Whole Life Carbon Assessment

RIBA Stage 2

Medical Teams Limited

For the site at:
335 Euston Road
London
NW1 3AD

London Borough of Camden

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	16.07.2024	Jiale Li	Lamya Salem	Jiale Li

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

SRE Main Office

3 London Square | Cross Lanes

Guildford | Surrey | GU1 1UJ

T: +44 (0)1730 710044

E: info@sre.co.uk

W: www.sre.co.uk

Contents

Executive Summary

Executive Summary

This Whole Life Carbon Assessment (WLCA) has been developed for Medical Teams Limited (The Client) to present the results of WLCA undertaken at RIBA stage 2 to calculate the whole life carbon emissions over the reference study period (RSP) of 60 years for a single storey building, occupied by a shoe repair business, (the Proposed Development) at 335 Euston Road, London.

The WLCA has been undertaken in line with the 'Whole Life Carbon Assessment for the Built Environment, RICS Professional Standard, 2nd edition[1]', as the best practice for this assessment. The assessment complies with The London Plan Policy SI 2[2], aiming to calculate and minimise the whole life-cycle carbon emissions from the Proposed Development. The assessment adheres to the London Plan Whole Life-Cycle Carbon Assessments Guidance (March 2022)[3] and utilizes the WLC assessment template for potential submission to GLA if needed.

Due to the nature of the building, the Proposed Development has been categorized as a 'small project' according to the RICS Professional Standard, 2nd edition, section 3.8, as it has a Gross Internal Area (GIA) of less than 1000 sqm Therefore, decisions on operational energy are based on professional experience and Part L. The Simplified Building Energy Model (SBEM) and OneClick LCA software are utilized to model the operational and embodied carbon impacts of the proposed design, determining the total Global Warming Potential (GWP) of all materials used for the development.

Based on the information provided by the Project Team, the overall results show that the Proposed Development will have cradle-to-grave emissions of approximately 970.21 kg CO_2e/m^2 under the decarbonized scenario and 1932.08 kg CO_2e/m^2 under the non-decarbonized scenario.

Module	Decarbonised scenario kg CO_2e/m^2	Non-Decarbonised scenario kg CO_2e/m^2
Life Cycle Stage A/ Upfront Carbon	**426.2**	**426.2**
A1-A3 Sequestered Carbon	-115.01	-115.01
A1-A3 Product stage (excl. sequestered carbon)	444.91	444.91
A4	11.9	11.9
A5	84.4	84.4
Life Cycle Stage B	**382.6**	**1317.17**
B1	13.19	26.38
B2	5.83	11.65
B3	4.72	6.18
B4	140.06	279.77
Operational Carbon	**218.8**	**993.19**
B6	218.64	992.37

[1] Whole life carbon assessment for the built environment, RICS professional standard, 2nd edition, September 2023
[2] The London Plan, Mayor of London, March 2021
[3] London Plan Whole Life-Cycle Carbon Assessments Guidance (March 2022)

Module	Decarbonised scenario kg CO_2e/m^2	Non-Decarbonised scenario kg CO_2e/m^2
B7	0.16	0.82
Life Cycle Stage C	**161.41**	**188.71**
C1-C4	161.41	188.71
D External impacts (not included in totals)	-76.63	-153.2
Embodied Carbon	**751.41**	**938.89**
Whole Life Carbon Emissions	**970.21**	**1932.08**

Table 1 - Whole Life Carbon result for the Proposed Development per lifecycle stage

Introduction

1.0 Introduction

Climate change is the greatest environmental challenge of our time. Global warming due to human-generated greenhouse gas (GHG) emissions into the atmosphere, referred to as carbon emissions, will have severe adverse environmental, biodiversity, social and economic effects around the world if temperature levels continue to rise.

This Whole Life Carbon Assessment (WLCA) has been performed by SRE Ltd on behalf of Medical Teams Limited (The Client) to represent the carbon impacts over the entire life cycle of the new construction at 335 Euston Road, London (hereon referred to as the Proposed Development).

The WLCA has been undertaken in compliance with the 'Whole Life Carbon Assessment for the Built Environment, RICS Professional Standard, 2nd edition', which emphasises the practical implementation of the existing and widely accepted environmental performance assessment structure of European standard EN 15978: 2011 'Sustainability of Construction Works' principles, but additionally provides guidance on sources of data and assumptions that should be used for all assessments in the UK. The assessment has complied with The London Plan Policy SI 2 minimising greenhouse gas emissions, aiming to calculate and minimise the whole life-cycle carbon emissions from the Proposed Development. The London Plan Whole Life-Cycle Carbon Assessments Guidance (March 2022) provides instructions on calculating WLC emissions, and it adheres to the information requirements for compliance with the policy. It also includes information on design principles and WLC benchmarks to aid planning applicants in designing buildings that have low operational carbon and low embodied carbon.

The aim of the assessment is to calculate and report the quantity of carbon impacts expected throughout all life cycle stages of the Proposed Development. This assessment helps identify the significant causes of carbon impacts and aids decision making during the design, procurement, construction and use phases. By doing so, it enables the Proposed Development to achieve the lowest carbon impacts across all life cycle stages.

Information detailed within the architecture drawings and supporting information received from the Project Team has been inputted into OneClick LCA software to evaluate the carbon content associated with all elements and components used in the Proposed Development. The Simplified Building Energy Model (SBEM) is utilized to predict the carbon content associated with the operational phase, as the Proposed Development is classified as a 'small project'.

The Reference Study Period (RSP) of 60 years is a standardised period over which the in-use stage of the Proposed Devwelopment is analysed. The result represents a 'Cradle-to-Grave' approach, encapsulating both the embodied and operational carbon resulting from all materials utilized in the proposed developments.

1.1 The Site and Proposed Development

The application site lies to the south of Euston Road and comprises a single storey building that is occupied by a shoe repair business (Class E use). It is located within the Central London Area and is on the periphery of the Euston Area Plan. The site also lies within the Fitzrovia Area Action Plan area. The site is adjacent to the Fitzroy Square Conservation Area. The location of the application site is shown in Figure 1.

Figure 1 - Location of the application site (Google Earth)

The Proposed Development at 335 Euston Road, London, consists of the demolition of the existing single story retail units and the construction of a new three-story building (plus basement) to be used as a medical facility. Including the basement, the total gross internal area (GIA) of all floors will be 152m^2. Figure 2 shows the proposed floors plans provided by the design team.

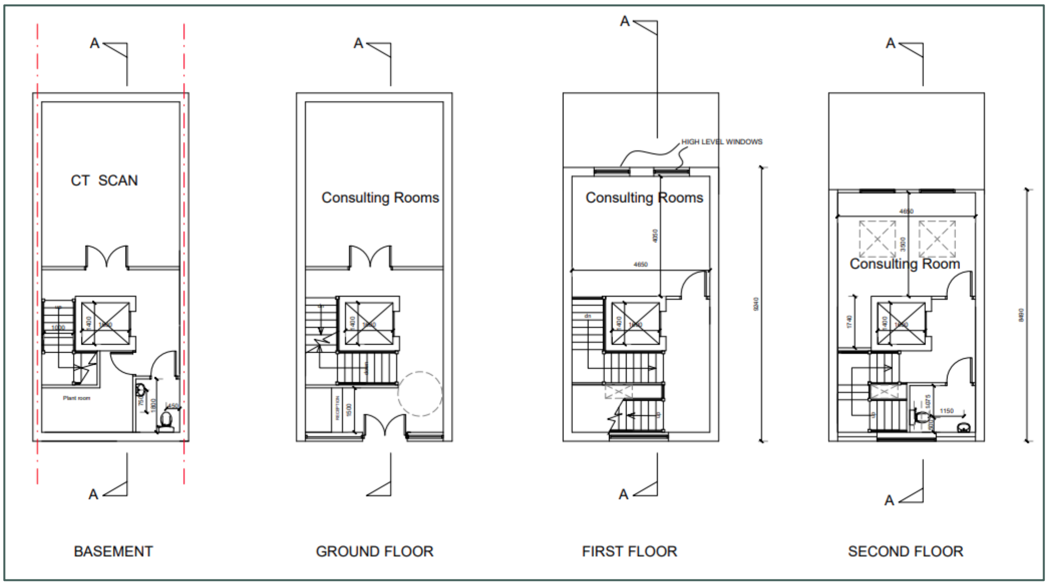


Figure 2 – Proposed floor plans (The Gillett Macleod Partnership)

1.2 Policy & Regulations

This WLCA has addressed the relevant planning policies and guidance. Table 2 below has summarised the policy context of each relevant policy.

Planning Policy	Sections	Policy Summary
The London Plan (March 2021)	Policy SI 2 Minimising greenhouse gas emissions	F. Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.
	Policy SI 7 Reducing waste and supporting the circular economy	A. Resource conservation, waste reduction, increases in material re-use and recycling, and reductions in waste going for disposal will be achieved by the Mayor, waste planning authorities and industry working in collaboration to: 1) promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible. 2) encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products. 3) ensure that there is zero biodegradable or recyclable waste to landfill by 2026. 4) meet or exceed the municipal waste recycling target of 65 per cent by 2030. 5) meet or exceed the targets for each of the following waste and material streams: a) construction and demolition – 95 per cent reuse/recycling/recovery b) excavation – 95 per cent beneficial use Design developments with adequate, flexible, and easily accessible storage space and collection systems that support, as a minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food.
National Planning Policy Framework (December 2023)[4]	14.Meeting the challenge of climate change, flooding and coastal change	<u>Planning for climate change</u> 159. New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards. 160. To help increase the use and supply of renewable and low carbon energy and heat, plans should: a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts); b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

[4] National Planning Policy Framework (December 2023)

		c) c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.
Camden Local Plan (2017)[5]	Policy CC1 Climate change mitigation	The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. We will: a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy; b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met; c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks; d. support and encourage sensitive energy efficiency improvements to existing buildings; e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and f. expect all developments to optimise resource efficiency.
Fitzrovia Area Action Plan Adopted March 2014[6]	Sustainability and local energy networks	The energy hierarchy A key aspect of sustainability is the reduction of carbon emissions. The energy hierarchy is a tool for reducing carbon emissions by prioritising firstly a reduction in energy use, secondly efficient forms of energy supply, and thirdly the use of renewable energy. Efficient energy supply Local energy systems, where heat and power are generated near to the place they are used, have been found to be the most cost-effective way for Camden to reduce carbon use. There are particular opportunities in Fitzrovia for developments to supply energy efficiently by using a local ('decentralised') energy system. Local energy networks (or decentralised energy systems) commonly take the form of a CHP (combined heat and power) system driven by a local boiler and generator. Developments are generally suitable for decentralised energy and CHP systems if they have high heating demands or have a mix of energy demands throughout the day (heat and electricity). Renewable energy Development should be designed with a target of 20% for the reduction of carbon emissions by using on-site renewable energy. Renewable technologies that may be appropriate in Fitzrovia include solar hot water panels, photovoltaic cells, ground source heat pumps and air source heat pumps.

Table 2 - Summary of planning policy requirements

[5] National Planning Policy Framework (December 2023)
[6] Fitzrovia Area Action Plan Adopted March 2014

Methodology

2.0 Technical Guidance

This WLCA for the Proposed Development will follow the industry-wide methodology and standards outlined in the following guidance, compliant with BS EN 15978:2011.

2.1 Whole Life Carbon Assessment for the Built Environment, RICS Professional Standard 2nd Edition

RICS Professional Standard (PS) 2nd edition addresses all element and component categories making up a built asset, during every stage: from extracting raw materials and manufacturing constituent construction products, through operation, to recovery or disposal at end of life. It also assesses the potential loads and benefits of recovery beyond the system boundary in the next life cycle. All aspects of WLCAs covered by this document are explained and put into context.

This document can be applied to any type of construction or civil engineering project, including building and/or infrastructure assets involving any of the following:

- New construction/new-build assets
- Demolition of existing and construction of new assets
- Retrofit/refurbishment of existing assets
- Masterplans with multiple built assets including associated project infrastructure
- Fit-out of built assets

2.2 Whole Life-cycle Carbon Assessments Guidance – Greater London Authority (2022)

The GLA guidance explains how to prepare Whole Life-cycle Carbon (WLC) assessment in line with Policy SI2 F of the London Plan (2021) using the WLC assessment template. Policy SI 2 F applies to planning applications that are referred to the Mayor of London. However, WLC assessments are also supported and encouraged on major applications that are not referable.

This guidance explains how to calculate WLC emissions, and the information required to be submitted to comply with the policy. It also includes information on design principles and WLC benchmarks to aid planning applicants in designing buildings that have low operational carbon and low embodied carbon.

2.3 TM65 Embodied carbon in building services: A calculation methodology (2021)

TM65 outlines the need for assessments of embodied carbon of products linked to MEP systems, to increase knowledge and facilitate WLC research in these areas. In this technical manual, embodied carbon is understood as the greenhouse gas emissions (GHG) associated with the making of a product, its installation, maintenance, repair and replacement, and its end of life. It covers the whole life cycle, excluding operational aspects and the potential recovery, reuse or recycling of materials. The embodied carbon associated with MEP design can be significant in a building's lifetime due to the materials that MEP equipment are made of and high replacement rates.

This guidance provides a consistent approach for:

- The data required from manufacturers
- An embodied carbon calculation methodology for MEP products, depending on how much information from manufacturers is available
- The way in which embodied carbon assessments are reported

2.4 Approved Document L, Conservation of fuel and power, Volume 2: Buildings other than dwellings, 2021 edition incorporating 2023 amendments

Approved Document L, Volume 2: Buildings other than dwellings gives guidance on how to comply with Part L of Schedule 1 to the Building Regulations and the energy efficiency requirements for buildings other than dwellings. This document gives guidance for building work in both new and existing buildings.

General Principles

3.0 General Principles

There are multiple definitions of a Zero Carbon Development, which can impact the method of reporting. For the purpose of this assessment, the following definition by the UK Green Building Council[7] has been used:

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

To this end, the WLCA has been undertaken in accordance with the guidance and technical manuals referenced in Section 1.2 and 2.0, which outlines the methodology and the mandatory requirements that the WLCA must adhere to.

3.1 WLCA Modules

A WLCA should follow a modular structure for carbon reporting, covering each stage and module of a building's life cycle (Figure 3).

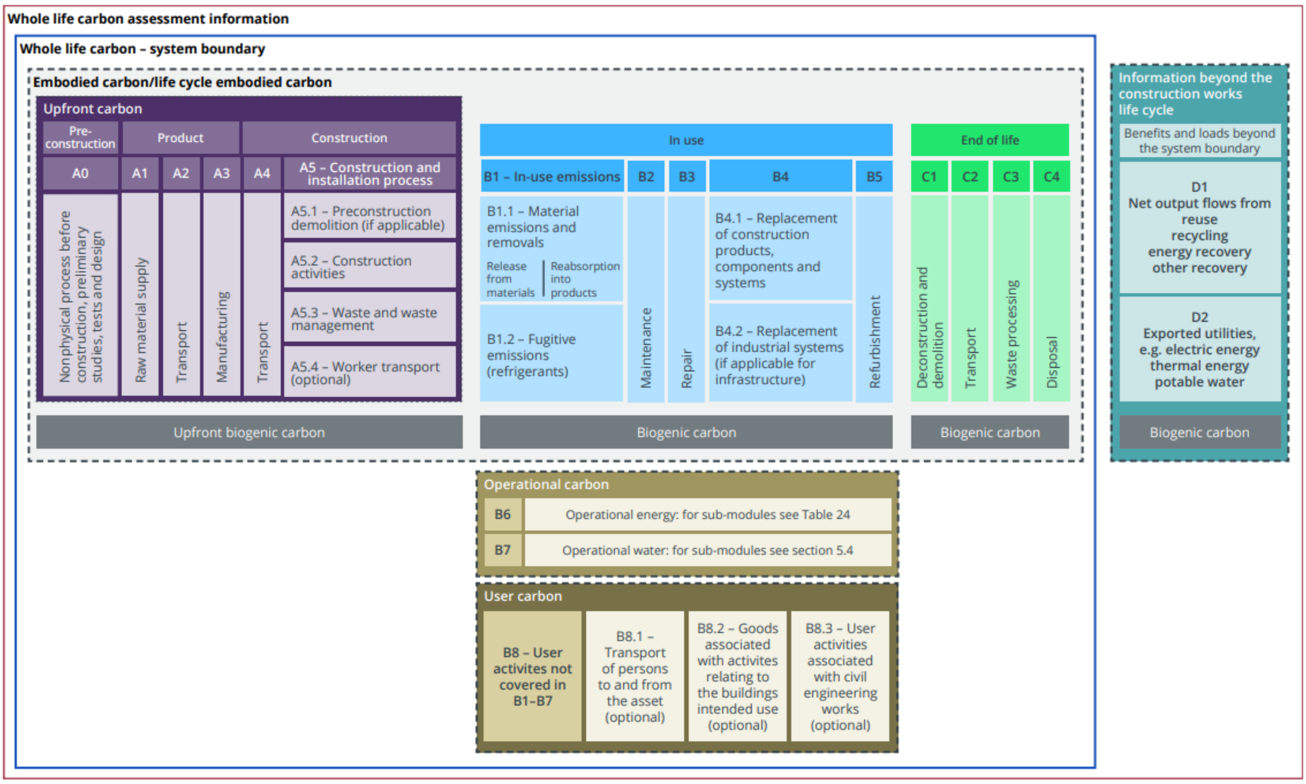


Figure 3 - Building and infrastructure life cycle stages and information modules (RICS WLCA Professional Standard, 2nd edition)

The modules are further broken down into sub-modules, summarised as follows:

- **Life cycle stage A:** covers all carbon emissions and removals from any activities necessary to complete the construction of the asset.
  - **Module A0 (pre-construction stage):** Non-physical pre-construction activities, such as surveys and activities associated with the design of the asset.

[7] Net Zero Carbon Buildings: A Framework Definition

- **Modules A1–A3 (product stage):** Emissions associated with the extraction (A1), transporting (A2) and manufacturing processes (A3) necessary to produce the construction products, components and technical equipment required to construct the asset.
- **Modules A4–A5 (construction stage):** Emissions arising from the transportation of construction products and the construction process, up to project completion. Module A5 also includes any on-site demolition or strip-out works required at the beginning of the project.

- **Life cycle stage B:** covers all carbon emissions and removals that occur over the in-use stage of the asset.
  - **Module B1:** covers direct emissions and removals from construction products, such as emission of blowing agents from insulation, refrigerant leakage from MEP equipment or removal of CO_2 through carbonation of concrete.
  - **Modules B2–B4**: cover material-related emissions that occur from maintenance, repair and replacement of any construction products, components, or elements of the asset over the RSP.
  - **Module B5**: covers any refurbishment or change in performance of the asset (e.g. retrofit/refurbishment or extension) planned at the outset of the project to occur at some point after construction is completed.
  - **Module B6**: covers the energy use of the asset over the in-use stage.
  - **Module B7**: covers water use over the in-use stage.
  - **Module B8:** covers user activities not included elsewhere and could include, for example, emissions from vehicles using a road or the impact of commuting to an office building over the in-use stage.

- Life cycle stage C: covers all 'end-of-life' impacts.
  - **Modules C1–C4**: cover impacts during the end-of-life stage of an asset. This includes deconstruction or demolition, waste processing, recovery or disposal and associated transport.

- Life cycle stage D: covers potential benefits and loads beyond the system boundary.
  - **Module D1**: covers the potential carbon loads and benefits beyond the system boundary from reuse, recycling, energy recovery or landfilling of any material arising from the construction (A4–A5), use (B2–B5) or end-of-life (C1–C4) stages.
  - **Module D2**: covers the potential carbon benefits beyond the system boundary of any utilities exported from the asset during in-use stages B6–B8, such as generated electricity or treated water.

The pre-construction stage (module A0) of buildings covers non-physical pre-construction activities, such as surveys and activities associated with the design of the asset. These can be a significant economic cost, but for buildings do not normally have a significant environmental impact. A0 is therefore generally assumed to be negligible for buildings.

Module B5 covers any refurbishment or change in performance of the asset (e.g. retrofit/refurbishment or extension) planned at the outset of the project to occur at some point after construction is completed. This would typically involve a predetermined change that will occur during the service life of the project, for example an extension, alteration or internal change planned to occur in the future. Since the Proposed Development does not plan for any alterations or improvements during its service life, no results have been calculated for Module B5.

Module B8 covers user activities not included elsewhere and could include, for example, emissions from vehicles using a road or the impact of commuting to an office building over the in-use stage. Quantification of the B8 impacts related to the asset under assessment is optional, and the information in module B8 constitutes additional information in the WLCA. For buildings where operation of the built asset itself is the main function, most of the energy impact is expected to sit under B6. For infrastructure, where the built asset itself may only provide the shell to house highly energy-intensive activities run by its users/operators, significant impacts can be expected to arise from the asset's utilisation. These need to be captured in B8. Since the Proposed Development is clarified as small development, Module B8 has been excluded.

The following terms are used to describe the modular project boundaries when calculating and reporting the carbon impacts of a project life cycle, as identified in Figure 3.

- Upfront Carbon (modules A0-A5)
- Embodied Carbon (modules A0-A5, B1-B5 and C1-C4)
- Operational Carbon (modules B6-B7)
- Whole life carbon (modules A, B and C)

3.2 Source of Data

A compliant WLCA must cover all items listed in the project's bill of quantities (BoQ), cost plan and quantity take-offs (QTOs), or as identified in other records (3D/BIM models, drawings, specifications, etc.). Given that this is a small project still in the early design stage, the quantity of the materials is based on estimates from the architectural drawings.
During the strategic and concept design phases (RIBA Stage 2), where usually a particular manufacturer's products are not chosen (and often even the materials to be used are not definite), generic data is the preferred data type to be used. Generic data is not manufacturer-specific and should be chosen as typical of the type of component, product and/or material to be used.

Table 3 below summaries the data source used for the Proposed Development in WLCA.

	Data Source	Description
Building Materials	OneClick - LCA Software	OneClick generic EPD database
	Cost Plan	Not Available
	Architectural Plans	Material Quantities
	MEP	CIBSE TM65
Operational Energy	Energy & Sustainability Statement	Energy Strategy and Consumption
Waste	Pre-Demolition audit	Not Available

Table 3 - Data Sources for the WLCA

3.3 Scope of the Analysis and Modelling Inputs

Table 4 below outlines the building elements that are covered in the WLCA to ensure consistency of reporting. The elemental breakdown structure used is derived from RICS' New rules of measurement (NRM)[8].

Building Element Group	Building Element (NRM Level 3)	Specification
0.1 Treatment, demolition works & Facilitating works	0.1.1.2 Demolition Works	Demolition/deconstruction of existing buildings and structures, and/or parts thereof, including transport from site and waste processing of removed materials. Since actual figures are not available at this stage, a standard assumption of 35 $kgCO_2e/m^2$ in the UK is adopted for the project. This is applied to the GIA of the existing areas being demolished (51.83 m^2). This assumption includes the energy and water use for demolition, waste generation, and transport to the demolition site, all of which have been categorized under A5.1 Pre-construction demolition.
	0.1.2 Facilitating works	Construction activity impacts include impacts from any construction activities and installation processes on-site, including temporary works, energy consumption for site accommodation and use of plant, machinery and equipment. All these impacts have been categorized under A5.2 Construction activities. Baseline building-specific impacts related to construction activities in the UK are anticipated to be 40 $kgCO_2e/m^2$ proposed GIA.
1 Substructure	1.1 Foundations and piling	Pile Foundations
	1.2.1 lowest slab	Precast concrete slab with mineral insulation for basement floor
	1.2.3 Basement retaining walls	Basement pile wall

[8] RICS NRM: New Rules of Measurement

Building Element Group	Building Element (NRM Level 3)	Specification
2 Superstructure	2.1 Frame	The external wall serves as the primary support for the building, while the elevator shaft contributes to the overall stability and integrity of the structure.
	2.2 Upper floors	200 mm timber joists with insulation and planed timber, timber floorboards, plaster ceilings.
	2.3 Roof	150 mm timber joists flat roof with 100mm insulation and a single ply membrane covering.
	2.4 Stairs and ramps	Wooden staircase, wood handrail, concrete elevator/stair shaft, lift
	2.5 External envelope including roof finishes	Masonry construction: 100 mm masonry external skin, 100mm cavity with 90mm EcoTherm Eco-Cavity Full Fill insulation and 10mm gap, 100mm light weight block internal skin. Aluminium curtain wall at ground floor
	2.6 Windows and external doors	External glass Door, Double glazed window
	2.7 Internal walls	Fixed gypsum board partitions along with steel stud framing components
	2.8 Internal doors	Internal wooden door
3 Finishes	3.1 Wall finishes	Assumed wall paints
	3.2 Floor finishes	Assumed ceramic floor tile in general space and bathroom, carpet in consulting rooms
	3.3 Ceiling finishes	Assumed acoustic ceiling tile
4 Fittings, Furnishings & Equipment (FF&E)	4.1 General fittings, furnishings and equipment	Reception table, Sanitary, consulting desks and chairs
5 Mechanical, Electrical & Plumbing (MEP)	5.2.1 Space heating and hot water	Air source heat pump (ASHP) for all space exclude plant room through ceiling cassettes with time and temperature control. Electric hot water system: instantaneous hot water heater for bathrooms only

Building Element Group	Building Element (NRM Level 3)	Specification
	5.2.4 Ventilation air terminals, ductwork and ancillaries, control dampers, attenuation, fire safety related to ventilation equipment	Mechanical Ventilation with Heat recovery (MVHR) with CO_2 sensors to all spaces exclude plant room.
	5.3.1.1 Internal lighting	LED lighting with passive infrared (PIR) sensors to all spaces and daylight sensors with all windows

Table 4 – Data inputs in each building element group for the Proposed Development

3.4 Scenarios and Assumptions

WLCAs generally predict impacts that will occur in the future. During the early design phase, predictions of the materials used, construction impacts, and operation of the asset will be made. A default contingency factor of 15% is applied to all life cycle stages and modules. Table 5 outlines the details of each life cycle stage/module covered in the WLCA, including the scenarios and assumptions applied, with appropriate references.

Module	Scenarios	Assumptions
A1-A3 Product Stage	Prediction of scenarios based on default specifications or generic data. The quantity uncertainty factors have been selected for each material to provide an indication of the uncertainty associated with the quantities used for the WLCA. Using generic data introduces significant uncertainty as it may not reflect the final product used. Therefore, applying the carbon data uncertainty factor during the early design phase is inappropriate.	Since the technical specification for the building components and product types is indicative, materials are selected based on UK average industry standard practice. Generic data are selected as representative of the type of component, product, and material to be used.

Module	Scenarios	Assumptions
A4 Transport to Site	During the early design phase, scenario data for A4 (transport to site) are based on the default distances or the data from a collective EPD.	Transport scenarios outlined in the RICS guidance have been utilised (Appendix B).
A5 Construction & Installation Process	Default wastage figures and default energy consumption on site should be used. The carbon impacts associated with pre-construction demolition have been allocated to module A5.1, using a standard assumption based on monitored demolition case studies in central London. A similar strategy has been applied to construction activities, which have been allocated to module A5.2. These are discussed in Table 4 above. The waste and waste management from the production and transport of products are allocated in A5.3. Installation and deconstruction waste impacts are assumed to be zero.	The waste rate based on traditional forms of construction in the UK has been adopted and is outlined in 0.
B1 In-use emissions	B1.1 Non-energy-related carbon removals or emissions from materials have been omitted due to lack of available information. Emissions arising from refrigerants have been included in module B1.2 following the CIBSE TM65 guidance.	The assumed annual refrigerant leakage rate in heat pumps is 3.8%, with an end-of-life leakage rate of 2%. The refrigerant type assumed is R32.
B2 Maintenance	Carbon impacts from maintenance activities, including cleaning, and any associated products used, and waste produced, have been allocated to B2.	An assumption of 10 $kgCO_2e/m^2$ gross internal area (GIA) may be applied to encompass all building element categories, or 1% of modules A1–A5, whichever is greater, following RICS and GLA WLCA guidance.
B3 Repair	Captures carbon impacts from all activities that relate to repair processes, and any products used, and waste produced including impacts from production, transportation to and from site, and installation of the repaired items	Module B3 is intended to provide a reasonable allowance for repairing unpredictable damage over and above the maintenance regime. Repair impacts are assumed as equivalent to 25% of B2 maintenance impacts for the relevant items and

Module	Scenarios	Assumptions
		10% of A1–A3 impacts for MEP in accordance with the CIBSE TM65 methodology, following RICS and GLA WLCA guidance.
B4 Replacement	A prediction of the service lives for materials and components needs to be made so that any replacement over the RSP can be calculated and reported in B4. For the purposes of consistency, the like-for-like replacement of products, components and systems are assumed over the RSP.	Indicative component lifespans in the UK have been adopted in the assessment and are outlined in Appendix C.
B5 Refurbishment	There are no planned alterations or improvements to the physical characteristics or performance of the built asset, such as retrofit or refurbishment, during the RSP period.	B5 has been excluded in this assessment.
B6 Operational Energy	For buildings, operational impacts must include all operational energy used in the building, including heating, hot water, cooling, ventilation, lighting, cooking, equipment and lifts, broken down separately by fuel type and energy end use.	Predictive operational energy consumption has been conducted based on the results of Part L 2021 calculations, given the project's classification as a small project. The energy consumption data is provided in Appendix E. To support design decision-making over the RSP, a non-decarbonised scenario and a decarbonised scenario must be calculated.
B7 Operational Water	Capture carbon impacts related to water supply and wastewater treatment, as measured and/or predicted over the life cycle.	For simple buildings, the maximum daily water consumption values are following the latest version of the BSRIA Rules of Thumb – Guidelines.

Module	Scenarios	Assumptions
C1-C4 End-of-Life	Since the end-of-life intentions are uncertain, the 'Business as usual'/ (baseline) scenario has been chosen to allocate C1: Deconstruction and demolition impacts. No additional effort has been made to enhance deconstruction or recovery potential. C2 (Transport impacts), C3 (Waste processing for reuse, recycling or other recovery) and C4 (Disposal impacts) all reflect the end-of-life routes applied in 'Business as usual' scenario.	Default end-of-life routes are employed, applicable to the most commonly used materials in construction.

Table 5 - RICS WLCA life cycle modules for the Proposed Development

3.5 Assumptions

Since project-specific information is currently unavailable, the assessment will utilize assumptions based on UK average industry standard practices (as detailed in Table 6) for key materials to establish a baseline for reporting.

Assumptions		
Substructure	Piling and Foundation	Reinforced concrete Ready-mix concrete, normal-strength, generic, C30/37, 10% recycled binders in cement Reinforcement steel (rebar), generic, 97% recycled content
	Basement Piled wall	Reinforced concrete Ready-mix concrete, normal-strength, generic, C30/37, 10% recycled binders in cement Reinforcement steel (rebar), generic, 97% recycled content
	Basement Floor	Reinforced concrete Ready-mix concrete, normal-strength, generic, C40/50, 10% recycled binders in cement Reinforcement steel (rebar), generic, 97% recycled content Mineral wool

Assumptions		
	External Wall	Generic UK clay brick, dry brick weight 2.13kg Eco-Cavity Full Fill Insulation Lightweight aerated autoclaved concrete (AAC, such as Aircrete) blocks for non-structural uses (600kg/m^3)
	Upper Floor	Softwood framing joists Reinforcement mesh Mineral wool Hot-dip galvanized steel sheets Double side plasterboard
	Internal Partitions	Structural steel profiles, generic, 60% recycled content Gypsum plaster board, regular, generic Mineral wool
	Roof	Softwood framing joists Polyurethane (PU) rigid foam Hot-dip galvanized steel sheets plasterboard

Table 6 – Key materials assumptions in LCA model

Results & Conclusion

4.0 Results

The results indicate that the Proposed Development will have cradle-to-grave emissions of approximately 970.21 kg CO_2e/m^2 under the decarbonized scenario and 1932.08 kg CO_2e/m^2 under the non-decarbonized scenario.

Table 7 below presents the Proposed Development's whole lifecycle carbon results over 60-year lifespan, broken down by life cycle stage for both scenarios.

Module	Decarbonised scenario kg CO_2e/m^2	Non-Decarbonised scenario kg CO_2e/m^2
Life Cycle Stage A/ Upfront Carbon	**426.2**	**426.2**
A1-A3 Sequestered Carbon	-115.01	-115.01
A1-A3 Product stage (excl. sequestered carbon)	444.91	444.91
A4	11.9	11.9
A5	84.4	84.4
Life Cycle Stage B	**382.6**	**1317.17**
B1	13.19	26.38
B2	5.83	11.65
B3	4.72	6.18
B4	140.06	279.77
Operational Carbon	**218.8**	**993.19**
B6	218.64	992.37
B7	0.16	0.82
Life Cycle Stage C	**161.41**	**188.71**
C1-C4	161.41	188.71
D External impacts (not included in totals)	-76.63	-153.2
Embodied Carbon	**751.41**	**938.89**
Whole Life Carbon Emissions	**970.21**	**1932.08**

Table 7 - Whole Life Carbon result for the Proposed Development per lifecycle stage

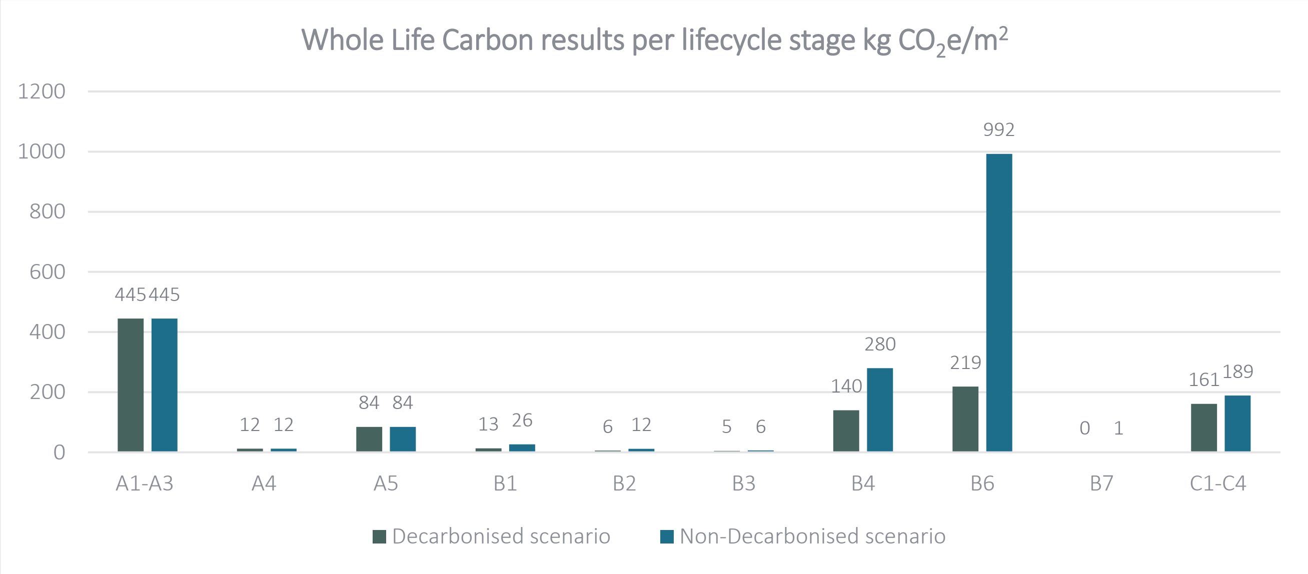


Figure 4 – Whole life carbon results per lifecycle stage for decarbonised and non-decarbonised scenarios

The figures presented in Figure 4 are the result of a point-in-time assessment, dependent on the information provided and collected at the time of WLCA completion. As the final quantities and remaining details of the installed components will become available, the WLCA model will need to be updated at RIBA Stage 6 (the Post-Construction Stage) in order to capture the embodied carbon emissions for the 'as-built' development more accurately.

4.1 Embodied Carbon

All material-related carbon impacts have been attributed to embodied carbon emissions, including modules A0–A5, B1–B5, and C1–C4. The results indicate that the embodied carbon emissions for the proposed scheme are 751.41 kg CO_2e/m^2 under the decarbonized scenario and 938.89 kg CO_2e/m^2 under the non-decarbonized scenario.

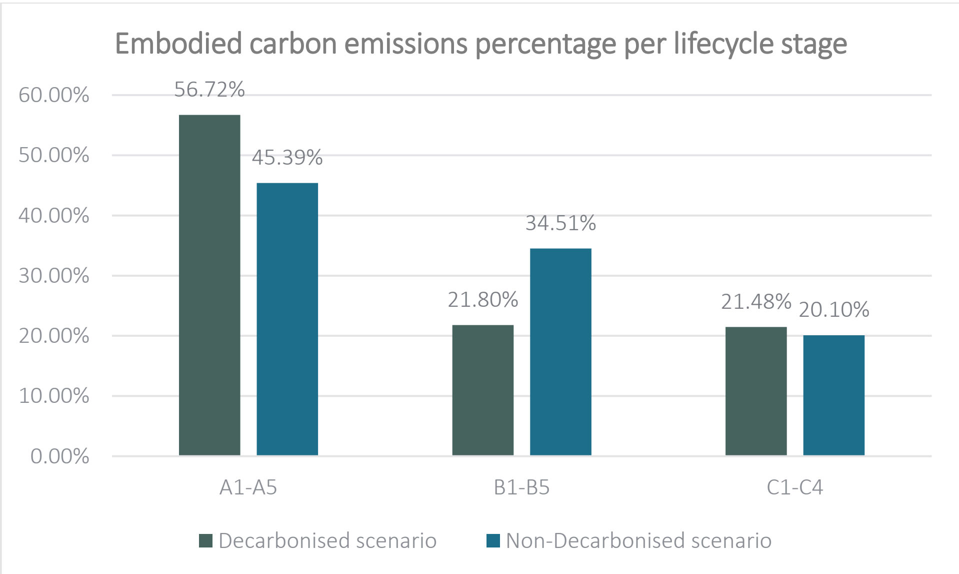


Figure 5 - Embodied carbon emissions breakdown per lifecycle stages

For both scenarios, Figure 5 demonstrates that the upfront carbon emissions for the Product and Construction Stages have the maximum contribution towards the total lifecycle embodied emissions of the Proposed Development. The emissions for lifecycle module A1-A5 are based on the manufacturing (A1-A3) and resourcing (A4) of the raw materials and the subsequent on-site construction emission from the installation process (A5).

4.1.1 Contribution of carbon-intensive materials

To present a more detailed overview of building material carbon emissions, the following breakdown as shown in Figure 6 outlines the contribution of various building elements and materials to the overall cradle-to-gate impacts (A1-A3) for the non-decarbonised scenario.

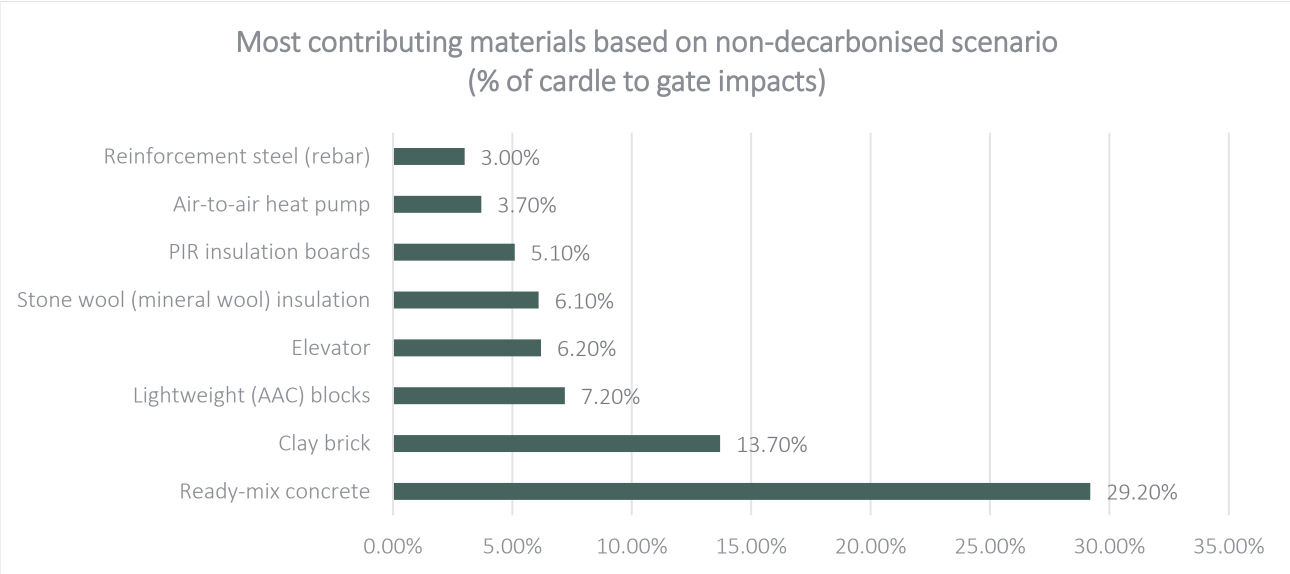


Figure 6 - Most contributing materials (non-decarbonised scenario)

The building's design extensively uses concrete for the foundation construction, making ready-mix concrete the primary contributor to carbon emissions during the production stages. To reduce the overall carbon footprint of the Proposed Development, it is highly recommended to consider sustainable alternatives.

The superstructure design extensively uses clay bricks and lightweight blocks for the external walls. These materials are the second and third most carbon-intensive, accounting for 13.7% and 7.2% of the A1-A3 impacts, respectively.

Although the three materials mentioned above are the most carbon-intensive at the production stage, they all serve as primary structural support elements. Due to their long lifespan, which matches that of the building, they will not require replacement during the study period and therefore will not contribute to carbon emissions at the B4 stage.

Building services equipment, such as elevators, are relatively high in embodied carbon during production. One elevator, modelled in this study, accounts for 6.20% of the cradle-to-gate impacts. Due to its short lifespan, scheduled replacements are required every 20 years over the 60-year RSP, contributing to module B4 carbon emissions. Additionally, elevators require frequent regular maintenance and repairs, which slightly contribute to module B2 and B3 emissions. Therefore, alternative solutions should be considered to reduce the embodied carbon emissions of the elevator.

4.2 Operational Carbon - Energy

For small projects like the Proposed Development (GIA of less than 1000m^2, or ten dwellings or fewer), it is allowable to only assess upfront and embodied carbon (modules A1–A5, B1–B5 and C1–C4), with other mechanisms used to reduce operational carbon.

Part L 2021 calculations has been used to predict the operation energy consumption for module B6 operational energy carbon. Appendix E has shown the Part L result for the energy consumption for the Proposed Development by end use. By utilizing an air source heat pump for space heating and cooling, it has been determined that there will be no need for rooftop photovoltaic panels to generate on-site renewable energy.

As shown in Figure 4 above, B6 operational energy carbon represents 219 kg CO_2e/m^2 for the decarbonized scenario and 992 CO_2e/m^2 for the non-decarbonized scenario over 60 years. Through decarbonisation, the B6 carbon emissions will decrease by 78%, significantly reducing the overall life cycle carbon footprint of the Proposed Development.

4.3 Discussion of the results

By completing the WLCA model and reviewing the design information available to date, observations in the following sections have been made.

4.3.1 Demolition of Existing building

The potential to use the existing building at the site has been explored with the Design Team to minimize associated embodied carbon emissions.

The application site consists of a single storey shoes & repairs shop with a GIA around 52 m^2 located on Euston Road in Camdon, north London. The existing building is located within a row of 2/3 storey terrace buildings extending from 327-337 Euston Road. Neither the existing building nor the neighbouring buildings along this terrace are listed.

The proposal seeks to demolish the existing single storey retail unit and erect a two storey plus basement and roof level building for use as a medical facility specialising in CT scans and MRI scans (Class E use).

As indicated in the existing ground floor plan (attached in Appendix F), the current layout does not align with the proposal. In case of retaining the existing structure, it will be required to demolish internal partitions, demolish the front and back external walls, execute excavation works to prepare for the basement space and modify the current foundation to accommodate the design of the Proposed Development.

Moreover, pre-construction activities such as temporary enabling works, monitoring of existing structures, fabric improvements, and installation of efficient MEP systems to meet Building Regulations (Part L) may potentially increase embodied carbon emissions from renovating existing structures. Additionally, the absence of a ground investigation report for the application site and uncertainties regarding the foundation lifespan raise questions about the feasibility of utilizing existing foundations for supporting the proposed new scheme.

Consequently, It is not possible to retain and improve the existing building. However, options are considered to enhance resource efficiency for the proposed scheme. The pre-demolition audit is recommended to ensure that 95% of construction and demolition waste will be diverted from landfill and 95% of excavation waste will be put to beneficial uses.

The baseline model does not include reused materials in its selection. Nonetheless, it is advised to consider reused materials for the Proposed Development, particularly for key materials like concrete, to mitigate the impacts associated with initial material manufacturing (A1-A3). Similarly, the use of locally sourced reused materials is encouraged, which can help minimize the impacts associated with initial material transportation (A4).

5.0 Low-carbon Options Appraisal

The assessment has examined low-carbon alternatives for the most impactful materials in terms of cradle-to-gate impacts (A1-A3) in the non-decarbonised scenario.

The design options appraisals are presented in Table 8, which includes comparisons with the baseline design to illustrate percentage improvements. The Design Team should evaluate the suitability of the alternative options listed.

Options	Specifications	Proposed Development's A1-A3 ($kgCO_2e/m^2$)	Percentage Improvement
Baseline	Foundation: Ready-mix concrete, normal-strength, generic, C30/37, 10% recycled binders in cement External wall: Generic UK clay brick, dry brick weight 2.13kg	444.91	-
Options 1	Foundation: Ready-mix concrete, RC 40/50 (40/50 MPa), 50% Cement replacement with blast furnace slag (GGBS)	431.26	3.07%
Options 2	External wall: Generic UK clay brick, dry brick weight 2.13kg, reused material, locally reused	383.93	13.71%
Options 3	Concrete masonry units, hollow blocks	418.35	6.0%

Table 8 - Options compared with Baseline

5.1.1 Recommendations for improvement

This section presents recommended opportunities on how to further reduce the Proposed Development's embodied carbon emissions. The improvement options identified at the current design stage are subject to feasibility. The feasibility of the recommended improvement options should be analysed during the next design stages to assess implications on cost, programme as well as market availability and procurement options.

The following options are under consideration:

- Incorporate elements of existing perimeter retaining wall.
- Reuses elements from the existing building should be investigated, such as: concrete elements, and comply with the recommendations of the Pre-Demolition audit to maximise the reuse on the site.
- Rebar specifications - low-carbon specification should be considered. Adopting a national EAF rebar manufactured with renewable energy could offer potential savings.
- Recycled gypsum plasterboard and stud framing shall be considered for the internal partitions within the conditioned areas.

To aid the tangibility of decarbonisation across the Proposed Development as it moves from design to construction, the following recommendations can be incorporated:

- Sustainable Procurement Plan shall be considered.
- Source materials with valid EPDs and Responsible Sourcing Certification and gather documentation. Procure EPDs at the product level, or if unavailable, EPDs at the manufacturer/Organisational level, for all material types and categories.

Additionally, to support responsible sourcing of materials and services, the following websites can be extremely useful resources to gather organisational and product-level material EPD/Certification:

- *Global product EPDs* – EPD Library | EPD International (environdec.com)
- *Global product/Organisation Responsible sourcing certificates* – Responsible Sourcing League Tables - BRE Group
- *Global PEFC timber products* – PEFC - Programme for the Endorsement of Forest Certification
- *Global FSC timber products* – FSC Certificates Public Dashboard
- *Global product/Organisation Responsible sourcing certificates – Greenbook Live: BES 6001 The Framework Standard for Responsible Sourcing*

6.0 GLA Benchmarking

The WLC benchmarks specified are used as a guide when projects are urged to examine how they can reduce WLC emissions. A further set of aspirational WLC benchmarks have been developed which are based on a 40% reduction in WLC emissions compared to the first set of WLC benchmarks. This is founded on the World Green Building Council's target to achieve a 40% reduction in WLC emissions by 2030. As of now, modules B6, B7 and D have not been included in the benchmarks due to their variability in predicted and actual readings upon construction and use of the Proposed Development.

GLA benchmarks are calculated by assessing the carbon emissions for different lifecycle stages of a development against its gross internal floor area to highlight areas of carbon reduction/mitigation. The WLC benchmark, aspirational WLC benchmark and the percentage breakdown by element groups from London Plan's Whole Life Carbon SPG have been summarised in Table 9.

Modules	WLC benchmark ($kgCO_2e/m^2$ GIA)	Aspirational WLC benchmark ($kgCO_2e/m^2$ GIA)	Breakdown of a typical development
A-C (excluding B6 & B7, including sequestration)	<1050	<690	Substructure: 28% - <294 Superstructure: 32% - <336 Façade: 11% - <116 Internal finishes: 8% - <84 FFE: 2% - <21 Services/MEP: 13% - <137 External works: 6% - <63

Table 9 – Summaries of the WLC benchmark, aspirational WLC benchmark and the percentage breakdown by element groups

The results have been based on the non-decarbonised scenarios. The comparison of the Proposed Development's Carbon Emissions against GLA retail benchmark is Illustrated in Figure 7.

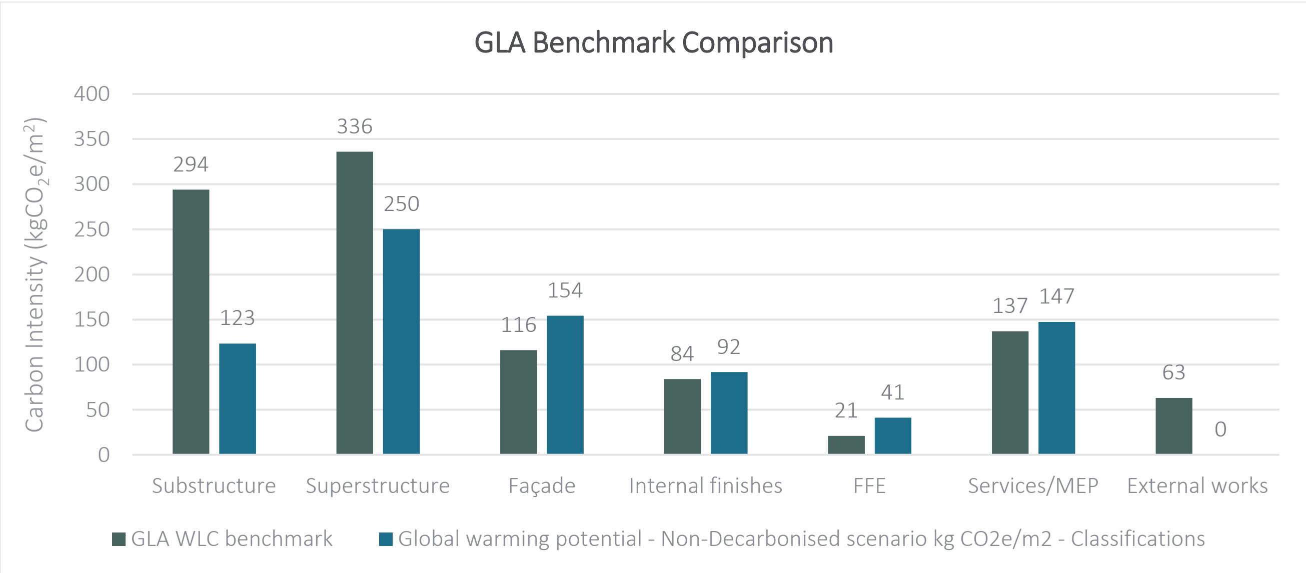


Figure 7 - Comparison of the Proposed Development's Carbon Emissions against GLA retail benchmarks

The results illustrated in Figure 7 indicate that carbon emissions for the substructure, superstructure, and external works are below the GLA benchmark. However, emissions for the façade, internal finishes, FFE, and services/MEP are slightly above the benchmark. Since this assessment is conducted at an early design stage, the material types and quantities for internal finishes, FFE, and services remain uncertain. Sustainable solutions are recommended for application in later stages.

The baseline model uses generic data without sustainable improvements, representing a worst-case scenario. Overall, Proposed Development's A-C (excluding B6 & B7, including sequestration) emissions have passed the GLA retail benchmark.

7.0 Conclusion

The WLCA undertaken at the early design stage has provided a baseline to establish a pathway to reduce the lifecycle emissions for 335 Euston Road. The assessment has identified carbon hotspots for the Proposed Development and suggested low carbon options that will help to reduce the embodied CO_2e emissions.

The Proposed Development's A-C (excluding B6 & B7, including sequestration) emissions have passed the GLA retail benchmark, which is established in the London Plan Guidance for WLCA.

The WLCA follows the RICS Professional Standard (PS) 2nd edition, and the Proposed Development can be categorised as a small project. Therefore, Part L 2021 calculations have been used to predict the operation energy consumption for module B6 operational energy carbon.

The WLCA has been completed to support the 'London Plan Policy SI 2' and the planning application for the Proposed Development. In order to mitigate the CO_2e emissions, the Project team should consider the potential for materials with lower embodied carbon emissions and seek to incorporate sustainable construction practices. The results have been summarised in Table 10 under both scenarios.

Module	Decarbonised scenario kg CO_2e/m^2	Non-Decarbonised scenario kg CO_2e/m^2
Life Cycle Stage A/ Upfront Carbon	**426.2**	**426.2**
A1-A3 Sequestered Carbon	-115.01	-115.01
A1-A3 Product stage (excl. sequestered carbon)	444.91	444.91
A4	11.9	11.9
A5	84.4	84.4
Life Cycle Stage B	**382.6**	**1317.17**
B1	13.19	26.38
B2	5.83	11.65
B3	4.72	6.18
B4	140.06	279.77
Operational Carbon	**218.8**	**993.19**
B6	218.64	992.37
B7	0.16	0.82
Life Cycle Stage C	**161.41**	**188.71**
C1-C4	161.41	188.71
D External impacts (not included in totals)	-76.63	-153.2
Embodied Carbon	**751.41**	**938.89**
Whole Life Carbon Emissions	**970.21**	**1932.08**

Table 10 - Summary of the Whole Life cycle carbon emissions of the Proposed Development

Appendices

Appendix A One click LCA inputs

Elemental Category		Element Description	Material Used	Total Qty	Unit
Foundations and Substructure	Foundation, Sub-Surface, Basement and Retaining Walls	Pile foundations	Pile cap, reinforced concrete, 1.6x1.6x0.5 m (5.25x5.25x1.64 ft)	4	Unit
		Basement Piled wall - rebar	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615	1649.05	kg
		Basement Piled wall - concrete	Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 10% (typical) recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	25	m^3
		GF - Slab rebar	Reinforcement steel (rebar), generic, 97% recycled content (typical), A615	845	kg
		GF - Insulation 100mm	Insulation, stone wool/mineral wool, above loadbearing ground floor slab (Paroc)	52	m^2
		GF - Slab concrete	Ready-mix concrete, normal-strength, generic, C40/50 (5800/7300 PSI), 10% (typical) recycled binders in cement (400 kg/m3 / 24.97 lbs/ft3)	31200	kg
Vertical Structures and Façade	External Walls and Façade	EW - curtain wall	Aluminium curtain walling, 2700 kg/m3 (GAA)	8.7	m^2
		EW - Masonry external wall	Clay brick, 2.13 kg/unit, 215x102.5x65 mm, RICS baseline datapoint (One Click LCA)	16870	Unit
		EW - Insulation	PIR insulation boards, aluminum composite foil faced, 66 mm, L = 0.022 W/mK, R = 3 m2K/W, 2.11 kg/m2, 32 kg/m3, Eco-Versal, Eco-Deck baseboard, Eco-Cavity, Eco-Cavity Full Fill (EcoTherm (2021))	236.17	m^2
		EW - Lightweight block	Lightweight (AAC) blocks (IStructE)	15	ton
	Columns and load-bearing vertical structures	Lift shaft	In-situ concrete assembly for stairs and elevator shafts per one metre height, EN15804 A1/A2	9.09	m
	Internal Walls and Non-Bearing Structures	Internal wall	Steel stud internal wall assembly, 100 mm, incl. mineral wool insulation, for UK	96.7	m^2
Horizontal Structures: Beams, Floors and Roofs	Floor Slabs, Ceilings, Roofing Decks, Beams and Roof	Upper floor - Softwood framing joists	Softwood studwork framing flooring, 100% FSC/PEFC (IStructE)	10	m^3
		Upper floors – Reinforcement mesh	Reinforcement mesh fabric (glass fibre), 0.16kg/m2, R131 (ADFORS)	145	m^2
		Upper Floors – Insulation	Stone wool (mineral wool) insulation, unfaced, L = 0.031 W/mK, R = 1 m2K/W, 31mm, 3.1 kg/m2, 100 kg/m3, (Range: 90-110kg/m3), 22% slag content, high pressure suitable (One Click LCA)	145	m^2

Elemental Category		Element Description	Material Used	Total Qty	Unit
		Upper Floors – galvanized steel joists	Hot-dip galvanized steel sheets, recommended sheet steel thickness range: 0.4-3.0 mm (0.015-0.12 in), zinc coating: 20 µm (787.4 µin) (0.28kg/m2 / 0.057 lbs/ft2 sheet steel)	177.63	kg
		Upper Floors – Plasterboard	Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)	145	m^2
		Roof - Softwood framing joists	Softwood studwork framing flooring, 100% FSC/PEFC (IStructE)	1.3	m^3
		Roof – single ply membrane	Unreinforced EPDM Membrane for single-ply roofing- Fully adhered, 1.1 mm, 1.56 kg/m2, Elevate RubberGard EPDM 1,1 mm (HOLCIM SOLUTIONS AND PRODUCTS)	29	m^2
		Roof – galvanized steel joists	Hot-dip galvanized steel sheets, recommended sheet steel thickness range: 0.4-3.0 mm (0.015-0.12 in), zinc coating: 20 µm (787.4 µin) (0.28kg/m2 / 0.057 lbs/ft2 sheet steel)	20.3	kg
		Roof – Insulation	Polyurethane foam insulation panel (PUR), composite facing PET, paper, PE, L=0.023 W/mK, R=1.30 m2K/W, 30 mm, 1.291 kg/m2, 43.0 kg/m3, Lambda=0.023 W/(m.K), TMS® 30 mm (SOPREMA SAS)	4.4	m^3
		Upper Floors – Plasterboard	Gypsum plaster board, regular, generic, 6.5-25 mm (0.25-0.98 in), 10.725 kg/m2 (2.20 lbs/ft2) (for 12.5 mm/0.49 in), 858 kg/m3 (53.6 lbs/ft3)	29	m^2
Other Structures and Materials	Other Structures and Materials	Wood handrail	Solid wood handrail, biogenic CO2 not subtracted (for CML), 6.65 kg/m, sustainable management, Main courante d`escalier en bois massif [gestion durable] (DONNEE ENVIRONNEMENTALE GENERIQUE PAR DEFAUT)	28.8	m
		Stair case	Quarter turn wooden staircase, width: 1.2 m, 98 kg/m (One Click LCA)	14.4	m
		Lift	Elevator for passenger transport, 972.6 kg/unit, 19,71 tkm, Kalea A4 Primo (Cibes Lift Group)	1	Unit
		Sanitary	Sanitary ceramic, EN15804+A1, ref. year 2021	86.8	kg
		Reception table	Curved front tabletop from melamine faced chipboard, 1200 X 1200, thickness: 25 mm, cutout depth: 400 mm, 24 kg/unit (One Click LCA)	1	Unit
		Desks	Work table with fixed top, 44.865 kg/unit (Task Systems Ltd)	3	Unit
		Chairs	Chair, 16.3 kg/unit, Mirra® 2 (Herman Miller (UK))	6	Unit
	Windows and Doors	Double glazed window	Double glazing windows with wooden frame, 30.7 kg/m2, 1.4 W/m2K, biogenic CO2 not subtracted (for CML), FDES collective utilisable par toute entreprise qui produit en France des fenêtres et portes fenêtres, double vitrage acoustique ou standard, en bois tropicaux. (INSTITUT TECHNOLOGIQUE FCBA)	10.3	m^2

Elemental Category		Element Description	Material Used	Total Qty	Unit
		Internal door	Wooden and engineered wood interior doors, biogenic CO2 not substracted, 485-1360 mm x 1597-2735 mm, min. thickness 39 mm, 41 kg/m2 (VHI)	16.2	m^2
		Entrance door	Aluminium framed insulated entrance doors system, double glazed, 1.23 m x 2.18 m, 28.83 kg/m2, SUPREME SD77 (Alumil S.A)	3.4	m^2
	Finishes and covering	Bathroom floor finishes	Ceramic tiles for bathrooms, 4 mm, 10.22 kg/m2, DEKTON (Cosentino Surfaces France)	6.48	m^2
		Floor tiles	Ceramic floor tile, 10 mm, average density 2000 kg/m3 (Mosa)	36.1	m^2
		Wall paints	Wall paints for interior use, 0.16 mm, 0.249 kg/m2, 1552 kg/m3, Alpha unidecor BL mat, Alpha unidecor BL satin, Alphacryl Morpha, Alphacryl Perlino, Alphacryl Pure Mat SF, Alpha Rezisto Easy Clean, Alpha Rezisto Mat, Alpha Rezisto Anti Marks, Alphacryl Plafond, Alpha Cover Mat, Alpha Projecttex, Alphamat SF, Alphatex SF, Alpha Tex Acryl, Alpha Humitex SF, Alpha Sanocryl, Alpha Sanoprotex, Alpha Tex Schimmelwerend, Alpha Isolux SF / Isolux SF (AkzoNobel)	368.45	m^2
		Ceiling tiles	Acoustic and decorative ceiling tiles with cardboard facing, biogenic CO2 not subtracted (for CML), 8.08 kg/m2, Dalle Gyptone® Activ`Air® Base 31 10 mm (PLACOPLATRE)	150	m^2
		Carpet tiles	Carpet tiles, 3.241 kg/m2, EcoWorx (Shaw Europe)	88.9	m^2
Building Technology	Building Systems and Installations	Air source heat pump	5.24 kW air-to-air heat pump heating only for individual housing, Pompe à chaleur (PAC) air/air assurant le chauffage en logement individuel (Uniclima)	1	Unit
		ceiling cassettes	Ceiling mount cassettes (indoor unit), P=7.73 kW, 21 kg/unit, FXFQ63B, FXFQ20B, FXFQ25B, FXFQ32B, FXFQ40B, FXFQ50B, FXFQ80B, FXFQ100B, FXFQ125B, FXZQ15A, FXZQ20A, FXZQ25A, FXZQ32A, FXZQ40A, FXZQ50A, FXCQ20A, FXCQ25A, FXCQ32A, FXCQ40A, FXCQ50A, FXCQ63A, FXCQ80A, FXCQ125A, FXKQ25MA, FXKQ32MA, FXKQ40MA, FXKQ63MA, Daikin VRV Cassette à flux circulaire VRV IV+ H/R (unité intérieure) - Sizes 15 to 125 (DAIKIN EUROPE N.V.)	5	Unit
		Temperature control	Temperature regulator, 0.96 kg/unit, Expert Control Link (3318992) couplé à une Sonde extérieure filaire (3318599) (ARISTON GROUP)	5	Unit
		instantaneous hot water heater	Electric water heater, 194 L, 2 KW, 33.4 kg/unit, SAGA S 200 (OSO Hotwater)	2	Unit
		MVHR	Ventilation centralized with heat recovery (Air handling unit (AHU)), capacity: 1000 m3/h, 100 kg/unit, EN15804+A1, ref. year 2021	1	Unit
		CO2 sensors	Battery powered thermal and humidity sensor, Product Environmental Profile - EASERGY CL110 (SCHNEIDER ELECTRIC INDUSTRIES SAS)	5	Unit

Elemental Category		Element Description	Material Used	Total Qty	Unit
		LED lighting with PIR sensors	Rectangular ceiling luminare with movement detection passive infrared sensor, LxWxH: 597x597x44 mm, 35W, 4610 lm, efficiacy: 132 lm/w, 3.14 kg/unit, Sense Pro 600x600 Pir (SG Armaturen AS)	13	Unit
		Daylight sensors	Sun sensor for automatic blinds and shutters control, Sunis WireFreeTM II io (SOMFY)	7	Unit

Appendix B RICS Transportation Values

Transport Scenario (both road and sea to be used)	km by road*	km by sea**
Locally manufacturer (ready-mix concrete)	20	-
Locally manufactured (general) e.g. aggregate, earth, asphalt	50	-
Regionally manufactured e.g. plasterboard, blockwork, insulation, carpet, carpet, glass	80	-
Nationally manufactured e.g. structural timber, structural steelwork, reinforcement, precast concrete	120	
European manufacturers e.g. Cross Laminated Timber (CLT), façade modules	1,500	100
Globally manufactured e.g., specialist stone cladding	500	10,000
* Means of transport assumed as average of all average rigid HGVs or other road vehicles where details available (average laden) ** Means of transport assumed as average container ship		

Appendix C RICS Material Replacement Values

Building Part	Building Elements/Components	Expected Lifespan
Substructure	Piling and foundations	60 years (or building lifespan)
	Lowest ground floor	
Superstructure: frame, upper floor and roof structure	Structural elements, e.g. columns, walls, beams, upper floor and roof structure	60 years (or building lifespan)
Facade	**Opaque modular cladding**	
	Rains screens, timber panels	30 years
	Brick, stone, block and precast concrete panels	60 years
	Glazed cladded/ curtain walling	35 years
	Windows and external doors	30 years
	Hardwood/steel/aluminium windows	
	Doors	20 years
Roof	**Roof Covering**	
	Single-ply membrane	30 years

Building Part	Building Elements/Components	Expected Lifespan
	Standing seam metal	30 years
	Tiles, clay and concrete	60 years
Superstructure	**Internal Partitioning and dry lining**	
	Stud work	30 years
	Blockwork	60 years
Finishes	**Wall Finishes**: Render/paint	30/5 years
	Floor Finishes	
	Carpet/Vinyl	7 years
	Stone tiles	25 years
	Raised access floor (RAF) pedestal/tile	50/30 years
	Ceiling Finishes	
	Substrate/paint	10 years
	Suspended grid (ceiling system)	25 years
FF&E	Loose furniture and fittings	10 years

Building Part	Building Elements/Components	Expected Lifespan
Services/MEP	Heat Source e.g. boilers, calorifiers	20 years
	Heat source, e.g. heat pumps (except ground surce)	15 years (20 years)
	Space heating and air treatment	20 years
	Central cooling systems (cooling only) e.g. fan coil systems, variable air volume, variable refrigerant volume	15 years
	Ductwork	
	Galvanised	40 years
	Plastic or flexible	15 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installations and controls	15 years
	Water and disposal installations	25 years
	Rainwater harvesting and grey water collection	30 years

Building Part	Building Elements/Components	Expected Lifespan
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
Hard Landscaping	Asphalt	35 years
	Concrete and stone paving	60 years
	Timber decking	15 years

Appendix D RICS Recommended waste rate data

Material/ Product	WR (Waste Rate)
Concrete in situ	5%
Concrete pre-cast (floor, beams and frames)	1%
Concrete (sprayed)	10%
Steel reinforcement	5%
Steel frame (beams, columns, braces)	1%
Sprayed cementitious fire protection to steel	10%
Concrete blocks (lightweight AAC)	10%
Concrete blocks (medium density)	5%
Brick (clay)	6%
Stone (cladding)	5%
Stone (landscaping)	10%
Mortar and render (internal and external)	4%
Screed	7.5%
Floor finish (tile)	4%

Material/ Product	WR (Waste Rate)
Floor finish (carpet)	8%
Timber frames (beams, columns, braces)	5%
Timber floors (joists, board)	5%
Timber formwork	10%
Aluminium frames	1%
Plasterboard	10%
Insulation	6%
Aggregate	10%
Asphalt	7%
Glass	5%
Roof cladding	5%

Appendix E Part L 2021 Calculation Result

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	171.3	171.3
External area [m²]	293.7	293.7
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	73.91	81.33
Average U-value [W/m²K]	0.25	0.28
Alpha value* [%]	25.23	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
100	**Residential Institutions: Hospitals and Care Homes**
	Residential Institutions: Residential Schools
	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	1.11	1.03
Cooling	19.28	18.78
Auxiliary	13.08	10.96
Lighting	12.91	18.42
Hot water	3.4	3.23
Equipment*	197.66	197.66
TOTAL**	**49.79**	**52.42**

* 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.

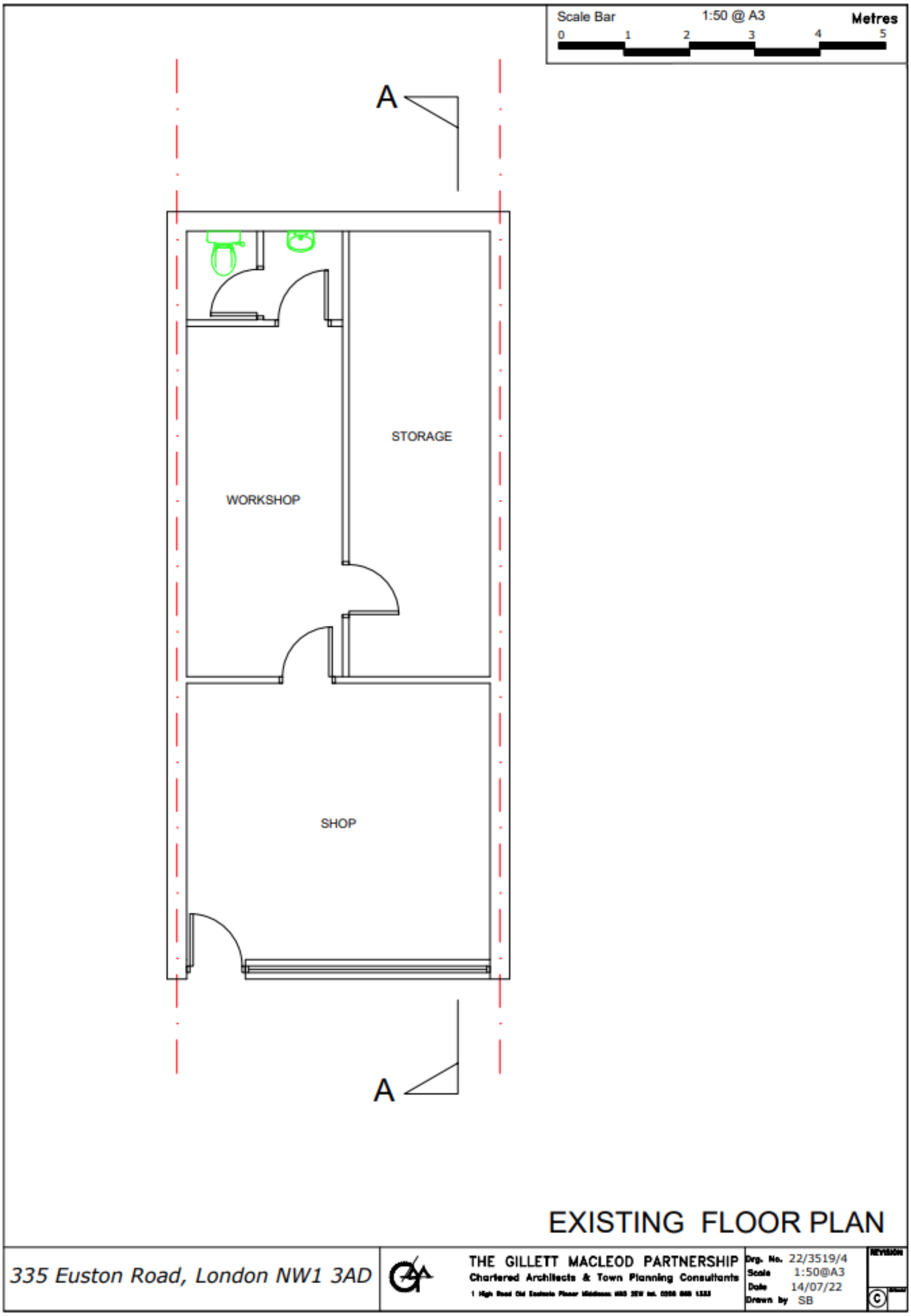
Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	338.27	323.41
Primary energy [kWh_{PE}/m²]	74.46	76.47
Total emissions [kg/m²]	6.68	6.87

Appendix F Existing Floor Plan (The Gillett Macleod Partnership)



SRE

SRE Main Office
3 London Square | Cross Lanes
Guildford | Surrey | GU1 1UJ
T: +44 (0)1730 710044
E: info@sre.co.uk
W: www.sre.co.uk