Elephant Park H1 Development

Whole Life-Cycle Carbon Assessment

May 2021

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lendlease

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▶ **Whole Life-Cycle Carbon Assessment**

Contents

1. INTRODUCTION

1.1. Introduction to Planning Application

1.1.1. This Whole Life-Cycle Carbon Assessment has been prepared by HDR | Hurley Palmer Flatt on behalf of Lendlease (Elephant & Castle) Limited ("Lendlease") to support an application for full planning permission ("the Application") for the redevelopment of Plot H1 ("the Site") within the Elephant Park Masterplan, Elephant and Castle, London, SE1 ("the Elephant Park Masterplan"). This standalone development proposal is referred to as "the H1 Development".

1.1.2. Plot H1 currently forms Phase MP5b within the Outline Planning Permission ("OPP") granted on 23 March 2013 for the Elephant Park Masterplan (LBS Ref: 12/AP/1092). Outline planning permission was granted under the OPP for development of Plot H1 for a mix of land uses, with matters of scale, appearance and landscaping reserved. The approved development on Plot H1 under the OPP is referred to as "the OPP Plot H1 Parameters".

1.1.3. The Application for Plot H1 seeks full planning permission to develop an office-led building (Class E) on the Site. It is being sought through a standalone planning application because it takes a form which is not capable of being approved in detail through the submission of reserved matters pursuant to the OPP. However, the H1 Development has been designed with the intention that it is to be delivered alongside the adjacent plots that have been and are being delivered under the OPP and will complete the Elephant Park Masterplan. In addition to the Application for the H1 Development, a non-material amendment application will be submitted in parallel to amend the Reserved Matters Application (RMA) approval for Plot H2, alongside a revised RMA for the Park, in order to align the public realm proposals hereby submitted with those approved on the neighbouring plots. This is explained further in Section 3.

1.1.4. The Elephant and Castle Town Centre has evolved significantly over the past decade and the Application for Plot H1 has been prepared to respond to the emerging context. Additionally, the New Southwark Plan and London Plan set ambitious targets for increasing employment space in the Borough within the Elephant and Castle Opportunity Area. The establishment of a new landmark commercial building in this location will provide new employment and business opportunities for local people and add to the vibrant mix of land uses at Elephant Park and the new Town Centre.

1.2. Introduction to the Whole Life-Cycle Carbon Assessment

1.2.1. This Statement is based on the final proposals and details how a Whole Life-Cycle Carbon Assessment has been prepared for the H1 Development in line with the London Plan Policy SI 2.

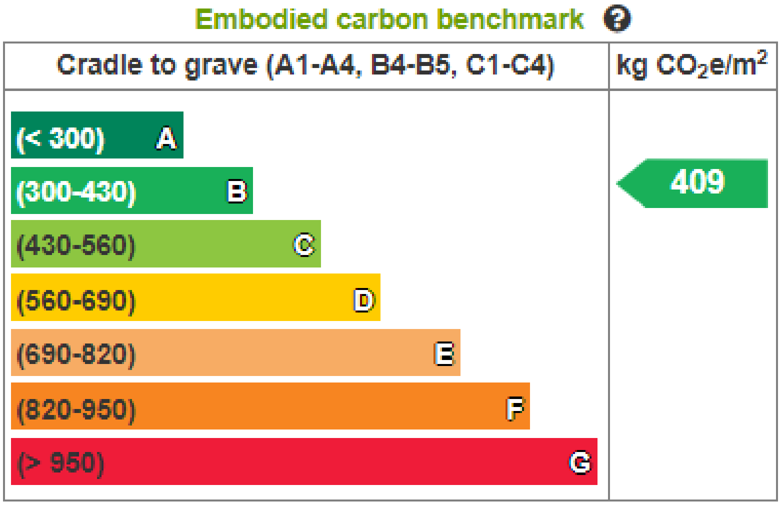
1.2.2. The following opportunities were identified to reduce embodied carbon:

- Considering material type, its efficient use, and expected lifespan.
- Choose low carbon versions of materials.
- Minimise wastage on site, consider construction processes and design for adaptability, disassembly and reuse.

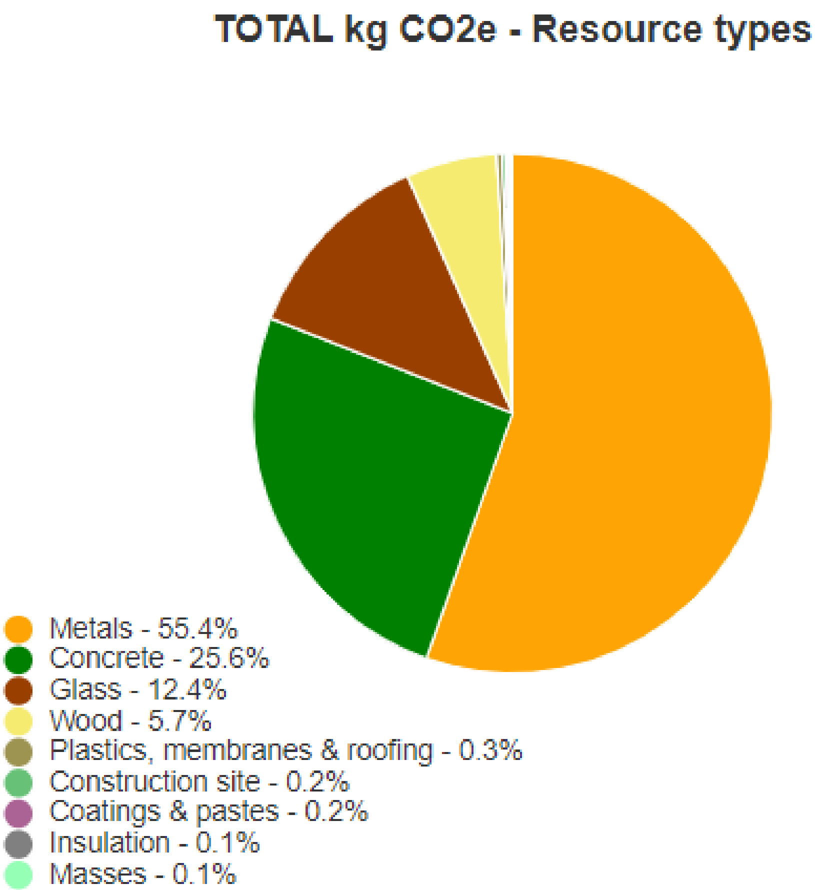
1.2.3. Conclusions can be drawn from the results summarised in the WLCA report:

- The H1 Development achieved a One Click LCA 'Carbon Heroes Benchmark'[1] rating of B, demonstrating 409kgCO2e/m2.

[1] https://www.oneclicklca.com/construction/carbonheroes/



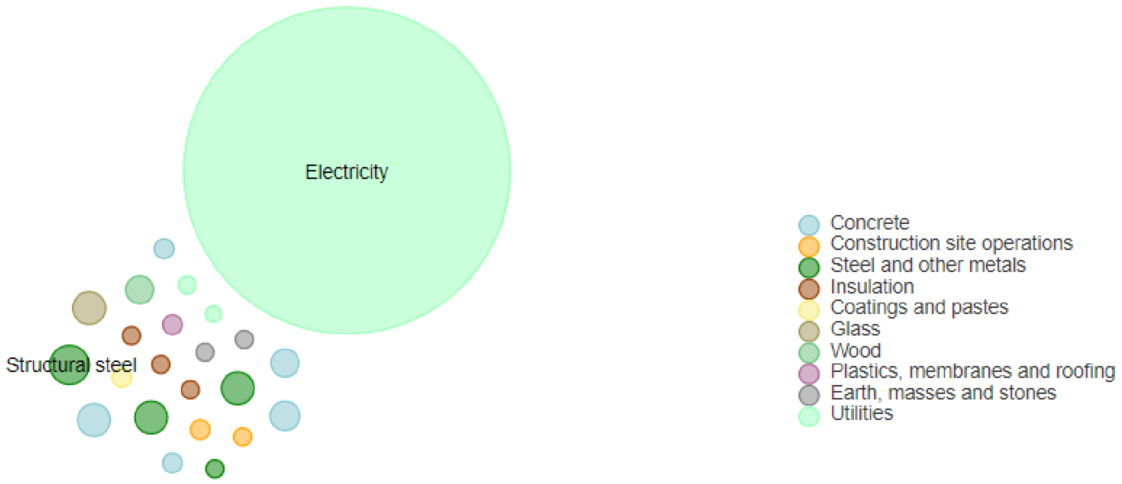
- ‘Product Stage’ emissions, associated with raw material supply, transport to manufacturing plant and manufacturing processes, form the largest contribution to the global warming potential of the development. The material contributing the most to kgCO2e emissions was found to be Metal (55.4%), followed by Concrete (25.6%), then Glass (12.4%).



1.2.4. The model on OneClick has been run first with the SAP 10 and then run again with the Electricity Steady Progression 2050 in line with the GLA requirements.

1.2.5. The graphs overleaf clearly show the Utilities section and the reduction in the energy consumption.

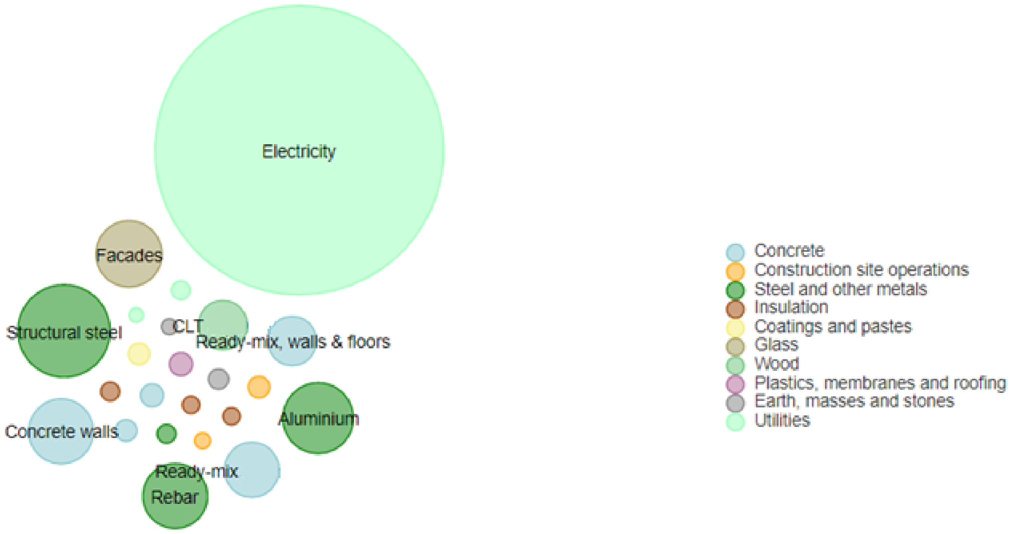
1.2.6. SAP 10 graph and data table TOTAL kg CO2e - Resource types:



TOTAL kg CO2e - Resource types

Item	Value	Unit
Utilities	1 400 000 000	
Metals	15 000 000	
Concrete	7 000 000	
Glass	3 400 000	
Wood	1 500 000	
Plastics, membranes & roofing	93 000	
Construction site	56 000	
Coatings & pastes	49 000	
Insulation	36 000	
Masses	32 000	

1.2.7. And SAP 2050 graph and data table TOTAL kg CO2e - Resource types:



TOTAL kg CO2e - Resource types

Item	Value	Unit
Utilities	99 000 000	
Metals	15 000 000	
Concrete	7 000 000	
Glass	3 400 000	
Wood	1 500 000	
Plastics, membranes & roofing	93 000	
Construction site	56 000	
Coatings & pastes	49 000	
Insulation	36 000	
Masses	32 000	

2. SITE AND SURROUNDINGS

This section provides details of the Elephant Park planning permissions and the Site in its existing context.

2.1. Elephant Park

2.1.1. Elephant Park is located in Elephant and Castle, within the administrative boundary of Southwark Council ("the Council"). The Masterplan occupies an area of 9.71 hectares, and is bounded by:

- New Kent Road (A201) to the north,
- Rodney Place and Rodney Road to the east,
- Wansey Street to the south; and
- Walworth Road (A215) and Elephant Road to the west.

2.1.2. Heygate Street bisects Elephant Park with junctions to Walworth Road to the west and Rodney Place and Rodney Road to the east.

2.2. The Outline Planning Permission

2.2.1. The Council granted two planning permissions for Elephant Park on 27 March 2013: the OPP and the Demolition Planning Permission (ref: 12/AP/3203).

2.2.2. In summary, the OPP granted consent for up to 254,400 sqm of residential floorspace, up to 16,750 sqm of retail floorspace, up to 5,000 sqm of business floorspace and up to 10,000 sqm of community, culture and leisure floorspace, alongside a new energy centre, a new park ("The Park"), and public realm.

2.2.3. The OPP reserved the detailed design elements of Elephant Park for future approval at the Reserved Matters stage but did establish a series of approved parameters and principles for the Development within three approved application documents: the Parameter Plans, the Development Specification and the Design Strategy Document ("DSD"), as well as being accompanied by a section 106 agreement that was entered into on the same date that the OPP was granted.

2.2.4. The OPP introduced five specific character areas within Elephant Park which were established to create a variety of experience and richness to the development: 1 - The Park; 2 - Walworth Road; 3- New Kent Road; 4- Walworth Local and 5- Rodney Neighbourhood. These are shown on Figure 1 below.

Figure 1 - Extract of character areas from the consolidated Design Strategy Document (Feb 2013)

2.2.5. Elephant Park was further sub-divided into 12 individual development plots (H1 to H7, H10, H11a, H11b, H12, and H13) plus a Pavilion to be located in the new park at the centre of the scheme (known as plot 'PAV1'), refer to Figure 2 below. The individual development plots comprise a mix of residential and/or other land uses and included varying heights and massing to fit into the specific character areas in which they are located and the surrounding urban context. In particular, the height and massing of all tall buildings within Elephant Park was informed by a townscape assessment that takes into account both local and strategic London views. The plots are delivered within five phases, which are defined on the Phasing Plan (the most recent version of which is provided in Figure 2 below).

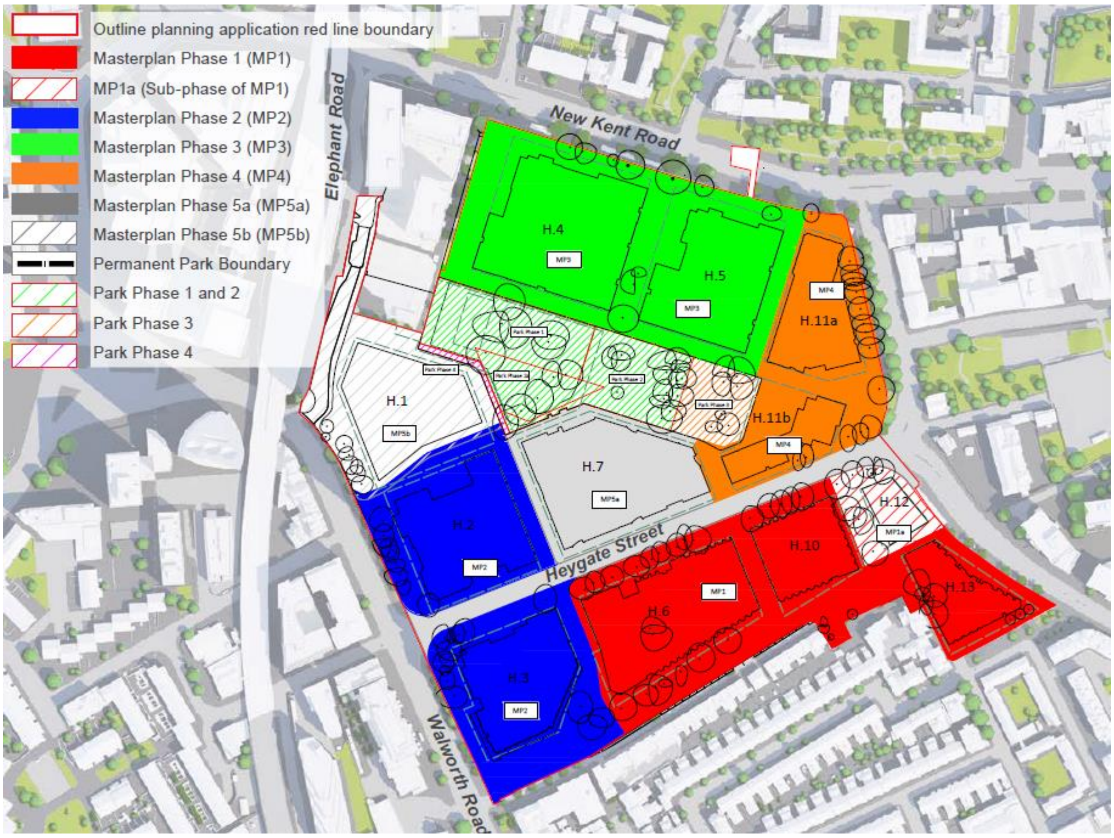


Figure 2 – Elephant Park phasing plan identifying the individual development plots

2.2.6. In addition to the built floorspace, the OPP provides significant areas of open space, including The Park, gateway spaces, pocket parks and new streets. Mature trees have been retained where possible and will be complemented with new landscape and new trees, which will ensure that there will be no net loss of trees on the Elephant Park site.

2.2.7. In March 2021, the Council approved a Detailed Phasing Plan for Elephant Park (Figure 2) setting out the current proposed sequence of construction works in respect of all phases and plots in the development. This Detailed Phasing Plan identified that Plot H1 would form part of the final phase MP5, sub-phase MP5b, of the Masterplan.

2.2.8. The Council approved the RMAs for the first phase of Elephant Park comprising Plots H6, H10 and H13 and associated public realm in February 2014. In December 2014, the Council approved the Reserved Matters Application for the second phase comprising Plots H2 and H3 and associated public realm. In October 2015, the Reserved Matters for the Energy Hub (Plot H12) and associated public realm were approved by the Council. RMAs for the third phase comprising Plot H4 and associated public realm, were approved by the Council in May 2017, and for Plot H5 and associated public realm in September 2017. RMAs for the fourth phase, comprising Plots H11a and H11b and associated public realm, were approved by the Council in September 2018. Most recently, the RMA for Plot H7 within Phase MP5a was approved by the Council in March 2020, and Reserved Matters for the Pavilion (Plot PAV1) were approved in October 2020. Plot H1 is the only plot within the Masterplan that does not have Reserved Matters Approval.

2.2.9. In response to the increased employment targets of the Council and in the context of the evolving Town Centre, the H1 Development is being brought forward as an office, further enhancing the mixed use nature of the Elephant Park Masterplan. The H1 Development and the OPP have been designed to interface and co-exist to deliver the Elephant Park Masterplan, and it is the intention that H1 will be delivered alongside the development that has been constructed and/or approved under the OPP. The Application has been structured to interface with the OPP so that the OPP and the H1 Development can be developed out harmoniously and without either prejudicing the other. It is intended that a planning obligation will accompany the H1 Development and will secure that, upon commencement of the H1 Development, no further development will be undertaken pursuant to the OPP within the areas of the OPP that also benefit from the permission granted pursuant to the Application. In this way, it will be clear that the H1 Development supersedes the OPP in this area of the Elephant Park Masterplan. The H1 Development is brought forward without prejudice to the lawfulness, deliverability and acceptability of what has gone before under the OPP, and is capable of implementation alongside the OPP.

2.2.10. The Planning Statement submitted in support of the Application describes how this planning application has been structured in relation to the OPP. In order to explain the relationship between the H1 Development and the OPP more generally, a Reconciliation and Comparison Statement is included in Appendix 1. The Reconciliation and Comparison Statement provides a technical overview of the H1 Development in comparison with the OPP Plot H1 Parameters and a reconciliation of the Elephant Park Masterplan to show how the H1 Development and the composite RMA approvals for all other Plots granted under the OPP come together to provide a final reconciliation against the development controls of the OPP.

2.3. Plot H1

2.3.1. The Site is bounded by:

- Castle Square and Sayer Street to the north,
- Sayer Street, the Pavilion and The Park to the east,
- Walworth Road and Elephant Road to the west; and
- Deacon Street and Plot H2 to the south.

2.3.2. As shown in Figure 3 below, the Site is largely surrounded by other elements of Elephant Park and sits at the confluence of The Park and Walworth Road Character Areas, marking the westernmost plot within the Masterplan. The Site is largely vacant however, at present, it contains a temporary modular building providing staff welfare in relation to the ongoing construction of the Elephant Park Masterplan along with accommodating the meanwhile use of the Urban Farm, as consented by Southwark (20/AP/2612) in November 2020.

2.3.3. The land uses surrounding the Site, particularly within the Elephant Park Masterplan, are primarily residential in character with commercial uses at ground level. To the east of the Site is The Park, the main public open space within the Elephant Park Masterplan. The southern boundary is characterised by Plots H2 and H7 which comprise mixed residential and commercial land uses. The area to the north and west is more varied and is characterised by the commercial uses within Castle Square and along Walworth Road, one of the main arterial routes in the Borough. There are no designated heritage assets (Conservation Areas or Listed Buildings) in close proximity to the Site.

2.3.4. The Site is situated within close proximity to the significant transport infrastructure around Elephant and Castle, with the Underground Railway Station to the north-west, and mainline Railway Station on the west side of Elephant Road. Further details are provided in the Design and Access Statement, prepared by Acme, that accompanies the Application.

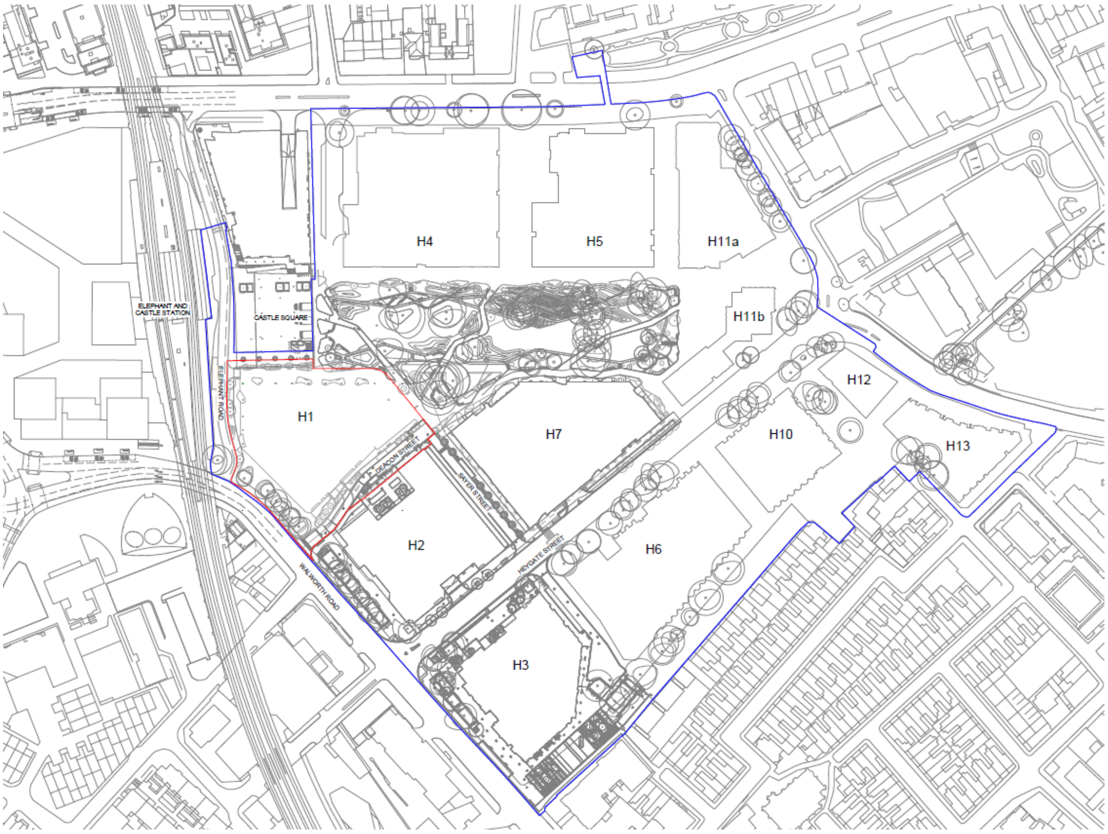


Figure 3 - Application Site boundary shown in red. OPP boundary line shown in blue.

3. DESCRIPTION OF DEVELOPMENT

This section describes what is being applied for in the Application for the H1 Development, explains why it is coming forward as a standalone planning application and how it relates to the Elephant Park Outline Planning Permission (OPP).

3.1. Description of Development

3.1.1. This section should be read in conjunction with the Design and Access Statement which is submitted in support of the Application and describes the principal components of the H1 Development.

3.1.2. This Application seeks full planning permission for the H1 Development. Specifically, the Application seeks approval for:

‘Redevelopment of the site to provide a building of ground plus 17-storeys (including a mezzanine floor) with basement and rooftop plant providing office floorspace (Class E) and areas of flexible floorspace for the following uses; office/retail/services/food and drink/medical or health floorspace (Class E), including ancillary cycle parking, accessible car parking, servicing, landscaping, public realm improvements and other associated works incidental to the development.’

3.2. The Proposed Development

3.2.1. Working in partnership with Southwark Council, Lendlease is delivering a £2.5 billion regeneration programme on 28 acres of land in the centre of Elephant and Castle creating one of the capital's most exciting places to live, work and visit. The vision for Elephant Park is to breathe new life into this special part of Central London, building on Elephant and Castle’s heritage to create thousands of high-quality new homes, jobs, business opportunities and green space for locals and Londoners.

3.2.2. The H1 Development will contribute to this vision by delivering an employment led development with an emphasis on health and wellbeing which maximises the connection with The Park. The vision for the Site is a direct response to its location, which will complement the transformation of Elephant and Castle Town Centre by diversifying the mix of uses in the neighbourhood and providing local employment and business opportunities to the area, whilst strengthening the connection between Elephant and Castle Town Centre and Walworth.

3.2.3. The H1 Development comprises ground plus 17 storeys (including mezzanine) with a basement level and rooftop plant, extending to a maximum height of 85.730 m AOD (including rooftop plant). The building will serve as a key focal point within Elephant Park and along Walworth Road, with the tallest element situated adjacent to the railway line and stepping down towards the neighbouring residential buildings.

3.2.4. The Application proposes 63,599 sqm (GIA) of floorspace, comprising 49,351 sqm (GIA) of offices, 8,681 sqm (GIA) of flexible of floorspace at ground floor, mezzanine and first floor level suitable for office, retail, food and drink, medical and health uses, alongside 5,566 sqm of shared plant, servicing and cycle parking facilities. All proposed uses fall within Use Class E of The Town and Country Planning (Use Classes) Order 1987 (as amended). A full breakdown of the proposed floorspace is provided in Table 3.1.

Table 3.1: Total Development Floorspace

Land Use (All Class E)	Floor Level	NIA (sqm)	GIA (sqm)	GEA (sqm)
Offices	02 - 16	40,783	49,351	49,565
Offices / medical or health	Mezzanine - 01	4,300	6,728	6,795
Offices / retail / services / medical or health	GF	259	264	277
Offices / retail / services / food and drink	GF	1,683	1,689	1,728
Ancillary (loading bay, plant, cycle facilities and other BOH space)	GF / Roof / Basement	-	5,566	6,258
Total	**All**	**47,025**	**63,599**	**64,624**

3.2.5. The H1 Development also proposes to provide 10% (GIA equivalent) of the office floorspace in the H1 Development as affordable workspace in line with emerging policy. As an alternative to the proposed affordable workspace, there is also a possibility that a new health hub to serve the local area could be provided within the H1 Development. Further information is provided in the supporting Affordable Workspace Strategy.

3.2.6. A key ambition of the H1 Development is to be open and accessible, evident through the provision of the active lobby - an extensive, publicly accessible ground floor space serving both future office occupants and the wider public. The ground floor frontages around the building will reflect the hierarchy of the adjacent streets and routes, with the frontages along Sayer Street North, Elephant Road and Walworth Road providing the main active frontages. This will enhance the surrounding streetscape and the relationship between the H1 Development and The Park, whilst also helping to strengthen the relationship between Elephant and Castle Town Centre and Walworth. The main office entrance is situated along the north elevation fronting Sayer Street North as it turns to meet Elephant Road, ensuring maximum visibility and accessibility for workers and visitors accessing the building from Elephant and Castle Railway and Underground Stations (through the viaduct archway pedestrian routes to be delivered as part of Delancey's Elephant and Castle Town Centre development).

3.2.7. The proposed H1 Development building will be complemented by the enhancement of the surrounding public realm, including Sayer Street North, which will be a pedestrian priority route and cycle route, along with improvements to Deacon Street and completion of the Elephant Road and Walworth Road landscape. The H1 Development public realm proposals have been developed in response to the key landscape Character Areas identified in the OPP, which define Elephant Park. The stepped approach to the massing facilitates the provision of external amenity space serving the office accommodation in the form of roof terraces, which will also allow for a strong visual connection between The Park and the building, whilst responding positively to the Site's prominent position on Walworth Road. The outdoor terraces and integration of public realm in the design of the H1 Development is also increasingly important in supporting occupier health and wellbeing in a post-Covid-19 workplace environment.

3.2.8. All servicing will be carried out from an internal loading dock, accessed from Deacon Street, with vehicles both entering and exiting Deacon Street from Walworth Road to minimise disruption to the wider street network within the Masterplan. The H1 Development will be car free other than allocated accessible spaces located on Deacon Street. Long stay cycle parking is proposed within the basement of the H1 Development, accessed from Walworth Road with further short stay cycle parking in the surrounding public realm.

4. APPROACH

4.1.1. This WLCA has been undertaken using Bionova Ltd's One Click LCA and in accordance with BS EN 15978 and the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment RICS. This WLCA has assessed the entirety of following modules for the H1 Development;

- Module A1 – A5 (Product sourcing and construction stage);
- Module B1 – B7 (Use stage);
- Module C1 – C4 (End of life stage); and
- Module D (Benefits and loads beyond the system boundary).

4.1.2. Material types and quantities were requested from the design team. A workshop took place on the 27/11/2020 with the following disciplines;

- HDR | Hurley Palmer Flatt – MEP;
- HDR | Hurley Palmer Flatt – Sustainability;
- Robert Bird & Partners – Structures; and
- ACME– Architects.

4.1.3. Appendix A includes a completed GLA WLC assessment template_ May 2020.

5. POLICIES

5.1. National Planning Policy Framework and Planning Policy Statements (February 2019)

5.1.1. The National Planning Policy Framework (2019) sets out the challenges presented by climate change. Paragraph 148 states:

"The planning system should support the transition to a low carbon future in a changing climate…It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure."

5.1.2. Paragraph 150 states:

"*New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure;"*

5.2. The London Plan

5.2.1. The London Plan was formally adopted by the Mayor in March 2021. The plan includes the following relevant policies;

- Policy GG2 Making the best use of land
- Policy GG3 Creating a healthy city
- Policy GG6 Increasing efficiency and resilience
- Policy D1A Infrastructure requirements for sustainable densities
- Policy D1B Optimising site capacity through the design-led approach
- Policy D13 Noise
- Policy G5 Urban greening
- Policy G6 Biodiversity and access to nature
- Policy G7 Trees and woodlands
- Policy G8 Food growing
- Policy SI1 Improving air quality
- Policy SI2 Minimising greenhouse gas emissions
- Policy SI3 Energy infrastructure
- Policy SI4 Managing heat risk
- Policy SI5 Water infrastructure
- Policy SI7 Reducing waste and supporting the circular economy
- Policy SI12 Flood risk management
- Policy SI13 Sustainable drainage
- Policy T1 Strategic approach to transport
- Policy T5 Cycling
- Policy T6 Car parking

5.2.2. In particular, Policy SI 2 Minimising greenhouse gas emissions - Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the energy hierarchy.

5.3. GLA Whole Life-Cycle Carbon Assessments Guidance Consultation Draft October 2020

5.3.1. Guidance document includes the following policy background;

National Building Regulations and the Mayor's net zero-carbon target for new development currently only 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 WLC emissions. Attention now needs to turn to WLC to incorporate the embodied emissions of a development.

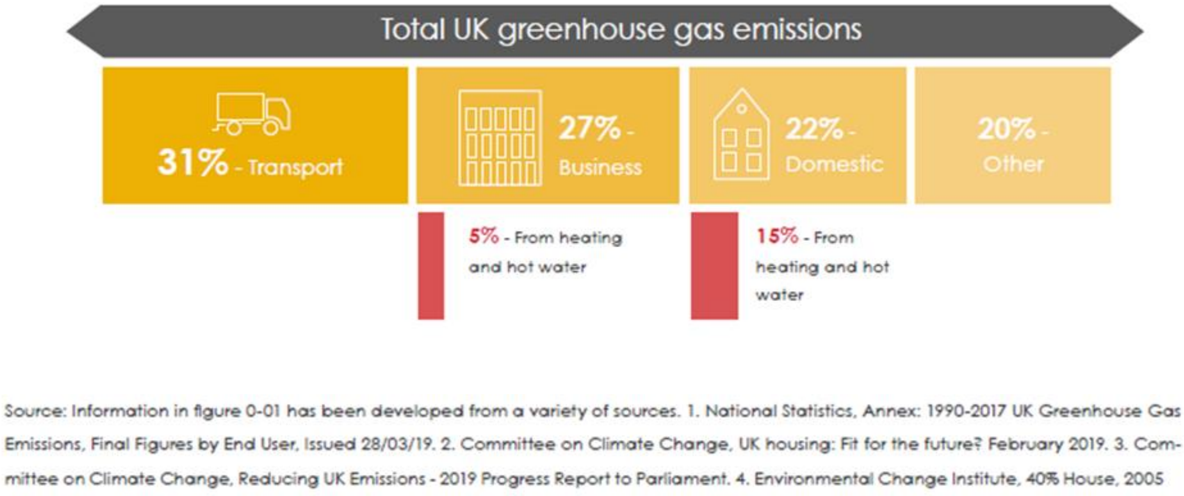
5.3.2. The Mayor's net zero-carbon target continues to apply to the operational emissions of a building. The WLC requirement is not subject to this target but, as set out in London Plan Policy SI 2, planning applicants are required to calculate the embodied emissions of the development, as well as the operational emissions, and demonstrate how these can be reduced as part of the WLC assessment. Planning applicants should continue to follow the GLA's Energy Assessment Guidance to assess and reduce operational emissions and insert the relevant information into the WLC assessment.

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

6. WHOLE LIFE-CYCLE CARBON ASSESSMENT METHODOLOGY

6.1. Whole Life-Cycle Carbon Assessment Methodology

6.1.1. In the UK, 49% of annual carbon emissions are attributable to buildings.

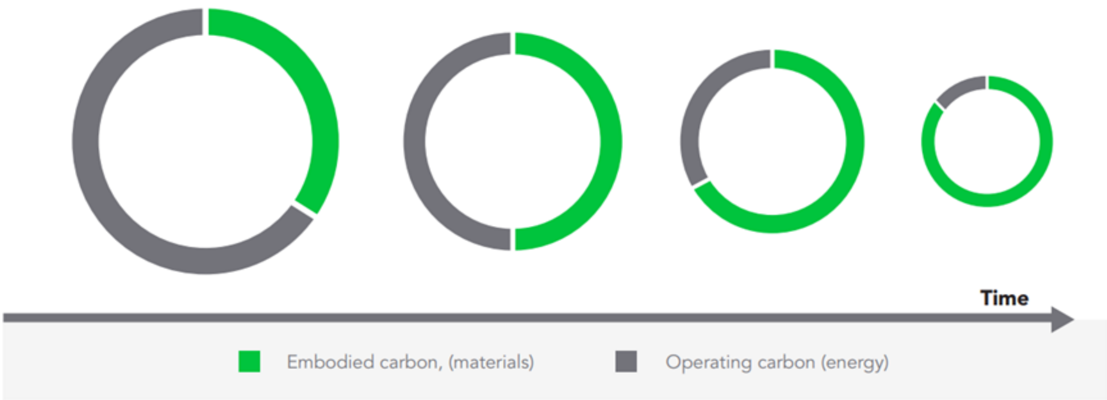


6.1.2. Whole life carbon of a building is formed of two key components:

6.1.3. **Operational Carbon**: emissions of carbon dioxide during the operational or in-use phase of a building. A new building with net zero operational carbon does not burn fossil fuels, is 100% powered by renewable energy, and achieves a level of energy performance in-use in line with our national climate change targets.

6.1.4. **Embodied Carbon**: carbon dioxide emitted during the manufacture, transport and construction of building materials, together with end of life emissions. Low embodied carbon buildings uses low impact materials, is made of re-used materials and can be disassembled at its end of life in accordance with circular economy principles.

6.1.5. The use of construction products leads to a wide range of environmental and social impacts across the life cycle of a building project, through initial procurement, wastage, maintenance and replacement. Construction products make a highly significant contribution to the overall life cycle impacts of a building. In some cases, they may even outweigh operational impacts. The introduction of Part L into the building regulations for England and Wales has led to reductions in the operational energy consumption of buildings and these regulations are being progressively tightened. As a result, greenhouse gas emissions from other aspects of buildings, such as embodied emissions, are becoming increasingly important in terms of reducing the overall emissions that lead to climate change over the building's lifetime. The graph below highlights the anticipated changing balance between the impact of embodied carbon and operating carbon over time.



Source: The Embodied Carbon Review, Bionova Ltd, 2018

6.1.6. To stay within the Intergovernmental Panel on Climate Change (IPCC) 1.5 degrees scenario, significant embodied carbon reductions are necessary. The World Green Building Council believes that to meet our climate change targets all new buildings must operate at net zero carbon by 2030 and all buildings operate at net zero carbon by 2050.

6.1.7. Life cycle assessment (LCA) is one of the best methodologies to allow building professionals to understand the energy use and other environmental impact associated with all the phases of a building's life cycle. The embodied energy of a building is the energy required to make, deliver, assemble and dispose of all the materials used in its construction, refurbishment and demolition. Embodied carbon is the CO2 emissions released due to the embodied energy plus any process emissions, such as the CO2 released by the chemical reaction when cement is produced. This report includes a completed GLA WLC Assessment.

6.1.8. The embodied carbon of a building is calculated by measuring the quantity of every material used over the life of the building and multiplying this by an emissions factor for each. To this are added emissions due to delivery of materials to site, construction activities, and waste.

6.1.9. The LCA process is governed under ISO 14000, a series of international standards addressing environmental management. The framework for appraising the environmental impacts of the built environment specifically is provided by EN 15978: 2011. It is part of the EN 15643 family of standards for the sustainability assessment of buildings. It sets out the principles for whole life assessment of the environmental impacts from built projects based on LCA.

6.1.10. For whole life principles to be integrated into the design, procurement and construction processes and beyond, and for project teams to be engaged in a timely fashion, carbon assessments should be carried out at key project stages from concept design to practical completion.

Source: Bionova Ltd.

6.2. WCLA Scope

6.2.1. Whole Life-Cycle Carbon (WLC) emissions are the carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal. They capture a building's operational carbon emissions from both regulated and unregulated energy use, as well as its embodied carbon emissions, i.e. 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. A WLC assessment provides a true picture of a building's carbon impact on the environment.

6.2.2. The following life cycle stages according to EN 15804:2012 are included in the WLCA:

Product Stage				Construction Process Stage			Use Stage				End-of-life Stage				Benefits and loads beyond the system boundary			
Raw material supply	Transport	Manufacturing	Transport to building site	Installation into building	Use/application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D

Table 1 - Life-cycle Stages according to EN15804: 2012 included in WLCA

6.2.3. Description of the life cycle stages, and analysis scope are provided in the table below:

A1-A3 Construction materials	Raw material supply (A1) includes emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed. Loss of raw material and energy are also considered. Transport impacts (A2) include exhaust emissions resulting from the transport of all raw materials from suppliers to the manufacturer's production plant as well as impacts of production of fuels. Production impacts (A3) cover the manufacturing of the production materials and fuels used by machines, as well as handling of waste formed in the production processes at the manufacturer's production plants until end-of-waste state.
A4 Transportation to site	A4 includes exhaust emissions resulting from the transport of building products from manufacturer's production plant to building site as well as the environmental impacts of production of the used fuel.
A5 Construction/ installation process	A5 covers the exhaust emissions resulting from using energy during the site operations, the environmental impacts of production processes of fuel and energy and water as well as handling of waste until the end-of-waste state.
B1-B5 Maintenance and material replacement	The environmental impacts of maintenance and material replacements (B1-B5) include environmental impacts from replacing building products after they reach the end of their service life. The emissions cover impacts from raw material supply, transportation and production of the replacing new material as well as the impacts from manufacturing the replacing material as well as handling of waste until the end-of-waste state.
B6 Energy use	The considered use phase energy consumption (B6) impacts include exhaust emissions from any building level energy production plus the environmental impacts of production processes of fuel and externally produced energy. Energy transmission also considered.
B7 Water use	The considered use phase water consumption (B7) impacts include the environmental impacts of production processes of fresh water and the impacts from wastewater treatment.
C1-C4 Deconstruction	The impacts of deconstruction include impacts for processing recyclable construction waste flows for recycling (C3) until the end-of-waste stage or the impacts of pre-processing and landfilling for waste streams that cannot be recycled (C4) based on type of material. Additionally, deconstruction impacts include emissions caused by waste energy recovery.
D External impacts/end-of-life benefits	The external benefits include emission benefits from recycling recyclable building waste. Benefits for re-used or recycled material types include positive impact of replacing virgin-based material with recycled material and benefits for materials that can be recovered for energy cover positive impact for replacing other energy streams based on average impacts of energy production.

Table 2 - Description of life cycle stages included in EN15804:2012 and analysis scope included in WLCA

6.2.4. Assessed Impact Categories are described below;

Impact category	Unit	Description
Global warming potential (greenhouse gases)	kgCO2eq	Describes changes in local, regional, or global surface temperatures caused by an increased concentration of greenhouse gases in the atmosphere. Greenhouse gas emissions from fossil fuel burning has been strongly correlated with two other impact categories: acidification and smog. Often called “carbon footprint”.
Acidification potential	kgSO2eq	Describes the acidifying effect of substances in the environment. Substances such as carbon dioxide dissolve readily in water, increasing the acidity, which contributes to global phenomena such as ocean acidification (IPCC 2014).
Eutrophication potential	kgPO4eq	Describes the effect of adding mineral nutrients to soil or water, which causes certain species to dominate an ecosystem, compromising the survival of other species and sometimes resulting in die-off of populations.
Ozone depletion potential	kgCFC11eq	Describes the effect of substances in the atmosphere to degrade the ozone layer, which absorbs and prevents harmful solar UV rays from reaching Earth’s surface.
Formation of ozone of lower atmosphere	kgC2H4eq	Describes the effect of substances in the atmosphere to create photochemical smog. Also known as summer smog.

Table 3 - Description of WLCA Assessment Categories

6.2.5. The table below lists the building elements included and excluded in the WLCA model:

Building Part / Element Group	Building element	Included / excluded
Demolition	0.1 Toxic/hazardous/contaminated material treatment	Excluded
	0.2 Major demolition works	Excluded
0 – Facilitating works	0.3 & 0.5 Temporary enabling works	Excluded
	0.4 Specialist groundworks	Excluded
1 - Substructure	1.1 Substructure	Included
	2.1 Frame	Included
	2.2 Upper floors incl. balconies	Included
	2.3 Roof	Included
	2.4 Stairs and ramps	Included
	2.5 External walls	Included
	2.6 Windows and external doors	Excluded
	2.7 Internal walls and partitions	Excluded
	2.8 Internal doors	Excluded
3 - Finishes	3.1 Wall finishes	Excluded
	3.2 Floor finishes	Excluded
	3.3 Ceiling finishes	Excluded
4- Fittings, furnishings and equipment (FF&E)	4.1 FF&E	Excluded

5 – Building services/ MEP	5.1 – 5.4 Building services	Excluded
6 – Prefabricated Buildings and Building Units	6.1 Prefabricated buildings and building units	Excluded
7 – Work to Existing Building	7.1 Minor demolition and alteration works	Excluded
8 – External Works	8.1 Site preparation works	Excluded
	8.2 Roads, paths, pavings and surfacings	Included
	8.3 Soft landscaping, planting and irrigation systems	Excluded
	8.4 Fencing, railings and walls	Excluded
	8.5 External fixtures	Excluded
	8.6 External drainage	Excluded
	8.7 External services	Excluded
	8.8 Minor building works and ancillary buildings	Excluded

Table 4 - Building elements included and excluded in the WLCA

6.3. Environmental Data Sources and ONE CLICK

6.3.1. One Click LCA was used in the undertaking of this LCA. The tool supports the CML impact assessment database and methodology (2002-2012 or newer) and all assessed impact categories. All the datasets in the tool follow EN 15804 standard. The software is fully compliant with the EN 15978 standard. One Click LCA has been third party verified by the Instytut Techniki Bodowlanej (ITB) for compliance with the following LCA standards: EN 15978, ISO 21931–1 and ISO 21929, and data requirements of ISO 14040 and EN 15804.

6.4. Operational Carbon (Energy)

6.4.1. The energy statement accompanying the planning application details how energy use has been minimised based on Part L2A compliance modelling. By contrast, the operational energy consumption used for module B6 is based on a CIBSE TM54 analysis.

6.4.2. The CIBSE TM54 analysis was undertaken based on a tailored Part L2A model to estimate regulated and unregulated loads. This model retained the operational profile as per the NCM database but updated occupancy density, and also included calculations for the annual energy consumption associated with the building's lifts and security equipment. The energy results from this modelling were used to inform this Whole Life-Cycle Carbon (WLC) Assessment as per the reporting requirements for regulated and unregulated energy. The module B6 Operational CO_2 emissions were calculated using SAP10 carbon factors, as well as the Non-2050 compliant – Steady Progression 2050 (FES 2050) Carbon Factors associated with analysis of the decarbonised operational energy as required by GLA's WLC assessment methodology.

6.4.3. Modules A1-A5 and module B6 have been considered together. Any energy use and emissions associated with water related systems i.e. operational water use (B7) has been captured under operational energy use (B6).

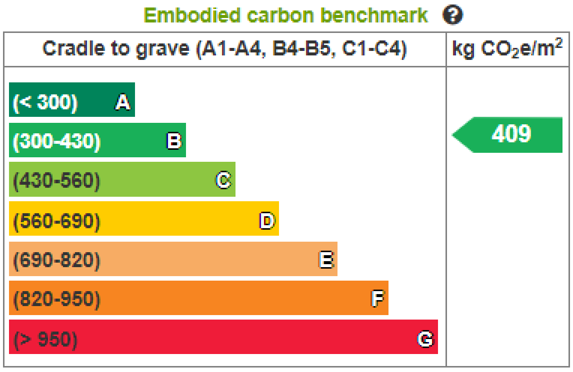
6.4.4. Decarbonised operational energy has been included in the GLA WLC assessment results table in Appendix A of this report using One Click Electricity, Non-2050 compliant - Steady Progression 2050 (FES 2020).

7. RESULTS

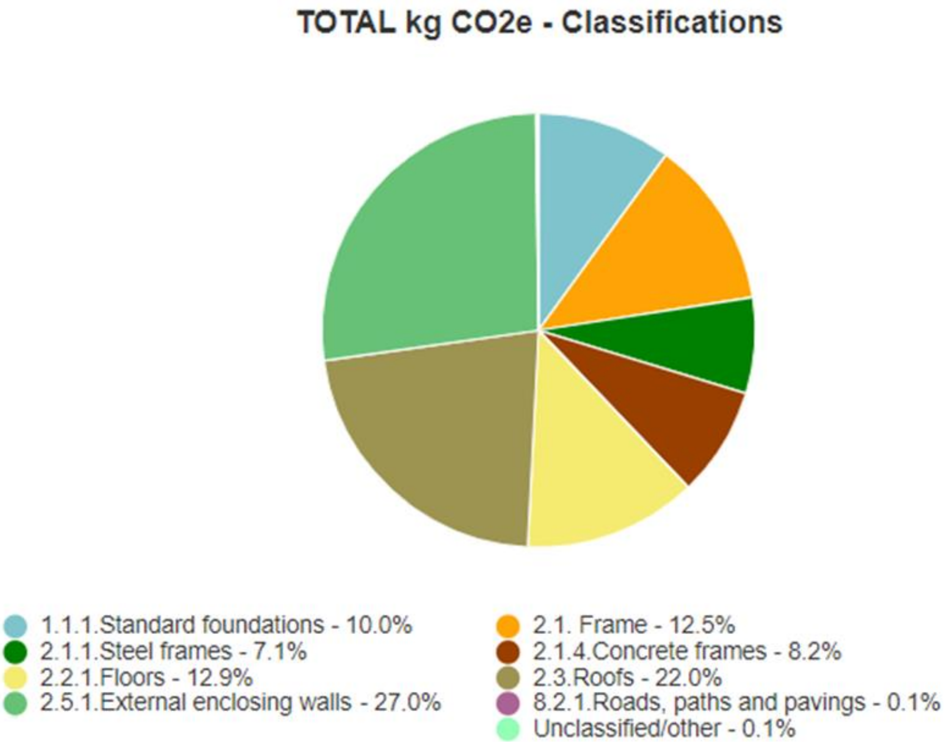
7.1. Current Grid Electricity

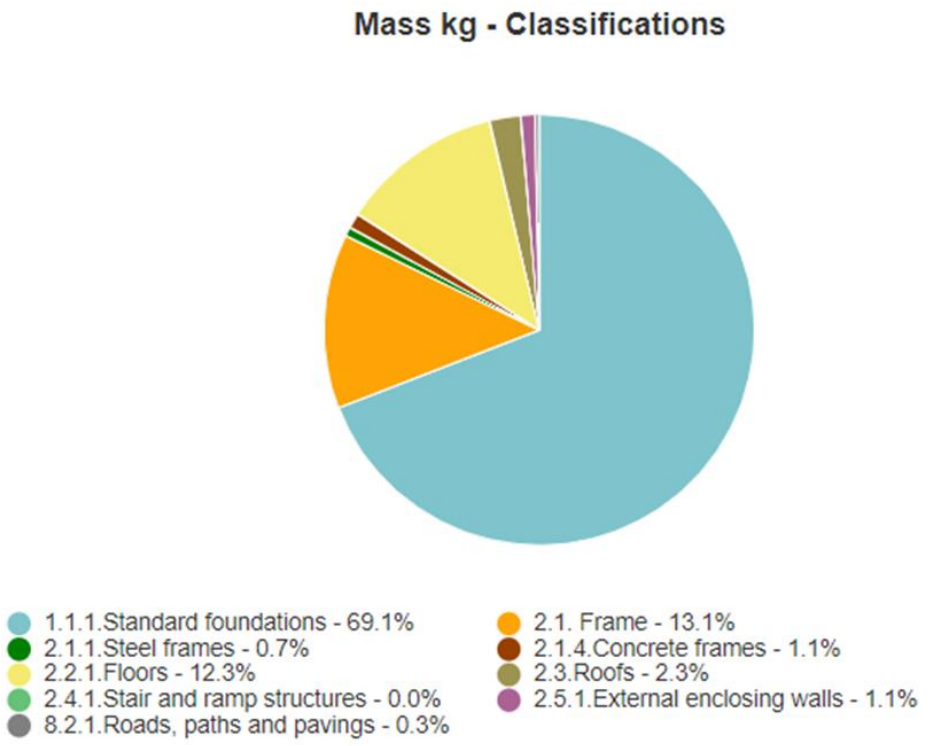
7.1.1. The WLCA results for the proposed design over a 60-year building service life are shown below.

7.1.2. The proposed design of the H1 Development has displayed the following summary results:

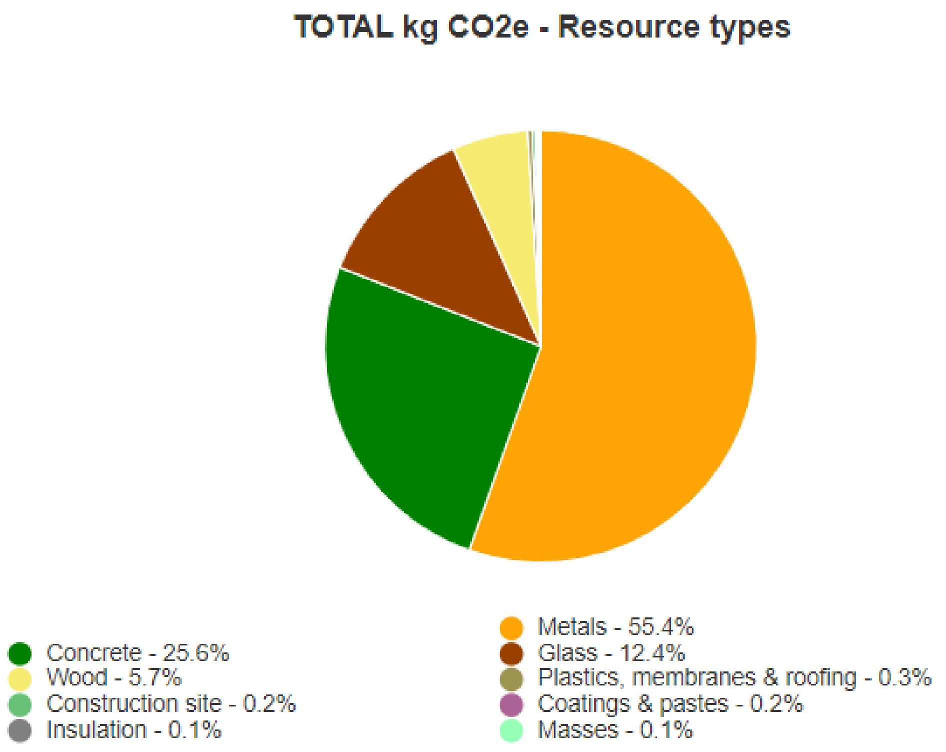


7.1.3. The total carbon dioxide emissions for the project is 409 kg/CO2e/m2 as calculated using ‘One Click’ software.

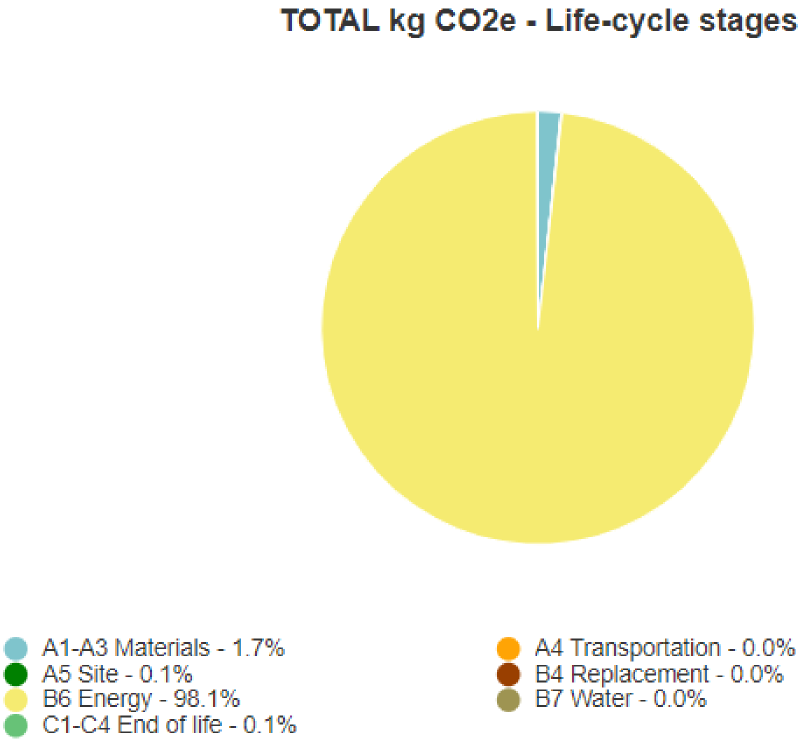




7.1.4. Product Stage emissions, associated with raw material supply, transport to manufacturing plant and manufacturing processes, form the largest contribution to the global warming potential of the development. The material contributing the most to kgCO2e emissions was found to be Metal (55.4%), followed by Concrete (25.6%), then Glass (12.4%).



7.1.5. The following chart and data show the Total Life Cycle stages for all the stages:



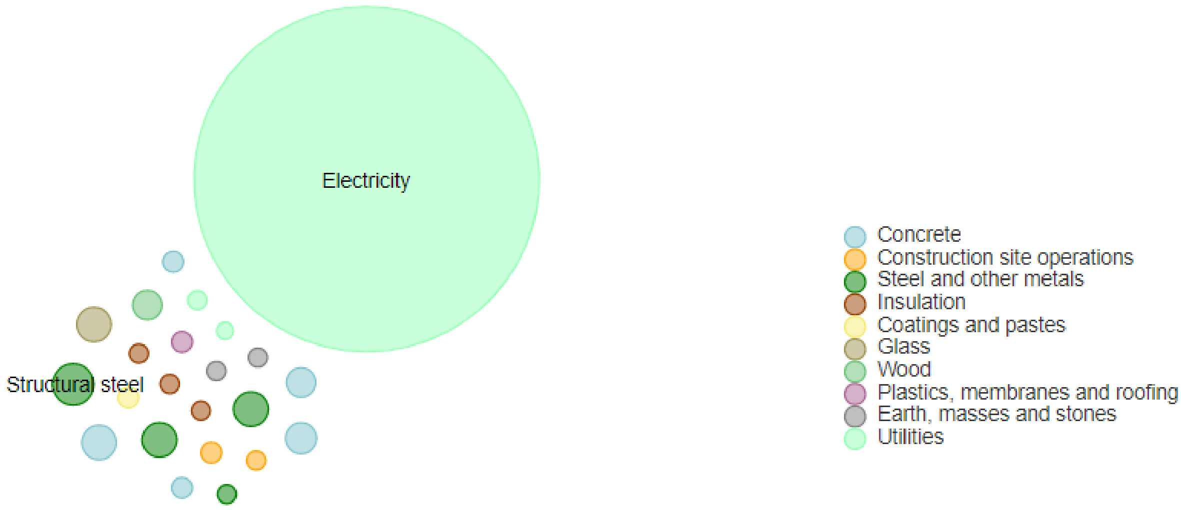
TOTAL kg CO2e - Life-cycle stages

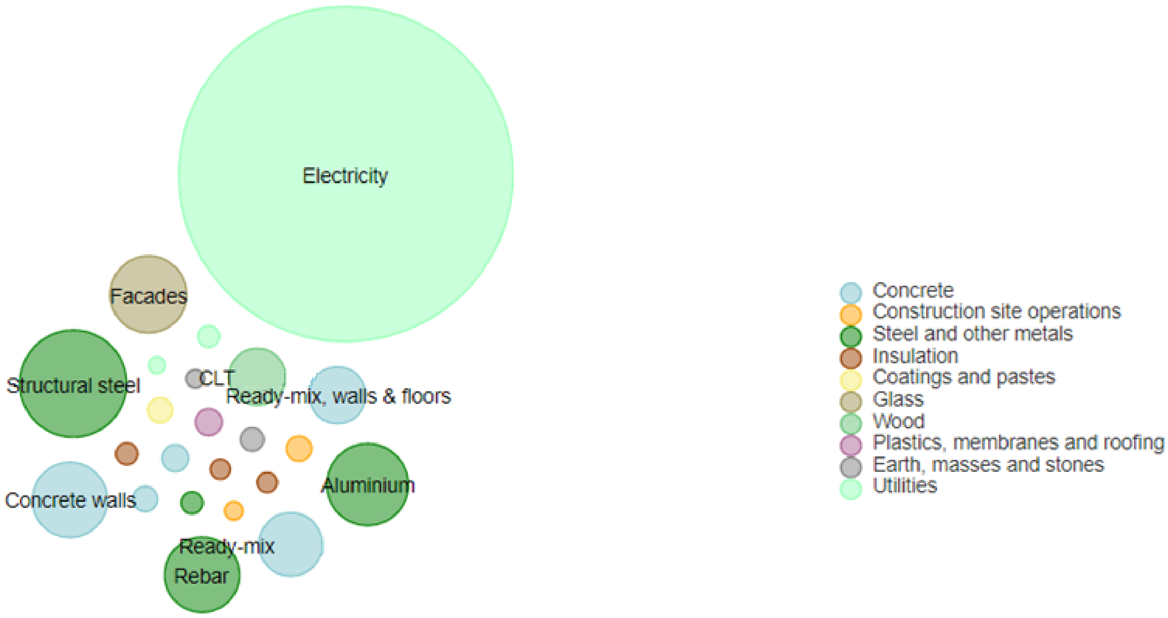
Item	Value	Percentage %
A1-A3 Materials	25 000 000	1.7 %
A4 Transportation	360 000	0.02 %
A5 Site	1 100 000	0.07 %
B4 Replacement	44 000	0.0 %
B6 Energy	1 400 000 000	98.15 %
B7 Water	1 700	0.0 %
C1-C4 End of life	800 000	0.05 %

7.2. Decarbonised Grid

7.2.1. Appendix A shows that the calculated operational energy WLC emissions for the development using current grid electricity carbon factors (SAP 10) are 157,494 kgCO2e/m2(GIA) and 41,232 kgCO2e/m2(GIA) for future decarbonised grid electricity.

7.2.2. The model run also with OneClick and the Electricity Steady Progression, shows the reduction in energy consumption in the decarbonisation model compared to the SAP 10 option. The comparison is shown in the graphs below:





7.2.3. The total KgCO2e in the graphs for the B6 module are: 1,400,000,000KgCO2e (SAP10) and 99,000,000KgCO2e (Steady Progression 2050)

7.3. Operational Water Use

7.3.1. The GLA WLC Appendix A also include B7 for the water use. This has been calculated, based on a similar project and on the targets for BREEAM, as 4.45 m3/person/year, which translates into 2 Kg CO_2e/m^2.

7.4. Opportunities Identified to Reduce Embodied Carbon

7.4.1. Making efficient use of resources is the best method of reducing embodied carbon:

- Considering material type, its efficient use, and expected lifespan.
- Choose low carbon versions of materials.
- Minimise wastage on site, consider construction processes and design for adaptability, disassembly and reuse.

7.4.2. The London Energy Transformation Initiative's (LETI) 'Supplementary Guidance to the Climate Emergency Design Guide – LETI Embodied Carbon Primer' highlights the below 'rules of thumb' strategies for reducing embodied carbon by building element:

Structure (Sub and super structure)	→ Compare the embodied carbon options for sub and superstructure at an early stage to identify an optimum solution. → Typical bay studies for the horizontal and vertical grid should be conducted at concept stage for different material arrangements to determine the impact on the total embodied carbon for each framing arrangement. → A structural rationalisation study should be conducted to determine the impact on overall material quantity versus efficiency in construction/fabrication. → Reduce the weight of structure where possible through voids. → Maximum embodied carbon quantities should be specified for structural components. Targets can be achieved by cement replacement such as GGBS, low carbon concrete mix design, low carbon materials and using recycled/repurposed materials. → Structural frame should be considered to have a dual purpose, ie the structure could serve as a shading device rather than introducing additional shading elements to control solar gain. → Explore recycled sources of material.
Envelope (Facade and roof)	→ Carry out embodied carbon comparisons on typical construction bays during early design stages where decisions can be guided by benchmarks / data. → Remember that it is the hidden parts (for example metal secondary framing) of a build up that often contain the most embodied carbon. → Where metals are used, limit their use and ensure they can be removed and recycled at end of life.
Mechanical, Electrical and plumbing (MEP)	→ Avoid over-provision of plant - a detailed load assessment must be undertaken. → Typically, fewer and simpler systems will reduce embodied carbon. → Explore options for plant room locations which reduce duct runs. → Design for deconstruction and recycling as MEP is typically replaced 2-3 times during the lifespan of a building. → Specify refrigerants with low Global Warming Potential (i.e <150) and ensure refrigerant leakage is carefully considered in the whole life carbon analysis.
Finishes and Furniture Fixtures and equipment (FF&E)	→ Consider eliminating materials where not needed e.g. by exposing services. → Utilise self-finishing internal surfaces like timber. → Consider the cleaning and maintenance regime to be undertaken. → Ensure the fit out requirement is clearly understood to avoid FF&E to be replaced when the first tenant moved in. → Carefully compare products based on EPD data, recycled material and also avoidance of harmful chemicals like formaldehydes and VOCs. → Consider the replacement cycle and specify for longevity. → Choose products that do not rely on adhesives so fabrics or finishes can be replaced. → Be wary of trends that are likely to date and require early replacement.
Design for Manufacture and Assembly (DfMA)	→ Compare embodied carbon of DfMA solutions with standard solutions. → If DfMA is to be used, identify the elements by the end of RIBA Stage 2. Examples include, bathroom or WC pods, plant modules, facade elements, repeatable rooms, pre-fabricated structural elements including twin wall, columns and planks. → Engage the supply chain early. → Lightweight materials are preferable for transportation purpose. → Ensure the repeatable systems are designed for deconstruction.

7.4.3. Specific guidance relating to the potential reduction of embodied carbon on the H1 Development is given below, in line with recommendations outlined by the LETI 'Embodied Carbon Primer - Supplementary guidance to the Climate Emergency Design Guide'. The recommendations below have been implemented as suitable.

7.4.4. Metal

7.4.5. Metal accounts for circa 55.4% of the global warming potential (kgCO2e) across the H1 Development, as analysed at this stage. The following strategies have been considered to reduce the embodied carbon impact of steel across the project:

- To facilitate the re-use of materials, bolted connections and clamped fittings would be preferred to welded joints where feasible.
- Where practicable, the designer would consider specifying standard connection details, including bolt sizes and the spacing of holes.
- In particular, studies on the façade have aimed for a reduction of material with a standardisation of sizes for all the elements
- The designer has considered easy and permanent access to connections where possible.
- Where feasible, steel should be free from coatings or coverings that would prevent visual assessment.
- The origin and properties of the component should be identified by bar-coding, e-tagging or stamping, and an inventory of products (material passport) should be kept.
- Long-span beams are considered to maintain flexibility of re-use in the future, allowing further cutting at a later stage.
- The designer has rationalised and simplified the design, eliminating unnecessary variations and taking advantage of any opportunities provided by manufacturing off site, using prefabricated solutions.
- The façade has been specified with 60-75% of recycled aluminium.

7.4.6. Concrete

7.4.7. Concrete accounts for circa 25.6% of the global warming potential (kgCO2e) across the development, as analysed at this stage. The most used cement is Portland Cement, which represents over 90% of the embodied carbon of a typical concrete mix. Although use of concrete has been reduced by introduction of CLT slabs, strategies implemented to reduce embodied carbon of concrete on H1 development include:

- Carrying out detailed assessment of strength grade requirements to ensure it's not over-specified.
- Use of granulated ground blast furnace slag (GGBS) as cement replacement.
- Increasing the recycled content of reinforcement steel (rebar).
- Reduction of slab thickness by slimming off the excess.

7.4.8. The potential savings due to use of admixtures has not been assessed at this stage but can be used to enhance the long-term durability of concrete without increasing cement content. We recommend where possible to review the durability and minimum strength requirements of the concrete mixes to deliver significant embodied carbon savings.

7.4.9. Timber

7.4.10. A CLT hybrid structure has been used for this project to reduce embodied carbon. The key driver is the ambition to reduce the carbon footprint of H1 Development and create an office building that is sustainable in the use of materials selected, during construction and in operation, and is considerate about the life cycle of resources used.

7.4.11. Enhanced use of timber could also offer the following wider benefits to the project:

- Timber can be lighter than other structural materials, reducing the amount of superstructure materials required.

- Some types of timber, such as pine and certain firs, have been shown to improve air quality and be of benefit to human health, although further consideration of glues and laminates should be given when using engineered timber.
- Humans respond favourably to the perceived warmth and natural aspect of the material.
- Wood is breathable and has a positive impact on indoor humidity regulation.

7.4.12. Glass

7.4.13. Glass requires the use of sand and minerals, which are non-renewable natural raw materials. In some cases, double glazing can be more carbon efficient than triple glazing, as the carbon footprint derived from using a triple glazing system can be higher than the operational carbon saving over the anticipated lifetime of the building. The impact of the frame material of any glass windows is also key.

7.4.14. Testing of different glass materials and types was undertaken analysing the performance from energy use of double and triple glazing as well as reducing the overall amount of glass. Only double glazing and aluminium frame with higher recycling content are specified.

7.4.15. Internal Finishes

7.4.16. Internal finishes are frequently replaced over the lifetime of a building and can require considerable maintenance and upkeep. While the overall quantity of this component is smaller compared to superstructure/substructure, the embodied carbon of maintenance and upkeep can be considerable across the whole life cycle, particularly in large buildings with significant wall/floor/ceiling area.

7.4.17. At H1 Development, the concept design is based on exposed soffits across the office floorplates, reducing the overall amount of materials and consequently overall embodied carbon.

7.4.18. As the internal design progresses, the following recommendations will be considered to reduce the embodied carbon impact of internal finishes:

- Linoleum is a natural alternative to vinyl. When produced correctly it can help to sequester carbon and will decompose naturally at the end of its useful life. Vinyl is plastic based so will not decompose and will often end up in landfill.
- Water based eco paints are readily available as alternatives to oil or water-based paints
- Cork can be harvested without felling trees and is a carbon store. As an internal finish, it offers a sense of warmth and acts as acoustic and thermal insulation, avoiding the need for additional finishes.
- Bamboo is a fast-growing wood and offers a rapid form of carbon sequestration. It can be made into a range of products, including flooring. Consider though that bamboo usually needs to be laminated, and the impacts this may have on its future reuse.
- Beyond the proposed structural CLT, timber can be used in finishes internally in a range of ways.
- Recycled products use no raw materials and are increasingly available. Plasterboard, kitchen tops and floor panels for example can all be specified as almost 100% recycled content.

7.4.19. Fixtures and Fittings

7.4.20. The following recommendations are made to reduce the embodied carbon impact of internal fixtures and fittings:

- Select FSC chain of custody certified timber and locally sourced natural materials.
- Use materials with a high percentage of recycled content.
- Compare material options by assessing maintenance requirements and embodied carbon.
- Choose refurbished white goods where possible and/or white goods that have a good energy rating (A+++ European standard) with energy saving options.

- Choose products and materials with a longlife cycle.

7.4.21. Construction Processes

7.4.22. Opportunities to reduce the carbon impact of the construction process, including waste, transportation of materials, and site activities are also discussed below.

7.4.23. Waste contributes to whole life embodied carbon through:

- Manufacture and delivery of materials delivered to site and then not used.
- Transportation of waste away from site.
- Energy to recycle into other products.
- Methane released if sent to landfill.

7.4.24. Reducing waste saves money and reduces natural resource consumption and CO2 emissions. The following issues have been considered to reduce the embodied carbon due to waste:

- Design out waste.
- Eliminate unnecessary elements.
- Standardise sizes and details to reduce offcuts.
- Reduce complexity to simplify construction process.
- Evaluate the reuse and recycling opportunities of materials before specifying.
- Consider off-site fabrication of buildings or elements to reduce waste.
- Prepare and implement a Site Waste Management Plan.
- Set up a logistics plan and utilise “just-in time” delivery as far as practical.
- Consider use of Construction Consolidation Centres.
- Reduce the amount of surplus materials by ordering the correct amount at the right time.
- Provide safe, secure and weatherproof materials storage areas to prevent damage and theft.
- Establish take-back schemes with suppliers to collect surplus materials.
- Engage with the supply chain to supply products and materials using minimal packaging, and segregate packaging for reuse.

7.4.25. WRAP provides lots of guidance on how to achieve these. www.wrap.org.uk

7.4.26. Opportunities to reduce CO2 emissions associated with construction processes and associated transport have been identified as:

- Energy efficient site accommodation.
- Efficient use of construction plant.
- Earlier connection to the electricity grid.
- Good practice energy management on site.
- Onsite measurement, monitoring and targeting.
- Fuel efficient freight driving and renewable transport fuels.
- Use of construction consolidation centres.
- Renewable (low carbon) biofuels.
- Reduce transport of waste.
- Business travel fleet management.
- Good practice energy management of corporate offices.
- Reuse of formwork – it is assumed that the timber formwork is reused three times before being discarded. If is recommended that formwork on the project is reused five times. Adopting standardised detailing would enable formwork to be re-used multiple times and would allow for repetition of reinforcement. Reusable plastic formwork should be considered.

7.4.27. Design for Adaptability, Disassembly and Recyclability

7.4.28. When a building is demolished, most of the materials are discarded, and along with them the embodied energy is lost. If buildings were designed for adaptability and disassembly, rather than demolition, greater proportions of building materials could be salvaged for reuse. In such a scenario, embodied energy would be recovered along with the materials, thereby reducing the total energy requirements of the built environment.

7.4.29. The following recommendations have been considered and implemented by the design team in addition to those mentioned throughout previous sections of this report:

- Modular design – considering separating structural elements from functions that could be changed or moved as part of future adaptation, for example not enclosing toilets within shear walls, restricting where these could move in future fit-outs.
- Considering where it may be possible to incorporate soft-spots or easily demountable structure for future alterations. The use of timber facilitates the connectivity and alterations.
- Considering spans, loads and structural grids that allow for changes and alternative uses. This has been fully considered and an almost completely regular grid that facilitates future changes is in place.
- Avoiding composite materials (e.g. concrete on metal deck), which may be hard to deconstruct. CLT slabs have been used throughout the office floors.
- Designing connections to be visible and reversible.
- Designing in shading to reduce cooling demand where possible. The façade has been designed to minimise solar gains with extensive external shading and reduced glazing areas.
- Use standard size products wherever possible rather than bespoke finishes.
- It is envisaged that the design will be developed using BIM (Building Information Modelling). It can be used to visualise, perform stress, deflection and other simulations in-house to avoid material intense methods. BIM is useful throughout the building life cycle to determine the best material choices, check manufacturability of part and mould designs to help avoid production delays, manufacturing defects or costly mistakes.
- Using lightweight material can reduce transportation costs, provided the distances and mode of transportation are also considered. The use of CLT for slabs, which is much lighter than concrete has fully supported this point.
- Quality control to reduce the need for frequent repairs and maintenance.

7.4.30. Building Circularity

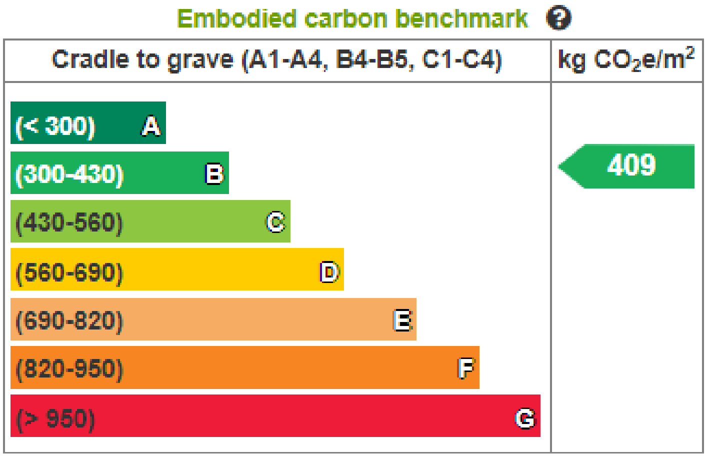
7.4.31. A Circular Economy statement has been undertaken and accompanies the planning application. The H1 development has a Building Circularity score of 39%. The calculated Building Circularity score represents the total materials circularity both in use of materials for the project as well as end of life handling. It is calculated as the average of Materials Recovered (representing use of circular materials in the project) and Materials Returned (representing how effectively materials are returned, instead of disposed of or downgraded in value).

8. CONCLUSION

8.1.1. A Whole Life-Cycle Carbon Assessment in accordance with the GLA requirements has been undertaken for the H1 Development. This has been done with the aim of 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. The WLCA has been run for the entire building, in line with the GLA requirements. This has been based on materials data provided by the project design team for applicable building elements required by the GLA methodology.

8.1.2. The following conclusions can be drawn from the results summarised in this report:

- The H1 Development achieved One Click LCA 'Carbon Heroes Benchmark' rating of B, demonstrating 409kgCO2e/m2.



8.1.3. 'Product Stage' emissions, associated with raw material supply, transport to manufacturing plant and manufacturing processes, form the largest contribution to the global warming potential of the development. The material contributing the most to kgCO2e emissions was found to be Metal (55.4%), followed by Concrete (25.6%), then Glass (12.4%).

8.1.4. As reported in the Appendix A, the calculated operational energy WLC emissions for the development using current grid electricity carbon factors (SAP 10) are 1,623 kgCO2e/m2(GIA) and 425 kgCO2e/m2(GIA) for future decarbonised grid electricity.

8.1.5. The GLA WLC Appendix A Module A-D, total emissions for the H1 Development using current grid electricity carbon factors (SAP 10) are 1,917.51 kgCO2e/m2(GIA) and 41,489 kgCO2e/m2(GIA) for future decarbonised grid electricity.

8.1.6. The development has minimised embodied carbon through several measures incorporated in the early design of the project such as:

- use of CLT slabs
- Modularisation for structure and façade
- aim for high recycled content on aluminium curtain walling
- optimised building mass and façade for minimal energy consumption in operation

APPENDIX 1

GLA WLC Assessment Template_ May 2020

Project details	
Project name	H1 Elephant Park
Planning application reference number (if applicable)	
Use Type	E
Brief description of the project	
GIA (m^2)	63,598
Authors (organisation or individuals)	HDR | Hurley Palmer Flatt (HDR)
Date of assessment	09.02.2021
Nationally recognised assessment method used	e.g. 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	[This should align with the software tool used at outline/detailed planning stage]
Source of carbon data for materials and products	[See guidance for acceptable sources]
EPD database used	[If using more than one database please list all]

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	26,457,797 kg CO2e	44,117 kg CO2e	103,292,920 kg CO2e	795,001 kg CO2e	-8,662,886 kg CO2e
TOTAL kg CO_2e/m^2 GIA	416.016	0.694	1624.154	12.500	-136.213
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 1 was used to inform design decisions	[Explain the reasons for any divergences from WLC benchmarks, including against the WLC aspirational benchmarks]				

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	26,457,797 kg CO2e	44,117 kg CO2e	27,117,560 kg CO2e	795,001 kg CO2e	-8,661,217 kg CO2e
TOTAL kg CO_2e/m^2 GIA	416	1	426	13	-136
Comparison with WLC benchmarks (see Appendix 2 of the guidance) if Assessment 2 was used to inform design decisions	[Explain the reasons for any divergences from WLC benchmarks, including against the WLC aspirational benchmarks. Please note that grid decarbonisation has not been accounted for in the benchmarks]				

Key site opportunities and constraints in reducing WLC emissions	

	Action	WLC reduction (kg CO_2e/m^2 GIA)
Summary of key actions to reduce whole life-cycle carbon emissions that have informed this assessment, including the WLC reductions	[This list does not need to be exhaustive but should identify the actions with the biggest impacts. Insert more lines if needed]	

	Further potential opportunities	WLC reduction potential (kg CO_2e/m^2 GIA)
Specify further opportunities to reduce the development's whole life-cycle carbon emissions. including the WLC reduction potential		

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						
2.1	Superstructure: Frame						
2.2	Superstructure: Upper Floors						
2.3	Superstructure: Roof						
2.4	Superstructure: Stairs and Ramps						
2.5	Superstructure: External Walls						
2.6	Superstructure: Windows and External Doors						
2.7	Superstructure: Internal Walls and Partitions						
2.8	Superstructure: Internal Doors						
3	Finishes						
4	Fittings, furnishings & equipment (FFE)						
5	Services (MEP)						
6	Prefabricated Buildings and Building Units						
7	Work to Existing Building						
8	External works						
		TOTAL	0 kg			0 kg	0 kg
		Material intensity (kg/m2 GIA)	0 kg/m2 GIA			0 kg/m2 GIA	0 kg/m2 GIA

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

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					Module D*
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment												0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	
0.2	Major Demolition Works												0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	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 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 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			68,366 kg CO2e	Included in C1	Included in C1	Included in C1	68,366 kg CO2e	-1,056,999 kg CO2e
1	**Substructure**	0 kg CO2e	2,383,960 kg CO2e	171,872 kg CO2e	114,560 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			709,294 kg CO2e	Included in C1	Included in C1	Included in C1	3,379,686 kg CO2e	-6,491,606 kg CO2e
2.1	Superstructure: Frame	0 kg CO2e	15,553,970 kg CO2e	178,467 kg CO2e	658,428 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	44,117 kg CO2e	0 kg CO2e			Included in C1	Included in C1	Included in C1	Included in C1	16,434,982 kg CO2e	Included in C1
2.2	Superstructure: Upper Floors	0 kg CO2e	Inclued in 2.1	Inclued in 2.1	Inclued in 2.1	0 kg CO2e	0 kg CO2e	0 kg CO2e	Included in B4	0 kg CO2e			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
2.3	Superstructure: Roof	0 kg CO2e	Inclued in 2.1	Inclued in 2.1	Inclued in 2.1	0 kg CO2e	0 kg CO2e	0 kg CO2e	Included in B4	0 kg CO2e			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
2.4	Superstructure: Stairs and Ramps	0 kg CO2e	Inclued in 2.1	Inclued in 2.1	Inclued in 2.1	0 kg CO2e	0 kg CO2e	0 kg CO2e	Included in B4	0 kg CO2e			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
2.5	Superstructure: External Walls	0 kg CO2e	7,083,006 kg CO2e	3,499 kg CO2e	278,581 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			16,995 kg CO2e	Included in C1	Included in C1	Included in C1	7,382,081 kg CO2e	-1,112,612 kg CO2e
2.6	Superstructure: Windows and External Doors	0 kg CO2e	Included in 2.5	Included in 2.5	Included in 2.5	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
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	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	0 kg CO2e	0 kg CO2e	0 kg CO2e
3	**Finishes**	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 kg CO2e	0 kg CO2e	0 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	0 kg CO2e	0 kg CO2e	0 kg CO2e
5	**Services (MEP)**										31,530,076 kg CO2e 71,660,964 kg CO2e	101,880 kg CO2e					103,292,920 kg CO2e	
6	**Prefabricated Buildings and Building Units**																0 kg CO2e	
7	**Work to Existing Building**																0 kg CO2e	
8	**External works**	0 kg CO2e	28,692 kg CO2e	1,473 kg CO2e	1,289 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e		0 kg CO2e			346 kg CO2e	Included in C1	Included in C1	Included in C1	31,800 kg CO2e	-1,669 kg CO2e
TOTAL kg CO2e		**0 kg CO2e**	**25,049,628 kg CO2e**	**355,311 kg CO2e**	**1,052,858 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**44,117 kg CO2e**	**0 kg CO2e**	**103,191,040 kg CO2e**	**101,880 kg CO2e**	**795,001 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**130,589,835 kg CO2e**	**-8,662,886 kg CO2e**
TOTAL - kg CO2e/m2 GIA		**0 kg CO2e/m2 GIA**	**394 kg CO2e/m2 GIA**	**6 kg CO2e/m2 GIA**	**17 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**1 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**1,623 kg CO2e/m2 GIA**	**2 kg CO2e/m2 GIA**	**13 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**2,053 kg CO2e/m2 GIA**	**-136 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.

	Mandatary cells for completion
	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					Module D*
Building element category			[A1] to [A3]	[A4][2]	[A5]	[B1]	[B2]*	[B3]*	[B4]*	[B5]*	[B6]	[B7]	[C1]	[C2]	[C3]	[C4]		
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment												0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e
0.2	Major Demolition Works												0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	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 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 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	0 kg CO2e	68,366 kg CO2e	0 kg CO2e
1	**Substructure**	0 kg CO2e	2,383,960 kg CO2e	171,872 kg CO2e	114,560 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			68,366 kg CO2e	Included in C1	Included in C1	Included in C1	3,379,686 kg CO2e	-1,056,999 kg CO2e
2.1	Superstructure: Frame	0 kg CO2e	15,553,970 kg CO2e	178,467 kg CO2e	658,428 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	44,117 kg CO2e	0 kg CO2e			709,294 kg CO2e	Included in C1	Included in C1	Included in C1	16,434,982 kg CO2e	-6,491,606 kg CO2e
2.2	Superstructure: Upper Floors	0 kg CO2e	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
2.3	Superstructure: Roof	0 kg CO2e	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
2.4	Superstructure: Stairs and Ramps	0 kg CO2e	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1	Included in 2.1			Included in C1	Included in C1	Included in C1	Included in C1	0 kg CO2e	Included in C1
2.5	Superstructure: External Walls	0 kg CO2e	7,083,006 kg CO2e	3,499 kg CO2e	278,581 kg CO2e	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5			16,995 kg CO2e	Included in 2.5	Included in 2.5	Included in 2.5	7,382,081 kg CO2e	-1,112,612 kg CO2e
2.6	Superstructure: Windows and External Doors	0 kg CO2e	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5			Included in 2.5	Included in 2.5	Included in 2.5	Included in 2.5	0 kg CO2e	Included in 2.5
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	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	0 kg CO2e	0 kg CO2e	0 kg CO2e
3	**Finishes**	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 kg CO2e	0 kg CO2e	0 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	0 kg CO2e	0 kg CO2e	0 kg CO2e
5	**Services (MEP)**	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	8,254,655 kg CO2e 18,761,025 kg CO2e	101,880 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	103,292,920 kg CO2e	0 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	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	0 kg CO2e	0 kg CO2e	0 kg CO2e
8	**External works**	0 kg CO2e	28,692 kg CO2e	1,473 kg CO2e	1,289 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e			346 kg CO2e	0 kg CO2e	0 kg CO2e	0 kg CO2e	31,800 kg CO2e	0 kg CO2e
TOTAL kg CO2e		**0 kg CO2e**	**25,049,628 kg CO2e**	**355,311 kg CO2e**	**1,052,858 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**44,117 kg CO2e**	**0 kg CO2e**	**27,015,680 kg CO2e**	**101,880 kg CO2e**	**795,001 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**0 kg CO2e**	**130,589,835 kg CO2e**	**-8,661,217 kg CO2e**
TOTAL - kg CO2e/m2 GIA		**0 kg CO2e/m2 GIA**	**394 kg CO2e/m2 GIA**	**6 kg CO2e/m2 GIA**	**17 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**1 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**425 kg CO2e/m2 GIA**	**2 kg CO2e/m2 GIA**	**13 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**0 kg CO2e/m2 GIA**	**2,053 kg CO2e/m2 GIA**	**-136 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.
[2] Use the 'European manufactured' transportation scenarios (see Table 7, page 19 of the RICS PS) to calculate transportation emissions of MEP equipment.

	Mandatary cells for completion
	N/A


lendlease