Norman Disney & Young
A TETRA TECH COMPANY

105 JUDD STREET LTD

105 Judd Street

Whole Life Cycle Assessment

13 April 2022

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RECORD OF REVISIONS

Revision	Date	Amendment Details	Revision prepared by	Revision Approved by
1.0	28/02/2022	Draft for comments	Andrew Vann	Alex Mitchell
2.0	03/02/2022	Updated to incorporate comments	Andrew Vann	Alex Mitchell
3.0	15/03/2022	Appendixes added	Andrew Vann	Alex Mitchell
4.0	13/04/2022	Planning issue	Andrew Vann	Alex Mitchell

EXECUTIVE SUMMARY

Norman Disney & Young (NDY) has been appointed by 105 Judd Street Ltd ('the Applicant') to produce a Whole Life Cycle Carbon Assessment (WLCA) in support of the planning submission for 105 Judd Street, a commercial office building in the Bloomsbury Conservation Area.

The application seeks planning permission for the partial demolition and erection of extension at part third floor, fourth floor, fifth floor and rooftop plant in connection with the ongoing use of the building for commercial, business and service uses (Class E); associated external alterations to the elevations, improvements to the public realm and replacement of the existing ramp; roof terraces at levels three, four and five; provision of cycle parking, waste/recycling storage and other services; associated external alterations'..

A Whole Life Cycle Carbon Assessment (WLCA) of the proposed Development was carried out to evaluate the environmental impact of the proposed development during its life cycle. This study was undertaken in line with Policy SI2 of the London Plan, 2021. The WLCA is in line with the RICS methodology as presented in the RICS Professional Statement document (RICS PS) and the draft GLA guidance for whole life cycle carbon assessments (October 2020). This document should be read in conjunction with the Design Access Statement (Stiff + Trevillion) and the Circular Economy Statement (NDY).

Whole Life Carbon Assessment Results

Table 1 shows the WLCA results for all lifecycle stages. The total carbon resulting from the Judd Street development is 9,577 tCO_2 (1,075 $kgCO_2/m^2$), with most emissions arising from operational energy and water (34.2%) along with building services (29.1%). Operational emissions (stages B6 & B7) amount to 3,277 tCO_2 (368 $kgCO_2/m^2$), this is derived from an energy use intensity of approximately 109 kWh/m^2. Embodied emissions amount to 6,300 tCO_2 (707 $kgCO_2/m^2$) with a majority of these emissions associated with ductwork and refrigerants in building services.

Table 1: Life Cycle Carbon Results ($kgCO_2/m^2$) across all life cycle stages by building category

Building Category	tCO_2e	$kgCO_2e/m^2$	%
1 Substructure	626	70.3	6.5%
2 Superstructure	1,099	123.4	11.5%
2 Facade	255	28.6	2.7%
2 Internal Elements	0	0.0	0.00%
3 Finishes	1,094	122.9	11.4%
5 Services (MEP)	2,791	313.5	29.1%
Site	434	48.7	4.5%
Energy and water	3,277	368	34.2%
Total	**9,577**	**1,075**	**100%**
Embodied Carbon	6,300	707.4	66%
Operational Carbon	3,277	368.0	34%

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

Figure 1 shows the WLCA results by building category and material for all embodied life cycle stages (stages A-C excluding B6&B7). The results show that most of the carbon impacts can be attributed to building services (313 $kgCO_2/m^2$), where HVAC equipment (particularly ductwork) comprises the majority of carbon emissions (147 $kgCO_2/m^2$) due to the high carbon intensity of galvanised steel. Emissions arising from refrigerant use also has a significant impact on results, amounting to 59 $kgCO_2/m^2$.

The superstructure and finishes are the next highest contributors to embodied carbon emissions at around 123 $kgCO_2/m^2$ each. Carbon in the superstructure is attributed to structural steel and precast concrete (51 $kgCO_2/m^2$ and 35 $kgCO_2/m^2$ respectively), while carbon in the finishes is attributed to raised access floors and galvanised steel in the framing for plasterboard (59 $kgCO_2/m^2$ and 52 $kgCO_2/m^2$ respectively).

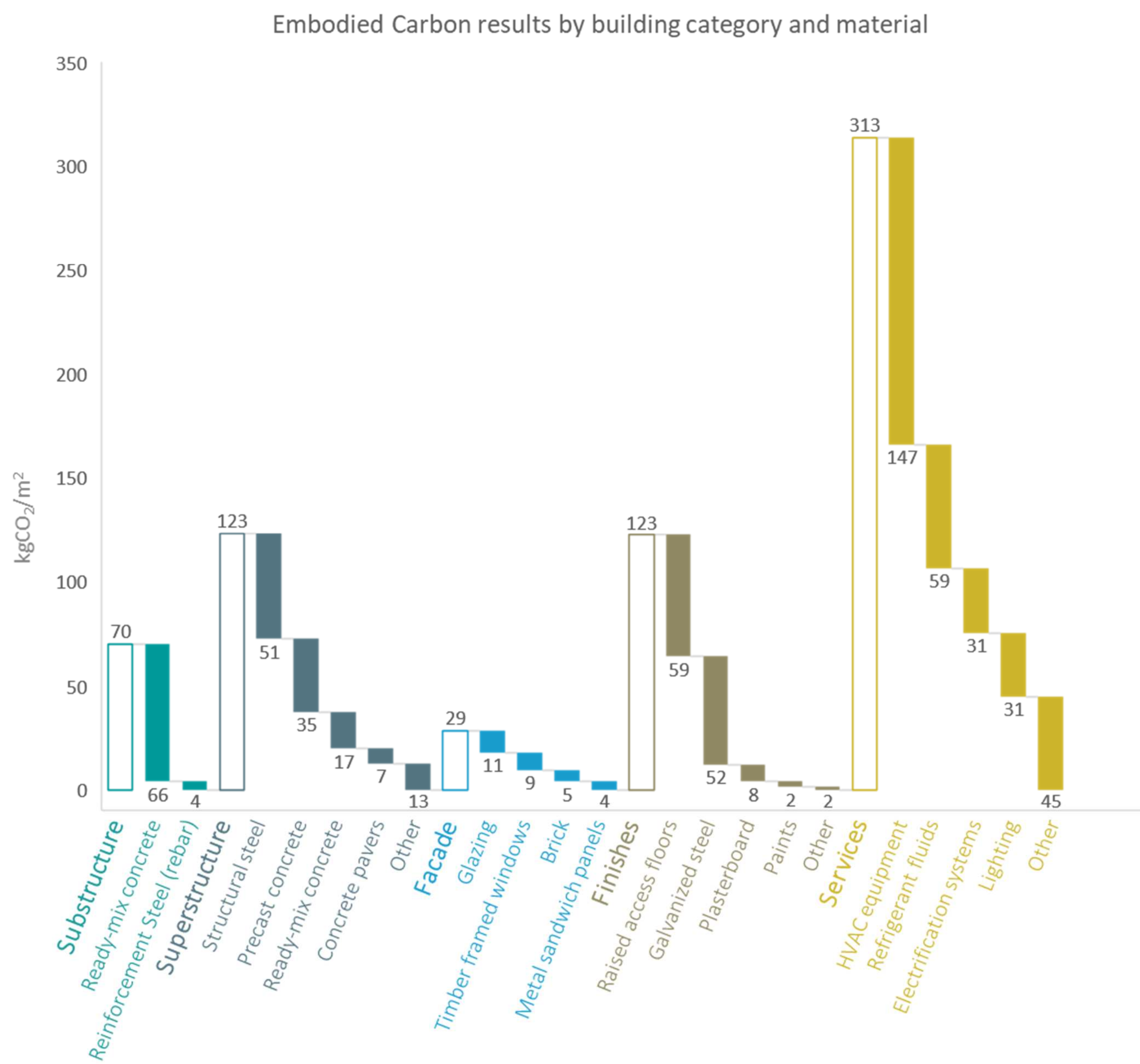

Figure 1: Life Cycle Carbon Results ($kgCO_2/m^2$) by building category and material

Comparison to the WLC Benchmark

Figure 2 shows a direct comparison between the WLCA results for the Development and the WLC benchmark and WLC Aspirational benchmark for stages A-C (excluding B6 & B7). The development performs better than the benchmark overall, with a 52.8% reduction and a carbon value of 707 $kgCO_2/m^2$. The development also compares better than the WLC aspirational benchmark, with a 21.4% decrease. The improvement in performance is due to the significant amount of structure that has been retained for this development.

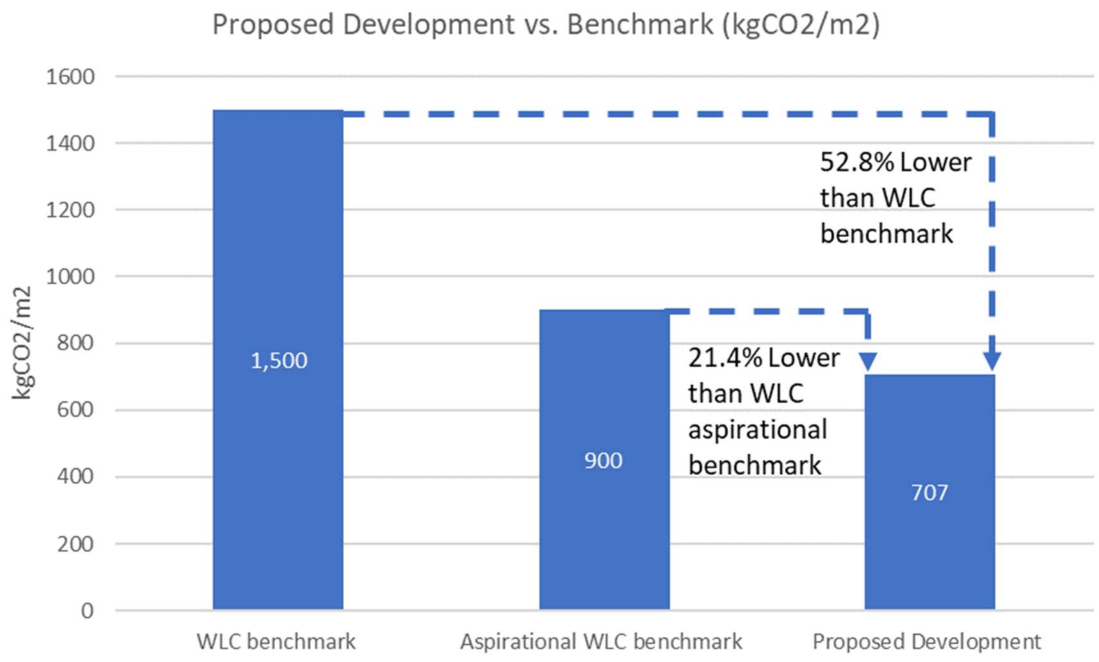

Figure 2: Comparison of the Development to the GLA benchmark ($kgCO_2/m^2$)

Actions taken to reduce carbon

Actions to reduce the whole life emissions of the proposed Development have been implemented in the design in line with the draft GLA whole life cycle carbon assessments guidance. The key actions taken to date include:

- Retention of building elements
- Fabric first approach to operational energy reductions
- GGBS in concrete (50-70%)
- 56% recycled steel content for structural stee sections

1 INTRODUCTION

Norman Disney & Young (NDY) has been appointed by 105 Judd Street Ltd ('the Applicant') to produce a Whole Life Cycle Carbon Assessment (WLCA) in support of the planning submission for 105 Judd Street, a commercial office building in the Bloomsbury Conservation Area.

The application seeks planning permission for the partial demolition and erection of extension at part third floor, fourth floor, fifth floor and rooftop plant in connection with the ongoing use of the building for commercial, business and service uses (Class E); associated external alterations to the elevations, improvements to the public realm and replacement of the existing ramp; roof terraces at levels three, four and five; provision of cycle parking, waste/recycling storage and other services; associated external alterations'.

A Whole Life Cycle Carbon Assessment (WLCA) of the proposed Development was carried out to evaluate the environmental impact of the proposed development during its life cycle. This study was undertaken in line with Policy SI2 of the London Plan, 2021. The WLCA is in line with the RICS methodology as presented in the RICS Professional Statement document (RICS PS) and the draft GLA guidance for whole life cycle carbon assessments (October 2020). This document should be read in conjunction with the Design Access Statement (Stiff + Trevillion) and the Circular Economy Statement (NDY).

1.1 Project Background

The project team has engaged with carbon as a sustainability opportunity throughout the design stage. The primary action taken in the design is the prioritisation of a 'retention over demolition/reuse over replace' approach to materials. This has led to a significant portion of the building being retained, leading to lower carbon emissions and waste than a full new-build approach.

1.1.1 Circular economy

Circular economy principles have been considered strongly through the following actions, which are detailed in the Circular Economy Statement provided by NDY. Emissions and savings associated with these actions are not captured in the results of this report but are discussed in section '3.7 Stage D emissions'. The following actions in particular influence materiality and the carbon emissions for the development:

- Rationalised column grid and floorplate flexibility to allow for an adaptable space
- An efficient and rationalised core and structural frame
- Potential prefabrication of brick & pier cladding
- Retention of existing foundations

1.2 Assessment Background and Features

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

1.2.1 Data Collection method

An RFI was issued to the design team requesting material quantities necessary to conduct the WLCA, with the team informed that the following hierarchy of data sources would be appropriate:

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

Given the early project stage, estimates (option 4) have been used to complete the RFI, and have been completed at a high level (bulk quantities and averages have been given for all items with conservative assumptions). Architectural information has been provided by Arcadis (Quantity Surveyor), and MEP and Structural information has been provided by NDY and HTS with support from Arcadis.

1.2.2 Operational energy (stage B6)

An operational energy modelling exercise has been undertaken following the CIBSE TM54 methodology in line with the local planning policies and the GLA requirements. The results of this energy model have been used to inform operational energy figures for this report, with an Energy Use Intensity of 109 kWh/m^2.

This WLCA is based on the status of the electricity grid, with decarbonisation accounted for in line with RICS PS using the National Grid Future Energy Scenario 2020. The resulting WLC emissions figures form the basis for the design decisions. Decarbonisation is only relevant to emissions that will arise in the future, i.e. during the In-use and End of Life (EoL) of a project – i.e. stages (B) and (C), and it can affect the carbon figures considerably. Therefore, decarbonisation factors are applicable to operational emissions (B6) and (B7) and to the carbon savings in module (D), as these are the areas decarbonisation is expected to have the highest impact. Results for operational carbon without decarbonisation are presented as a part of the GLA template in Appendix 1.

1.2.3 Operational water (stage B7)

The annual water demand has been calculated in accordance with the RICS PS and is based on:

- The anticipated occupancy schedule of a typical office development e.g. 260 days per annum; and
- Water demand values provided by the 'BSRIA Rules of thumb – Guidelines for the building services, 5th edition'.

1.2.4 Material selection and inputs

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

1.2.5 Steel recycling and concrete replacements

Assumptions around steel recycling and cement replacement rates have been provided by HTS and are as follows:

- 70% GGBS replacement in concrete foundations
- 50% GGBS in superstructure concrete
- 54% GGBS in steel (assessed as 40% due to lack of a closer, conservative proxy)

1.2.6 Decarbonisation

The figures throughout the report show the primary assessment for this development which uses the National Grids Future Energy Scenario (FES) to apply decarbonised figures to the operational energy consumption across the building's 60 year life (equivalent to 'assessment 2' in the GLA template). This is done following the RICS PS guidance and is calculated in OneClick LCA. Carbon figures that do not apply a decarbonised emissions profile are provided in the GLA template in Appendix 1.

1.2.7 Naming conventions for 2. Superstructure

Building categories are determined by the NRM 1 which is the recommended system under the RICS PS guidance. For the superstructure, certain sub-categories can be bundled together and are worth distinguishing from one another. For these sub-categories, the report will use alternative nomenclature throughout for clarity, this is as follows:

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

- Hereby referred to as **"Superstructure"**

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

- Hereby referred to as **"Façade"**

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

- Hereby referred to as **"Internal Elements"**

2 ASSESSMENT SCOPE

2.1 Life Cycle Stages

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

As seen in Figure 3 this assessment covers all life cycle stages A-C. Stage D, which is excluded from figures in this report (unless explicitly stated), relates to circular economy principles that can be found in the Circular Economy Statement (NDY).

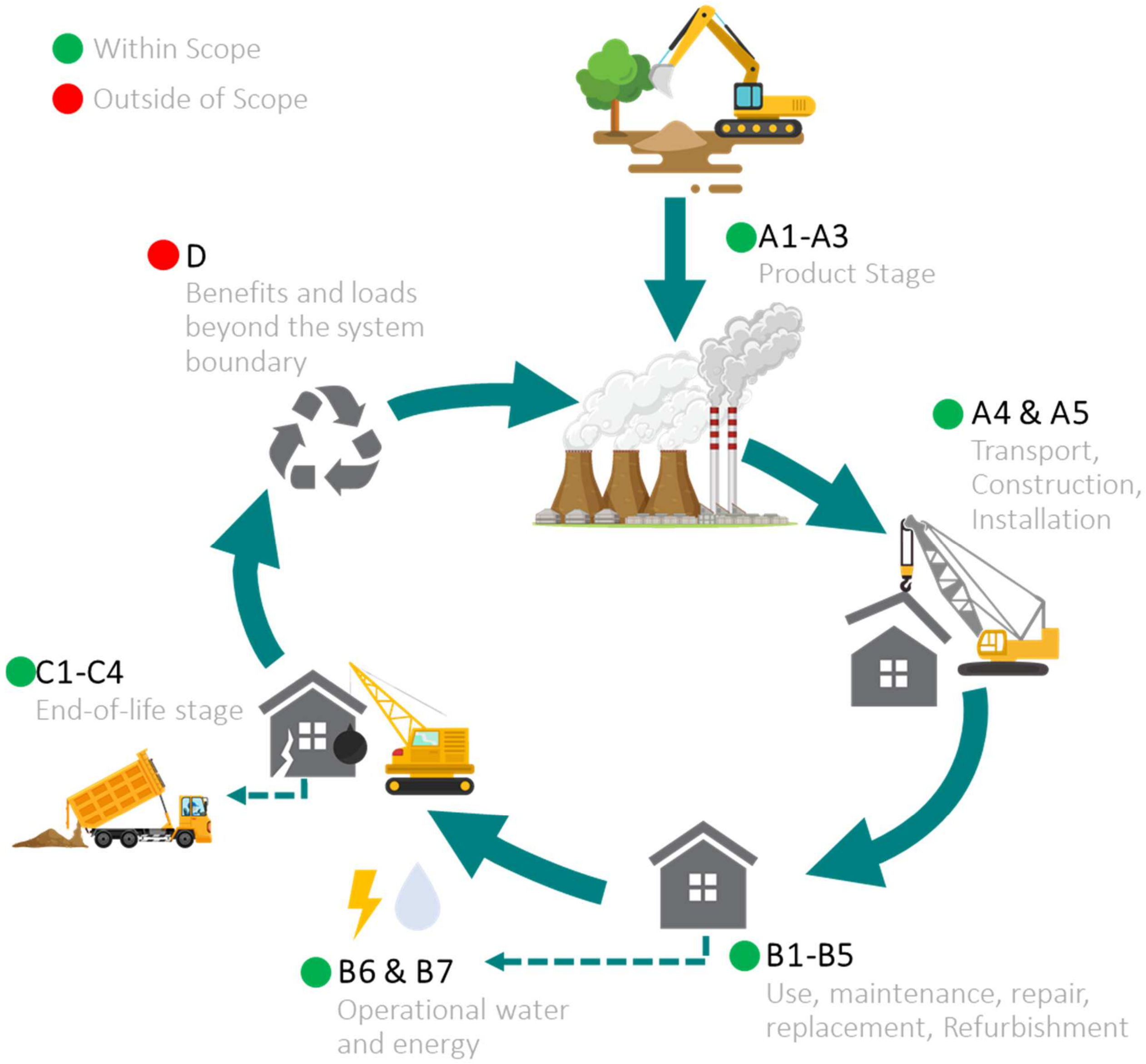

Figure 3: Scope of life cycle stages covered in this assessment

2.2 Building Elements

The WLCA includes all building elements listed in Table 2 that are applicable to the Development. The building elements are broken down according to the RICS New Rules of Measurement (NRM) classification system level 2 sub-elements. This development has new-build and refurbishment elements and material quantities provided relate to a fit-out delivered to Cat A.

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

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

3 RESULTS

3.1 Result Summary

shows the WLCA results for all lifecycle stages. The total carbon resulting from the Judd Street development is 9,577 tCO2 (1,075 kgCO2/m2), with most emissions arising from operational energy and water (34.2%) along with building services (29.1%). Operational emissions (stages B6 & B7) amount to 3,277 tCO2 (368 kgCO2/m2), this is derived from an energy use intensity of approximately 109 kWh/m2. Embodied emissions amount to 6,300 tCO2 (707 kgCO2/m2) with a majority of these emissions associated with ductwork and refrigerants in building services.

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

Building Category	tCO_2e	$kgCO_2e/m^2$	%
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Site	434	48.7	4.5%
Energy and water	3,277	368	34.2%
Total	**9,577**	**1,075.4**	**100%**
Embodied Carbon	6,300	707.4	66%
Operational Carbon	3,277	368.0	34%

3.2 Detailed Embodied Carbon Breakdown by Category and Material

Figure 4 shows the WLCA results by building category and material for all embodied life cycle stages (stages A-C excluding B6&B7). The results show that most of the carbon impacts can be attributed to building services (313 $kgCO_2/m^2$), where HVAC equipment (particularly ductwork) comprises the majority of carbon emissions (147 $kgCO_2/m^2$) due to the high carbon intensity of galvanised steel. Emissions arising from refrigerant use also has a significant impact on results, amounting to 59 $kgCO_2$/m2.

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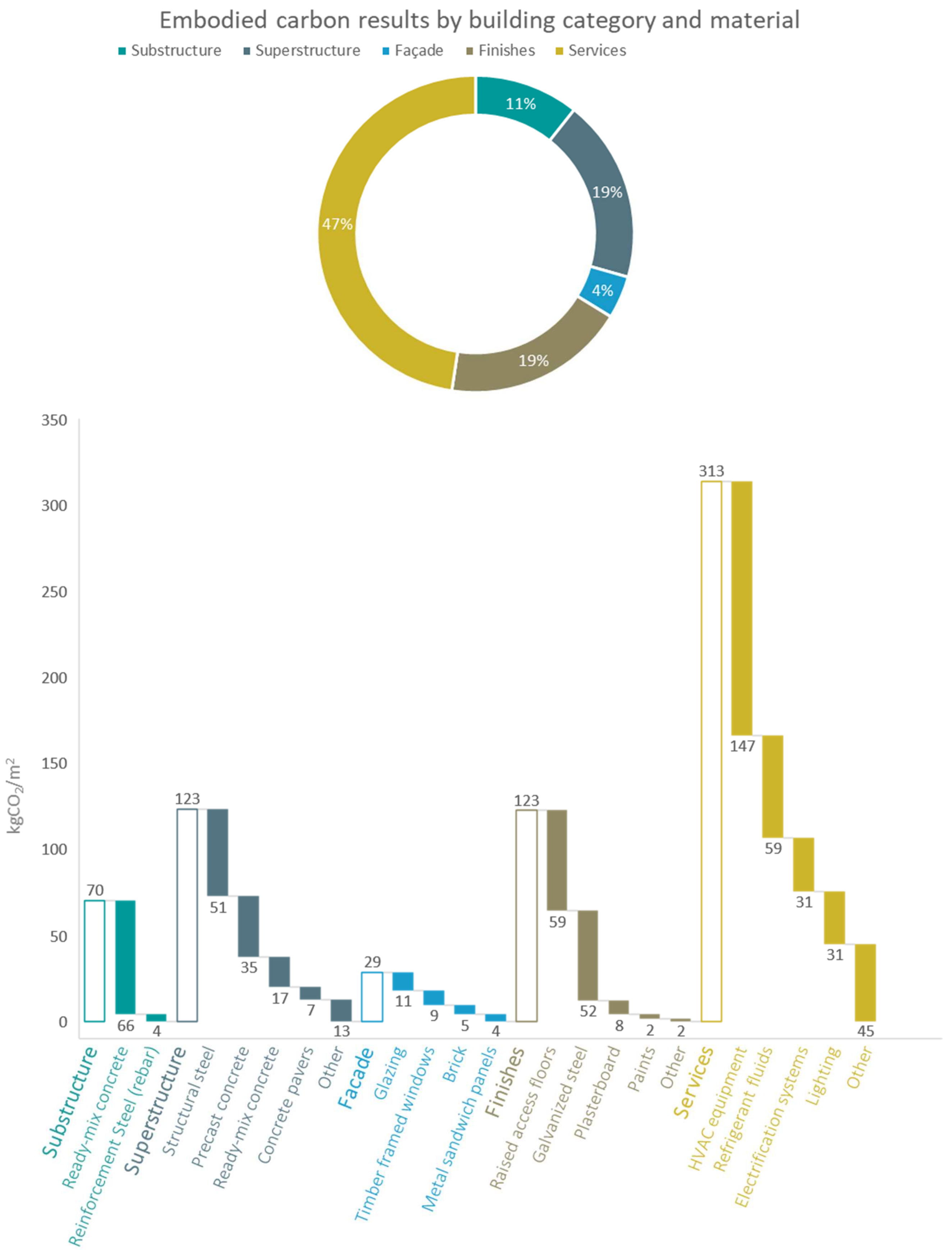

Figure 4: Breakdown of embodied carbon by building category and material ($kgCO_2/m^2$)

3.3 LCA Results by Stage

Figure 5 shows the lifecycle carbon by stage, excluding operational stages B6 & B7. The largest impacts come from Stages A1-A3 (257 $kgCO_2/m^2$) which is associated with upfront material extraction, manufacture, and transport. Emissions in stage B4 are also significant (230 $kgCO_2/m^2$), as this represents the replacement of materials throughout the building life-cycle. Stage B4 emissions are mostly represented by the replacement of ductwork and MEP equipment over the 60 year life.

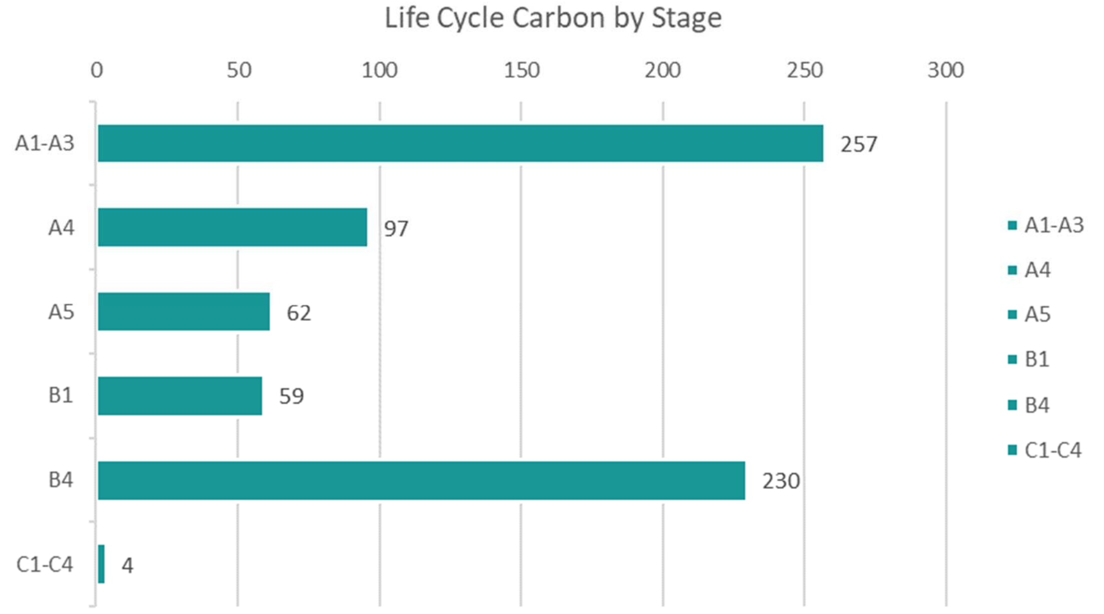

Figure 5: Carbon by life cycle stage (excluding B6 & B7)

3.4 Comparison to the WLC Benchmark

This section presents the comparison of the WLCA results against the GLA WLC benchmarks in accordance with the draft GLA whole life cycle carbon assessments guidance (October 2020). Table 4 and Figure 6 below present the performance of the Development against the current and aspirational WLC targets set by the GLA.

Table 4: Comparison between the development, WLC benchmark, and Aspirational WLC benchmark

	WLC benchmark kgCO2e/m2 (GIA)	Aspirational WLC benchmark kgCO2e/m2 (GIA)	Proposed Development kgCO2e/m2 (GIA)
Modules A1-A5	900 to 1,000	550 to 600	428.2
Modules B – C (excluding B6 & B7)	400 to 500	250 to 300	421.5

Figure 6 shows a direct comparison between the WLCA results for the Development and the WLC benchmark and WLC Aspirational benchmark for stages A-C (excluding B6 & B7). The development performs better than the benchmark overall, with a 52.8% reduction and a carbon value of 707 $kgCO_2/m^2$. The development also compares better than the WLC aspirational benchmark, with a 21.4% decrease. The improvement in performance is due to the significant amount of structure that has been retained for this development.

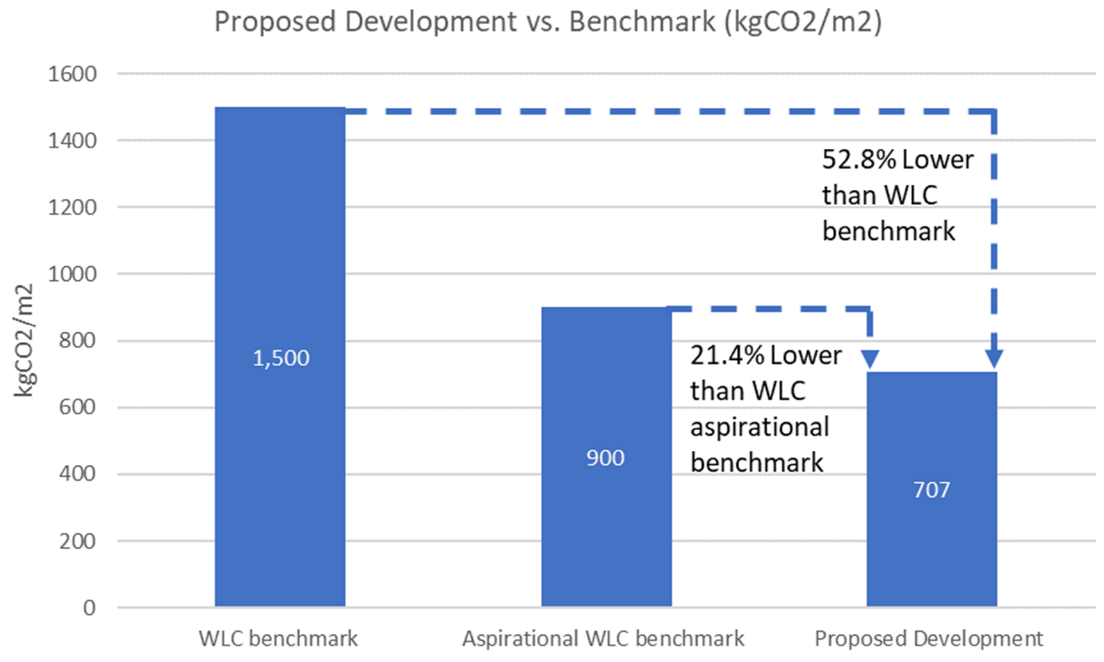

Figure 6: Comparison with GLA WLC and aspirational benchmarks

The draft GLA whole life carbon cycle assessments guidance document also provides a typical breakdown of the typical development's emissions by each building element. These are presented in Table 5.

Table 5: Breakdown of Comparison with the WLC benchmarks (excluding modules B6, B7 and site emissions)

	WLC benchmark ($kgCO_2e/m^2$ GIA)	Aspirational WLC benchmark ($kgCO_2e/m^2$ GIA)	Proposed Development ($kgCO_2e/m^2$ GIA)
Modules A1-A5			
Substructure	180 -200	110-120	69.8
Superstructure	504-560	308-336	132.5
Finishes	72-80	44-48	67.4
FF&E	18-20	11-12	0.0
Services (MEP)	117-130	71.5-78	95.9
External works	9-10	5.5-6	48.7
Modules B – C (excluding B6 & B7)			
Substructure	4-5	2.5-3	0.5
Superstructure	104-130	65-78	19.5
Finishes	108-135	67.5-81	55.5
FF&E	36-45	22.5-27	0.0
Services (MEP)	140-175	87.5-105	217.6
External works	8-10	5-6	0.0

3.5 Actions taken to reduce carbon

Actions to reduce the whole life emissions of the proposed Development have been implemented in the design in line with the draft GLA whole life cycle carbon assessments guidance. The key actions taken to date include:

- Retention of building elements
- Fabric first approach to operational energy reductions
- GGBS in concrete (50-70%)
- 56% recycled steel content for structural stee sections

3.6 Stage D emissions

Stage D emissions are equal to -79 $kgCO_2/m^2$ much of which is associated with the use of materials such as steel which have high potential for recycling and reuse. The capacity for the project to realise these emissions is covered in detail in the Circular Economy Statement (NDY). Overall, the development has worked to reduce material use and design for adaptability and disassembly in a way that makes these emissions savings achievable. The major actions that can be undertaken to realise these savings are:

- Rationalised column grid and floorplate flexibility to allow for an adaptable space
- An efficient and rationalised core and structural frame
- Potential prefabrication of brick & pier cladding
- Retention of existing foundations

4 CONCLUSION

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

The WLCA was undertaken in accordance with the RICS methodology and in line with the draft GLA guidance for whole life cycle carbon assessments (October 2020).

The whole life cycle impact related with the proposed Development has been estimated to be 9,577 tCO_2e over a 60-year period. The largest contributor is operational energy and water at 34.2% of total impacts (368 $kgCO_2e/m^2$).

The breakdown of the embodied carbon over the life cycle showed that the building's building services as the most carbon intensive category at 29.1% of total carbon (313.5 $kgCO_2e/m^2$), with refrigerant fluids and ductwork acting as the primary drivers of carbon in that category.

4.1 Actions taken to reduce WLC emissions of the proposed Development

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

- CLT Structure for the extension structure
- Procure 100% green tariff energy for construction works
- Procure modular and prefabricated materials where possible
- Investigate use of alternative MEP equipment to avoid use of R410a refrigerant
- Explore alternative ductwork distribution

4.2 Comparison with the WLC benchmarks developed by the GLA

As part of this WLCA the results have been compared against the GLA benchmarks in accordance with the draft GLA whole life cycle carbon assessment guidance (October 2020), in order to have a realistic prospect of achieving net zero carbon for the whole UK building stock by 2050.

The benchmark comparison highlighted that the whole life carbon of the proposed Development (stages A-C, excluding B6 and B7) is lower compared to the current WLC benchmark dictated by the draft GLA guidance. In particular, the proposed Development is expected to have an embodied carbon impact 52.8% lower than the current WLC benchmark and an impact 21.4% lower than current WLC aspirational benchmark (Figure 2).

APPENDIX 1

Project details	
Project name	105 Judd Street
Planning application reference number (if applicable)	
Use Type	E
Brief description of the project	The application seeks planning permission for the partial demolition and erection of extension at part third floor, fourth floor, fifth floor, and rooftop plant in connection with ongoing use of the building for commercial, business, and service uses (Class E).
GIA (m^2)	8905
Authors (organisation or individuals)	
Date of assessment	28/02/2022
Nationally recognised assessment method used	BS EN 15978, with additional guidance from RICS Professional Statement
Reference study period (if not 60 years)	[This cell should only be filled in if the reference study period, i.e. the assumed building life expectancy, exceeds or is less than 60 years. Applicants should state the reference study period in this cell. While the assessment should still be done to 60 years, applicants may, if they choose to, submit an additional assessment of the modules B, C and D for the actual reference study period by copying and pasting an additional 'GWP potential for all life-cycle modules' table, see below].
Software tool used	OneClick LCA
Source of carbon data for materials and products	As per RICS guidance using
EPD database used	OneClick LCA Database

Estimated WLC emissions (Assessment 1)
N.B. This forms the WLC baseline for the development. The results from Assessment 1 below are automatically populated here.

	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
TOTAL kg CO_2e	3,689,560 kg CO2e	2,835,450 kg CO2e	10,004,145 kg CO2e	33,499 kg CO2e	-809,443 kg CO2e
TOTAL kg CO_2e/m^2 GIA	414.324502	318.4109714	1123.430057	3.761771477	-90.89754183
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 1 was used to inform design decisions					

Estimated WLC emissions (Assessment 2)
N.B. The results from Assessment 2 below are automatically populated here.

	Module A1-A5	Module B1-B5	Module B6-B7	Module C1-C4	Module D
TOTAL kg CO_2e	3,689,560 kg CO2e	2,576,732 kg CO2e	3,277,052 kg CO2e	33,499 kg CO2e	-718,930 kg CO2e
TOTAL kg CO_2e/m^2 GIA	414.32	289.36	368.00	3.76	-80.73
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 2 was used to inform design decisions	The development is lower than the benchmark mainly due to the retention of existing structures and building components along with a rationalised design that is built for flexibility				

Key site opportunities and constraints in reducing WLC emissions	Whole life carbon opportunities have been taken advantage of primarily in the form of retaining much of the existing building structure and components.

Summary of key actions to reduce whole life-cycle carbon emissions that have informed this assessment, including the WLC reductions	Action	WLC reduction (kg CO_2e/m^2 GIA)
	Retention of majority of existing building	220
	GGBS procurement for concrete	16
	High recycling rate for procured steel	20

Specify further opportunities to reduce the development's whole life-cycle carbon emissions. including the WLC reduction potential	Further potential opportunities	WLC reduction potential (kg CO_2e/m^2 GIA)
	CLT structure for extension structure	~110
	Procure 100% green tariff energy for construction	~62
	Procure modular and prefabricated materials	
	Alternative MEP strategies / refrigerant specification	

MATERIAL QUANTITY AND END OF LIFE SCENARIOS		Product and Construction Stage (Module A)		Assumptions made with respect to maintenance, repair and replacement cycles (Module B)	Material 'end of life' scenarios (Module C)	Benefits and loads beyond the system boundary (Module D)	
Building element category		Material type	Material quantity (kg)			Estimated reusable materials (kg)	Estimated recyclable materials (kg)
	Note/example	Breakdown of material type in each category [Insert more lines if needed] e.g. Concrete	65000 kg	For all primary building systems (structure, substructure, envelope, MEP services, internal finishes)	Declare 'end of life' scenario as per project's Circular Economy Statement	0 kg	25 kg
		e.g. Reinforcement	5000 kg			2 kg	8 kg
		e.g. Formwork	250 kg			0 kg	0 kg
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment						
0.2	Major Demolition Works						
0.3	Temporary Support to Adjacent Structures						
0.4	Specialist Ground Works						
1	Substructure	Ready-mix concrete for external walls and floors	1,412,064 kg	60 years	Concrete crushed to aggregate (for sub-base layers), Portland Cement 300 kg / m3	1,412,064 kg	
		Reinforcement for concrete (rebar)	67,508 kg	60 years	Steel recycling		67,508 kg
2.1	Superstructure: Frame	Ready-mix concrete for external walls and floors	21,000 kg	60 years	Concrete crushed to aggregate (for sub-base layers), Portland Cement 300 kg / m3	21,000 kg	
		Reinforcement for concrete (rebar)	14,880 kg	60 years	Steel recycling		14,880 kg
		Structural steel and steel profiles	189,970 kg	60 years	Steel recycling		189,970 kg
2.2	Superstructure: Upper Floors	Concrete slabs (hollow and solid)	680,022 kg	60 years	Rebar separated (2 %), concrete to aggregate	680,022 kg	
		Hot-dip galvanized/zinc coated steel	14,563 kg	60 years	Steel recycling		14,563 kg
		Ready-mix concrete for external walls and floors	336,120 kg	60 years	Concrete crushed to aggregate (for sub-base layers), Portland	336,120 kg	
		Reinforcement for concrete (rebar)	49,239 kg	60 years	Steel recycling		49,239 kg
2.3	Superstructure: Roof	Brick, common clay brick	151,500 kg	30 years	Brick/stone crushed to aggregate (for sub-base layers)	151,500 kg	
		Other precast concrete products	324,000 kg	30 years	Rebar separated (2 %), concrete to aggregate	324,000 kg	
		Other steel/iron	6,104 kg	30 years	Steel recycling		6,104 kg
2.4	Superstructure: Stairs and Ramps						
2.5	Superstructure: External Walls	Brick, common clay brick	160,890 kg	30 years	Brick/stone crushed to aggregate (for sub-base layers)	160,890 kg	
		Concrete masonry units (CMU)	775 kg	30 years	Concrete crushed to aggregate (for sub-base layers), Portland	775 kg	
2.6	Superstructure: Windows and External Doors	Glass facades and glazing	41,997 kg	35 years	Glass recycling		41,997 kg
		Wooden frame windows	40,908 kg	30 years	Glass-containing product recycling (80 % glass)		40,908 kg
		Sandwich panels, metal	2,817 kg	30 years	Recycling sandwich panel metals (20% metal)		2,817 kg
2.7	Superstructure: Internal Walls and Partitions						
2.8	Superstructure: Internal Doors						
3	Finishes	Carpet flooring	294 kg	10 years	Plastic-based material incineration		
		Hot-dip galvanized/zinc coated steel	220,391 kg	30 years	Steel recycling		220,391 kg
		Paints, coatings and lacquers	18,271 kg	10 years	Landfilling (for inert materials)		
		Regular gypsum board	286,946 kg	30 years	Gypsum recycling		286,946 kg
		Wall and floor tiles	220,976 kg	10 years	Brick/stone crushed to aggregate (for sub-base layers)	220,976 kg	
		Raised flooring systems	316,524 kg	30 years	Steel recycling		316,524 kg
		Furniture	1,620 kg	10 years	Wood-containing product incineration (80% wood)		
4	Fittings, furnishings & equipment (FFE)						
5	Services (MEP)	Aluminium	6,381 kg	20 years	Aluminium recycling		6,381 kg
		Electrification components and systems	29,590 kg	30 years	Metal-containing product recycling (90 % metal)		29,590 kg
		HVAC components and equipment	324,155 kg	20 years	Metal-containing product recycling (90 % metal)		324,155 kg
		Lighting	52,788 kg	15 years	Landfilling (for inert materials)		
		Other insulation	629 kg	20 years	Landfilling (for inert materials)		
		Pipes (water, heating, sewage)	18,879 kg	20 years	Metal-containing product recycling (90 % metal)		18,879 kg
		Rock wool insulation	6,143 kg	20 years	Landfilling (for inert materials)		
		Water heating and handling equipment	15,540 kg	25 years	Landfilling (for inert materials)		
		Copper	1,758 kg	20 years	Copper recycling		1,758 kg
		PUR (polyurethane foam) insulation	1,824 kg	20 years	Plastic-based material incineration		
		Cables	9,009 kg	30 years	Landfilling (for inert materials)		
6	Prefabricated Buildings and Building Units						
7	Work to Existing Building						
8	External works						
		TOTAL	5,046,076 kg			3,307,348 kg	1,632,608 kg

Material intensity (kg/m2 GIA)	567 kg/m2 GIA		371 kg/m2 GIA	183 kg/m2 GIA

Confirm here whether Assessment 1 or Assessment 2 (see below) is to form the basis of design decisions	Assessment 2

ASSESSMENT 1 - current status of the electricity grid

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES[1] (kgCO2e)		Sequestered (or biogenic) carbon (negative value) (kgCO2e)	Product stage (kgCO2e)	Construction process stage (kgCO2e)		Use stage (kgCO2e)							End of Life (EoL) stage (kgCO2e)				TOTAL Modules A-C $kgCO_2e$	Benefits and loads beyond the system boundary (kgCO2e)
			Module A			Module B							Module C					
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		Module D*
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment																0 kg CO2e	
0.2	Major Demolition Works																0 kg CO2e	
0.3	Temporary Support to Adjacent Structures	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
0.4	Specialist Ground Works	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
0.5	Temporary Diversion Works	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
1	**Substructure**	0 kg CO2e	145,312 kg CO2e	452,259 kg CO2e	24,362 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			4,377 kg CO2e				#############	-21,331 kg CO2e
2.1	Superstructure: Frame	0 kg CO2e	439,872 kg CO2e	11,662 kg CO2e	14,794 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			1,645 kg CO2e				#############	-175,079 kg CO2e
2.2	Superstructure: Upper Floors	0 kg CO2e	168,739 kg CO2e	330,102 kg CO2e	18,200 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			8,849 kg CO2e				#############	-44,320 kg CO2e
2.3	Superstructure: Roof	0 kg CO2e	47,045 kg CO2e	15,189 kg CO2e	587 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	47,045 kg CO2e	0 kg CO2e			651 kg CO2e				#############	-11,007 kg CO2e
2.4	Superstructure: Stairs and Ramps	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
2.5	Superstructure: External Walls	0 kg CO2e	21,452 kg CO2e	6,266 kg CO2e	1,397 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	21,375 kg CO2e	0 kg CO2e			222 kg CO2e				50,711 kg CO2e	-2,221 kg CO2e
2.6	Superstructure: Windows and External Doors	-14,324 kg CO2e	98,864 kg CO2e	13,678 kg CO2e	6,477 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	98,864 kg CO2e	0 kg CO2e			14,660 kg CO2e				#############	-12,437 kg CO2e
2.7	Superstructure: Internal Walls and Partitions	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
2.8	Superstructure: Internal Doors	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
3	Finishes	0 kg CO2e	530,679 kg CO2e	26,669 kg CO2e	42,427 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	556,775 kg CO2e	0 kg CO2e			2,597 kg CO2e				#############	-45,842 kg CO2e
4	Fittings, furnishings & equipment	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
5	Services (MEP)	0 kg CO2e	840,777 kg CO2e	3,547 kg CO2e	9,529 kg CO2e	528,054 kg CO2e	0 kg CO2e	0 kg CO2e	1,583,337 kg CO2e	0 kg CO2e	9,830,736 kg CO2e	173,409 kg CO2e	498 kg CO2e				#############	-497,205 kg CO2e
6	Prefabricated Buildings and Building Units	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
7	Work to Existing Building	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
8	External works	0 kg CO2e	0 kg CO2e	0 kg CO2e	434,000 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				#############	0 kg CO2e
	TOTAL kg CO2e	-14,324 kg CO2e	2,292,739 kg CO2e	859,372 kg CO2e	551,772 kg CO2e	528,054 kg CO2e	0 kg CO2e	0 kg CO2e	2,307,396 kg CO2e	0 kg CO2e	9,830,736 kg CO2e	173,409 kg CO2e	33,499 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	#############	-809,443 kg CO2e
	TOTAL - kg CO2e/m2 GIA	-2 kg CO2e/m2 GIA	257 kg CO2e/m2 GIA	97 kg CO2e/m2 GIA	62 kg CO2e/m2 GIA	59 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	259 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	1,104 kg CO2e/m2 GIA	19 kg CO2e/m2 GIA	###############	##########	##########	##########	#############	-91 kg CO2e/m2 GIA

Notes:
* Report non-decarbonised values for both material and operational emissions using current status of the electricity grid.
[1] If you have entered a reference study period in cell C10 because the assumed building life expectancy is greater or less than 60 years, this table should be copied and pasted below using the actual assumed life expectancy. This should be done for both GWP reporting tables and should be clearly labelled.
[2] Use the 'European manufactured' transportation scenarios (see Table 7, page 19 of the RICS PS) to calculate transportation emissions of MEP equipment

(blue)	Mandatary cells for completion
(crossed)	N/A

ASSESSMENT 2 - expected decarbonisation of the electricity grid

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES[1] (kgCO2e)		Sequestered (or biogenic) carbon (negative value) (kgCO2e)	Product stage (kgCO2e)	Construction process stage (kgCO2e)		Use stage (kgCO2e)							End of Life (EoL) stage (kgCO2e)				TOTAL Modules A-C $kgCO_2e$	Benefits and loads beyond the system boundary (kgCO2e)
			Module A			Module B							Module C					
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		Module D*
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment																0 kg CO2e	
0.2	Major Demolition Works																0 kg CO2e	
0.3	Temporary Support to Adjacent Structures	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
0.4	Specialist Ground Works	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
0.5	Temporary Diversion Works	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
1	Substructure	0 kg CO2e	145,312 kg CO2e	452,259 kg CO2e	24,362 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			4,377 kg CO2e				#############	-18,937 kg CO2e
2.1	Superstructure: Frame	0 kg CO2e	439,872 kg CO2e	11,662 kg CO2e	14,794 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			1,645 kg CO2e				#############	-155,277 kg CO2e
2.2	Superstructure: Upper Floors	0 kg CO2e	168,739 kg CO2e	330,102 kg CO2e	18,200 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			8,849 kg CO2e				#############	-39,243 kg CO2e
2.3	Superstructure: Roof	0 kg CO2e	47,045 kg CO2e	15,189 kg CO2e	587 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	41,549 kg CO2e	0 kg CO2e			651 kg CO2e				#############	-9,725 kg CO2e
2.4	Superstructure: Stairs and Ramps	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
2.5	Superstructure: External Walls	0 kg CO2e	21,452 kg CO2e	6,266 kg CO2e	1,397 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	18,878 kg CO2e	0 kg CO2e			222 kg CO2e				48,214 kg CO2e	-1,968 kg CO2e
2.6	Superstructure: Windows and External Doors	-14,324 kg CO2e	98,864 kg CO2e	13,678 kg CO2e	6,477 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	87,314 kg CO2e	0 kg CO2e			14,660 kg CO2e				#############	-11,086 kg CO2e
2.7	Superstructure: Internal Walls and Partitions	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e		ss		0 kg CO2e	0 kg CO2e
2.8	Superstructure: Internal Doors	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
3	Finishes	0 kg CO2e	530,679 kg CO2e	26,669 kg CO2e	42,427 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	492,056 kg CO2e	0 kg CO2e			2,597 kg CO2e				#############	-40,813 kg CO2e
4	Fittings, furnishings & equipment	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
5	Services (MEP)	0 kg CO2e	840,777 kg CO2e	3,547 kg CO2e	9,529 kg CO2e	528,054 kg CO2e	0 kg CO2e	0 kg CO2e	1,408,881 kg CO2e	0 kg CO2e	3,103,644 kg CO2e	173,409 kg CO2e	498 kg CO2e				#############	-441,882 kg CO2e
6	Prefabricated Buildings and Building Units	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
7	Work to Existing Building	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				0 kg CO2e	0 kg CO2e
8	External works	0 kg CO2e	0 kg CO2e	0 kg CO2e	434,000 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			0 kg CO2e				#############	0 kg CO2e
	TOTAL kg CO2e	-14,324 kg CO2e	2,292,739 kg CO2e	859,372 kg CO2e	551,772 kg CO2e	528,054 kg CO2e	0 kg CO2e	0 kg CO2e	2,048,678 kg CO2e	0 kg CO2e	3,103,644 kg CO2e	173,409 kg CO2e	33,499 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	#############	-718,930 kg CO2e
	TOTAL - kg CO2e/m2 GIA	-2 kg CO2e/m2 GIA	257 kg CO2e/m2 GIA	97 kg CO2e/m2 GIA	62 kg CO2e/m2 GIA	59 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	230 kg CO2e/m2 GIA	0 kg CO2e/m2 GIA	349 kg CO2e/m2 GIA	19 kg CO2e/m2 GIA	###############	##########	##########	##########	#############	-81 kg CO2e/m2 GIA

Notes:
* Report decarbonised values for both material and operational emissions using expected decarbonisation of the electricity grid.
[1] If you have entered a reference study period in cell C10 because the assumed building life expectancy is greater or less than 60 years, this table should be copied and pasted below using the actual assumed life expectancy. This should be done for both GWP reporting tables and should be clearly labelled.

(blue)	Mandatary cells for completion
(crossed)	N/A

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NDY QA SYSTEM

Revision No:	4.0
Revision Date:	13 April 2022
Reason Description:	Planning issue
Client Name:	105 Judd Street LTD
Client Contact:	George Grace
Project Leader:	Mike Arnold
Editor:	Andrew Vann
File Location:	\\tt.local\NDY\lon\w\U144xx\U14499\001\G-\24_Reports
Filename:	rp220202u0003

Authorisation By: Mike Arnold

Michael Arnold.

Verification By: Alex Mitchell

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