Mendick Waring Limited

# Welling FC

Whole Life Cycle Assessment Report

December 2023

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# 1.0 Executive Summary

MWL has been appointed by Woolwich Road Limited ('the Applicant') to produce a Whole Life Cycle Carbon Assessment (WLCA) in support of the planning submission for the proposed a mixed-use residential development which partly refurbishes and partly rebuilds the Park View Road stadium for Welling United Football Club in the London Borough of Bexley DA16.

The development is located in Welling to the east of the town centre, within the London Borough of Bexley and will deliver 104 residential flats, a new stadium (with associated support accommodation) for Welling United FC, a 3G all-weather pitch, and commercial space fronting Park View Road.

A Whole Life Cycle Carbon Assessment (WLCA) of the proposed Development was carried out to evaluate the environmental impact of the proposed development during its life cycle. This study was undertaken in line with Policy SI2 of the London Plan, 2021.

The WLCA is in line with the Royal Institute of Chartered Surveyors (RICS) methodology as presented in the RICS Professional Statement document (RICS PS) and the GLA Whole Life Carbon Assessment Guidance document (March 2022).

**Whole Life Carbon Assessment Results**

Table 1 shows the results from the WLCA across all life-cycle stages (A-C). The total carbon resulting from the Development is approximately 9955 tCO2 excluding B6 & B7 or 871 kgCO2/m2[1]. Most embodied carbon emissions are arising from the superstructure (approx. 30%) along with the building services (15%). Operational emissions (stages B6 & B7) amount to 6285 tCO2 (551 kgCO2/m2) for a 60 year period.

Embodied emissions throughout the life cycle amount to 16.240 tCO2 (1422 kgCO2/m2) with a majority of these emissions associated with the frame and the foundations.

**Table 1:** Whole Life Carbon Results for all life-cycle stages

| Life Cycle stages | $tCO_2e$ | $kgCO_2e/m^2$ | % |
|---|---|---|---|
| A1-A3 Product sourcing | 7,861 | 688 | 48% |
| A4-A5 Construction Process | 707 | 62 | 4% |
| B1-B5 In Use | 1,168 | 102 | 7% |
| B6 – B7 Operational energy and water | 6,285 | 551 | 39% |
| C1-C4 End of life | 216 | 18 | 1% |
| D - Benefits and loads beyond the system boundary | N/A | N/A | N/A |
| **Total** | 16240 | 1422 | N/A |
| **Embodied** | 9954 | 758 | N/A |
| **Operational** | 6285 | 551 | N/A |

**Embodied carbon results (excluding operational stages B6 & B7) by building category**

Figure 1 shows the embodied carbon (A1-A5, B1-B5, C1-C4) results for the Development, with a breakdown showing the top materials in each building category.

The main driver of embodied carbon emissions is the concrete frame and steel rebar which accounts for 56 % of total embodied carbon emissions while the next largest contributors are internal partitions and finishes.

Other significant emissions arise from the following elements:

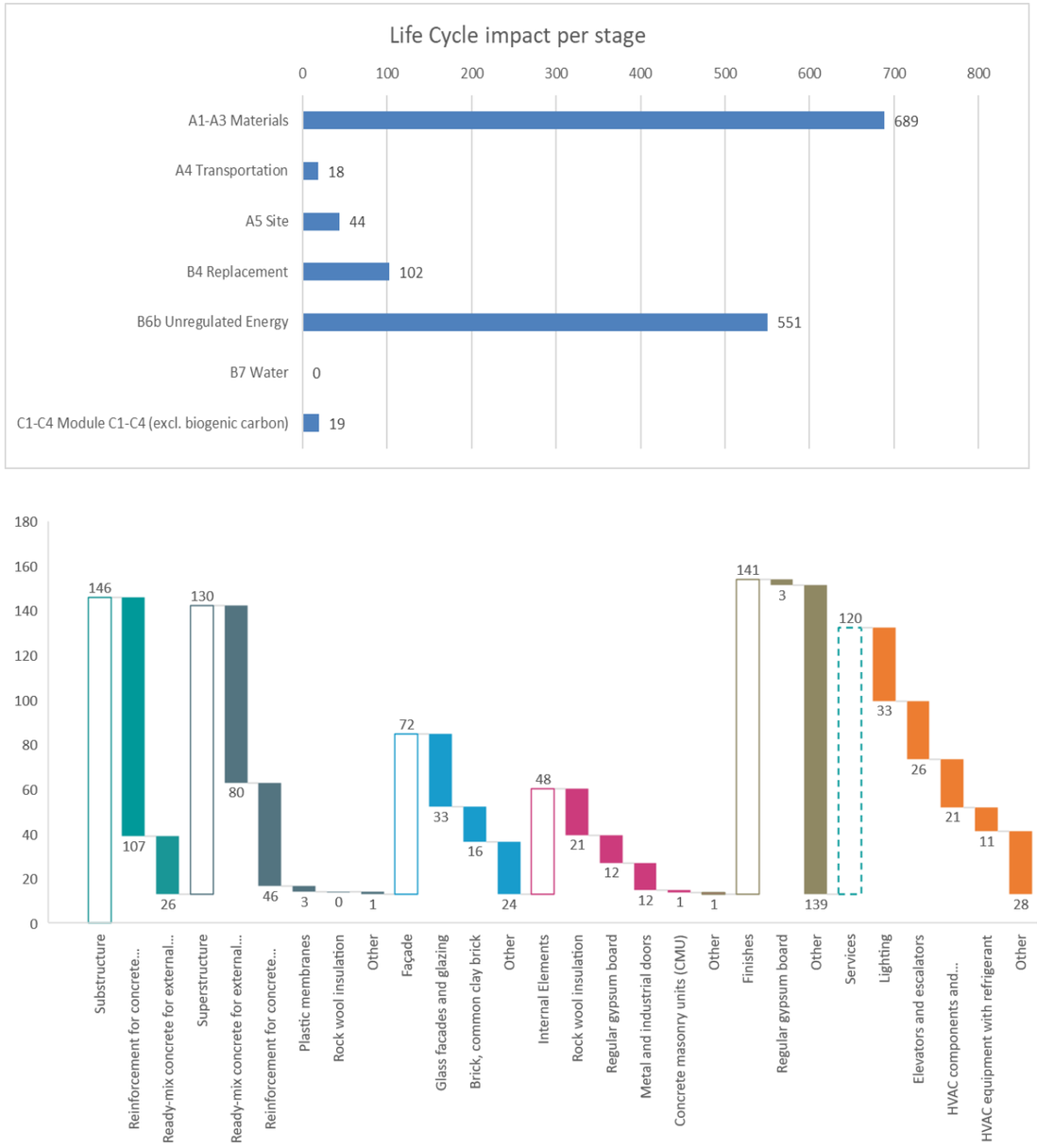
- Superstructure: 493 $kgCO_2/m^2$ (56%)
- Finishes: 38 $kgCO_2/m^2$ (4 %)

[1] The above figures are WIP for the residential parts of the development only.

- Internal Partitions: 67 $kgCO_2/m^2$ (8 %)

**Note**: FFE has been included on a percentage basis using the GLA benchmark proportions and does not yet represent material quantities.

**Figure 1: L**ife Cycle Carbon Results (kgCO2/m2) as presented by the WLC Benchmarks (stages A-C excluding B6 & B7)




## 1.1 Comparison to the WLC Benchmark

Figure 2 shows a direct comparison between the WLCA results for the Development and the GLA's WLC benchmark and WLC Aspirational benchmark for stages A-C (excluding B6 & B7).

The development performs better than the benchmark overall, with a 27% reduction and a carbon value of 871 $kgCO_2/m^2$. Compared to the aspirational benchmark, the Development performs performing very similarly, with just an 8% increase which can be mitigated at the more detailed stages of the project.

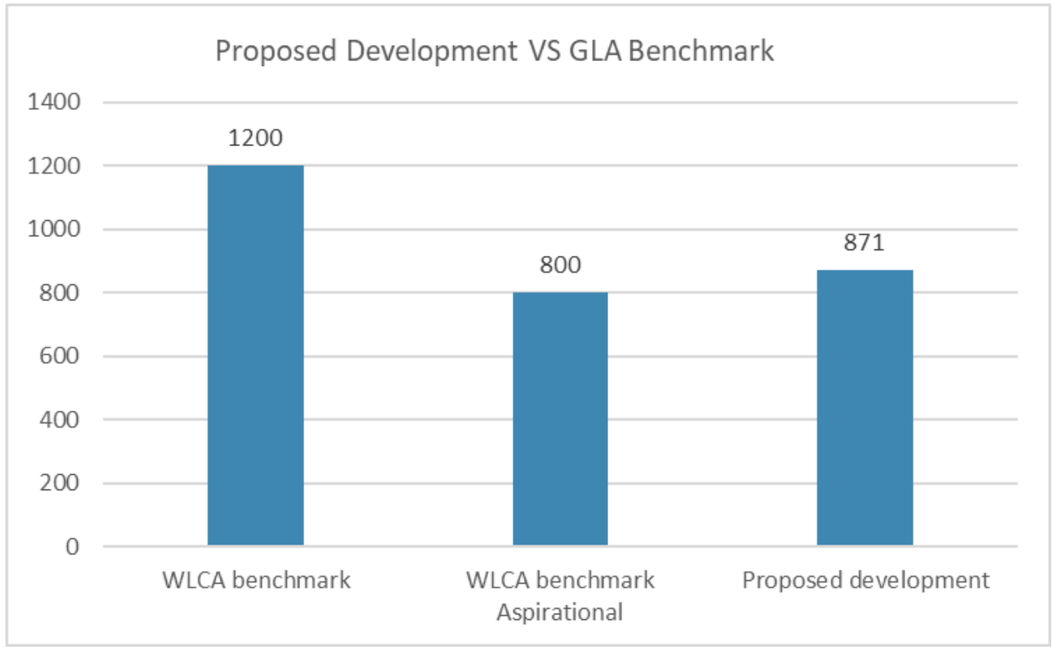



**Figure 2:** Comparison of the Development to the GLA benchmark (kgCO2/m2)

## 1.2 Actions Taken to Reduce Whole Life Cycle Carbon Emissions

Actions to reduce the whole life emissions of the proposed Development have been implemented in the design in line with the GLA Whole Life Carbon Assessment Guidance document (March 2022). The design team has worked extensively and iteratively with carbon in order to inform decision making. Some of the major steps taken to date include

- Specify concrete with high GGBS (minimum of 50%)

- Specify steel rebar with a recycled content (20% or higher)

Other actions have been taken to reduce carbon across the development, including:

- Operational Carbon:
  - Highly efficient equipment heating and cooling
  - Highly efficient mechanical ventilation with heat-recovery
  - Efficient light fixtures
- Embodied Carbon:
  - 70% GGBS replacement in substructure concrete
  - 50% GGBS replacement in superstructure concrete
  - 20% recycled steel content for structural steel
  - Local materials such as stone and brick used for development

# 2.0 Introduction

MWL has been appointed by Woolwich Road Limited ('the Applicant') to produce a Whole Life Cycle Carbon Assessment (WLCA) in support of the planning submission for the

The development is located in Welling to the east of the town centre, within the London Borough of Bexley and will deliver 104 residential flats, a new stadium (with associated support accommodation) for Welling United FC, a 3G all-weather pitch, and commercial space fronting Park View Road. (Figure 3). ('the site').

A Whole Life Cycle Carbon Assessment (WLCA) of the proposed Development was carried out to evaluate the environmental impact of the proposed development during its life cycle. This study was undertaken in line with Policy SI2 of the London Plan, 2021.

The WLCA is in line with the Royal Institute of Chartered Surveyors (RICS) methodology as presented in the RICS Professional Statement document (RICS PS) and the GLA Whole Life Carbon Assessment Guidance document (March 2022).

## 2.1 Project Background

The project team has engaged with carbon as a key design driver from the outset as presented in the following paragraphs. Feasibility studies were undertaken on a range of alternatives to consider the retainment options of the existing facilities on site as well as the massing of the proposed development.

### 2.1.1 Designing with carbon

Understanding the sustainability implications of a new build, the team has employed carbon as a key driver of design and has acted to minimize the impact of the new development. Throughout stage 2, the following studies have been undertaken to inform design decisions, these are further elaborated on in Section 5.1 'Actions taken to reduce carbon':

Throughout design these actions have been taken in line with a whole-life-embodied carbon target of 1200 kgCO2/m2 as per the GLA's WLC aspirational benchmark.

### 2.1.2 Circular economy

In line with carbon, circular economy principles have been considered strongly through stage 2, given the relationship between materiality, carbon, and circularity. The design team as carefully looked at both the way materials can be procured and how they can be recirculated at end of life. These actions are further outlined in the Circular Economy Statement produced by MWL. The emissions and savings associated with these actions are not captured in the results of this report but are discussed in section '4.7 Stage D emissions.

**Figure 3.** Proposed development

## 2.2 Assessment Background and Features

The following section outlines how key information throughout the assessment has been handled and provides notes on any points of interest associated with the development or the assessment. Any item not highlighted in this section is following the RICS PS guidance and any of the associated assumptions, estimates, and practices mentioned in the RICS PS document. The study period for the assessment is 60 years, and results are given on a normalized basis using the Gross Internal Area (GIA). The software used for the WLCA is OneClick LCA.

## 2.3 Data Collection method (ALL LIFECYCLE STAGES)

The cost plan has been provided by the Quantity Surveyor (BPM). An RFI subsequently was issued to the design team requesting further information about the material types and quantities necessary to conduct the WLCA, with the team being informed that the following hierarchy of data sources would be appropriate:

1 Material delivery records
2 Bill of Quantities
3 BIM model
4 Estimates based on consultant drawings

Bill of Quantities (Option 2) and quantity estimates (Option 4) have been used to complete the RFI and information has been provided using the highest level of detail that can be provided at the current stage. Information has been provided by MWL (MEP), and Create (Architectural).

**NOTE:**

The current design is coordinated to RIBA Stage 2 level only. Assumptions made for the purpose of WLCA are subject to detailed design and development with the client, design team and main contractor.

2. Data on the manufacturer, manufacturer location, transport distance to site, service life, product EPD and recycled content are unknown as the project has only been designed to RIBA Stage 2.

### 2.3.1 Operational energy and water

The operational energy profiles for the proposed development have been extracted from the residential SAP calculations. For the non domestic part of the development a modelling exercise has been undertaken using the SBEM methodology. The results of this energy model have been used to inform operational energy figures for this report, with an Energy Use Intensity of 77 kWh/m2.

### 2.3.2 Decarbonisation

This WLCA is based on the status of the electricity grid with future decarbonisation accounted for in line with RICS PS using the National Grid Future Energy Scenario 2021. The resulting WLC emissions figures form the basis for the design decisions. Decarbonisation is only relevant to emissions that will arise in the future, i.e. during the In-use and End of Life (EoL) of a project – i.e. stages (B) and (C), and it can affect the carbon figures considerably. Therefore, decarbonisation factors are applicable to operational emissions (B6) and (B7) and to the carbon savings in module (D), as these are the areas decarbonisation is expected to have the highest impact.

In this assessment, decarbonisation has been applied in line with the National Grid Future Energy Scenario (FES) 2021- Steady Progression Scenario on OneClick. However, this has been applied to stages B6 and B7 only.

### 2.3.3 Biogenic carbon of timber

When reporting on all life cycle stages, emissions from biogenic carbon are separated from A1-A3 emissions and are taken and returned at stage C. In line with RICS guidance biogenic carbon is excluded from any reporting of A1-A5 emissions and is reported separately.

### 2.3.4 Material selection and inputs

No specific manufacturers or suppliers were provided as part of the RFI and data collection process, and as a result EPD's of the closest similar product have been used. The database used is the OneClick LCA database.

### 2.3.5 Steel recycling and concrete replacements

Assumptions around steel recycling and cement replacement rates are as follows:

1 20% Recycling for steel rebars
2 70% GGBS in substructure concrete
3 50-% GGBS in superstructure concrete for slabs, beams and columns.

### 2.3.6 Naming conventions for 2. Superstructure

Building categories are determined by the New Rules of Measurement (NRM) which is the recommended system under the RICS PS guidance. For the superstructure, certain sub-categories can be bundled together and are worth distinguishing from one another. For these sub-categories, the report will use alternative nomenclature throughout for clarity, this is as follows:

2.1 – 2.4 Superstructure – includes frame, upper floors, roof, stairs and ramps.

- Hereby referred to as "Superstructure"

2.5-2.6 Superstructure – includes external walls, windows and external doors.

- Hereby referred to as "Façade"

2.7 – 2.8 Superstructure – includes internal walls and partitions, internal doors.

- Hereby referred to as "Internal Elements"

### 2.3.7 Stage D Emissions

Stage D emissions are excluded from the main assessment but have been considered as a design driver throughout stage 2. This has been done with the understanding that the emission benefits associated with Stage D are subject to future actions, which have been communicated to the Applicant and the design team.

## 2.4 General

**Assumptions**

- Occupancy as per the accommodation schedule.
- Service life has been treated in line with Table 9 of the RICS PS guidance
- Transportation has been treated in line with Table 7 of the RICS PS guidance
- Wastage has been treated in line with standard OneClick LCA / EPD scenarios
- End-of-Life scenarios are based on default OneClick LCA / EPD scenarios

**Limitations**

The current stage of the design means that the following information is limited or unavailable:

- Service life
- Transportation to site
- Wastage
- End-of-Life scenarios
- Specific material quantities for:
  - Building Services
  - Furniture, Fittings & Equipment (FFE)
- Product specifications

## 2.5 Demolition / Strip Out

**Limitations**

- Specific information on demolition activities and excavation materials is not available at this stage.
- Any allowance for temporary works (scaffolding), remedial works or strengthening works to the whole structure has been excluded.

## 2.6 Operational Water

**Limitations**

- No specific water or wastewater consumption / production information is available. An overall assumption of 105l/p/day.

## 2.7 Building Services

At the current stage, the cost plan does not have enough detail to accurately determine the whole life-carbon of building services elements.

The cost coverage that could be accounted for in the whole-life carbon assessment was very low (<15%). Since this does not provide enough fidelity to accurately determine the whole-life carbon, we have instead taken the GLA benchmark figure for MEP elements as a percentage of the total.

## 2.8 FF&E

At the current stage, the cost plan does not have enough detail to accurately determine the whole life-carbon of FF+E.

The cost coverage that could be accounted for in the whole-life carbon assessment was low (<15% %). Since this does not provide enough fidelity to accurately determine the whole-life carbon, we have instead taken the GLA benchmark figure for FF+E, as a percentage of the total.

# 3.0 PLANNING POLICY REQUIREMENTS

## 3.1 Current Planning Policy Framework

The planning policy documents which set out the targets related to whole life cycle carbon assessments and embodied carbon for the proposed Development are outlined below:

- The London Plan, March 2021;
- Whole Life Cycle Carbon Assessments guidance, March 2022.
- Bexley Local Plan, April 2023

The above-mentioned documents have been reviewed and the policies that set performance targets in relation to whole life cycle assessments are presented below.

## 3.2 The London Plan, March 2021

The London Plan has been developed by the Mayor and the Geater London Authority (GLA) to set out the development framework for London from 2019 to 2041. The Mayor has formally published the new London Plan in March 2021.

Key policies of the London Plan relating to environmental sustainability are outlined below:

- Policy SI 2 Minimising greenhouse gas emissions requires all major developments to be net zero-carbon, by reducing greenhouse gas emissions and minimise both annual and peak energy demand in accordance with the energy hierarchy: (1) Be Lean, (2) Be Clean, (3) Be Green and (4) Be seen.
    - 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, aims to:
    - 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
    - encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products
    - ensure that there is zero biodegradable or recyclable waste to landfill by 2026;
    - meet or exceed the municipal waste recycling target of 65 per cent by 2030;
    - meet or exceed the targets for each of the following waste and material streams:
    - construction and demolition – 95% reuse/recycling/recovery
    - excavation – 95% 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.

Policy SI 7 requires referable applications to promote circular economy outcomes and aim to be net zero-waste.

## 3.3 Whole Life Cycle Carbon Assessments guidance, March 2022

The Whole Life Cycle Assessment Guidance, published by the GLA in March 2022, provides information on how to comply with the Mayor's ambition stated in the London Plan and explains how to prepare a whole life cycle carbon assessment which should accompany all referable planning applications in line with the London Plan Policy SI2.

In the UK, the framework for appraising the environmental impacts of the built environment is provided by BS EN 15978: 2011: (Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method). It sets out the principles and calculation method for whole life assessment of the environmental impacts from built projects based on life-cycle assessment. Underpinning BS EN 15978 is the RICS Professional Statement: Whole Life Carbon assessment for the built environment.

A WLCA will have links to the Energy Assessment for the development and the Circular Economy Statement. which will be submitted as part of the planning application.

- A WLCA will be carried out with a nationally recognised assessment methodology and will demonstrate actions that have and will be taken to reduce WLC emissions. It should cover
- Operational carbon emissions (regulated and unregulated);
- Embodied carbon emissions;
- Future potential carbon emissions 'benefits', post 'end of life', including benefits from reuse and recycling of building structure and materials.

- This document provides guidance for Whole Life Cycle Assessment to ensure that applicants seeking planning permission for major schemes:
- Calculate the embodied and operational emissions of the development and demonstrate how these can be reduced as part of the WLCA;
- Compare their own results against WLC benchmarks as part of their WLCA and which the GLA will refer to in its review of these assessments; and
- Recognise opportunities to further reduce the development's WLC emissions.

### 3.4 Bexley Local Plan, April 2023

The Bexley Local Plan adopted in April 2023 replaces, in full, the Bexley Core Strategy and remaining extant policies of the Bexley Unitary Development Plan (UDP) and the UDP Proposals Map. The Local Plan contains strategic, non-strategic and site allocation (for residential and residential-led mixed-use development) polices.

- POLICY DP30 Mitigating climate change and Energy reduction in new buildings requires that all Major development proposals must meet London Plan requirements and 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.

## 4.0 Assessment Scope

### Life Cycle Stages

The Whole Life Cycle Assessment (WLCA) has been undertaken in accordance with the Whole Life Cycle Carbon Assessments guidance and the Royal Institute of Chartered Surveyors (RICS) methodology. This page presents the life cycle stages of the WLCA, which is undertaken using OneClick LCA, which covers the whole BS EN 15978 and RICS PS scope.

As seen in Figure 4 this assessment covers life cycle stages A-C. Stage D, which is excluded from total figures in this report (unless explicitly stated), relates to circular economy principles that can be found in the Circular Economy Statement (MWL). As circular economy principles have been taken seriously, and have real-world carbon implications, the results for this stage are also reported to provide deeper insight into circular economy strategies.

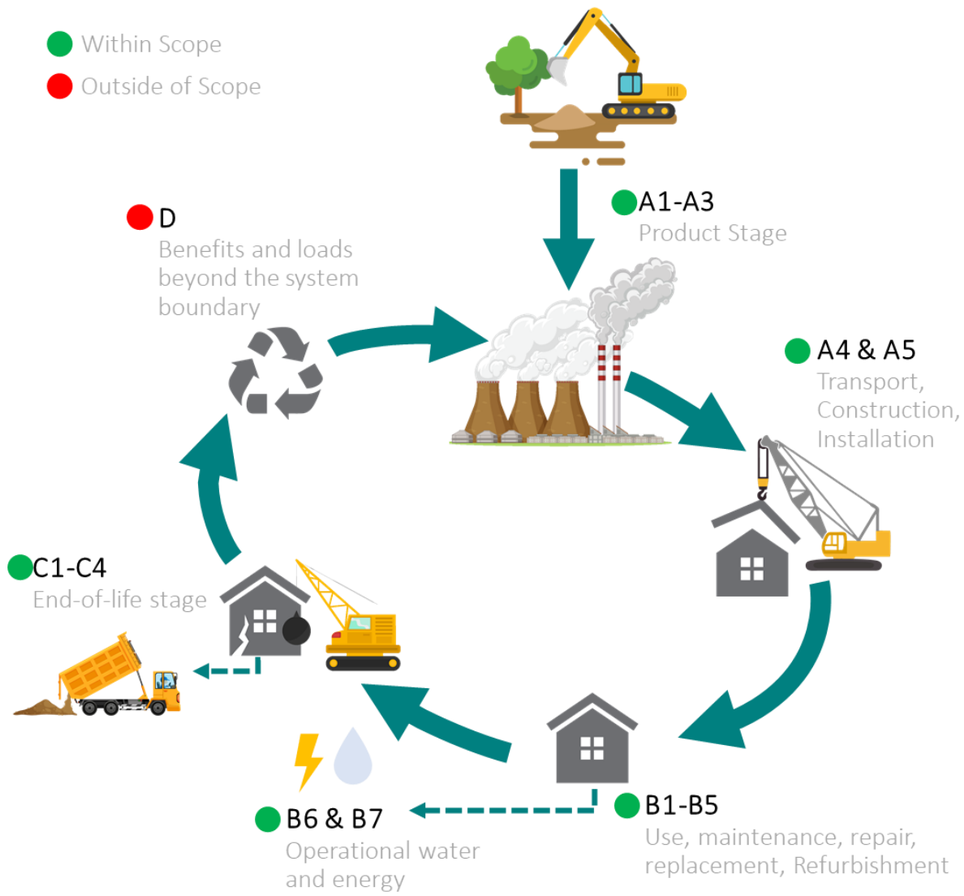



**Figure 4**: Scope of life cycle stages covered in this assessment

### 4.1 Building Elements

The WLCA includes all building elements listed in Table 2 that are applicable to the Development. The building elements are broken down according to the RICS New Rules of Measurement (NRM) classification system level 2 sub-elements.

**Table 2:** Scope of building elements covered according to RICS NRM classification

| Group element | Building element | Included (Yes/No) |
|---|---|---|
| **Demolition** | 0.1 Toxic/Hazardous/Contaminated Material treatment | N/A |
| | 0.2 Major Demolition Works | No |
| **0 - Facilitating works** | 0.3 & 0.5 Temporary/Enabling Works | N/A |
| | 0.4 Specialist groundworks | N/A |
| **1- Substructure** | 1.1 Substructure | Yes |
| **2- Superstructure** | 2.1 Frame | Yes |
| | 2.2 Upper floors incl. balconies | Yes |
| | 2.3 Roof | Yes |
| | 2.4 Stairs and ramps | Yes |
| | 2.5 External Walls | Yes |
| | 2.6 Windows and External Doors | Yes |
| | 2.7 Internal Walls and Partitions | Yes |
| | 2.8 Internal Doors | Yes |
| **3- Finishes** | 3.1 Wall finishes | Yes |
| | 3.2 Floor finishes | Yes |
| | 3.3 Ceiling finishes | Yes |
| **4- Fittings Furnishings and equipment (FF&E)** | 4.1 Fittings furnishings & equipment incl. building-related* and non-building-related** | N/A |
| **5- Building services/MEP** | 5.1–5.14 Services incl. building-related* and non-building-related** | Yes |
| **6- Prefabricated Buildings and Building Units** | 6.1 Prefabricated Buildings and Building Units | N/A |
| **7- Work to Existing Building** | 7.1 Minor Demolition and Alteration Works | N/A |
| **8- External works** | 8.1 Site preparation works | N/A |
| | 8.2 Roads, paths, paving and surfacing | Yes |
| | 8.3 Soft landscaping, planting and irrigation systems | Yes |
| | 8.4 Fencing, railings and walls | N/A |
| | 8.5 External fixtures | N/A |
| | 8.6 External drainage | N/A |
| | 8.7 External services | N/A |
| | 8.8 Minor building works and ancillary buildings | N/A |

## 4.2 Materials and Products

The draft GLA whole life cycle carbon assessment guidance sets specific criteria for carbon data sources to be suitable for whole life cycle assessments which are in line with the RICS methodology.

The following sources of carbon data for materials and products used in this assessment are in line with the draft guidance and the RICS PS:

- Type III Environmental Product Declarations (EPDs) and equivalent, and datasets in accordance with:
  - BS EN 15804;
  - ISO 21930;
  - ISO 14067;
  - ISO 14025;
  - ISO 14040 and 14044;
  - PAS 2050.
- If EPDs could not be sourced for a product or system, then an EPD of the closest similar product was used. If that was not possible then a bespoke EPD was produced using carbon factors from the Bath ICE Database 10, material quantities, and with allowances for fabrication processes, transport etc.

**NOTE:**

Data on the manufacturer, manufacturer location, transport distance to site, service life, product EPD and recycled content are unknown as the project has only been designed to RIBA Stage 2.

### 4.2.1 Demolition of the existing structure

The proposed Development involves the demolition of existing structures. As outlined in the RICS PS 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. Therefore, all carbon emissions associated with demolition works of the existing structures are reported separately and not aggregated with the rest of the project emissions. However, for improving the deconstruction and demolition process and due to potential opportunities for recovery, carbon emissions arising from demolition works should be estimated.

# 5.0 Result Summary

Table 13 shows the results from the WLCA across all life-cycle stages (A-C). The total carbon resulting from the proposed development is 9955 tCO2 (871 kgCO2/m2), with most of the embodied carbon emissions arising from the superstructure (30 %) along with the services (15 %). Operational emissions (stages B6 & B7) amount to 6285 tCO2 (551 kgCO2/m2), this is derived from an energy use intensity of approximately 77 kWh/m2. Embodied emissions amount to 9954 tCO2 (871 kgCO2/m2) with a majority of these emissions associated with the steel rebar in the structure.

Table 3: Whole Life Carbon Results for all life-cycle stages

| Life Cycle stages | $tCO_2e$ | $kgCO_2e/m^2$ | % |
|---|---|---|---|
| A1-A3 Product sourcing | 7,861 | 688 | 48% |
| A4-A5 Construction Process | 707 | 62 | 4% |
| B1-B5 In Use | 1,168 | 102 | 7% |
| B6 – B7 Operational energy and water | 6,285 | 551 | 39% |
| C1-C4 End of life | 216 | 18 | 1% |
| D - Benefits and loads beyond the system boundary | N/A | N/A | N/A |
| **Total** | 16240 | 1422 | N/A |
| **Embodied** | 9954 | 871 | N/A |
| **Operational** | 6285 | 551 | N/A |

## 5.1 Detailed Embodied Carbon Breakdown by Category and Material

The figure below shows the embodied carbon (A1-A5, B1-B5, C1-C4) results for the Development, for each building category. The main driver of embodied carbon emissions is the steel in the superstructure steel rebar which is attributed to the upper floors and the concrete frame accounts for 26 % of total embodied carbon emissions. The next largest contributors are external walls 30 % as well as the internal partitions at approximately 8%.

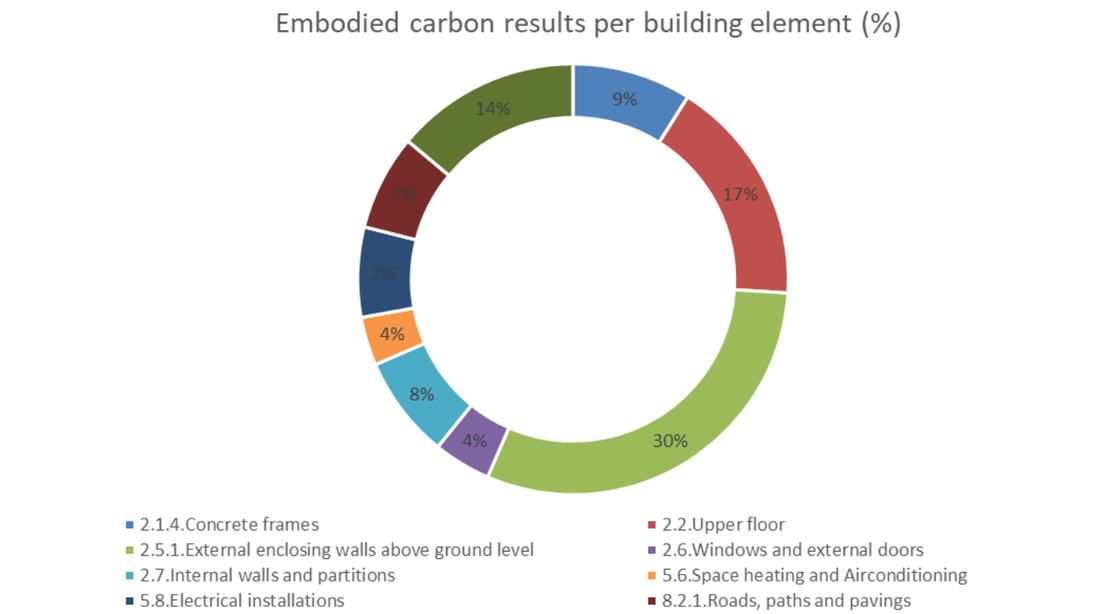



Figure 5: Embodied carbon results per building element

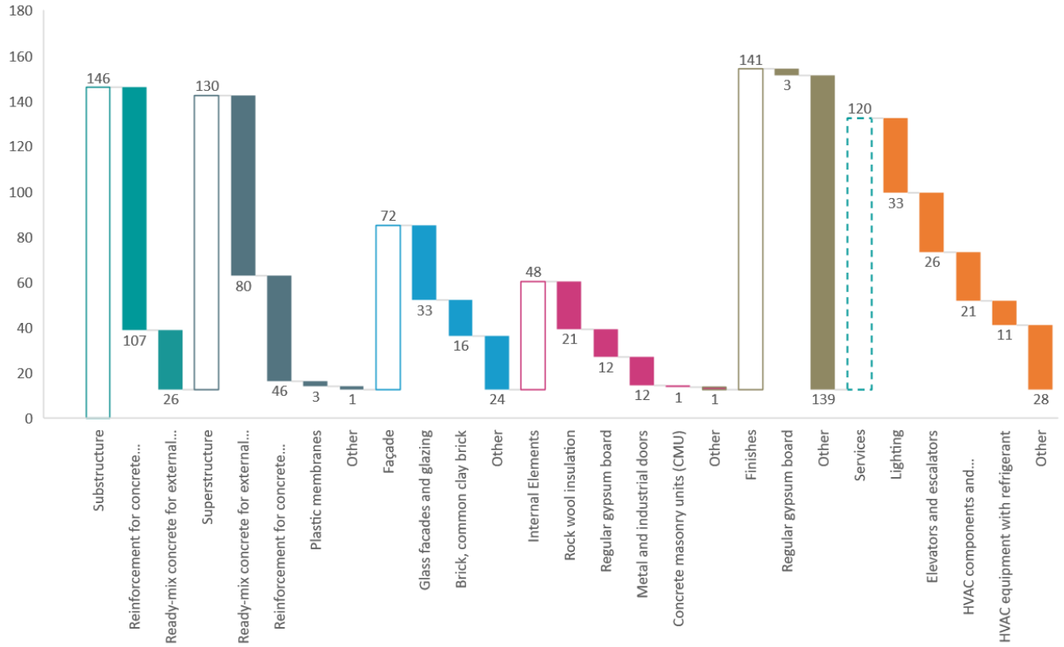



**Figure 6:** Breakdown of embodied carbon by building category and material (kgCO2/m2)

## 5.2 LCA Results by Stage

Figure 7 shows the lifecycle carbon by stage across all whole life cycle carbon stages. The largest impacts come from product emission stages A1-A3 (689 kgCO2/m2), which is driven by intensive materials like steel. Stages C1-C4 (19 kgCO2/m2) & B4 (102 kgCO2/m2) has the next highest impact, due to the energy required to process the materials towards the end of their cycle and the replacement of materials particularly building services.

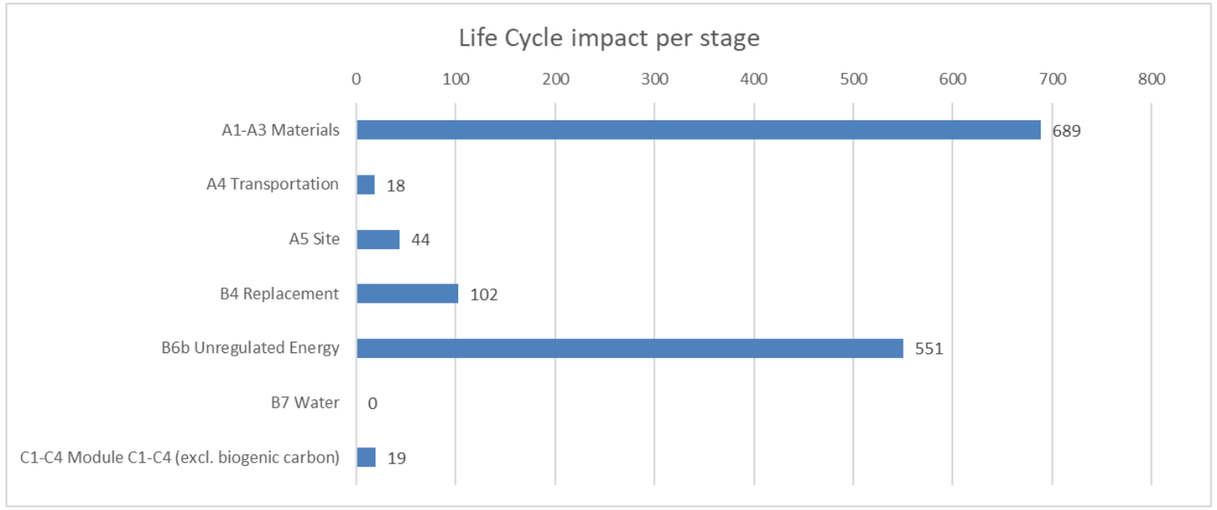



**Figure 7**: Carbon by life cycle stage

## 5.3 Regulated and Unregulated Emissions Stage B6

The operational energy profiles for the proposed development have been extracted from the residential SAP calculations. An SBEM modelling exercise has been undertaken for the non-domestic areas of the development. The results of this energy model have been used to inform operational energy figures for this report.

The total emissions associated with operational energy (B6) is 551 kgCO2/m2 equivalent to 39 % of total whole life carbon emissions.

## 5.4 Comparison to the WLC Benchmark

This section presents the comparison of the WLCA results against the GLA WLC benchmarks in accordance with the GLA Whole Life Carbon Assessment Guidance document (March 2022). Both the WLC and aspirational WLC targets are presented below. Figure 8 present the performance of the Development against the current and aspirational WLC targets set by the GLA. The Developments estimated carbon emissions are 871 kgCO2/m2 which presents a 27 % improvement on the WLC benchmark across all life-cycle-stages, and a 8 % increase on the aspirational benchmark.

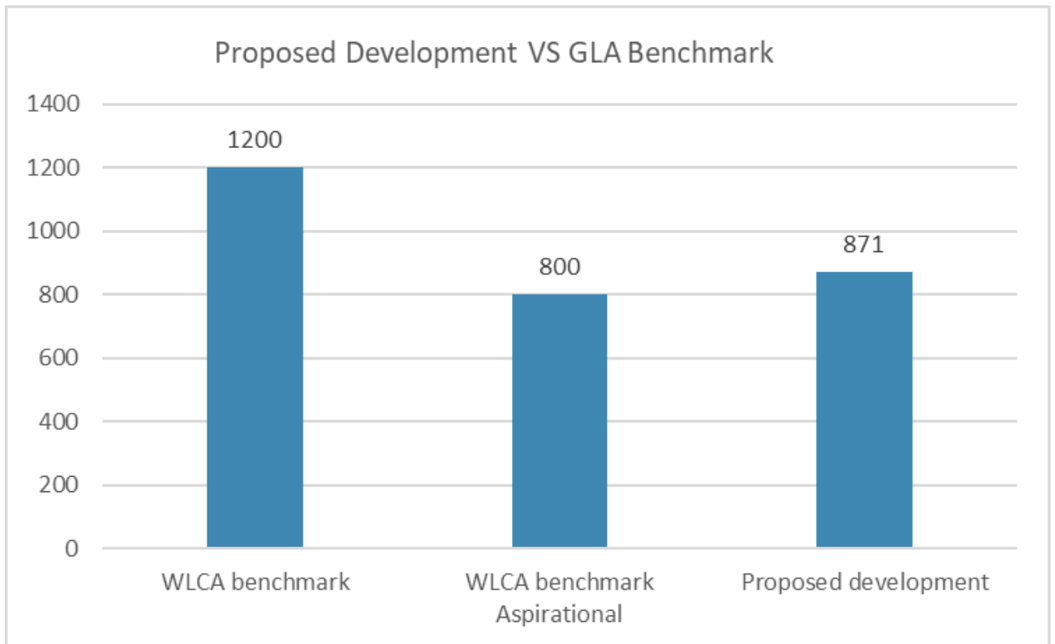



**Figure 8:** Comparison with GLA WLC and aspirational benchmarks

The GLA whole life carbon cycle assessments guidance document also provides a typical breakdown of the typical development's emissions by each building element. These are presented in **Error! Reference source not found.**.

## 5.5 Other actions taken to reduce carbon

Other actions have been taken to reduce carbon across the development, including:

- Specify concrete with high GGBS (minimum of 50%)
- Specify steel rebar with a recycled content (20% or higher)
- Operational (See Energy Strategy for further information)
    - Highly efficient equipment heating and cooling
    - Highly efficient mechanical ventilation with heat-recovery
    - Efficient light fixtures
- Embodied carbon
    - 70% GGBS replacement in substructure concrete
    - 50% GGBS replacement in superstructure concrete.
    - 20% recycled steel content for structural steel
    - Local materials such as stone and brick used for development

## 5.6 Carbon Emissions associated with Demolition

Currently a specific estimate for demolition emissions is not available.

An assessment of demolition emissions will be pursued in coming stages and opportunities to reduce demolition emissions will be recommended and put forward to the contractor. Additionally, carbon emissions will be considered alongside opportunities for reuse of existing building elements as discussed in the following section.

## 5.7 Stage D Emissions

Stage D emissions are associated with the use of materials which have high potential for recycling and reuse. The capacity for the project to realise these emissions is covered in detail in the Circular Economy Statement (MWL). Overall, the development has worked to reduce material use and design for adaptability and disassembly in a way that makes these emissions savings achievable. The major actions that can be undertaken to realise these savings are:

- Optimise materials used in the sub-structure and super structure. Design for durability and adaptability, by reducing the number of columns in the floor plate to maximise flexibility.
- Specify materials with recycled content and aim to specify materials from manufacturers who offer take-back schemes.
- Reduce resources other than materials and including energy, water and land, as the proposed scheme utilises a pre-developed site.
- Design for durability, longevity and flexibility, to keep building elements and materials in use for longer and enable flexible fit-out arrangements without significant alterations and waste generation.
- Prioritise materials that are responsibly and sustainably sourced.
- Manage waste sustainably and at the highest value, including demolition, construction and municipal waste.

Throughout the design, major building elements have been designed with circularity at the forefront so that stage D benefits can be fully realised. For this reason, the design team

has been working with biogenic carbon integrated into carbon figures as a means of tracking the potential savings that could be lost if circularity principles are not maintained throughout the next stages.

# 6.0 Opportunities for carbon reductions

As shown throughout this assessment the proposed design has been developed to incorporate flexibility and adaptability with the aim to respond to future changing requirements and a changing climate. Further actions can be potentially considered and explored at next stages of design in order to reduce the proposed Development's embodied carbon over its lifecycle. These future opportunities are outlined in the following sections.

## 6.1 Design Changes (A1-A3 and A4 Stages)

The recommendations in this section are provided to understand where there may have been further opportunities for carbon reduction in the design. They relate to lean design opportunities and material procurement opportunities. Generally, the project team should look to engage and analyse the supply chain early to identify opportunities to procure low carbon materials and prioritise EPDs where possible and beneficial to carbon transparency.

**General**

- Prioritise supply from manufacturers with EPDs and provide those EPDs in order to refine carbon insights

**Superstructure**

- Lightweight materials across development and reduced spans where possible
- Potential recycling and reuse of steel or other materials occurring as part of the demolition works. This will be explored at future stages
- Structural steel produced with Electric Arc Furnace (EAF) and renewable energy
- Replace the concrete frame construction with CLT where possible
- 50% GBBS will be explored

**Façade**

- Pre-fabricate façade elements
- Consider additional reuse or reclamation of façade elements

**Internal elements**

- Use timber rather than steel joints for internal wall partitions
- Reclaim internal wall elements
- Investigate use of prefabricated wall elements
- Use insulation elements with recycled content

**Finishes**

- Reduce metals in finishes

**Furniture, Fittings & Equipment (FFE)**

- Reclaim furniture or associated materials wherever possible

**Services**

- Reduce length of pipework and ductwork runs
- Design MEP systems in modules and design for disassembly
- Procure alternative duct-materials (for example Kingspan koolduct)
- Consider alternative pipework materials, particularly for metals
- Procure equipment from manufacturers with EPDs or with complete TM65 for their products
- Implement passive strategies where possible

## 6.2 Transport (A4)

The recommendations in this section are aimed at reducing emissions associated with transportation of elements to site. These should be actions in RIBA stages 4 and 5.

- Procure low carbon transport methods where possible
- Pre-fabricate and reduce vehicle idling on site
- Source locally produced products if possible

## 6.3 Construction (A5)

Construction emissions are currently estimated in line with the RICS guidance on a project-cost basis. In order to reduce A5 emissions the following should be considered and actioned in Stages 4 and 5.

- 100% green energy procured by the contractor for construction work
- Divert waste from landfill
- Implement design strategies building-wide that reduce the construction programme time

## 6.4 In-Use Emissions (B1-B5)

Elements within this assessment have been allocated standard assumptions from RICS around service life, waste, repair, and maintenance. To reduce emissions in this category the following should be considered:

- Prioritise durable materials in procurement, specifically targeting low-impact materials with longer than usual warranties
- This information should be fed into the next assessment so that standard service life assumptions can be replaced with more accurate information
- Design all elements for disassembly where relevant

- Where procurement of low-carbon products or materials may not be possible now, consider a design solution that enables installation of future low-carbon or lean-design alternatives

## 6.5 End-of-Life (C1-C4)

The end-of-life stages should be considered at the point of procurement, particularly when going out for tender and engaging with suppliers. The following actions should be undertaken in stages 4 and 5 to reduce C-stage emissions:

- Procure from suppliers with a buy-back program
- Procure materials that are highly recyclable
- Design for easy disassembly and rapid transport from site
- Identify local recycling, and reuse opportunities that minimize transport distances at the time of disposal or reuse.

# 7.0 Conclusion

A WLCA of the proposed Development was carried out to evaluate the environmental impact of the building elements during its whole life (60 years) in line with Policy SI 2 of the London Plan.

The WLCA was undertaken in accordance with the RICS methodology and in line with the GLA Whole Life Carbon Assessment Guidance document (March 2022).

The whole life cycle impact related with the proposed Development has been estimated to 9955 tCO2 excluding B6 & B7 or 871 kgCO2/m2, with most embodied carbon emissions arising from the superstructure (30%) along with the building services (15%). Operational emissions (stages B6 & B7) amount to 6285 tCO2 (551 kgCO2/m2) for a 60 year period.

**Actions taken to reduce WLC emissions of the proposed Development**

Actions to reduce the whole life emissions of the proposed Development have been implemented in the design in line with the GLA Whole Life Carbon Assessment Guidance document (March 2022). The design team throughout stage 2 has worked extensively and iteratively with carbon in order to inform decision making. Some of the major steps taken to date include

- Specify concrete with high GGBS (minimum of 50%)
- Specify steel rebar with a recycled content (20% or higher)

Other actions have been taken to reduce carbon across the development, including:

- Operational (See Energy Strategy for further information)
    - Highly efficient equipment heating and cooling
    - Highly efficient mechanical ventilation with heat-recovery
    - Efficient light fixtures
- Embodied carbon
    - 70% GGBS replacement in substructure concrete
    - 50% GGBS replacement in superstructure concrete.
    - 20% recycled steel content for structural steel
    - Local materials such as stone and brick used for development
- Local materials such as stone and brick used for development

## 7.1 Comparison with the WLC benchmarks developed by the GLA

As part of this WLCA the results have been compared against the GLA benchmarks in accordance with the GLA Whole Life Carbon Assessment Guidance document (March 2022),in order to have a realistic prospect of achieving net zero carbon for the whole UK building stock by 2050.

The benchmark comparison highlighted that the whole life carbon of the proposed Development (stages A-C, excluding B6 and B7) is lower compared to the current WLC benchmark dictated by the GLA guidance.

In particular, the proposed Development is expected to have an embodied carbon impact 27 % lower than the current WLC benchmark and is very close to the aspiration GLA targets with an small increase of 8%.