floor finishes	Carpet Tiles; Burmatex Oska to student cluster bedrooms	3800.56	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, Graphplex (Interface Europe Manufacturing BV)	EPD	Provide area in m2
	3.2.Floor finishes	Vinyl to cluster kitchen/Lounges (includes Latex) - assumes 3.25kg/m2	4431.375	KG	1	Vinyl	Flooring	Assumed vinyl flooring 2mm thick, 3.25kg/m2	Ramboll	Luxury vinyl floor tile, glue down, 0.118 in (3.0 mm), 16.43 oz/ft2 (5.015 kg/m2), Art Select (Design	EPD	Assuming 3.25kg/m2 (2mm thick vinyl)
	3.2.Floor finishes	Carpet Tiles to studios	6874.93	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	EPD	Provide area in m2
	3.2.Floor finishes	Carpet tiles to cluster corridor: laid to pattern	864.595	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	EPD	Provide area in m2
	3.2.Floor finishes	Carpet tiles to student circulation	1722.88	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	EPD	Provide area in m2
	3.2.Floor finishes	Lift Lobbies - assume floor finish, carpet tiles	338.47	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	EPD	Provide area in m2

	3.2.Floor finishes	Carpet tiles to amenity space	448.8	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	EPD	Provide area in m2
	3.2.Floor finishes	Carprt Tiles to Management Suite	66	M2	1	Carpet	Carpet Tiles	Assumed carpet tiles with 50% recycled content and 1100 g/m² pile weight	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
	3.2.Floor finishes	Vinyl to communal disabled toilets - assumes 3.25kg/m2	16.3475	KG	1	Vinyl	Flooring	Assumed vinyl flooring 2mm thick, 3.25kg/m2	Ramboll	Luxury vinyl floor tile, glue down, 0.118 in (3.0 mm), 16.43 oz/ft2 (5.015 kg/m2), Art Select (Desig	EPD	Assuming 3.25kg/m2 (2mm thick vinyl)
	3.2.Floor finishes	Vinyl to student Laundry/cleaner stores - PC Sum - assumes 3.25kg/m2	226	KG	1	Vinyl	Flooring	Assumed vinyl flooring 2mm thick, 3.25kg/m2	Ramboll	Luxury vinyl floor tile, glue down, 0.118 in (3.0 mm), 16.43 oz/ft2 (5.015 kg/m2), Art Select (Designflooring)	EPD	Assuming 3.25kg/m2 (2mm thick vinyl)
	3.2.Floor finishes	Staircase carpet - student - PC Sum	91	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
	3.2.Floor finishes	Floor paint to staircase above level 3 - assumes 0.242kg/m2	284	KG	1	Epoxy	Epoxy floor	Assumed epoxy flooring	Ramboll	Epoxy floor covering, 2 mm, 5.188 kg/m2	EPD	Provide area in m2
	3.2.Floor finishes	Staircase stringer trimming - allow for 200mm high finish x 10mm / skirting /MDF apply 500kg/m3	440	KG	1	Timber	Skirting boards	Assumed MDF generic	Ramboll	Timber, MDF	ICE	Provide kg (density 500kg/m3)
	3.2.Floor finishes	Staircase nosings - first 3 floors only - assumes 50mm width and 1.90kg/m2	20.52	KG	1	Aluminium	Sheets	General European mix - ICE	IstructE	Aluminium sheet, European Mix, Inc Imports	ICE	Assuming 1.90kg/m2 for 0.7mm thick profile, 2.7ka/m2 for 1mm thick
	3.2.Floor finishes	Entrance Lobby - Vinyl plank (Amtico) - assumes 3.25kg/m2	244	KG	1	Vinyl	Flooring	Assumed vinyl flooring 2mm thick, 3.25kg/m2	Ramboll	Luxury vinyl floor tile, glue down, 0.118 in (3.0 mm), 16.43 oz/ft2 (5.015 kg/m2), Art Select (Desig	EPD	Assuming 3.25kg/m2 (2mm thick vinyl)
	3.2.Floor finishes	Entrance flooring to Student areas; pedimatt entrance matting - in Revolving door - assumes 3.25kg/m2	42	KG	1	Vinyl	Flooring	Assumed vinyl flooring 2mm thick, 3.25kg/m2	Ramboll	Luxury vinyl floor tile, glue down, 0.118 in (3.0 mm), 16.43 oz/ft2 (5.015 kg/m2), Art Select (Designflooring)	EPD	Assuming 3.25kg/m2 (2mm thick vinyl)
	3.2.Floor finishes	Non-slip paint to bike storage - assumes 0.242kg/m2	15	KG	1	Epoxy	Epoxy floor	Assumed epoxy flooring	Ramboll	Epoxy floor covering, 2 mm, 5.188 kg/m2	EPD	Provide area in m2
	3.2.Floor finishes	Non-slip paint to refuse areas/Plant room - assumes 0.242kg/m2	73	KG	1	Epoxy	Epoxy floor	Assumed epoxy flooring	Ramboll	Epoxy floor covering, 2 mm, 5.188 kg/m2	EPD	Provide area in m2
	3.2.Floor finishes	Reception/Management office/POST Room - assumes 3.25kg/m2	213	KG	1	Vinyl	Flooring	Assumed vinyl flooring 2mm thick, 3.25kg/m2	Ramboll	Luxury vinyl floor tile, glue down, 0.118 in (3.0 mm), 16.43 oz/ft2 (5.015 kg/m2), Art Select (Designflooring)	EPD	Assuming 3.25kg/m2 (2mm thick vinyl)
	3.3.1.Finishes to ceilings	Student bedroom ceiling; plasterboard, skim & paint - assumes 10kg/m2	106755	KG	1	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)
	3.3.1.Finishes to ceilings	Student bedroom ceiling; plasterboard, skim & paint, area 10,675 m2, assumes 3 mm thick	27755	KG	1	Plaster Gypsum	Interior Applications	Gypsum Plaster	Ramboll	Gypsum-based plaster, for most internal backgrounds, 94.6% gypsum, 5.4% additives, 861.5 kg/m3, Thistle Universal OneCoat (British Gypsum Saint Gobain)	EPD	2.6 kg for 3mm thick coat, 4.3kg/m2 for 5mm thick coat, 8.6kg/m2 for 10mm thick coat
	3.3.1.Finishes to ceilings	Student bedroom ceiling; plasterboard, skim & paint	10675	M2	1	Paint	Vinyl matt emulsion - Walls/Ceilings	Indoor & outdoor use	Ramboll	Paint, vinyl matt emulsion, indoor and outdoor use, 1240-1360 kg/m3, 17 m2/l, Johnstone's Trade Covaplus Vinyl Matt Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Provide area in m2
	3.3.1.Finishes to ceilings	Student Communal Ceiling; plasterboard, skim & paint - assumes 10kg/m2	13635	KG	1	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)
	3.3.1.Finishes to ceilings	Student Communal ceiling; plasterboard, skim & paint, area 1363.5 m2, assumes 3 mm thick	3545	KG	1	Plaster Gypsum	Interior Applications	Gypsum Plaster	Ramboll	Gypsum-based plaster, for most internal backgrounds, 94.6% gypsum, 5.4% additives, 861.5 kg/m3, Thistle Universal OneCoat (British Gypsum Saint Gobain)	EPD	2.6 kg for 3mm thick coat, 4.3kg/m2 for 5mm thick coat, 8.6kg/m2 for 10mm thick coat
	3.3.1.Finishes to ceilings	Student Communal ceiling; plasterboard, skim & paint	1364	M2	1	Paint	Vinyl matt emulsion - Walls/Ceilings	Indoor & outdoor use	Ramboll	Paint, vinyl matt emulsion, indoor and outdoor use, 1240-1360 kg/m3, 17 m2/l, Johnstone's Trade Covaplus Vinyl Matt Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Provide area in m2
	3.3.1.Finishes to ceilings	Student Circulation Ceiling; plasterboard, skim & paint - assumes 10kg/m2	25874.75	KG	1	Plasterboard	Plasterboard/Tileboard	Specialty gypsum board for tiling surface	Ramboll	Gypsum plasterboard, reinforced, water resistant, with square edges, 1200x900x6/12.5 mm, 800 kg/m3, 10µ water resistance, Glasroc H TILEBACKER (British Gypsum)	EPD	Assuming 10kg/m2 (12.5mm thick)
	3.3.1.Finishes to ceilings	Student circulation ceiling; plasterboard, skim & paint, area 2587.475 m2, assumes 3 mm thick	6727	KG	1	Plaster Gypsum	Interior Applications	Gypsum Plaster	Ramboll	Gypsum-based plaster, for most internal backgrounds, 94.6% gypsum, 5.4% additives, 861.5 kg/m3, Thistle Universal OneCoat (British Gypsum Saint Gobain)	EPD	2.6 kg for 3mm thick coat, 4.3kg/m2 for 5mm thick coat, 8.6kg/m2 for 10mm thick coat
	3.3.1.Finishes to ceilings	Student circulation ceiling; plasterboard, skim & paint	2587	M2	1	Paint	Vinyl matt emulsion - Walls/Ceilings	Indoor & outdoor use	Ramboll	Paint, vinyl matt emulsion, indoor and outdoor use, 1240-1360 kg/m3, 17 m2/l, Johnstone's Trade Covaplus Vinyl Matt Base L, Base M, Base D, Base Z, Base Z2 (PPG Architectural Coatings UK (2020))	EPD	Provide area in m2
	3.3.1.Finishes to ceilings	Student Staircase Ceiling; painted exposed concrete soffit - assumes 0.242kg/m2	14.68456	KG	1	Paint	Concrete sealant	Assumed coating for concrete elements	Ramboll	Concrete sealant, generic, silicone/siloxane solution	OC	Provide kg/ton
	3.3.1.Finishes to ceilings	Student Entrance Ceiling; plasterboard, skim & paint - assumes 10kg/m2	751.8	KG	1	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 vapo	EPD	Assuming 8.4kg/m2 of elevation area (12.5mm thick)
	3.3.1.Finishes to ceilings	Student entrance ceiling; plasterboard, skim & paint, area 2587.475 m2, assumes 3 mm thick	195	KG	1	Plaster Gypsum	Interior Applications	Gypsum Plaster	Ramboll	Gypsum-based plaster, for most internal backgrounds, 94.6% gypsum, 5.4% additives, 861.5 kg/m	EPD	2.6 kg for 3mm thick coat, 4.3kg/m2 for 5mm thick coat, 8.6kg/m2 for 10mm thick coat
	3.3.1.Finishes to ceilings	Student entranceceiling; plasterboard, skim & paint	75	M2	1	Paint	Vinyl matt emulsion - Walls/Ceilings	Indoor & outdoor use	Ramboll	Paint, vinyl matt emulsion, indoor and outdoor use, 1240-1360 kg/m3, 17 m2/l, Johnstone's Trade C	EPD	Provide area in m2
	3.3.1.Finishes to ceilings	Ceiling to student Laundry/cleaner stores/disabled Wc's - assumes 0.242kg/m2	18.06046	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)
	3.3.1.Finishes to ceilings	Refuse Area/LV Room Ceiling - Painted Soffit - assumes 0.242kg/m2	72.634364	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)
	3.3.1.Finishes to ceilings	Ceiling to Bike Store; 1nr layer 136mm Rockwool High Impact Soffit Slab fixed to underside of soffit - assumes 50mm of rockwool	3	M3	1	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, Lamt	EPD	Provide m3
	3.3.1.Finishes to ceilings	Ceiling to Amenity Space, Reception area - possible Acoustic - 6.4kg/m2	2586	KG	1	Insulation	Acoustic baffles	Assumed Rock Wool	Ramboll	Frameless acoustic baffles, 50mm, 6.4kg/m2, 128kg/m3, Contour (ROCKWOOL FRANCE)	EPD	Assuming 6.4kg/m2 (50mm thick)
	3.3.1.Finishes to ceilings	Allowance for forming ceiling bulkheads: ne 300 wide - 300mm wide, 1207m, assumes 10kg/m2	3621	KG	1	Plasterboard	Plasterboard/Tileboard	Specialty gypsum board for tiling surface	Ramboll	Gypsum plasterboard, reinforced, water resistant, with square edges, 1200x900x6/12.5 mm, 800 kg	EPD	Assuming 10kg/m2 (12.5mm thick)
	3.3.1.Finishes to ceilings	Access hatches to bulkheads: 600 x 600 non fire rated; tamper proof lock MDF Panel - 600 x 600 x 18mm *(367) - 500 kg/m3	1189	KG	1	Timber	Skirting boards	Assumed MDF generic	Ramboll	Timber, MDF	ICE	Provide kg (density 500kg/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

8. External Works											
RICS category ▼	Material Description #	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Notes/Assumptions
8.2.1.Roads, paths and pavings	Hard paving; 600 x 600, assuming 30mm thick, 862m²	62,064	KG	1	Concrete	Precast Concrete Paving	Assumed Precast concrete	Ramboll	Precast concrete paving products, 2350 kg/m3 (BPCF)		Provide m3 or kgs, Assuming 72kg/m2 (30mm thick), 192kg/m2 (80mm thick)
8.2.1.Roads, paths and pavings	Bound gravel Surfacing, assuming 100mm thick, 42m²	6,720	KG	1	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3		Provide m3 or kg - Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
8.6.1.Surface water and foul water drainage	Drainage to external works	862	M2	1	Soil	Wastewater drainage	Wastewater drainage system per m²	OC	Wastewater drainage system		provide m²
8.5.1.Site/Street furniture and equipment	Benches; 2400 long	3	UNIT	1	FF&E	Bench	Wooden bench	Ramboll	Wooden bench, 13.5 kg/unit, OVO Bench Collection (Benchmark)		Provide units
Select		19,029	Select	Select	Select	Select	N/A	N/A	N/A		N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A		N/A

Appendix D – First Street Block C, Proposed PV System



**Feed It Green LTD**

The Box Studios, 17 Boundary Street
L59UB
England, United Kingdom

Contact person:

Lindsay Reynolds
Phone: 0333 207 4227
E-Mail: info@feeditgreen.com

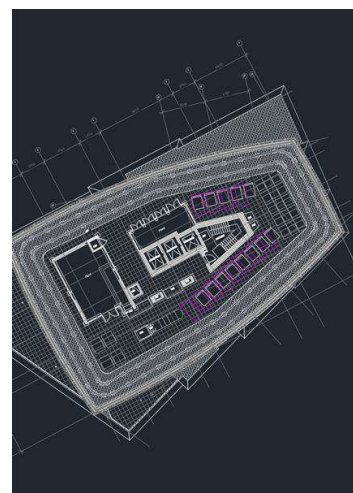
Project Name: Downings

07/05/2026

Your PV system from Feed It Green LTD

Address of Installation

Botanic Avenue 2,
Manchester,
M15 6JW



Project Overview

PV System

Grid-connected PV System with Electrical Appliances

Climate Data	Manchester, GBR (2001 - 2020)
Values source	Meteonorm 8.2(i)
PV Generator Output	6.65 kWp
PV Generator Surface	28.4 m ²
Number of PV Modules	11
Number of Inverters	1

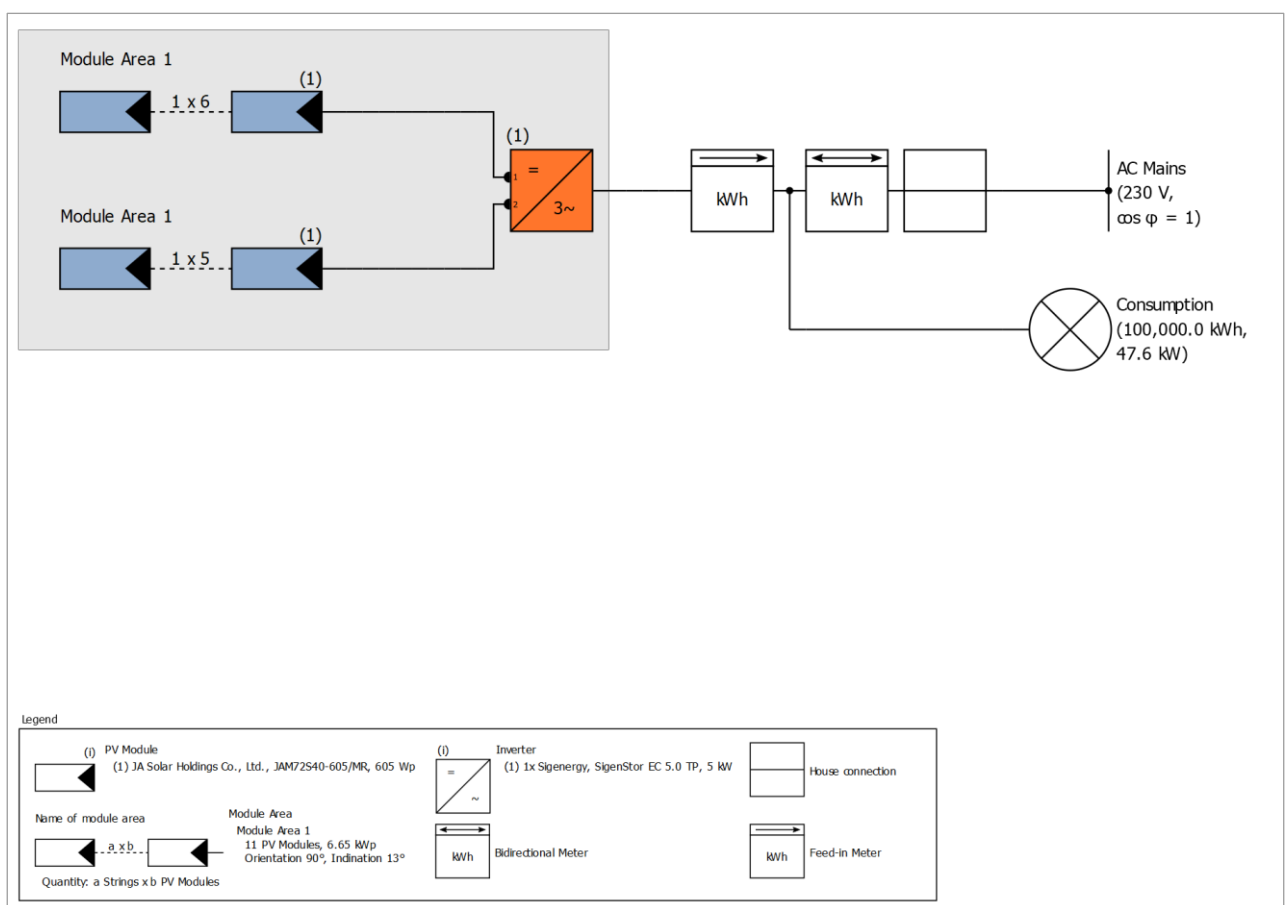


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	6.66 kWp
Spec. Annual Yield	879.09 kWh/kWp
Performance Ratio (PR)	91.10 %
PV Generator Energy (AC grid)	5,885 kWh/Year
Own Consumption	5,663 kWh/Year
Grid Export	221 kWh/Year
Own Power Consumption	96.2 %
CO ₂ Emissions avoided	1,364 kg / year
Level of Self-sufficiency	5.7 %

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the System

Overview

System Data

Type of System	Grid-connected PV System with Electrical Appliances
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Climate Data

Location	Manchester, GBR (2001 - 2020)
Values source	Meteonorm 8.2(i)
Data resolution	1 h
Simulation models used:	
- Diffuse Irradiation onto Horizontal Plane	Hofmann
- Irradiance onto tilted surface	Hay & Davies

Module Areas

1. Module Area - Module Area 1

PV Generator, 1. Module Area - Module Area 1

Name	Module Area 1
PV Modules	11 x JAM72S40-605/MR (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	13 °
Orientation	East 90 °
Installation Type	Mounted - Roof
PV Generator Surface	28.4 m ²

Inverter configuration

Configuration 1

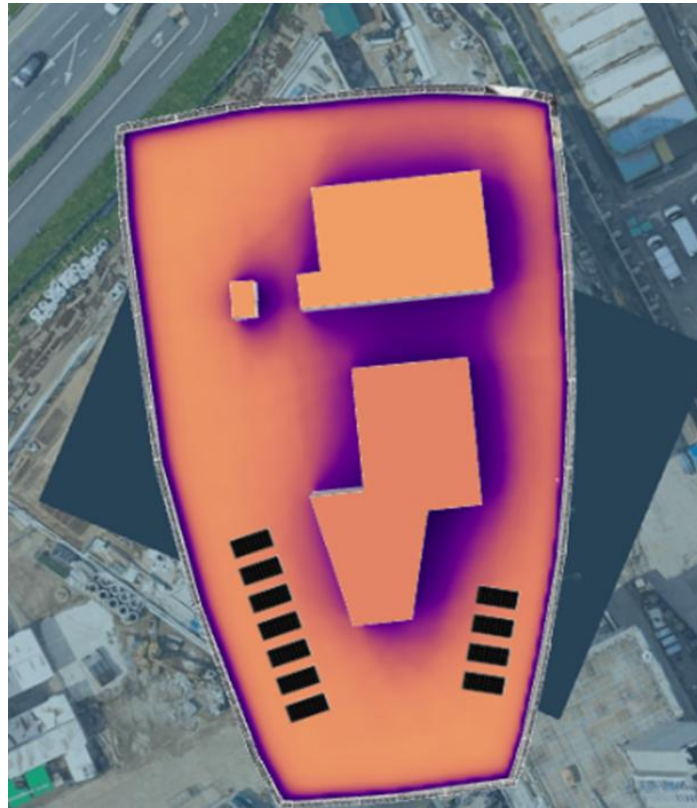
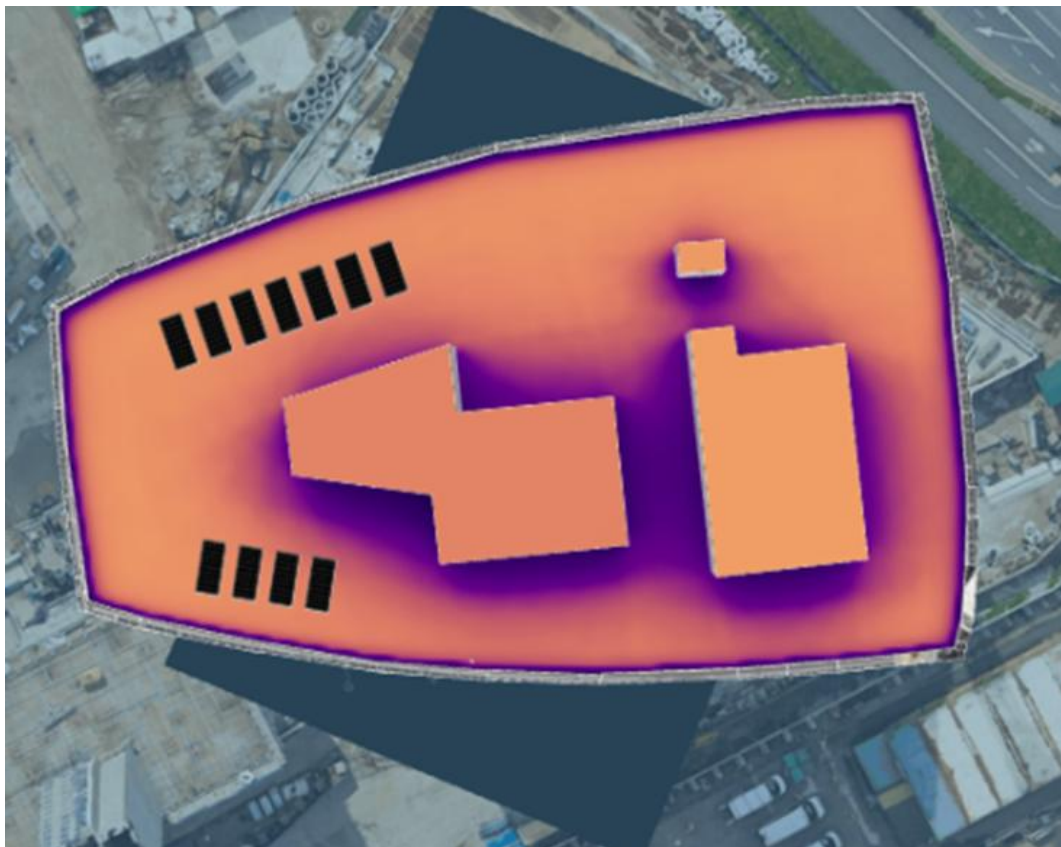
Module Area	Module Area 1
Inverter 1	
Model	SigenStor EC 5.0 TP (v1)
Manufacturer	Sigenergy
Quantity	1
Sizing Factor	133.1 %
Configuration	MPP 1: 1 x 6 MPP 2: 1 x 5

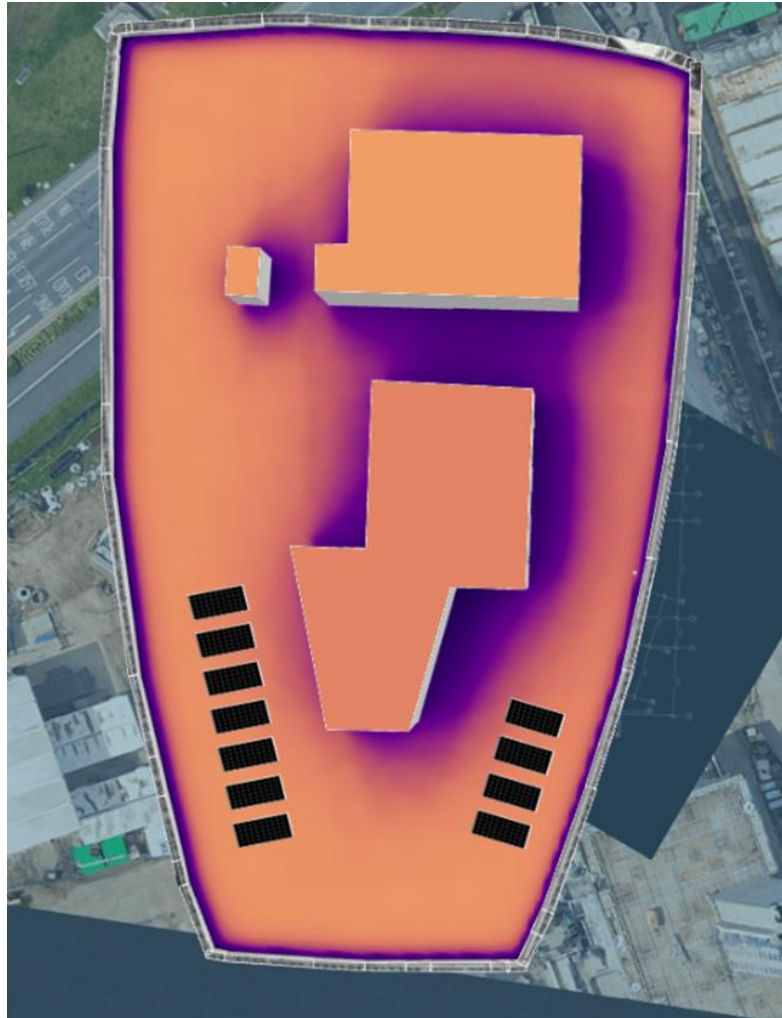
AC Mains

AC Mains

Number of Phases	3
Mains voltage between phase and neutral	230 V
Displacement Power Factor (cos phi)	+/- 1

Images of the project





Plans and parts list

Circuit Diagram

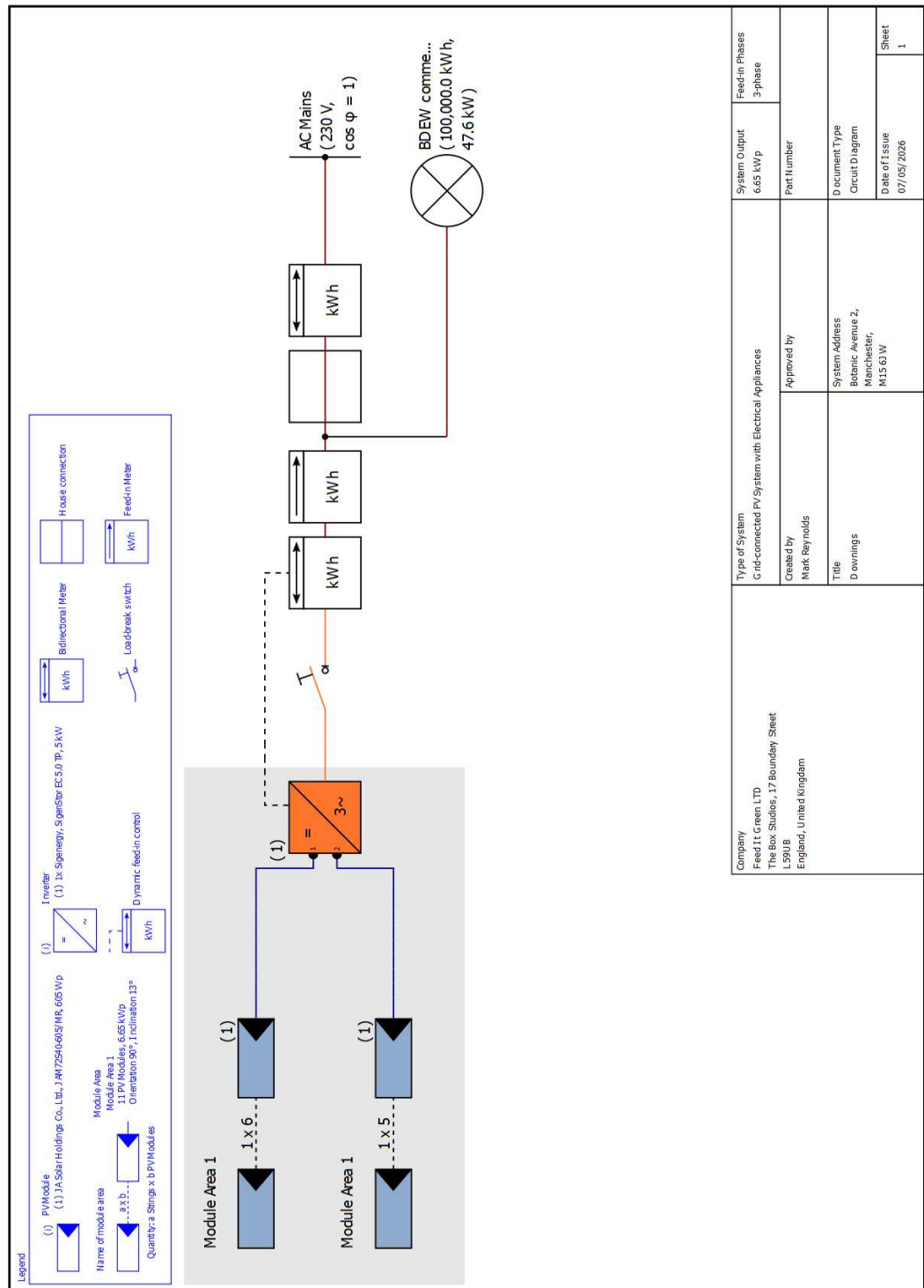


Figure: Circuit Diagram

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		JA Solar Holdings Co., Ltd.	JAM72S40-605/MR	11	Piece
2	Inverter		Sigenergy	SigenStor EC 5.0 TP	1	Piece
3	Components			Dynamic feed-in control	1	Piece
4	Components			Feed-in Meter	1	Piece
5	Components			House connection	1	Piece
6	Components			Bidirectional Meter	1	Piece
7	Components			Load-break switch	1	Piece