

# **Sister Manchester, Plot C**

## **Whole Life Carbon Report**

**SISCO-BHE-ZZ-ZZ-RP-SU-00010**

**059150**

31 July 2025

Revision 01

| Revision | Description | Issued by | Date       | Checked |
|----------|-------------|-----------|------------|---------|
| 01       | Issue       | AT        | 31/07/2025 | NC      |

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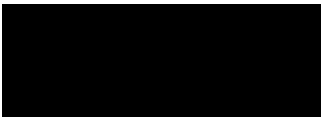
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# 1 Executive Summary

This Whole Life Carbon Assessment (WLCA) has been prepared in support of the Application for Full Planning Permission and Listed Building Consent for works to the Holloway Wall and Listed Building Consent for works to the Viaduct, for Sister – Plot C Development by ID Manchester Limited and University of Manchester. The WLCA forms part of the Environmental Standards Statement (ESS) and Energy and Carbon Statement and has also been written to comply with the *GMCA Design Guidance for Net Zero*.

*The proposals comprise the demolition of Barnes-Wallis, Wright Robinson, Manchester Meeting Place, Morton, Moffat Buildings and the construction of two office buildings (Use Class E). At the base of the building the buildings will be connected via an open shared lobby space, which shall comprise a variety of uses including social amenity spaces, as well as food and beverage establishments (Use Class E, Sui Generis – drinking establishment). The proposals will also include interventions to the Holloway Wall, incorporating it into the new commercial element. Additionally, the proposals will involve the change of use of the railway arches to retail and food and beverage uses (Use Class E and Sui Generis – drinking establishment). The proposals will also include the creation of a new public square, access and other associated works.*

This report presents a whole life carbon assessment of construction materials, as well as site works and expected operational demands of the proposed building. During RIBA stage 2, several design interventions were specified as part of design development, in order to reduce the environmental impact of the building. This was followed by final data collation from all the consultants and assessing life cycle environmental impact of all building materials in One Click LCA. To ensure a complete assessment of building, material quantities from consultants were also aligned with the cost plan from the cost consultants.

ID Manchester Limited is committed to an upfront embodied carbon target not exceeding 800kgCO<sub>2</sub>/m<sup>2</sup> for the proposed development. It is worth noting that this target was aligned to the LETI/RIBA targets and methodology which has a slightly reduced building element scope (excludes external works, loose FF&E and renewable electricity generation) and were also produced based on the RICS 1<sup>st</sup> edition (2017) methodology. We note that the *GMCA Design Guidance for Net Zero* also references the LETI targets but asks for the RICS 2<sup>nd</sup> edition (2023) methodology to be undertaken. Therefore, whilst the assessment has been carried out in accordance with the latest methodology, we have highlighted where this will have produced a higher result than the 1<sup>st</sup> edition – most notably with demolition included, increased transport emissions associated with the need to account for return empty journeys and explicit contingency factors.

A series of carbon studies have been undertaken to assess various options for different building elements, including four different structural materiality options. The results of these studies, and their influence on the design, can be seen in Section 7. Currently the assessment has been modelled assuming industry standard carbon factors in line with RICS 2<sup>nd</sup> edition and its referenced discipline specific documents (e.g. CWCT, IStructE). Significant design work has already occurred to prioritise a low carbon solution and onward optimisation will continue in the future stages, therefore improving against the baseline position focus on betterment of material carbon performance with some further opportunities presented in Section 8.

The upfront embodied carbon intensity of the whole development is **796 KgCO<sub>2</sub>e/m<sup>2</sup>**. Whole Life carbon, Cradle-to-grave (A-C) excluding B6 & B7 is **1,425 KgCO<sub>2</sub>e/m<sup>2</sup>**. Please see Table 1—1 below for a detailed breakdown.

Table 1—1 Whole life carbon summary

|                                                                                                                            | WLCA Module                                                                 | Non-decarbonised scenario      |                                                                       | Decarbonised scenario          |                                                                       |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------|
|                                                                                                                            |                                                                             | Total<br>(KgCO <sub>2</sub> e) | Embodied<br>carbon intensity<br>(KgCO <sub>2</sub> e/m <sup>2</sup> ) | Total<br>(KgCO <sub>2</sub> e) | Embodied<br>carbon intensity<br>(KgCO <sub>2</sub> e/m <sup>2</sup> ) |
| Plots C1 & C2                                                                                                              | <b>Upfront embodied carbon (A1-A5) excluding carbon sequestration</b>       | <b>60,246,433</b>              | <b>796</b>                                                            | <b>60,246,433</b>              | <b>796</b>                                                            |
|                                                                                                                            | Module B1-B5                                                                | 43,948,330                     | <b>580</b>                                                            | 22,008,046                     | <b>291</b>                                                            |
|                                                                                                                            | Module B6-B7 ( <i>operational energy + water</i> )                          | 70,317,101                     | <b>929</b>                                                            | 15,463,131                     | <b>204</b>                                                            |
|                                                                                                                            | Module C1-C4                                                                | 6,797,554                      | <b>90</b>                                                             | 5,400,501                      | <b>71</b>                                                             |
|                                                                                                                            | Module D                                                                    | -40,671,076                    | <b>-537</b>                                                           | -20,400,617                    | <b>-269</b>                                                           |
|                                                                                                                            | <b>Cradle-to-grave (A-C) excluding B6&amp;B7, including biogenic carbon</b> | <b>107,918,134</b>             | <b>1,425</b>                                                          | <b>84,580,796</b>              | <b>1,117</b>                                                          |
|                                                                                                                            |                                                                             |                                |                                                                       |                                |                                                                       |
| Elements reported outside target scope<br><br>(Loose FF&E, Renewable energy generation, service tunnel and external works) | <b>Upfront embodied carbon (A1-A5) excluding carbon sequestration</b>       | <b>5,692,160</b>               |                                                                       | <b>5,692,160</b>               |                                                                       |
|                                                                                                                            | Module B1-B5                                                                | 4,029,160                      |                                                                       | 4,307,968                      |                                                                       |
|                                                                                                                            | Module B6-B7 ( <i>operational energy + water</i> )                          | -                              |                                                                       | -                              |                                                                       |
|                                                                                                                            | Module C1-C4                                                                | 1,551,500                      |                                                                       | 1,197,410                      |                                                                       |
|                                                                                                                            | Module D                                                                    | -2,577,800                     |                                                                       | -1,290,535                     |                                                                       |
|                                                                                                                            | <b>Cradle-to-grave (A-C) excluding B6&amp;B7, including biogenic carbon</b> | <b>11,126,868</b>              |                                                                       | <b>10,233,347</b>              |                                                                       |

Please note these results include an added 15% contingency, in line with RICS V2 guidelines for Early-Stage Design.

For the decarbonised scenario, the following apply:

- **Grid decarbonisation:** Represents a scenario in which there is a gradual reduction in the energy and carbon intensity of electricity production.
- **Material decarbonisation:** Accounts for the expected decarbonisation transition related to the extraction, transportation and manufacturing processes of materials.

At this stage the development is expected to fall within the ID Manchester Limited upfront embodied carbon target of 800kgCO<sub>2</sub>/m<sup>2</sup>. Note that this includes the 15% contingency in line with RICS V2 guidelines for Early-Stage Design. As there aren't currently Greater Manchester Combined Authority targets for non-residential buildings the development has been compared to targets set for office buildings by the Greater London Authority (GLA). The A1-A5 result of 796 kg CO<sub>2</sub>e/m<sup>2</sup> GIA is significantly better than the standard GLA benchmark of 950 kg CO<sub>2</sub>e/m<sup>2</sup> GIA for an office building. This has been achieved through careful consideration of upfront embodied carbon from project infancy, so that any design decisions made took embodied carbon into account as a key consideration. Further information on the Whole Life Carbon reduction strategy is available in Section 7. Further reduction opportunities will be implemented to try and bring the result down further.

The A-C result of 1,425 kg CO<sub>2</sub>e/m<sup>2</sup> GIA is marginally higher than the standard benchmark for A-C of 1,400 kgCO<sub>2</sub>e/m<sup>2</sup>. At this early stage in the design most elements have a service life equivalent to standard benchmarks, which tend to be conservative.

Further information on how the team will aim to reduce the B-C emissions is available in Section 8 with the most critical items being:

- The façade design will be optimised so that any elements that do need replacing can be done so without the need to replace the entire module.
- Standard service life assumptions have been made, which will be refined throughout the post-planning design stages and wherever possible with manufacture specific EPDs prioritised.
- The team also plan to explore further the refrigerant type used in the system to ensure that low carbon alternatives are being implemented where feasible.

## 2 Introduction

### 2.1 Scope of the Document

Buro Happold have prepared this Whole Life Carbon Assessment (WLCA) report to present the findings from whole life carbon assessment of construction materials, as well as site works and expected operational demands of Sister – Plot C Development referred to hereafter as “the Site”. The Site is to be developed by ID Manchester Limited and University of Manchester. The WLCA forms part of the Environmental Standards Statement (ESS) and Energy and Carbon Statement and has also been written to comply with the *GMCA Design Guidance for Net Zero*.

**Section 3:** Outlines the delivery of the Whole Life Carbon Assessment against the Planning Policy requirements.

**Section 4:** Details the methodology of the assessment in accordance with RICS 2<sup>nd</sup> edition

**Section 5:** Describes the project embodied carbon targets, noting there is no explicit target for non-residential buildings in the GMCA guidance. It also outlines why RICS 2<sup>nd</sup> edition results will be increased in comparison to RICS 1<sup>st</sup> edition results and the associated LETI/RIBA targets,

**Section 6:** Presents the project whole life carbon results for the project, split between upfront carbon (A1-A5) and whole life carbon (A-C).

**Section 7:** Outlines the reduction measures that have already been implemented on the project to aim to reduce the environmental impact of the building.

**Section 8:** Indicates the further whole life carbon measures that are being considered by the design team in future stages.

### 2.2 Site Description

*The Site is in Manchester City Centre and is bound by the Manchester South Junction and Altrincham Railway (MSJ&AR) Viaduct to the north, London Road to the east, The Mill to the south and the Renold Building to the west.*

*The Site currently comprises the landscaped area known as the Bowling Green, the Barnes Wallis and Wright Robinson Building, Manchester Meeting Place and Morton Labs all associated with the former UMIST Campus of the University of Manchester. Although not listed these buildings are of heritage interest. The Site also contains the Grade II Holloway Wall and the MSJ&AR Viaduct. The Moffat Building is also contained within the Plot C boundary, this building is not considered to yield any heritage interest, however it is physically connected to the Holloway Wall.*

*The Site is located within the Whitworth Street Conservation Area, with the north aspect of the Plot C boundary (viaduct) forming the Conservation Area boundary. The Site therefore forms part of the designated area. The Site also includes a small parcel of land located to the north of the main site, accessed off Sackville Street. This parcel of land was previously used as a waste storage area and is enclosed by fencing and a gate.*

The following figures shows the proposed site boundary (red line) and an indication of the site layout respectively.



**Figure 2—1 Development Proposed Red Line Boundary**

## 2.3 Description of the Development

The proposals comprise the demolition of Barnes-Wallis, Wright Robinson, Manchester Meeting Place, Morton, Moffat Buildings and the construction of two office buildings (Use Class E). At the base of the building the buildings will be connected via an open shared lobby space, which shall comprise a variety of uses including social amenity spaces, as well as food and beverage establishments (Use Class E, Sui Generis – drinking establishment). The proposals will also include interventions to the Holloway Wall, incorporating it into the new commercial element. Additionally, the proposals will involve the change of use of the railway arches to retail and food and beverage uses (Use Class E and Sui Generis– drinking establishment). The proposals will also include the creation of a new public square, access and other associated works.

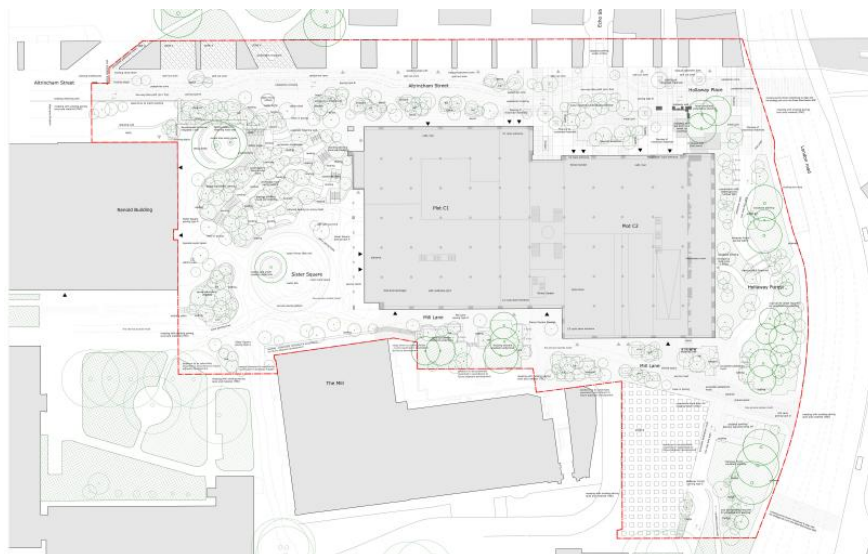


**Figure 2—2 Proposed Site Layout**

## 3 Planning Policy Context

This Whole Life Carbon Assessment should be read alongside the Environmental Standards Statement (ESS) and Energy and Carbon Statement (SISC0-BHE-ZZ-ZZ-RP-SU-00010), within which Section 4.3 has full details of the Planning Policy Context. This report has also been written to comply with the *GMCA Design Guidance for Net Zero*.

The ESS has been prepared in response to Policy JP-S2: Carbon and Energy, and JP-S3: Heat and Energy Networks, of the 'Places for Everyone Joint Development Plan' and Policies EN4 and EN6 of Manchester Local Development Framework Core Strategy Development Plan and applies to the Sister Plot C office development which forms part of a larger regeneration masterplan of the former University of Manchester North Campus.

### 3.1 BREEAM Mat 01

The project is targeting BREEAM 'Excellent', beyond GMCA policy requirements, and has conducted a Life Cycle Assessment (LCA) study at Concept Design stage for BREEAM NC V6.0 MAT01 criteria (Environmental impacts from construction products - Building life cycle assessment (LCA)) to understand the environmental impacts of the materials and identify opportunities and options to reduce this impact. The LCA study analyses significantly different superstructure options over their life cycle.

The aim of BREEAM MAT01 credit is to reduce the burden on the environment from construction products by recognising and encouraging measures to optimise construction product consumption efficiency and the selection of products with a low environmental impact (including embodied carbon), over the life cycle of the building. Details of the study are presented in Section 7.

### 3.2 Design Guidance for Net Zero Guidance for applicants on how to design to achieve Net Zero Carbon buildings

In March 2025 the GMCA issued *Design Guidance for Net Zero: Guidance for applicants on how to design to achieve Net Zero Carbon buildings*. This document is part of a suite of three documents regarding Net Zero, and focusses on building design to achieve Net Zero targets. This report details how the development has designed for low embodied carbon at early design stages, including reporting against the specific measures outlined in Chapter 4 of the document.

# 4 Methodology

## 4.1 Whole Life Cycle Assessment background

Whole life-cycle carbon emissions are the total greenhouse gas emissions arising from a development over its lifetime, ranging from the emissions associated with raw material extraction, the manufacture and transport of building materials, to installation/construction, operation, maintenance and eventual material disposal. This report covers a ‘cradle-to-grave’ Whole Life Carbon Assessment (WLCA) which includes modules A-C. Note that Module A0 which covers non physical pre-construction activities such as surveys is considered negligible for buildings. Additionally, inclusion of Module B8 which covers user activities such as commuting to a building is optional and has not been encompassed in this assessment. Modules D1 and D2 have been combined within the modelling and are reported separately.

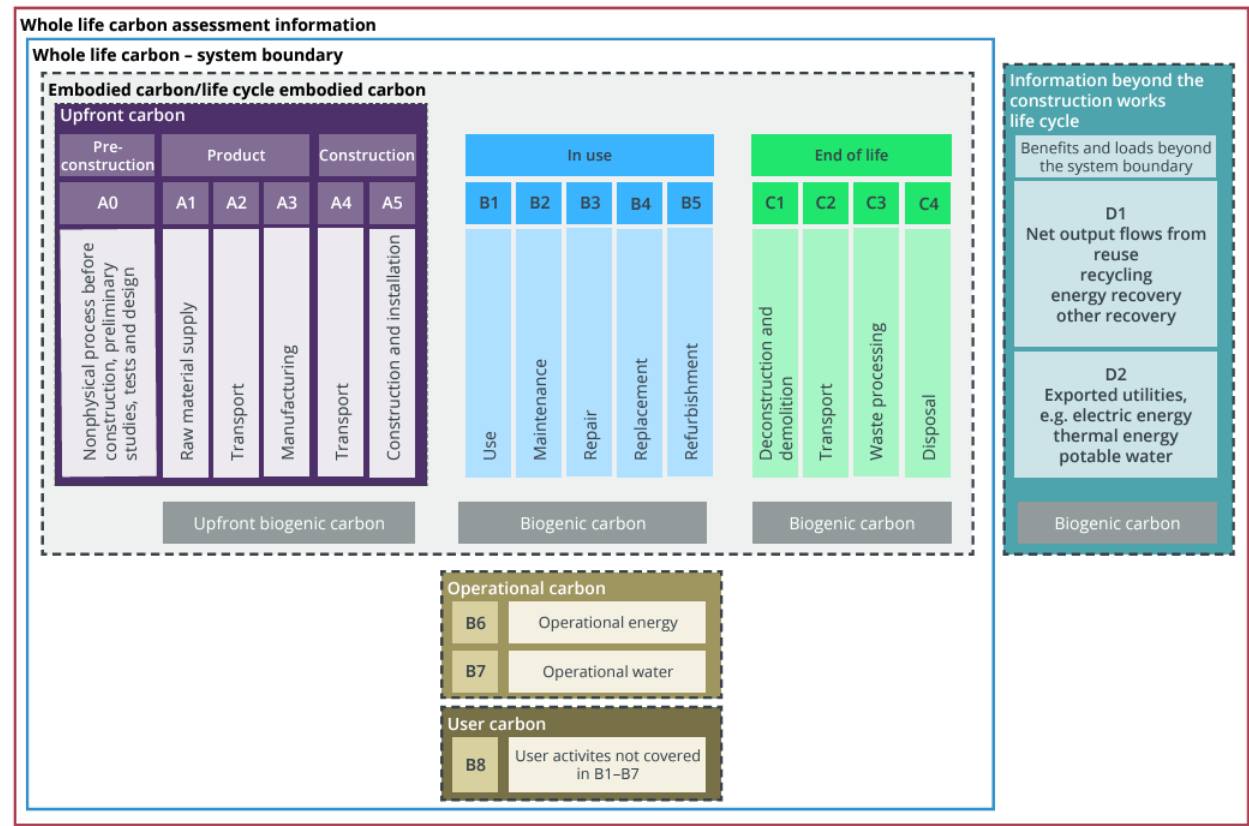


Figure 4—1 Building and infrastructure life cycle stages and information modules (RICS Whole Life Carbon Assessment 2023)

## 4.2 Scope of assessment

Table 4—1 demonstrates which building elements from the development have been included across the embodied carbon assessments for the Whole Life Carbon Assessment.

Table 4—1 Elements included within scope of LCA assessments

| Building element                  | Element sub-category                                     | Included                                                 |
|-----------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| Facilitating works and demolition | a) Demolition works                                      | Y                                                        |
|                                   | b) Facilitating works                                    | Y                                                        |
| Substructure                      | a) Foundations and piling                                | Y                                                        |
|                                   | b) Basement and lowest floor                             | Y                                                        |
| Superstructure                    | a) Frame                                                 | Y                                                        |
|                                   | b) Upper floors and roof                                 | Y                                                        |
|                                   | c) Stairs, ramps                                         | Y                                                        |
|                                   | d) External envelope                                     | Y                                                        |
|                                   | e) Windows and external doors                            | Y                                                        |
|                                   | f) Internal walls                                        | Y                                                        |
|                                   | g) Internal doors                                        | Y                                                        |
| Finishes                          | a) Wall finishes                                         | Y                                                        |
|                                   | b) Floor finishes                                        | Y                                                        |
|                                   | c) Ceiling finishes                                      | Y                                                        |
| FF&E                              | a) FF&E                                                  | Y (excluded from project target in accordance with RICS) |
| Core and Local Services           | a) Public health                                         | Y                                                        |
|                                   | b) HVAC                                                  | Y                                                        |
|                                   | c) Electrical installations                              | Y                                                        |
|                                   | d) On-site renewable energy generation                   | Y (excluded from project target in accordance with RICS) |
|                                   | e) Systems including life safety, lift and conveyor etc. | Y                                                        |
| Hard Landscaping                  | a) Hard landscaping and boundary protection              | Y (excluded from project target in accordance with RICS) |

#### 4.2.1 Life cycle sequence for a project with demolition

When any full or partial demolition or deconstruction of an existing structure is required, to facilitate the construction of a new asset within the designated site boundary or as an extension to the existing asset, the impacts associated with that demolition or deconstruction must be included in the WLCA in sub-module A5.1.

This requirement is illustrated within the RICS 2<sup>nd</sup> edition which outlines the lifecycle sequence for such a project, as seen in Figure 4—2, for which this asset is represented by 'Asset 2'. As the detailed processing routes for the demolished materials are unavailable, as is typically the case at early design stages, then 35kgCO<sub>2</sub>/m<sup>2</sup> of demolished area has been applied.

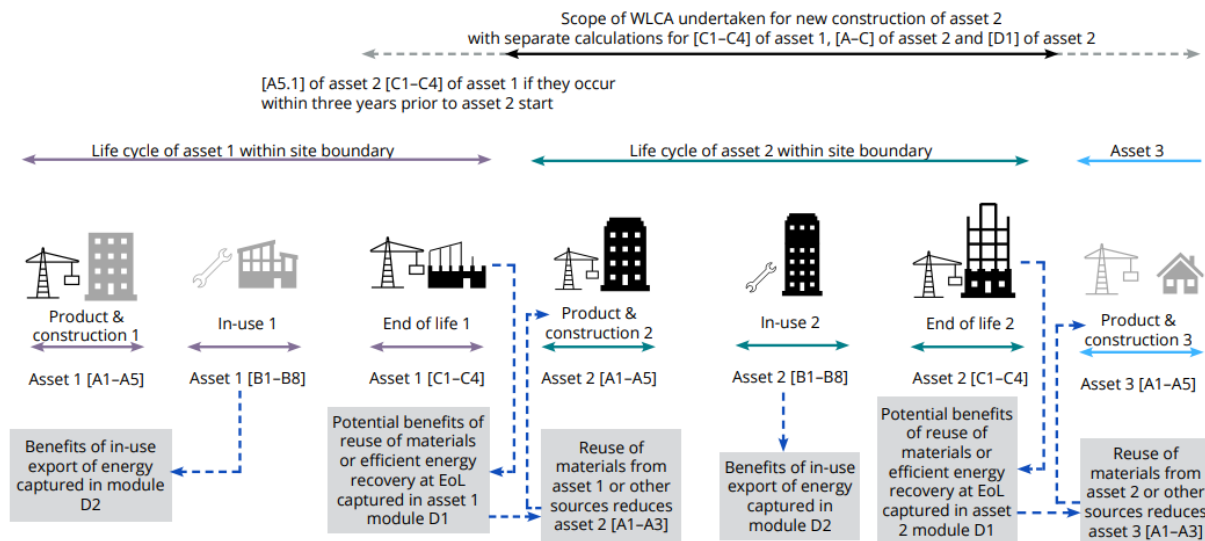


Figure 4—2 'Illustrative life cycle sequence for a building that evolves through a subsequent refurbishment' (RICS 2023)

### 4.3 Sourcing of material quantities

The assessment collated the most up-to date and representative data that was available for material quantities for the building and the associated infrastructure on the site. In line with RICS Version 2 Guidance for WLCA at Early Design Phase, key inputs can be seen in Table 4—2 below:

Table 4—2 WLCA Element Data Sources

| WLCA Element                             | Key input source                                                                                        |
|------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Gross Internal Floor Area [GIFA]         | Stage 2 cost plan                                                                                       |
| Substructure                             | Quantities from RIBA Stage 2 Cost plan<br>Supplemented by Stage 2 information from Structural engineers |
| Superstructure                           | Quantities from RIBA Stage 2 Cost plan<br>Supplemented by Stage 2 Architectural floor plans             |
| Building Services                        | Modelled using the RICS 2 <sup>nd</sup> edition MEP supplementary table (see section 0)                 |
| Hard Landscaping                         | Quantities from RIBA Stage 2 Cost plan                                                                  |
| Furniture, Fixtures and Equipment (FF&E) | GLA benchmarks based on m2 (see section 4.3.2)                                                          |
| Internal Finishes                        | Quantities from RIBA Stage 2 Cost plan<br>Supplemented by Stage 2 Architectural information             |
| Energy Consumption                       | Stage 2 Operational Energy report                                                                       |
| Water Consumption                        | Stage 2 Water consumption prediction                                                                    |
| Construction Site Emissions              | RICS 2 <sup>nd</sup> edition benchmark based on m2 (see section 4.3.3)                                  |
| Demolition Emissions                     | Demolished buildings area provided by architect<br>RICS 2 <sup>nd</sup> edition benchmark based on m2   |

4.3.1 MEP modelling

Modelling of MEP is one of the trickiest aspects of any Whole Life Carbon Assessment due to the number and complexity of the elements. In the past there has been a continual underrepresentation of emissions associated with MEP due to systems not being modelled in their entirety.

In the latest version of RICS, a list of supplementary assumptions has been provided to enhance the precision in benchmarking of MEP and services in buildings in lieu of exact material and equipment specification. Through the adoption of the supplementary assumption, the selected MEP strategy can be represented based on the simple building sizing figures such GIA, number of levels and the occupancy. Combining the assumptions with standard industry practise for material selection, it is possible to generate an embodied carbon benchmark specific to the services of the building. This is the process that has been undertaken for this early design stage for the project.

4.3.2 FF&E modelling

In lieu of any detail on the FF&E for the project at this early design stage the FEE modelling has been based on the GLA documentation which includes a split for each building element category per building element type. According to the GLA *Whole Life-Cycle Carbon Assessments* document, the benchmark upfront embodied carbon target for an office development is 950 kgCO<sub>2</sub>e/m<sup>2</sup>, as shown in the figure below.

| Offices*                           |                                                           |                                                                        |                                                                                                                                                                                                 |
|------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Modules                            | WLC benchmark<br>(kgCO <sub>2</sub> e/m <sup>2</sup> GIA) | Aspirational WLC benchmark<br>(kgCO <sub>2</sub> e/m <sup>2</sup> GIA) | Breakdown of a typical development                                                                                                                                                              |
| A1-A5<br>(excluding sequestration) | <950                                                      | <600                                                                   | Substructure: 19 per cent<br>Superstructure: 36 per cent<br>Façade: 17 per cent<br>Internal finishes: 10 per cent<br>FFE: 2 per cent<br>Services/MEP: 14 per cent<br>External works: 2 per cent |

Figure 4—3 GLA Whole Life-Cycle Carbon Assessments

According to the same documentation the typical upfront carbon breakdown for medium scale residential has 2% attributed to FF&E.

Based on the above, this leads to an FFE upfront carbon of 950kgCO<sub>2</sub>e/m<sup>2</sup> times 2%, giving a final value of **19kgCO<sub>2</sub>e/m<sup>2</sup>**. Based on recent studies with in-depth FF&E calculations this is a reasonable benchmark figure for Cat A. A similar exercise has been undertaken for the B-C modules, leading to another **40.5kgCO<sub>2</sub>e/m<sup>2</sup>**.

4.3.3 Construction site emissions

RICS 2<sup>nd</sup> edition stipulates that the carbon impacts arising from any on-site construction-related activities must be considered in module A5. This includes temporary works associated with installation processes; any construction activities and installation processes on-site, including energy consumption for site accommodation and use of plant, machinery and equipment; and the impacts associated with any waste generated through the construction process, its treatment and disposal, including the disposal of packaging waste.

For Sister Plot C, Construction activities (A5.2) have been modelled using the RICS V2 benchmark of 40 KgCO<sub>2</sub>e/m<sup>2</sup>. Waste and waste management (A5.3) are included similarly to RICS V1. Worker transport (A5.4) is optional and has not been included in the scope of this assessment.

Module A5 should be split and reported as four separate sub-modules:

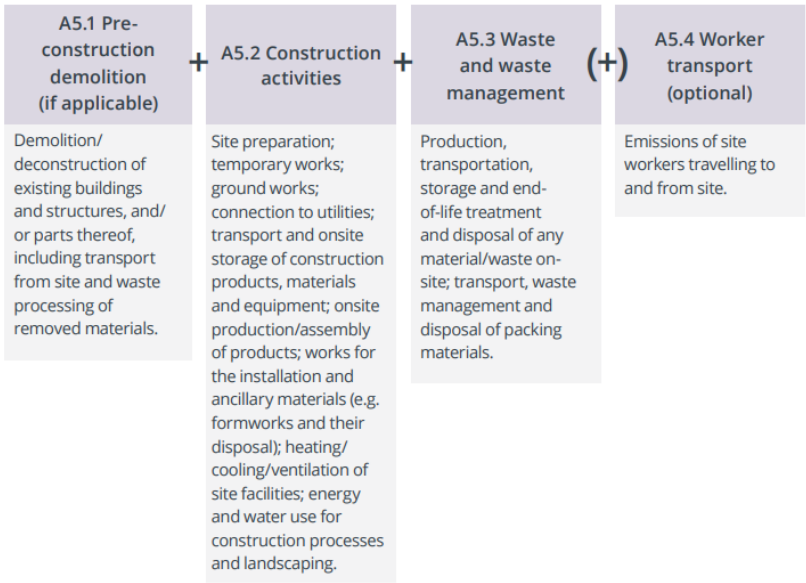


Figure 4—4 Sub-modules of module A5 (RICS V2)

4.4 LCA Software

The assessment has been carried out with One Click LCA software. The software holds 11 third party certifications and complies with over 30 certifications and standards for Life Cycle Assessment and Life Cycle Costing, including all versions of LEED and BREEAM. The software includes curated and verified global and local databases. The up-to-date list of integrated databases can be found here: <https://www.oneclicklca.com/support/faq-and-guidance/documentation/database/>.

One Click LCA has been third party verified by ITB for compliancy with the following LCA standards: EN 15978, ISO 21931–1 and ISO 21929, and data requirements of ISO 14040 and EN 15804. The full compliancy documentation is available at <https://www.oneclicklca.com/support/faq-and-guidance/documentation/compliance-and-certifications/>.

The analysis is carried out using the *Whole life carbon assessment, RICS - 2nd Edition*’ tool developed by One Click LCA. The tool has been updated to align with Professional Standard Whole life carbon assessment for the built environment, 2nd edition.

## 4.5 Key material carbon factors (A1-A3)

Unless development-specific information is given within the RIBA Stage 2 material or provided directly by the design team, the following assumptions have been made relating to key materials in order to provide the most accurate representation of construction emissions within the UK as is possible during early stage design. This is based off the *IStructE How to calculate embodied carbon* – a source of information directly referenced by RICS 2<sup>nd</sup> edition guidance..

**Table 4—3 Key carbon material carbon factors**

| Material                               | A1-A3 Carbon Factor (kgCO <sub>2</sub> /kg) |
|----------------------------------------|---------------------------------------------|
| Concrete in-situ C32/40 (unreinforced) | 0.113                                       |
| Precast concrete C40/50 (unreinforced) | 0.173                                       |
| Steel reinforcement bars               | 0.72                                        |
| PT Strand                              | 1.724                                       |
| UK Open Rolled Steel                   | 1.64                                        |
| UK Closed Sections Steel               | 2.59                                        |
| UK Plate Steel                         | 2.47                                        |
| UK Softwood timber                     | 0.156                                       |
| UK Glulam                              | 0.28                                        |

### 4.5.1 Whole Life Carbon modelling default scenarios

Other assumptions for the other life cycle modules are detailed in the table below:

**Table 4—4 WLCA Modelling default scenarios**

| Scenario                            | Default using within WLCA                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transport [A4]                      | Transport has been assumed in line with RICS 2 <sup>nd</sup> edition guidance Table 17                                                                                                                                                                                                                                                                                           |
| Waste Processing [A5]               | Wastage parameters inputted in line with RICS 2 <sup>nd</sup> edition Guidance Table 18                                                                                                                                                                                                                                                                                          |
| Maintenance [B2]                    | RICS 2 <sup>nd</sup> edition assumption used in lieu of detailed maintenance scenario (10kgCO <sub>2</sub> /m <sup>2</sup> )                                                                                                                                                                                                                                                     |
| Repair/year [B3]                    | RICS 2 <sup>nd</sup> edition assumption used in lieu of detailed maintenance scenario (2.5kgCO <sub>2</sub> /m <sup>2</sup> )                                                                                                                                                                                                                                                    |
| Service life [B4]                   | Service lives inputted in line with RICS 2 <sup>nd</sup> edition Guidance Table 20                                                                                                                                                                                                                                                                                               |
| Energy consumption [B6]             | Emissions in line with Appendix H of RICS 2 <sup>nd</sup> edition Guidance (Note this is significantly more than RICS 1 <sup>st</sup> edition due to it taking into account the embodied carbon emissions of the energy infrastructure).                                                                                                                                         |
| Water consumption [B7]              | Water emissions based on RICS 2 <sup>nd</sup> edition Guidance                                                                                                                                                                                                                                                                                                                   |
| End of Life [C]                     | C1: Modelled based on <i>Good practice demolition scenario- 30% of A5.2 impacts</i> in OneClick<br>C2: Transport parameters associated with individual product/ manufacturer information<br>C3: Waste processing parameters associated with individual product/ manufacturer information<br>C4: Disposal parameters associated with individual product/ manufacturer information |
| Benefits beyond system boundary [D] | Processed within OneClick in accordance with RICS 2 <sup>nd</sup> edition tool                                                                                                                                                                                                                                                                                                   |

4.5.2    **Uncertainty Factor**

The RICS 2<sup>nd</sup> edition is much more specific with regards to uplift factors that must be applied to the results, with a breakdown shown in the following table. At this stage, a blanket contingency factor of 15% has been applied. See 5.2.2 for more details.

## 5 Project Targets

### 5.1 Project Targets

ID Manchester Limited is committed to an **upfront embodied carbon target not exceeding 800kgCO<sub>2</sub>/m<sup>2</sup>** for the proposed development. It is worth noting that this target was aligned to the LETI/RIBA targets and methodology which has a slightly reduced building element scope (excludes external works, loose FF&E and renewable electricity generation) and were also produced based on the RICS 1<sup>st</sup> edition (2017) methodology.

We note that the GMCA *Design Guidance for Net Zero* also references the LETI targets but asks for the RICS 2<sup>nd</sup> edition (2023) methodology to be undertaken. Therefore, whilst the assessment has been carried out in accordance with the latest methodology, we have highlighted where this will have produced a higher result than the 1<sup>st</sup> edition – most notably with demolition included, increased transport emissions associated with the need to account for return empty journeys and explicit contingency factors.

LETI and RIBA are part of the Technical Steering Group of the UK Net Zero Carbon Building Standard, and have already stated that they will be looking to update their targets going forward to align with the new standard, and the RICS 2<sup>nd</sup> edition methodology. The project team will monitor these updates and align performance against latest industry standards.

### 5.2 Comparison of targets to RICS 2<sup>nd</sup> edition

As noted, there are some significant differences between the RICS 1<sup>st</sup> edition methodology, upon which LETI targets quoted in the GMCA documentation are based, and RICS 2<sup>nd</sup> edition methodology, which is the expected route outlined in the same guidance document. This chapter outlines some of those key differences, focussing on changes that would impact upfront carbon reporting. This provides some context to the results presented in the next chapter, as whilst the project is still hitting its upfront embodied carbon target, the development would be even better performing if assessed against the 1<sup>st</sup> edition.

#### 5.2.1 Demolition

The new methodology requires the reporting of demolition emissions as part of the A5 module. If the detailed processing routes for the demolished materials are unavailable, as is the case at early design stages, then 35kgCO<sub>2</sub>/m<sup>2</sup> of demolished area is to be applied. Due to the area of the existing building on the site the change is relatively significant for this project contributing 11 kgCO<sub>2</sub>/m<sup>2</sup> towards the new development. RICS 1<sup>st</sup> edition explicitly states that this would not be reported as part of the results, whilst some Planning Policy, such as the current GLA methodology would ask for this to be reported separately.

Please refer to the Circular Economy Statement (SISC0-BHE-ZZ-ZZ-RP-SU-00002) for details on how the development aims to minimise non-hazardous demolition, excavation, construction and operational waste sent to landfill.

### 5.2.2 Uplift factors

Within the modelling for the assessment, a conservative position has been taken to avoid carbon creep later in design or through construction. For example, where the intention is to reuse paving in the external works this has currently been modelled as new. However, there were plenty of projects that have previously not taken that approach and therefore the RICS 2<sup>nd</sup> edition considers contingency factors to account for this.

The RICS 2<sup>nd</sup> edition is much more specific with regards to uplift factors that must be applied to the results, with a breakdown shown in the following table. **At this stage, a blanket contingency factor of 15% has been applied.** This assessment has determined that the respective uplifts to the total results are as follows:

Table 5—1 Contingency factor calculation

| Stage                                                                   | Contingency factor | Carbon data uncertainty factor                                                                 | Quantities uncertainty factor                                                                 |
|-------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Concept design<br><i>Usually, RIBA Stages 2</i>                         | <b>Yes – 15%</b>   | <b>No</b>                                                                                      | <b>No</b>                                                                                     |
| Detailed design & Construction<br><i>Usually RIBA Stage 3,4 &amp; 5</i> | <b>Yes – 6%</b>    | <b>Yes – Calculate using carbon data quality matrix to find asset carbon confidence score*</b> | <b>Yes – Calculate using Quantities uncertainty levels table to find the asset QUL score*</b> |
| Post completion                                                         | <b>No</b>          | <b>Yes – Calculate using carbon data quality matrix to find asset carbon confidence score*</b> | <b>Yes – Calculate using Quantities uncertainty levels table to find the asset QUL score*</b> |

\* Based on top 10 materials or products contributing to WLC

### 5.2.3 Transport calculations

RICS 2<sup>nd</sup> edition requires the consideration of an empty running factor to be considered in the A4 transport emissions calculations for road freight. As the assumed transport distances have also changed it is not a simple comparison exercise to run, however based on precedent projects of a similar typology this typically leads to an uplift of 15% for this life cycle module.

### 5.2.4 Whole life carbon changes

#### 5.2.4.1 Decarbonised scenario

One of the most significant changes to the RICS 2<sup>nd</sup> edition methodology is the reporting of both a decarbonised and non-decarbonised scenario. For operational energy, in the UK, the falling short scenario (excluding negative emissions from BECCS), from the latest Future Energy Scenarios (FES) developed by National Grid, must be used for the decarbonisation scenario. Alongside grid decarbonisation, it is expected that extraction, transportation and manufacturing processes will also decarbonise. To reflect a likely scenario for decarbonisation of the sector to 2050, RICS have provided standard scenarios for material impacts.

5.2.4.2 Operational energy carbon factor

For RICS 2<sup>nd</sup> edition, the carbon conversion factors used must account for both direct and indirect GHG emissions: scopes 1, 2 and 3, including well-to-tank (WTT) and transmission and distribution (T&D) impacts, and should account for the embodied carbon of energy infrastructure where applicable and available, as shown in the figure below. This leads to a significant increase in the B6 emissions compared to a typical 1<sup>st</sup> edition assessment.

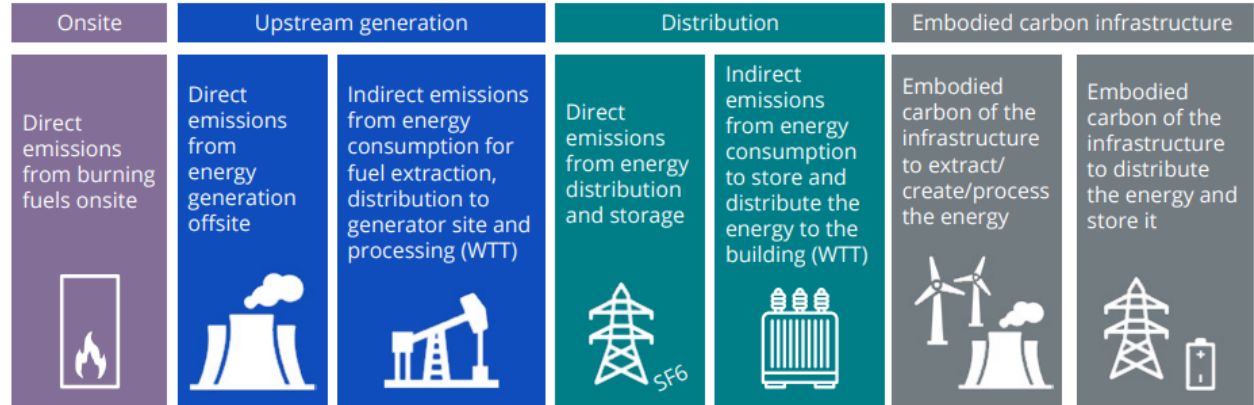


Figure 5—1 Carbon conversion factor inclusions  
([https://www.rics.org/content/dam/ricsglobal/documents/standards/Whole\\_life\\_carbon\\_assessment\\_PS\\_Sept23.pdf](https://www.rics.org/content/dam/ricsglobal/documents/standards/Whole_life_carbon_assessment_PS_Sept23.pdf))

## 6 Whole Life Carbon Results

### 6.1 Planning stage results

Table 6—1 presents a summary of the Whole Life Carbon Assessment results for Sister – Plot C Development. Results under both a ‘decarbonised’ and ‘non-decarbonised’ scenario are presented.

The upfront embodied carbon intensity of the whole development is **796 KgCo2e/m<sup>2</sup>**. Whole Life carbon, Cradle-to-grave (A-C) excluding B6 & B7 is **1,425 KgCo2e/m<sup>2</sup>**.

**Table 6—1 Whole Life Carbon Summary**

|                                                                                                                                         | WLCA Module                                                                 | Non-decarbonised scenario      |                                                                       | Decarbonised scenario          |                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------|
|                                                                                                                                         |                                                                             | Total<br>(KgCO <sub>2</sub> e) | Embodied<br>carbon intensity<br>(KgCO <sub>2</sub> e/m <sup>2</sup> ) | Total<br>(KgCO <sub>2</sub> e) | Embodied<br>carbon intensity<br>(KgCO <sub>2</sub> e/m <sup>2</sup> ) |
| <b>Plots C1 &amp; C2</b>                                                                                                                | <b>Upfront embodied carbon (A1-A5) excluding carbon sequestration</b>       | <b>60,246,433</b>              | <b>796</b>                                                            | <b>60,246,433</b>              | <b>796</b>                                                            |
|                                                                                                                                         | Module B1-B5                                                                | 43,948,330                     | <b>580</b>                                                            | 22,008,046                     | <b>291</b>                                                            |
|                                                                                                                                         | Module B6-B7 (operational energy + water)                                   | 70,317,101                     | <b>929</b>                                                            | 15,463,131                     | <b>204</b>                                                            |
|                                                                                                                                         | Module C1-C4                                                                | 6,797,554                      | <b>90</b>                                                             | 5,400,501                      | <b>71</b>                                                             |
|                                                                                                                                         | Module D                                                                    | -40,671,076                    | <b>-537</b>                                                           | -20,400,617                    | <b>-269</b>                                                           |
|                                                                                                                                         | <b>Cradle-to-grave (A-C) excluding B6&amp;B7, including biogenic carbon</b> | <b>107,918,134</b>             | <b>1,425</b>                                                          | <b>84,580,796</b>              | <b>1,117</b>                                                          |
|                                                                                                                                         |                                                                             |                                |                                                                       |                                |                                                                       |
| <b>Elements reported outside target scope<br/><br/>(Loose FF&amp;E, Renewable energy generation, service tunnel and external works)</b> | <b>Upfront embodied carbon (A1-A5) excluding carbon sequestration</b>       | <b>5,692,160</b>               |                                                                       | <b>5,692,160</b>               |                                                                       |
|                                                                                                                                         | Module B1-B5                                                                | 4,029,160                      |                                                                       | 4,307,968                      |                                                                       |
|                                                                                                                                         | Module B6-B7 (operational energy + water)                                   | -                              |                                                                       | -                              |                                                                       |
|                                                                                                                                         | Module C1-C4                                                                | 1,551,500                      |                                                                       | 1,197,410                      |                                                                       |
|                                                                                                                                         | Module D                                                                    | -2,577,800                     |                                                                       | -1,290,535                     |                                                                       |
|                                                                                                                                         | <b>Cradle-to-grave (A-C) excluding B6&amp;B7, including biogenic carbon</b> | <b>11,126,868</b>              |                                                                       | <b>10,233,347</b>              |                                                                       |

Please note these results include an added 15% contingency, in line with RICS V2 guidelines for Early-Stage Design.

6.1.1 Upfront carbon results (A1-A5) breakdown

This report section breaks down the upfront embodied carbon emissions associated with the development. As shown in Table 6—2, the Embodied carbon intensity of the development (excluding loose FF&E, PV and external works) is **796 KgCo2e/m2**. Biogenic carbon is not included within this breakdown.

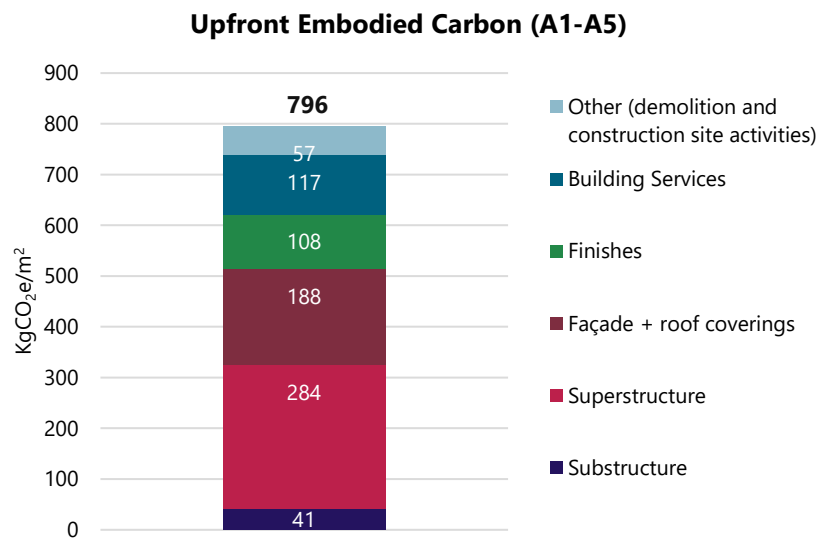


Figure 6—1 Upfront embodied carbon impact (A1-A5)

Table 6—2 Upfront embodied carbon impact (A1-A5)

| Building elements                                   | Total upfront embodied carbon (KgCO <sub>2</sub> e) | Embodied carbon intensity (KgCO <sub>2</sub> e/m <sup>2</sup> ) |
|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------|
| Substructure                                        | 3,112,787                                           | 41                                                              |
| Superstructure                                      | 21,543,737                                          | 284                                                             |
| Façade + roof coverings                             | 14,253,664                                          | 188                                                             |
| Finishes                                            | 8,184,857                                           | 108                                                             |
| Building Services                                   | 8,864,786                                           | 117                                                             |
| Other (demolition and construction site activities) | 4,286,602                                           | 57                                                              |
| Total                                               | 60,246,433                                          | 796                                                             |
| Fittings, Furnishings & Equipment (FF&E)            | 1,654,679                                           |                                                                 |
| On-site energy generation                           | 228,629                                             |                                                                 |
| Service Tunnel                                      | 2,171,998                                           |                                                                 |
| External works                                      | 1,636,854                                           |                                                                 |

Table 6—3 A5 element breakdown (construction and installation)

| A5 element breakdown             | Total carbon emissions (KgCO <sub>2</sub> e) | Carbon intensity (KgCO <sub>2</sub> e/m <sup>2</sup> ) |
|----------------------------------|----------------------------------------------|--------------------------------------------------------|
| A5.1 Pre construction demolition | 803,068                                      | 11                                                     |
| A5.2 Construction activities     | 3,483,534                                    | 46                                                     |
| A5.3 Waste and waste management  | 1,903,841                                    | 25                                                     |

Table 1—1Table 6—4 displays the breakdown of A5 emissions from construction and installation. Construction activities and waste management account for the biggest proportions of the A5 emissions, which includes from any construction activities and installation processes on-site, including temporary works, energy consumption for site accommodation and use of plant, machinery and equipment. 11 kgCO<sub>2</sub>e /m<sup>2</sup> is associated with the demolition of the existing buildings on site.

6.1.2 Whole life carbon results (A-C) breakdown

This report section breaks down the whole life carbon emissions associated with the development. As shown in Table 6—4 the whole life carbon intensity of the development (excluding loose FF&E, PV and external works) is **1,424 KgCo2e/m2**. Biogenic carbon is included within this breakdown.

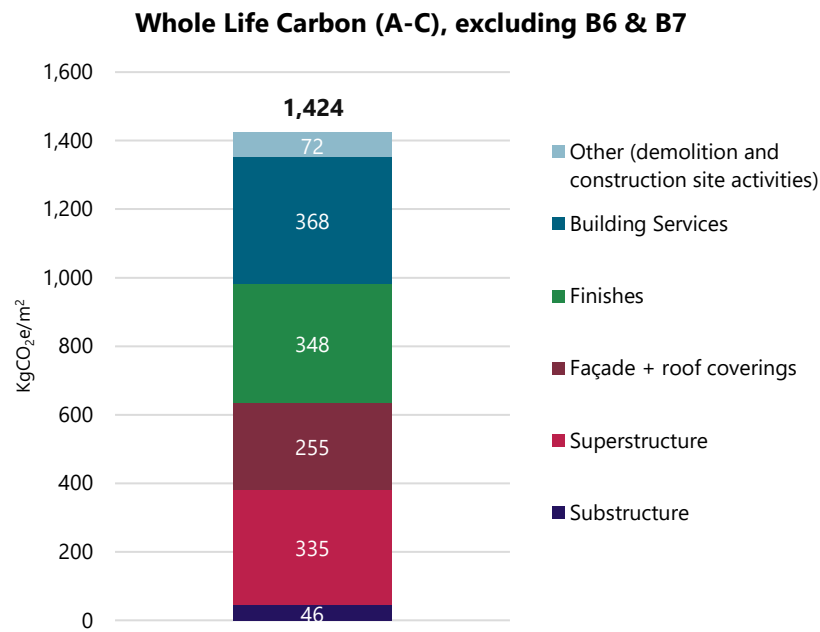


Figure 6—2 Whole Life carbon impact (A-C, excluding B6&B7)

Table 6—4 Whole Life carbon impact (A-C, excluding B6&B7)

| Building elements                                   | Total upfront embodied carbon (KgCO <sub>2</sub> e) | Embodied carbon intensity (KgCO <sub>2</sub> e/m <sup>2</sup> ) |
|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------|
| Substructure                                        | 3,447,805                                           | 46                                                              |
| Superstructure                                      | 25,345,340                                          | 335                                                             |
| Façade + roof coverings                             | 19,338,528                                          | 255                                                             |
| Finishes                                            | 26,349,532                                          | 348                                                             |
| Building Services                                   | 27,893,835                                          | 368                                                             |
| Other (demolition and construction site activities) | 5,432,162                                           | 72                                                              |
| <b>Total</b>                                        | <b>107,807,202</b>                                  | <b>1,424</b>                                                    |
| Fittings, Furnishings & Equipment (FF&E)            | 5,181,757                                           |                                                                 |
| On-site energy generation                           | 692,177                                             |                                                                 |
| Service Tunnel                                      | 2,444,877                                           |                                                                 |
| External works                                      | 2,808,057                                           |                                                                 |

6.1.3 Most contributing materials (A-C)

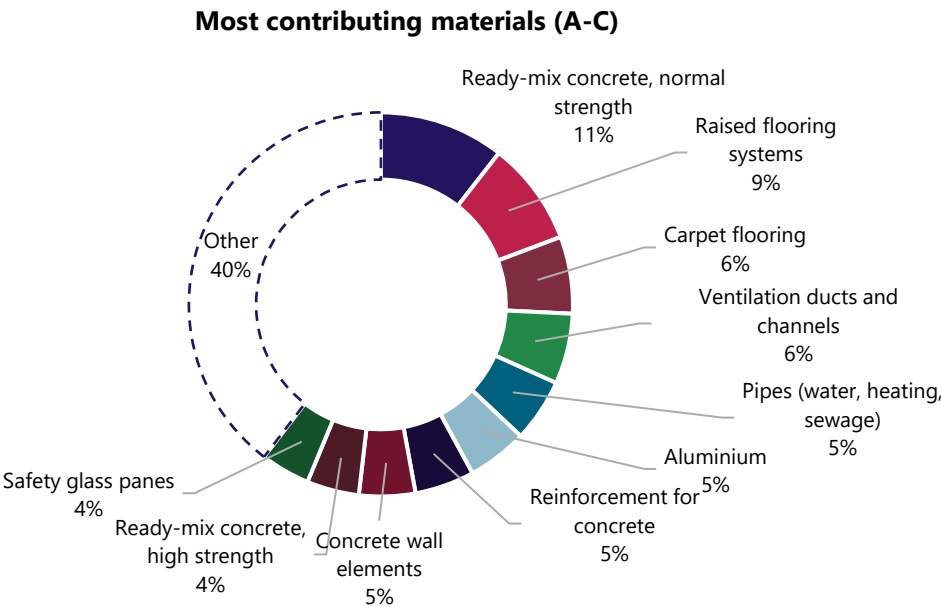


Figure 6—3 Most contributing materials (A-C)

## 7 Whole Life Carbon Reduction Measures Implemented

### 7.1 Reporting against ‘Design Guidance for Net Zero’

Significant design work has already occurred to prioritise a low carbon solution for the building. These measures have been aligned against the recommendations in the Design Guidance for Net Zero.

#### 7.1.1 Compact building form

The development is simple and compact in its form, leading to operational efficiencies and also reduced façade area for a given GIA, thereby reducing façade emissions. The building has a form factor of approximately 0.44, which is significantly lower than those presented in the GMCA guidance, as seen below. However, residential buildings, upon which the studies are based, tend to have higher form factors due to the requirement for every individual flats to have an interaction with the façade. Therefore, it is worth noting that 0.44 is still very low for an office building.

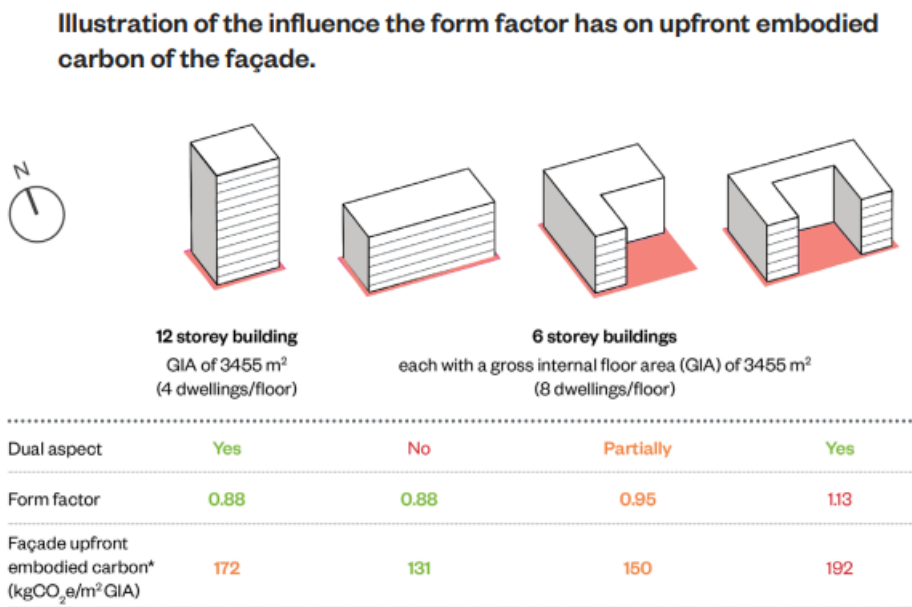


Figure 7—1 Form factor implications on performance (GMCA Design Guidance for Net Zero)

#### 7.1.2 Transparency of design

The simple and compact building form also lends itself well to avoiding non-typical features such as significant overhangs and large transfer structures which are relatively high in embodied carbon. The reuse and modification of the existing basement avoids the need to construct a new basement. The incorporation of the railway arches into the development avoids the need to construct new buildings. Shading devices are being incorporated into the façade where necessary to mitigate solar gains, and at the same time the upfront embodied carbon is being assessed to find a suitable balance between the two.

#### 7.1.3 Lean and light structure

Significant design work has already occurred to prioritise a low carbon solution, including the assessment of four different structural solutions. The following figures show the different options that were tested as part of this process:

|                         | Baseline                      | Option 1           | Option 2    | Option 3       |
|-------------------------|-------------------------------|--------------------|-------------|----------------|
| <b>Frame</b>            | Reinforced concrete           | Steel frame        | Steel frame | Glulam columns |
| <b>Upper floors</b>     | PT slab                       | Composite concrete | CLT slab    | CLT slab       |
| <b>Roof</b>             | Precast PT                    | As baseline        | As baseline | As baseline    |
| <b>Stairs and ramps</b> | Reinforced concrete           | As baseline        | As baseline | As baseline    |
| <b>facade</b>           | Precast concrete panels       | As baseline        | As baseline | As baseline    |
| <b>External windows</b> | Aluminium frame double glazed | As baseline        | As baseline | As baseline    |

**Figure 7—2 Structural options tested as part of BREEAM Mat01 study**

Based on this analysis, the concrete option was chosen as the one to be taken forward as it is the best performing solution across the impact categories. It is worth noting that a significant amount of work had already gone into the design to move the solution from a standard RC frame to a PT slab, so the baseline option was already a very carbon efficient scheme.

The options were also considered in a context beyond just their environmental performance, with reasons for exclusion of other options outlined below:

- Steel frame & composite slab – higher carbon option, less efficient for chosen grid option.
- Steel frame & CLT slab – cost prohibitive, over 18m high - challenges with fire performance, insurance difficulties.
- Glulam frame & CLT slab – cost prohibitive, over 18m high - challenges with fire performance, insurance difficulties.

### 7.1.4 Architectural elements

Several façade options were considered through the design process, with the whole life carbon impact of these solutions a key part of the design decision matrix. To provide embodied carbon comparisons, Buro Happold shared a study comparing a range of build-ups all achieving the same U-values to meet LETI targets. Note, these results come with a significant range which is reflective of the number of assumptions that must be made when trying to conduct high level comparative performance optioneering.

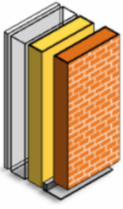
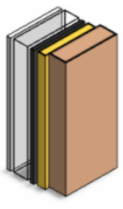
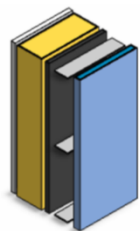
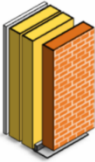
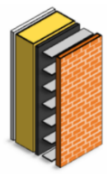
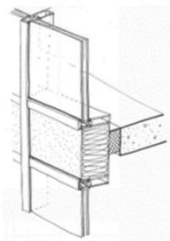
| Primary Façade Type                                                                                                                                                                        | Weight | Baseline A1-A3 Embodied Carbon Range [per m <sup>2</sup> FSA] | Primary Façade Type                                                                                                                                                       | Weight | Baseline A1-A3 Embodied Carbon Range [per m <sup>2</sup> FSA] | Primary Façade Type                                                                                                                                                          | Weight | Baseline A1-A3 Embodied Carbon Range [per m <sup>2</sup> FSA] |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------|
| <b>Traditional brick-faced precast concrete</b><br><br>Assumes 150mm thick concrete + 50mm thick UK brick | ●      | 164 - 305                                                     | <b>Traditional precast concrete</b><br><br>Assumes 150mm thick concrete panel            | ●      | 126 - 219                                                     | <b>Aluminium rainscreen with SFS</b><br><br>Assumes 3mm thick semi-finished flat cladding | ●      | 124 - 319                                                     |
| Primary Façade Type                                                                                                                                                                        | Weight | Baseline A1-A3 Embodied Carbon Range [per m <sup>2</sup> FSA] | Primary Façade Type                                                                                                                                                       | Weight | Baseline A1-A3 Embodied Carbon Range [per m <sup>2</sup> FSA] | Primary Façade Type                                                                                                                                                          | Weight | Baseline A1-A3 Embodied Carbon Range [per m <sup>2</sup> FSA] |
| <b>Handset brick masonry with SFS</b><br><br>Assumes 103mm thick UK brick                               | ●      | 182 - 325                                                     | <b>Brick slip on metal rainscreen with SFS</b><br><br>Assumes 23mm thick UK brick slip | ●      | 204 - 432                                                     | <b>Aluminium stick curtain wall</b><br><br>Includes opaque insulated spandrel at slab   | ●      | 152 – 480<br>(100% Opaque)<br><br>158 – 312<br>(100% Glazed)  |

Figure 7—3 Early-stage façade upfront carbon estimates

The precast solution is a low embodied carbon option and interacts well with the structural solution and therefore does not have a negative impact on other discipline carbon targets. It was also chosen as it is a robust solution which, with good maintenance, is designed to last for the building design life.

The building also minimises internal finishes, with several areas where the concrete is exposed. This not only reduces upfront impacts but also reduces those elements that typically need replacing regularly over the life of a building. It also makes access to systems easier, thereby facilitating the ease of repair and maintenance.

### 7.1.5 Building services

Whilst the early stage analysis has been based on the RICS 2nd edition supplementary table, studies have been undertaken to reduce the impact of the building services. These include strategies to use low Global Warming

Potential (GWP) refrigerants, and exploring alternatives to traditional insulated galvanised steel ductwork and steel and copper insulated pipework. These studies will be further developed during detailed design.

#### **7.1.6 Embodied hierarchy for materials**

Section 7.1.3 provides details on the structural material choice for the development. Through the next stages the procurement of low carbon materials will be a key priority for the project in order to minimise its environmental impact. Clear contractor requirements will also be developed to ensure that the good design work is carried through into construction.

Section 8 describes in more detail how the project will seek to reduce its carbon impact going forward.

## 8 Further Whole Life Carbon Reduction Opportunities

### 8.1 Upfront embodied carbon (A1-A5) reduction opportunities

Significant design work has already occurred to prioritise a low carbon solution and onward optimisation will continue in the future stages, therefore improving against the baseline position will focus on betterment of material carbon performance. With regards to material specification, the current assessment is based on industry guidance. However, the ambition is to drive further conversations with manufacturers to procure low carbon materials and explore any emerging technologies, to reduce the embodied carbon. The recommendations will be communicated to the contractors in order to help them with material procurement.

This section provides a summary of strategies that are recommended to reduce the upfront embodied carbon of the project in order to be on track to reduce the upfront embodied carbon (A1-A5):

- **Low Carbon Steel Rebar in Superstructure and Substructure (-15 kgCO<sub>2</sub>/m<sup>2</sup>)**  
While the current assumptions are aligned with IStructE edition 3 guidance (<0.72 kgCO<sub>2</sub>/kg), lower carbon steel rebar can be procured from the market.
- **Low Carbon Concrete**  
While the current assumptions have been aligned with IStructE Edition 3 guidance (25% cement replacement), there is a recommendation to explore the use of further cement replacement in elements where technically feasible. It is worth noting that in 2023 a Joint Taskforce of the IStructE, Concrete Zero and MPA produced a paper that determined as GGBS is a constrained resource that is almost fully utilised globally, it should not be used unless technically required as it will have no global decarbonisation effect. Future best practice is likely to become the use of fly ash in the short term with a longer-term transition to calcined clay, though, in accordance with BS8500, the maximum current cement replacement allowance without GGBS is 55%.
- **Low Carbon Structural Steel Sections**  
While the current assumptions are aligned with IStructE Edition 3 guidance, lower carbon hot rolled open steel sections could be procured from the market.
- **Low Carbon Ductwork**  
Use of low carbon Ductwork in lieu of typical galvanized steel ductwork can help lower emissions.
- **Ensuring reuse of elements are carried through to construction**  
The current design makes use of reused materials, such as the external works pavers. These have conservatively been modelled as new for the purpose of this assessment however the team will continue to undertake the work to enable these reuse opportunities to be realised which can then be reflected in the assessment numbers.

### 8.2 Other upfront carbon opportunities

**Construction emissions (A5)-** Construction activity emissions include site investigations, temporary works, worker accommodation and any on-site electricity use, water use and fuel consumption. These should be monitored during construction to contribute to an accurate as-built embodied carbon calculation at project completion. However, in

absence of this information, 40 kg CO<sub>2</sub>e/m<sup>2</sup> GIA based on RICS 2nd Edition guidance, has been used. It must be noted that this value should be superseded with site-specific data when available. Therefore, it is recommended that energy efficient strategies are deployed during construction and less waste is generated to minimise the embodied carbon associated with module A5.

**Transport emissions (A4)**- Transport distances and carbon factors are currently based on RICS guidance, The project will aim to maximise selection of locally available materials and reducing the transport emissions.

### **8.3 Whole life embodied carbon (A-C, excluding B6, B7) reduction opportunities**

The focus to date has been on reducing the upfront embodied carbon of the building. The focus during later RIBA stages should also be on specifying materials that have a longer service life than the standard conservative assumptions, reducing the replacement cycles and therefore the replacement emissions.

#### **8.3.1 Service Life**

For module B4, replacement, at this stage in the design, reasonable service life periods have been assumed based on Table 20: Indicative component lifespans of the RICS 2<sup>nd</sup> edition. Based on previous project experience, these numbers tend to be slightly conservative, and we anticipate an increase in service lives and associated decrease in emissions when we work with specific manufacturers for construction. Preference should be given to products with longer service lives appropriate to that layer to minimise life cycle embodied carbon. The need to provide manufacturer specific EPDs will be a key criteria in the contractor requirements, to improve embodied carbon accuracy but also to determine more exact service lives.

#### **8.3.2 Maintenance and Repair**

At this stage in the design, for module B2, due to the lack of data, a total figure of 10 kgCO<sub>2</sub>e/m<sup>2</sup> GIA has been used to cover all building element categories as per the RICS methodology. The guidance has also been followed for module B3, where 25% of module B2 is taken – 2.5 kgCO<sub>2</sub>e/m<sup>2</sup> GIA.

In later phases, the team should work with the client to develop Operation & Maintenance (O&M) manuals for the development, clearly identifying the maintenance strategy for the building. From this, suitable scenarios for both maintenance and repair can be established. Again, from project experience we anticipate this to lead to a reduction in the carbon numbers.

#### **8.3.3 End of Life Scenarios**

The development has been designed for longevity, with the substructure and superstructure designed for a service life in excess of 60 years. However, when the end of life for elements does come, there is a strong ambition to enable easy disassembly and open up opportunities for reuse.

## 9 Conclusion

The whole life carbon analysis undertaken for Sister Plot C captures the impacts of the building elements at RIBA Stage 2 and follows the GMCA guidance.

The RIBA Stage 2 upfront embodied carbon (A1-A5) result is estimated to be **796 kg CO<sub>2</sub>e/m<sup>2</sup> GIA**, which meets the ID Manchester Limited upfront embodied carbon target of <800 kg CO<sub>2</sub>e/m<sup>2</sup> GIA. Measures have been identified to further reduce embodied carbon. These include procurement of low carbon materials and reuse of existing elements. Refinement of assumptions on transport distances, product service lives and end of life scenarios at later design stages may result in further reductions.

The whole life embodied carbon results of **Module A-C of 1,425 kg CO<sub>2</sub>e/m<sup>2</sup> GIA** (excluding B6 and B7, including sequestered carbon).

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