HODKINSON

Whole Life Cycle Carbon Emissions Assessment

Domvs London

52 Avenue Road

Final

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BSc (Hons), MSc, CEnv, MIEMA

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ABOUT HODKINSON CONSULTANCY

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry and tailor teams to suit each individual project.

We are able to advise at all stages of projects from planning applications to handover.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for quality and construction efficiency.

Executive Summary

This Whole Life Cycle Carbon Emissions (WLCCE) Assessment has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by Domvs London.

The purpose of this WLCCE assessment is to demonstrate that the proposed development at 52 Avenue Road has undertaken an initial assessment based on the information available to date which will need to be updated as the project progresses.

National Building Regulations and the Mayor's net zero-carbon target for new development account for a building's operational carbon emissions. As methods and approaches for reducing operational emissions have become better understood, and as targets have become more stringent, these emissions are now beginning to make up a declining proportion of a development's carbon emissions. Attention now needs to turn to WLCCE to incorporate embodied carbon emissions, enabling a better understanding of the environmental impact of the proposed development.

This WLCCE assessment is being undertaken in compliance with London Plan 2021 SI 2 *"Minimising Greenhouse Gas Emissions"* policy, the methodology has followed the principles of BS EN 15978 and has used both the GLA guidance and RICS as the methodology for assessment. This has been facilitated through the use of GLA approved One Click LCA software. WLCCE are the carbon emissions resulting from the construction and the use of a building over its entire life, through four stages described as life-cycle modules, shown in Figure i below;

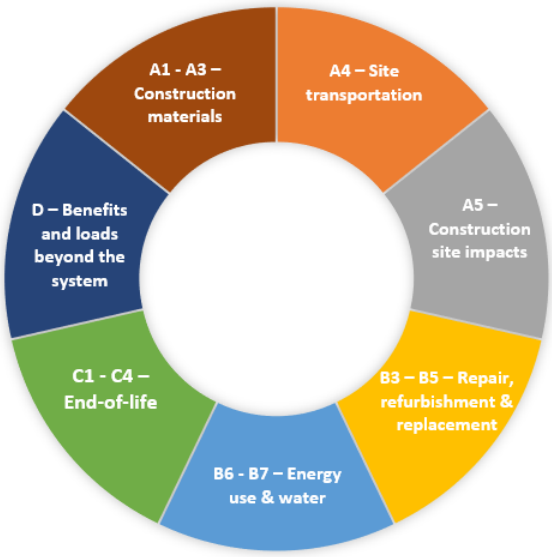

Figure i: Life cycle modules

They capture a building's operational carbon emissions from both regulated and unregulated energy use, as well as its embodied carbon emissions. Embodied emissions are those associated with raw material extraction, manufacture and transport of building materials, construction and the emissions associated with maintenance, repair, and replacement as well as dismantling, demolition, and eventual material disposal.

The assessment provides a picture of a building's carbon impact on the environment. The following table outlines the assumptions made within this WLCCE assessment:

Table i: WLCCE assumptions

Data	Data source
Material types and volumes (A1-A3)	Material types were taken from the cost plan provided by the applicant. Carbon Designer in One Click LCA was used to estimate material volumes based on building area. 95% of the cost allocated to each building element category has been accounted for in the assessment.
Transport data (A4)	Default values provided by One Click for construction traffic.
Construction site impacts (A5)	Site impacts were estimated based on a construction value provided by applicant and baseline target provided by BRE. Additional information on the excavation figures were provided via the cost plan.
Refrigerants (B1)	Refrigerant quantity has been estimated based on the use of R32 within the Ground Source Heat Pumps with an annual leakage rate of 5% and 10% end of life leakage (One Click defaults).
Maintenance (B2)	An assumption has been made regarding the ongoing water use for the window cleaning and roof maintenance. For module B2 emissions, a total figure of 10 $kgCO_2e/m^2$ (GIA) has been used to cover all building element categories. An additional allowance for the swimming pool has been included.
Repair and Replacement data (B3-B4)	Default values provided by RICS and One Click EPD database for products inputted into software.
Refurbishment (B5)	At present One Click does not have ways to consider B5 emissions. However, based on the information provided for B3 and B4 it is likely that these have emissions have been accounted for.
Operational energy (B6)	Regulated and unregulated annual energy consumption values obtained from the Energy Statement provided by Aval Consulting Group, October 2022.
Operational water (B7)	Water consumption based on Building Regulations Part G 'Enhanced Consumption' of 110 l/pp/d using dwelling numbers from the accommodation schedule.

Data	Data source
End of life (C1-C4)	Default values provided by One Click based on the information within the EPD database. Note that One Click reports all module C emissions as one figure, it is not yet able to split them across C1-C4.
Building areas	The total Gross Internal Floor Area (GIA) is 6, 552 m^2
Number of occupants	Approx. 72 occupants based on the accommodation schedule.
Assessment period	60 years

Based on the information provided to date, through the Stage One assessment, the total carbon emissions are expected to be 1,1005 $kgCO_2/m^2$ GIA over 60 years (including sequestered carbon) and 1,320 $kgCO_2/m^2$ GIA over 60 years (excluding sequestered carbon). **The expected total WLLCE are lower than the GLA WLC Benchmark for residential buildings, demonstrating that the development has taken account of relevant policy and reduced emissions as far as reasonably possible.**

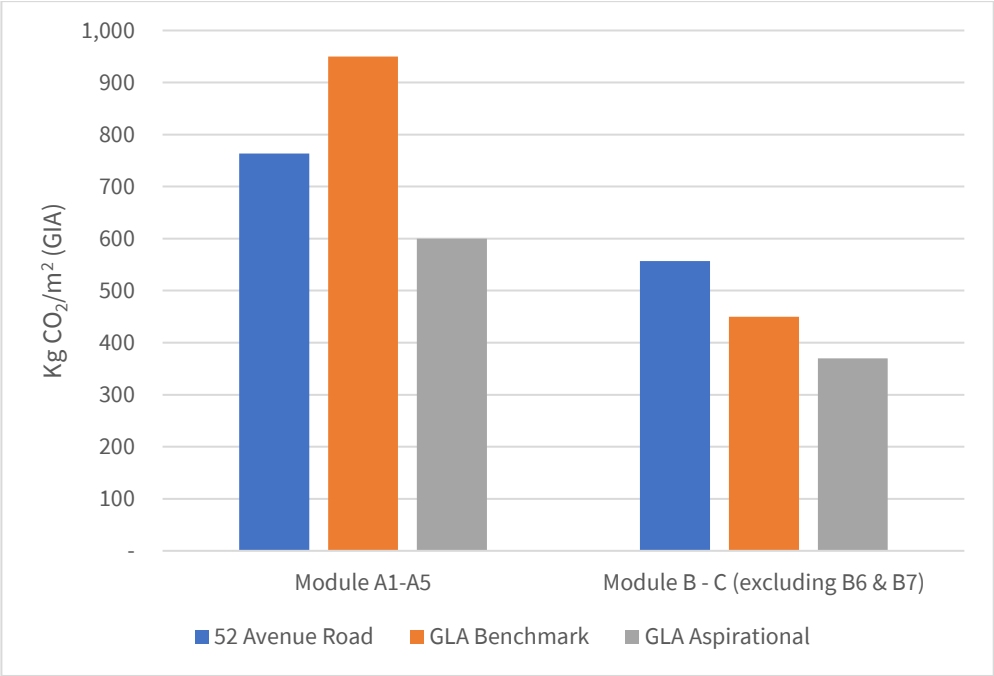

Figure ii: Total $kgCO_2$ /m^2 Gross Internal Floor Area (GIA) performance compared to GLA Benchmarks

A series of high-level opportunities to further reduce carbon emissions post planning have also been made. These measures will be looked at in detail in the next stage of the design development process and included, where possible. This will be secured through a post-construction assessment at planning determination.

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1. INTRODUCTION

1.1 This Whole Life Cycle Carbon Emissions (WLCCE) Assessment has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by Domvs London.

1.2 The purpose of this WLCCE assessment is to demonstrate that the proposed development at 52 Avenue Road has undertaken an initial assessment based on the information available to date which will need to be updated as the project progresses.

1.3 National Building Regulations and the Mayor's net zero-carbon target for new development account for a building's operational carbon emissions. As methods and approaches for reducing operational emissions have become better understood, and as targets have become more stringent, these emissions are now beginning to make up a declining proportion of a development's carbon emissions. Attention now needs to turn to WLCCE to incorporate embodied carbon emissions, enabling a better understanding of the environmental impact of the proposed development.

1.4 The assessment of the proposed development endeavours to help the design team understand, at concept design stage, the lifetime consequences of their design decisions. This report should be read in conjunction with the *'GLA Whole Life Carbon Assessment Template'* within **Appendix A.**

2. DEVELOPMENT OVERVIEW

Site Location

2.1 The proposed development site is located on the edge of Primrose Hill in the London Borough of Camden, as shown in Figure 1 overleaf.

Figure 1: Site Location – Map data © 2022 Google

2.2 The site is currently occupied by a disused two-storey detached residential dwelling arranged over basement, ground, and first floors, set within a large double corner plot.

Proposed Development

2.3 The proposed development is described as follows:

"Demolition of existing dwelling and erection of three, 3 storey buildings over part lower ground/basement, comprising a total of 12 townhouses (12 x 4 bed), together with associated landscaping improvements, restored access onto Avenue Road and on-site disabled parking"

2.4 Figure 2 below illustrates the proposed site layout.

Figure 2: Proposed Site Layout (Domvs London, April 2022)

2.5 The total Gross Internal Floor Area (GIA) is 6,554 m^2. The principles noted within this report apply to this GIA.

3. POLICY AND REGULATIONS

Regional Policy: The London Plan

London Plan (2021)

3.1 The London Plan sets out an integrated economic, environmental, transport and social framework for the development of London. The following policies are considered relevant to the Site.

Policy SI 2 Minimising Greenhouse Gas Emissions, states:

'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: Operational carbon emissions will make up a declining proportion of a development's whole life-cycle carbon emissions as operational carbon targets become more stringent. To fully capture a development's carbon impact, a whole life-cycle approach is needed to capture its unregulated emissions (i.e., those associated with cooking and small appliances), its embodied emissions (i.e., those associated with raw material extraction, manufacture and transport of building materials and construction) and emissions associated with maintenance, repair and replacement as well as dismantling, demolition and eventual material disposal). Whole life-cycle carbon emission assessments are therefore required for development proposals referable to the Mayor. Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life-cycle carbon assessments. The approach to whole life-cycle carbon emissions assessments, including when they should take place, what they should contain and how information should be reported, will be set out in guidance'.

Local Policy: Camden Borough Council Local Plan

3.2 The Camden Borough Council's Local Plan was adopted in July 2017. The following policies are considered relevant to the Site:

Policy CC1 Climate change mitigation states:

"The Council will require all developments to minimise the effects of climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction. Embodied carbon is the carbon impact associated with the production, transport, assembly, use, and disposal of materials. This Council will expect developers to consider the service life of buildings and their possible future uses to optimise resource efficiency. The durability and lifespan of the buildings' components should be matched to its likely service life, and where appropriate the building should be designed to be flexible in terms of adaptation to future alternative uses in order to avoid the need for future demolition. As part of the assessment of resource efficiency, all developments involving five or more dwellings are encouraged to assess the embodied carbon emissions associated with the development."

Guidance Documents

3.3 Guidance has been released by the Greater London Authority *"Whole Life-Cycle Carbon Assessments guidance – March 2022".* It outlines how to prepare a WLCCE assessment which should accompany all referable planning applications in line with London Plan Policy SI 2 *"Minimising Greenhouse Gas Emissions"*.

3.4 In addition to the GLA guidance the RICS Professional Statement Whole life carbon assessment (2017) was also used.

3.5 The above documents are used to complete the WLCCE assessment, further planning reports submitted alongside this report will also be used and/or referenced within this assessment, including:

> Energy Statement – AVAL Consulting Group (October 2022)

> Financial Viability Study – JLL (October 2022)

4. WHOLE LIFE CYCLE CARBON EMISSIONS ASSESSMENT

4.1 Undertaking WLCCE assessments is a way to fully understand and minimise the carbon emissions associated with building designs over the entire life cycle of the building. This will be done to quantify the WLCCE that will be released from the proposed development, considering not only operational and embodied emissions but also demolition, construction, and refurbishment/replacement cycles.

4.2 The London Plan requires all referable and major developments to calculate and reduce WLCCE, this is both embodied and operational carbon:

> **Operational carbon** is the energy required to heat and power a building;

> **Embodied carbon** is the carbon that is released in the manufacturing, production, and transportation of the building materials used.

4.3 In addition to the two metrics above there are additional life cycle stages that are considered during WLCCE assessments, these include demolition, end of life and refurbishment/replacement cycles.

4.4 The two metrics (operational and embodied) and the additional life cycle stages, as noted above, have been included in this WLCCE assessment as per GLA guidance.

4.5 Undertaking a WLCCE assessment provides a full overview of the material and construction of a building using science-based metrics whilst also identifying the overall best combined opportunities for reducing lifetime emissions, and also helps to avoid any unintended consequences of focusing on operational emissions alone.

Methodology

4.6 WLCCE assessments are sensitive to changes in design and specification and therefore detailed design will impact the results as the scheme progress. As noted in the GLA guidance, WLCCE assessments should be conducted at the following stages in order to maximise design efficiencies:

> Pre application.

> Stage 1 submission (RIBA 2/3).

> Post construction (RIBA 6).

4.7 This assessment is considered to be the Stage 1 submission.

4.8 A set of WLCCE benchmarks have been developed by the GLA in which applicants are required to compare against their own results as part of the assessment and which the GLA will refer to in its review of these assessments. An 'aspirational' set of benchmarks have also been devised for applicants that wish to go further. Both sets of benchmarks are included in this assessment are being reported on.

Study Period

4.9 The reference study period (RSP) is 60 years, this is based on the principles outlined in BS EN 15978: 2011, section 7.3 and the RICS guidance. RSPs are fixed to enable comparability between whole life carbon results for different projects. It ensures that the assessment is representative of typical service life of different building elements.

Operational Carbon

4.10 Operational energy is the inputted energy required for all heating and power needs. It can be split into two variants:

> **Regulated emissions** - which are assessed using the Government's approved methodology for Building Regulations Part L compliance, the Standard Assessment Procedure (SAP) for residential units; and

> **Unregulated emissions** – energy use as a direct result of user behaviour. This includes cooking, white goods (fridges, washing machines, etc), and plug-in electrical loads (televisions, laptops, lamps, etc).

4.11 Both of the above elements have been accounted for in this WLCCE assessment, these were provided by the Energy Specialist (Aval Consulting Group, July 2022). For clarity, as unregulated energy demands are largely reliant on the behaviour of occupants, they have been considered a fixed entity in the calculations in accordance with the guidance.

Energy calculations

4.12 The estimated annual energy demand for dwellings has been calculated using a combination of Standard Assessment Procedure (SAP) and iSBEM software methodology. The notional energy prediction for the proposed development used the dimensions of the proposed development, as well as notional U-values and heating specifications stated in the Buildings Regulations 2013. The notional energy prediction for the proposed development used the dimensions of the proposed development, as well as notional U-values and heating specifications stated in the Buildings Regulations 2013.

4.13 The proposed development's energy strategy prioritises demand reduction measures, by prioritising building fabric optimization to lessen the need for artificial lighting, heating, and cooling. performance.

Embodied Carbon

One Click LCA

4.14 OneClick LCA is the software that has been used to conduct the WLCCE assessment. This is a web based piece of design software for buildings and infrastructure approved for use by the GLA.

4.15 OneClick LCA consists of a large database of generic and average Life Cycle Indicator (LCI) data, and global Environmental Product Declaration (EPDs). The most suitable option for each material (where available) was chosen from the database in OneClick. The material LCI data has been chosen to be representative of the typical UK supply chain.

4.16 The life cycle stages (or modules) included within the WLCCE assessment as standard are shown in Figure 3 below.

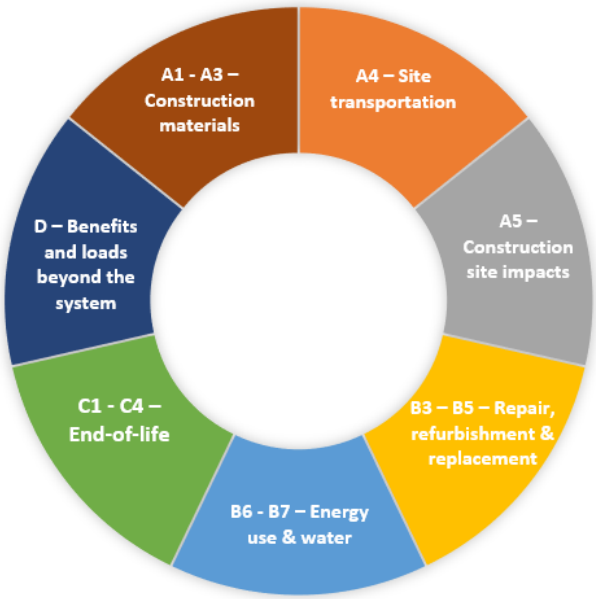

Figure 3: Life cycle stages

4.17 At this stage it is not expected that all the information will be available. Where this is the case, One Click has been used. As the design develops, we will update and refine the tool to reflect the quantity and types of materials being used.

Construction Impacts

4.18 In addition to embodied carbon in the materials used for construction, greenhouse gas (GHG) emissions will be created by transportation of materials to site and operation of onsite plant and machinery. Guidance from RICS indicates 1.4 tonnes of CO_2e per £100,000 of project value, this is further referenced and approved by the BRE.

4.19 An early-stage project value has been provided by the Applicant, which would result in construction transport GHG emissions of **854 tonnes of CO_2e**.

Potable Water Use

4.20 The carbon impact associated with water use during the operation of the proposed development is also required to be reported, in accordance with the RICS guidance. Water consumption is based on Building Regulations Part G 'enhanced consumption' of 110 litres/per person/per day (including external water use) and multiplied by the intended full occupancy of the development annually.

4.21 Approximately 72 occupants have been estimated, based on estimates in Accommodation Schedule. This gives an estimated **annual water consumption of 2,891 m^3** for the entire development for 60 years. An additional allowance has been added to the calculations for the ongoing water required for maintenance and for the swimming pool.

Carbon Sequestration

4.22 Sequestered carbon in timber has been included in the WLCCE assessment as all timber is assumed to be sustainably sourced.

Data Sources

4.23 The assessment has utilised multiple data sources described above and is based on the level of detail available at the current stage of design. The following data sources have been used:

Table 1: Data Sources

Data	Data source
Material types and volumes (A1-A3)	Material types were taken from the cost plan provided by the applicant. Carbon Designer in One Click LCA was used to estimate material volumes based on building area. 95% of the cost allocated to each building element category has been accounted for in the assessment.
Transport data (A4)	Default values provided by One Click for construction traffic.
Construction site impacts (A5)	Site impacts were estimated based on a construction value provided by applicant and baseline target provided by BRE. Additional information on the excavation figures were provided via the cost plan.
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Maintenance (B2)	An assumption has been made regarding the ongoing water use for the window cleaning and roof maintenance. For module B2 emissions, a total figure of 10 $kgCO_2e/m^2$ (GIA) has been used to cover all building element categories. An additional allowance for the swimming pool has been included.
Repair and Replacement data (B3-B4)	Default values provided by RICS and One Click EPD database for products inputted into software.
Refurbishment (B5)	At present One Click does not have ways to consider B5 emissions. However, based on the information provided for B3 and B4 it is likely that these have emissions have been accounted for.
Operational energy (B6)	Regulated and unregulated annual energy consumption values obtained from the Energy Statement provided by Aval Consulting Group, October 2022.

Data	Data source
Operational water (B7)	Water consumption based on Building Regulations Part G 'Enhanced Consumption' of 110 l/pp/d using dwelling numbers from the accommodation schedule.
End of life (C1-C4)	Default values provided by One Click based on the information within the EPD database. Note that One Click reports all module C emissions as one figure, it is not yet able to split them across C1-C4.
Building areas	The total Gross Internal Floor Area (GIA) is 6, 552 m^2
Number of occupants	Approx. 72 occupants based on the accommodation schedule.

4.24 For clarity, all assumptions made within the WLCCE assessment have been noted within this report. The assessment and comments made throughout should be taken within the context of carbon and energy use only.

5. WHOLE LIFE CYCLE CARBON RESULTS

5.1 As noted above, this is an initial assessment based on the best available information which will need to be updated as the project progresses in line with GLA requirements.

Benchmark Comparison

5.2 The results when compared to the GLA benchmark values, as noted in the GLA guidance note *"Whole Life-Cycle Carbon Assessments guidance –March 2022"* are shown in Table 2 below:

Table 2: Whole Life Carbon Baseline (GLA Guidance)

	Project kg CO_2/m^2	GLA WLC Benchmark	GLA Aspirational Benchmark
Modules A1 – A5 (excluding sequestered carbon)	764 kg CO_2e/ m^2 GIA	<850 kg CO_2e/ m^2 GIA	<500 kg CO_2e/ m^2 GIA
Modules B – C (excluding B6 and B7)	557 kg CO_2e/ m^2 GIA	<350 kg CO_2e/ m^2 GIA	<300 kg CO_2e/ m^2 GIA

	Project kg CO_2/m^2	GLA WLC Benchmark	GLA Aspirational Benchmark
Total for A – C (including sequestered carbon)	1,005 kg CO_2e/ m^2 GIA	<1200 kg CO_2e/ m^2 GIA	<800 kg CO_2e/ m^2 GIA

5.3 It must be noted that no benchmark has been set by the GLA for operational and energy use (life cycle stages B6-B7) due to insufficient data at present. The results for these have therefore been omitted from the totals above.

5.4 The total emissions, as demonstrated above, based on the GLA guidance is therefore **1,320 $kgCO_2/m^2$ GIA over 60 years (excluding sequestered carbon);** 764 $kgCO_2/m^2$ for modules A1-A5 and 556 $kgCO_2/m^2$ for modules B – C.

5.5 When operational energy and water emissions are included, the total emissions are expected to be **1,436 $kgCO_2/m^2$ GIA over 60 years.**

5.6 When sequestered carbon is taken into account the following figure becomes **1,121 $kgCO_2/m^2$ GIA over 60 years.**

5.7 A set of WLCCE benchmarks have been developed by the GLA in which applicants are required to compare against their own results as part of the assessment and which the GLA will refer to in its review of these assessments. An 'aspirational' set of benchmarks have also been devised for applicants that wish to go further. Both sets of benchmarks are included in this assessment are being reported on.

5.8 **The expected total WLLCE are lower than the GLA WLC Benchmark demonstrating that the development has taken account of relevant policy and reduced emissions as far as reasonably possible based on current information available, as shown in Figure 4.**

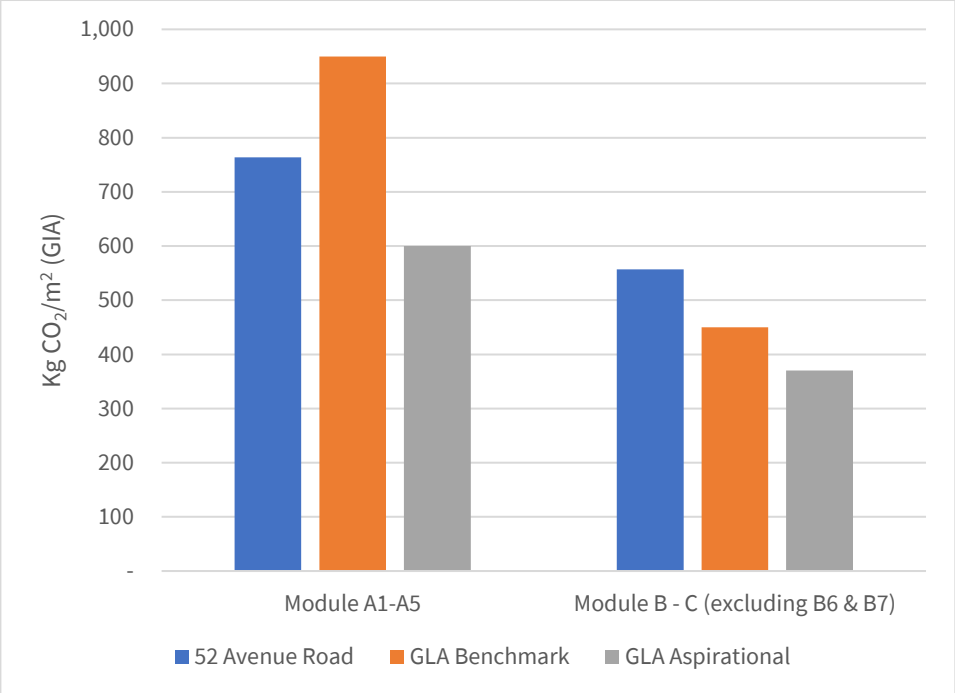

Figure 4: Total kgCO_2/m^2 GIA performance compared to GLA Benchmarks

5.9 These benchmarks will be subject to change as the WLCCE assessment gets updated in future. The full results are as follows:

Table 3: Full WLCCE Results

Category	Global warming potential	Total kgCO_2e over 60 years	Total kgCO_2e/m^2 GIA over 60 years
A1-A3	Construction Materials	4,067,530	620.62
A4	Transport	45,063	6.88
A5	Site operations	892,360	136.15
B1	In Use	78,401	11.96
B2	Maintenance	8,821	1.35
B3	Repair	130,092	19.85
B4	Replacement/Refurbishment	1,296,117	197.76
B6	Operational energy use	747,649	114
B7	Operational water use	14,112	2.15
C1-C4	End of life	2,136,491	325.98

	Total	**9,416,634**	**1,437**
Other	Carbon sequestration	-2,064,602	-315
	Total	**7,352,032**	**1,121**

5.10 **The operational energy (B6) makes up 8% of the overall emissions for the proposed development; 8% for regulated energy use and 0.013% for unregulated use. This is a low % due to the incorporation of the energy hierarchy measures which enables an overall 74.3 % reduction beyond Building Regulations. This is an exceedance of the requirements of the London Plan.**

5.11 Materials (A1 – A3) make up 43% of the overall emissions. This should be a key area in which focus is given to reduce embodied carbon. A focus on the materials being selected and reducing the quantities and mass of materials will be necessary in the next stage of the assessment.

5.12 10% of emissions are a result from the transport of materials to site from the factory and construction stages (A4 and A5), whilst this is small in comparison to elements it is still important to reduce transport emissions through the local sourcing of materials and to reduce consumption of energy and water during consumption, where possible.

5.13 There are also impacts, with the in-use life-cycle module B1-B5 making up approximately 16% of all embodied carbon emissions. This is primarily due to materials that will need replacing over the 60-year study period.

5.14 An overview of the percentage share of $kgCO_2e$ by life cycle stage is shown in Figure 5 below.

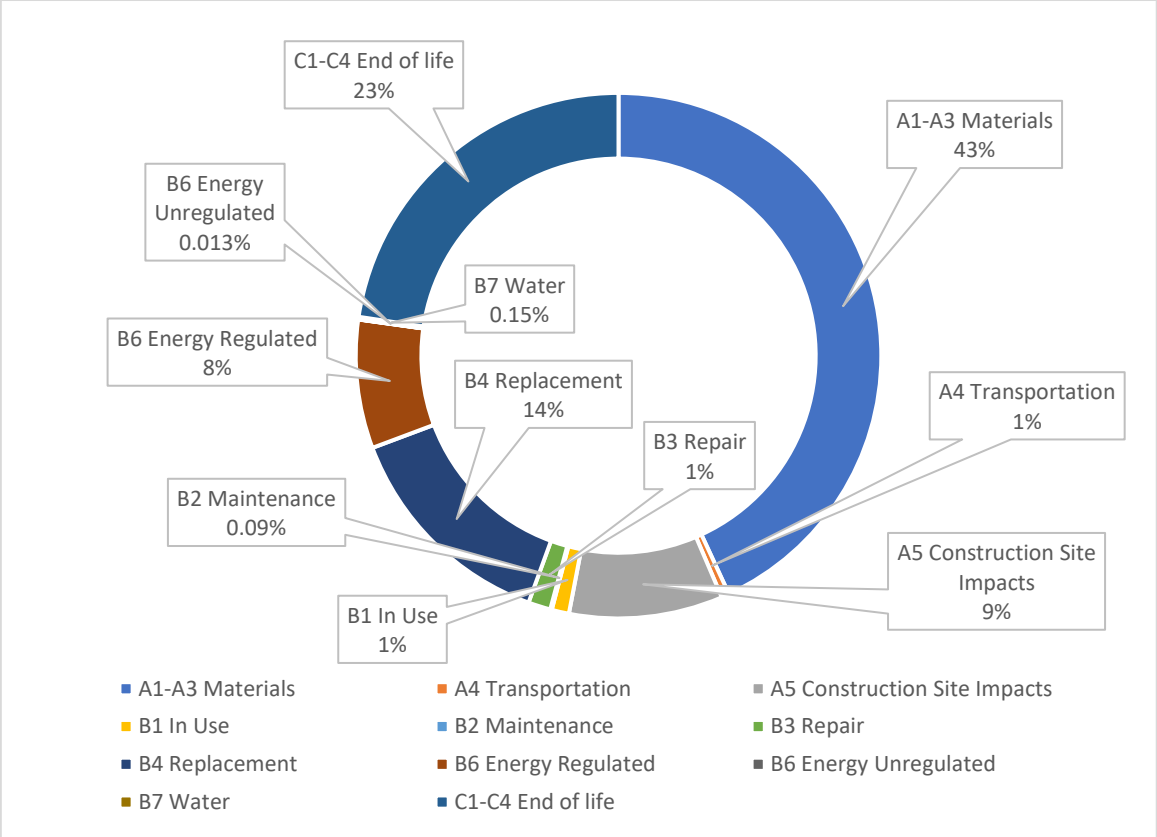

Figure 5: Percentage Share of Total $kgCO_2e$ - Life-cycle stages

6. OPPORTUNITIES

6.1 A set of opportunities are set out below that could be considered as a part of the detail design post planning to further reduce WLCCE. The opportunities presented below only account for reductions to carbon emissions. They are not considered as feasible options at this stage; they are opportunities that the design team could consider.

Reduced material use

6.2 The façade is under constant wear from the environment which can lead to frequent repairs and maintenance. By using **durable materials** for the extension, this not only reduces the cost and frequency of refurbishment but also reduces the use of material replacement and its associated carbon footprint.

6.3 Similarly, **an extensive maintenance and repair schedule** could also be produced during the design life of the development to ensure that specific materials and pieces of equipment are able to remain in situ during their expected lifespan. This will minimise the need to replace and refurbish

and reduce emissions under life cycle stages C1-C4. It is understood that this should be a relatively straight forward exercise given that a majority of the development will be constructed within a factory environment.

Recycled materials

6.4 At **end-of-life concrete can be completely recycled**. After demolition, concrete can be processed and used as recycled aggregate in fresh concrete. If the site is intended for new construction the demolished concrete can be crushed on-site and used onsite as hard core, fill, or in landscaping.

6.5 The design team are investigating the re-use of the existing materials. It is proposed that 100% of the existing development is to be reused. A 'crusher' will be bought on to site for the existing shell building (already stripped within) which will be used as a piling mat and then left in situ as an aquafying/drainage layer. This will be quantified at the next stage as the exact quantities of reuse are not available.

Sustainable procurement

6.6 In general, it is recommended to choose suppliers with established procedures for selection of EPDs and clearly specify products and manufacturers through the design stages.

6.7 To reduce the impacts of transport, locally sources material suppliers should be considered. Regarding recycled aggregates, they should be considered only when locally available due to the impact of transport of these materials.

7. CONCLUSION

7.1 This Whole Life Cycle Carbon Emissions (WLCCE) Assessment has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by Domvs London.

7.2 The purpose of this WLCCE assessment is to demonstrate that the proposed development at 52 Avenue Road has undertaken an initial assessment based on the information available to date which will need to be updated as the project progresses.

7.3 The total carbon emissions are expected to be 1,1005 $kgCO_2/m^2$ GIA over 60 years (including sequestered carbon) and 1,320 $kgCO_2/m^2$ GIA over 60 years (excluding sequestered carbon). **The expected total WLLCE are lower than the GLA WLC Benchmark for residential buildings, demonstrating that the development has taken account of relevant policy and reduced emissions as far as reasonably possible.**

7.4 A series of high-level opportunities to further reduce carbon emissions post planning have also been made. These measures will be looked at in detail in the next stage of the design development process and included, where possible. This will be secured through a post-construction assessment at planning determination.

APPENDICES

Appendix A – GLA Spreadsheet