JAW

Merton Vision, London Borough of Merton

Life Cycle Carbon Assessment

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JAWSustainability

Contents

1 Introduction

This report summarises the life cycle carbon assessment for the redevelopment of Merton Vision in order to meet the sustainability requirements of the London borough of Merton.

The site currently accommodates several buildings which provide facilities to Merton Vision. The current proposal is to demolish these building and redevelop the site to provide a two-storey development, which would host improved facilities for Merton Vision across the ground floor, with a GP practice across part of the ground floor and the first floor. The site location is shown in Figure 1.1

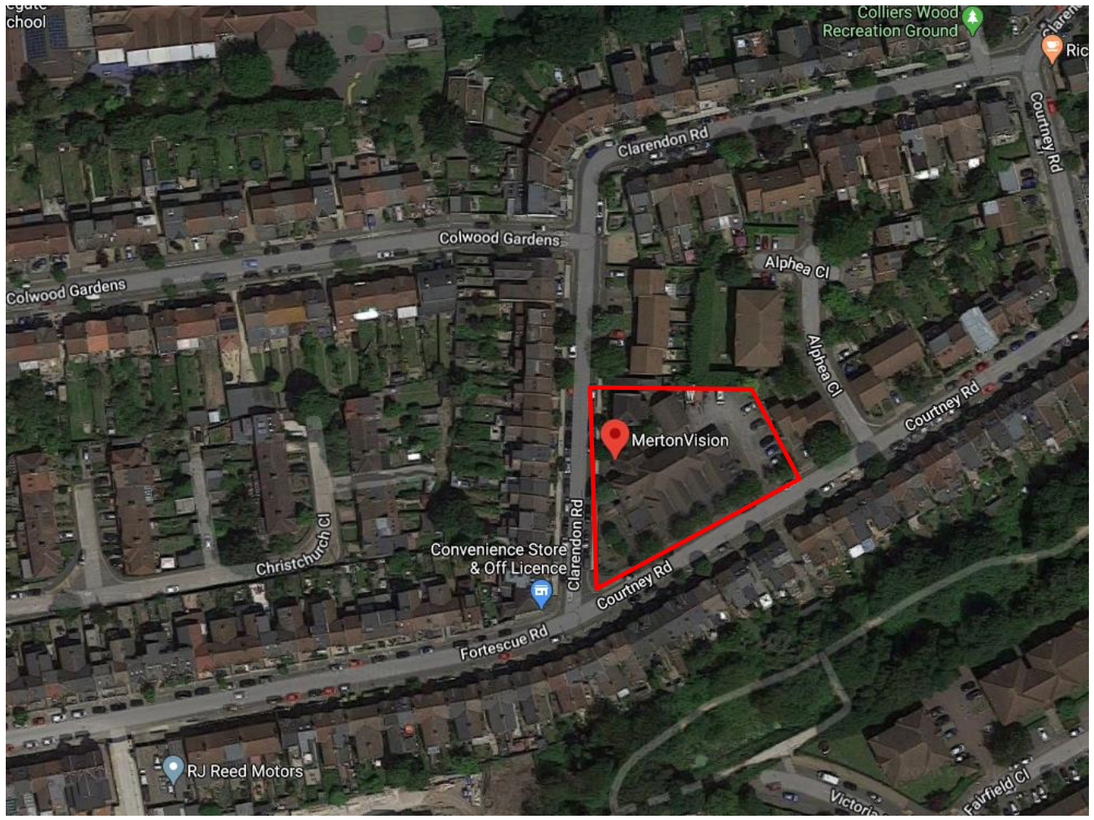

Figure 1.1 – Merton Vision Location

2 Methodology

The aim of this life cycle carbon assessment is to compare carbon emissions associated with the redevelopment and operation of the new proposal, to the continued operation of the existing building.

All emissions associated with the proposed materials for the new development were calculated using One Click LCA's 'LCA for BREEAM UK' Tool. Whole life-cycle carbon emissions are the total greenhouse gas emissions arising from a development over its lifetime, from the emissions associated with raw material extraction, the manufacture and transport of building materials, to installation/construction, maintenance and eventual material disposal.

Operational energy emissions were then quantified for the existing building, in its current state, and for the proposed new development. Operational emissions were quantified using Dynamic Simulation Modelling in the VE Compliance module of IES 2019, to generate a Building Regulation UK Part L (BRUKL) report for each building.

The different in the operational energy emissions was then calculated, and compared to the material emissions to calculated a "payback time", at which point less emissions are produced from the construction and running of the new development, then continuing to operate the current building in its current state.

3 Building Embodied Emissions

3.1 Existing Development

As the proposal is to compare the running of the existing building in its current state, to the construction and running of a new development, no embodied emissions have been included.

3.2 Proposed Development

The scope of assessment included all embodied life cycle emissions associated with the construction of the new building. Life cycle assessment includes the product, construction, use and end of life stages. The stages included within this section are outlined in Table 3.1. Operational Energy Use is excluded from his section but covered for both the existing and proposed development in the next section.

Product			Construction		Use							End of Life			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Raw Material	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition	Transport	Waste Processing	Disposal
✓	✓	✓	✓	✗	✗	✗	✗	✓	✓	✗	✗	✓	✓	✓	✓

Table 3.1 – Stages of the LCA

The reference study period for this LCA was 60 years, as per the default.

This is a provisional life cycle assessment conducted prior to technical design, as such it is not fully comprehensive, and is based on information provided by the design team, as well as assumptions on likely material use. The proposed development was modelled within IES VE, with the primary constructions input to the model. These results were then exported to One Click LCA's 'LCA for BREEAM UK' Tool.

The building elements covered by the assessment are outlined in Table 3.2.

Building Element	Proposed Construction
Foundations	Reinforced concrete trench foundations
Ground Floor	Suspended beam and block floor, 150mm insulation, 75mm screed
Frame	Hot rolled steel frame
Upper Floors	130mm composite concrete deck, isolating membrane, 75mm screed
Pitched Roof	Primary steel frame with cut roof timber frame in fill between, clay tiles, batten and counter batten, moisture membrane, 150mm timber rafters, rockwool insulation between, 75mm ridged board insulation, vapour control membrane, 15mm plasterboard
Flat roof	Single ply membrane, separating fleece, 18mm exterior grade plywood on softwood frame insulation as above
External Walls	Cavity walls, outer brick leaf, 150mm rockwool insulation, 140mm medium dense concrete block, 15mm plaster board
Windows and External Doors	Thermally broken double-glazed aluminium window system
Internal Walls and Partitions	Metal stud with 2 layers of 15mm plasterboard either side, 50mm Iso wool insulation between
Internal Doors	Timber Doors
External areas	Tarmacadam to road and entrance and permeable block paving for paths and parking bays

Table 3.2 Included building areas

4 Operation Energy Emissions

4.1 Existing Development

The operational energy emissions from the existing development has been modelled based on assumptions from visual inspection, building age and EPC guidelines.

4.1.1 Building Fabric

The figures used for the building fabric of the existing development are outlined in Table 4.1.

Fabric Element	Estimated Performance
Ground Floor	1.2 W/m²K
External Walls	2.1 W/m²K
Roof	2.3 W/m²K
Windows	4.8 W/m²K, g=0.85
External Doors	2.2 W/m²K
Air tightness	25 m³/m²h @ 50 Pa

Table 4.1 – Existing development building fabric

4.1.2 Building Services

The figures used for the building services of the existing development are outlined in Table 4.2.

Services Element	Estimated Performance
Heating	Gas boiler, 83% efficient
Cooling	-
Ventilation	Natural ventilation
Hot Water	Gas boiler, 83% efficient
Lighting	Halls - 60/ lm/W, LOR 0.6 Other spaces - 25 lm/W, LOR 0.6 Manual control

Table 4.2 – Existing development building services

4.2 Proposed Development

The operational energy emissions from the proposed development has been modelled based on an initial provisional energy strategy, which is still subject to completion.

4.2.1 Building Fabric

The figures used for the building fabric of the proposed development are outlined in Table 4.3.

Element	Proposed Specification
Ground Floor	0.12 W/m²K
External Walls	0.22 W/m²K
Roof	0.15 W/m²K
Windows	1.4 W/m²K, g=0.3
External Doors	1.4 W/m²K
Air tightness	2.5 m³/m²h @ 50 Pa

Table 4.3 – Proposed development building fabric

4.2.2 Building Services

The figures used for the building services of the proposed development are outlined in Table 4.4.

Element	Proposed Specification
Heating	VRF, SCOP 3.4
Cooling	VRF, SEER 5.1
Ventilation	MVHR, 1.5 W/(l/s), 90% HR efficiency in occupied rooms
Hot Water	Electric hot water
Lighting	80 lm/W, photoelectric dimming in perimeter rooms, occupancy sensing throughout

Table 4.4 – Proposed development building services

5 Results

5.1 Building Embodied Emissions

The embodied emissions associated with the material inputs into the new development are shown in Table 5.1, broken down by RICS category.

RICS Category	Life Cycle Emissions (kgCO2e)
Standard foundations	278,754
Steel frames	92,428
Lowest floor construction	77,719
External Windows	67,271
External enclosing walls above ground floor level	56,161
Internal Walls and Partitions	44,747
Roofs, coverings and roof systems	39,497
Upper Floors	36,473
Roads, paths and pavings	19,440
Internal Doors	446
Total (kgCO2e)	**712,936**

Table 5.1

5.2 Operation Energy Emissions

The operational energy emissions for the existing and proposed development are outlined in table 5.2. The difference in operational energy emissions between the new proposed development and the existing building is 48,031 kgCO2e/year.

		Existing Development		Proposed Development	
		Gas	Electricity	Gas	Electricity
Monthly Energy Use (MWh)	Jan	41.25	7.09	0.00	8.67
	Feb	36.37	6.44	0.00	7.61
	Mar	33.62	7.06	0.00	8.05
	Apr	19.08	6.12	0.00	6.39
	May	9.12	6.74	0.00	6.80
	Jun	4.44	6.71	0.00	7.53
	Jul	2.54	7.04	0.00	8.27
	Aug	3.29	7.04	0.00	8.11
	Sep	6.36	6.42	0.00	7.10
	Oct	16.43	7.38	0.00	7.65
	Nov	28.93	7.08	0.00	8.16
	Dec	39.70	6.18	0.00	8.15
Summed total (MWh/year)		241.12	81.30	0.00	92.48
Annual emissions by source (kgCO2e / year)		50,636	18,942	0	21,547
Total annual emissions (kgCO2e / year)		**69,578**		**21,547**	

5.3 Payback Time

The results indicate that the total embodied emissions from the construction of the new development will be 712,936 kgCO2e. The difference in operational energy emissions between the new proposed development and the existing building is 48,031 kgCO2e/year. This indicates that the emissions from the construction and running of the new proposed development will be less then emissions from the continued running of the building in its current state in 15 years.

6 Actions

6.1 Construction Materials

6.1.1 Recycled binders within the concrete

Concrete is the largest single material contributor the buildings life cycle emissions. During this assessment, a typical concrete mix has been used, that uses 10% recycled cement replacements (such as ground granulated blast-furnace slag or fly ash from power stations). Products are available in London that can have a recycled cement replacement content of up to 55%, which can have a significant impact on the carbon emissions of the product.

These will be considered by the design team when conducting the technical design.

6.1.2 Recycled Aggregate

Depending on the application and type of concrete, there are opportunities to use recycled aggregates and demolition waste in new on-site concrete. This prevents waste and minimises the requirement for new resources. Using recycled aggregates directly from the demolition of the site minimise emissions associated with the transport of materials.

6.1.3 Reduce volume of concrete

Design decisions will be taken which minimise the volume of concrete within the building, by ensuring a highly efficient structural design is conducted. This has the added benefit of reduce the project cost, as well as life cycle carbon emissions. It will be reviewed at the technical design stage.

6.1.4 Façade design and material selection

The proposed cladding system standard brickwork façade. This is a robust and standardised material that requires little to no maintenance over its life and can often be reclaimed at the end of the building's life.

6.1.5 Select low carbon materials

When selecting and specifying products across the development, products should be identified that have a low embodied carbon. This information can often be found in the product Environmental Product Declaration (EPD), if available.

Insulating materials will be specified to maximise thermal performance whilst still paying attention to the environmental impact of the materials used. The use low embodied energy products will be further investigated.

Responsible sourcing will also be pursued. All timber used on site during the construction phase and within the building will be from legal sources. Where possible, FSC or equivalent timber will be used. Sourcing of other materials will include products where the manufacturer employs an environmental management system such as ISO 14001 or BES 6001. Where possible, site won reclaimed materials will be reused and materials will be sourced locally.

Non-toxic materials will be used wherever possible, including the specification of products with low VOC content in line with European testing standards.

All the building elements will achieve high ratings on the BRE Green Guide to Specification. Materials will be specified to have a low embodied energy, considering whole life cycle analysis.

6.2 Transportation to site

All construction materials should be sourced from suppliers as close as possible to the site. This minimise transportation distances and emissions associated with the transport of these materials.

6.3 Material replacement and refurbishment

A comprehensive maintenance and repair schedule should be in place throughout the developments life to ensure that all equipment and materials last for their full lifespan, minimising the requirement to replace or refurbish elements the building.

6.4 Energy use

The development has been designed to comply with the London plans energy requirements, and as such demonstrates a significant improvement over the building regulation baseline. An energy strategy has been developed following the energy hierarchy 'Be Lean, Be Clean, Be Green, Be Clean'. The development employs an efficient building fabric, including well insulated walls and highly efficient glazing, efficient systems and PV Panels to maximise carbon savings for the site.

6.5 Water use

Water fittings will be specified with low flow rates to minimise water consumption. WC will be dual flush. Water fittings will be specified with the following or similar flow rates if specified:

- WC - 6/4 litre dual flush
- Wash basin taps – 7.5 l/min
- Showers – 8 l/min
- Urinal 4 l/bowl/hour
- Kitchenette tap 7.5 l/min
- Dishwashers (domestic – 13 l/cycle, commercial – 6 l/rack)

Water meters will be installed to encourage building operators to monitor consumption.

6.6 Deconstruction

The demolition and deconstruction of the development should be considered at the design stage. Materials that can be separated from each other to allow for more effective recycling at the end of life should be considered.

The development is proposing a steel frame structure, which allows for simple disassembly at the end of the building's life cycle. Internal walls are steel stud and plasterboard which can be simply separated and recycled. The external façade is brickwork, which can be reclaimed at the end of the building's life cycle.

6.7 Durability, Adaptability and Flexibility

The development has been designed for a specific client and purpose, to ensure it meet the requirements of the occupants. However, the use of a structural steel frame, and primarily non-structural internal walls, allows the development to be redeveloped in the future if requirements changed.

The development follows the cooling hierarchy to minimise overheating. A dynamic overheating assessment was conducted and recommended that mechanical cooling was introduced.

The site is in flood zone 1 so is not considered to be at risk of flooding.

7 Conclusion

This report summarises the life cycle carbon assessment for the redevelopment of Merton Vision in order to meet the sustainability requirements of the London borough of Merton.

The aim of this life cycle carbon assessment is to compare carbon emissions associated with the redevelopment and operation of the new proposal, to the continued operation of the existing building.

All emissions associated with the proposed materials for the new development were calculated using One Click LCA's 'LCA for BREEAM UK' Tool. Operational energy emissions were then quantified for the existing building, in its current state, and for the proposed new development. using Dynamic Simulation Modelling.

The results indicate that the total embodied emissions from the construction of the new development will be 712,936 kgCO2e. The difference in operational energy emissions between the new proposed development and the existing building is 48,031 kgCO2e/year. This indicates that the emissions from the construction and running of the new proposed development will be less then emissions from the continued running of the building in its current state in 15 years.

Actions were then suggested that help minimise the buildings life cycle carbon emissions.

Figures in this report are based on provisional estimates of material and energy use.