

Land adjacent to Windhover Roundabout, Bursledon

Sustainability

Whole Life Carbon Assessment & BREEAM Mat01 LCA

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1.

Executive Summary

Executive Summary

WLCA & BREEAM Mat01 LCA

Ramboll UK Limited ('Ramboll') has been appointed by Wates Developments Ltd ('the Client') to undertake a Whole Life Carbon Assessment (WLCA) and BREEAM Mat01 LCA for the proposed development of two industrial units at the Land adjacent to Windhover Roundabout, Bursledon. Currently the design is at Concept Stage and is located at the Land adjacent to Windhover Roundabout and between Bursledon Road (A3024) and West End Road (A27), Bursledon, Hants, SO31 8BN hereafter referred to as the 'Proposed Development'. The Proposed Development encompasses two Units (Unit 1 and Unit 2) with indicative Gross Internal Areas (GIA) of 9,586 m² and 7,209 m² respectively. Unit 1 has been quantified as the basis for the study (Unit 2 is similar in design and size to Unit 1 and therefore assumed to have similar results and findings) as well as the Hard Landscaping areas of the Site. It should be noted that the planning application is up for 18,580 m² of GIA.

The WLCA aims to measure the projected carbon emissions associated with the Proposed Development, comply with BREEAM NC v6.0 Mat 01 credits, and serve as a baseline for future assessments. Additionally, it identifies key carbon hotspots and evaluates design options to reduce carbon emissions. As the design is at early stage (outline planning application), quantities and specification have been estimated based on the current illustrative design and are subject to change at later stages. The assessment follows the RICS Professional Standard Whole life carbon assessment for the built environment 2nd edition and BREEAM Mat 01 requirements.

Key Findings

The upfront carbon emissions (A1-A5) for the development of Unit 1 were found to be 461 kgCO₂e/m², or 4,744 tonnes CO₂e total. The whole life embodied carbon emissions (A-C) of Unit 1 were found to be 596 kgCO₂e/m² or 6,036 tonnes CO₂e total. Similar results are expected for Unit 2

Significant emissions were identified in the structural frame, roof, substructure and external works. Addressing the material choices and construction processes in these areas could lead to 15% carbon reductions at the next stage of design.

The project is on track to achieve 3No. BREEAM Mat 01 credits at Concept Design.

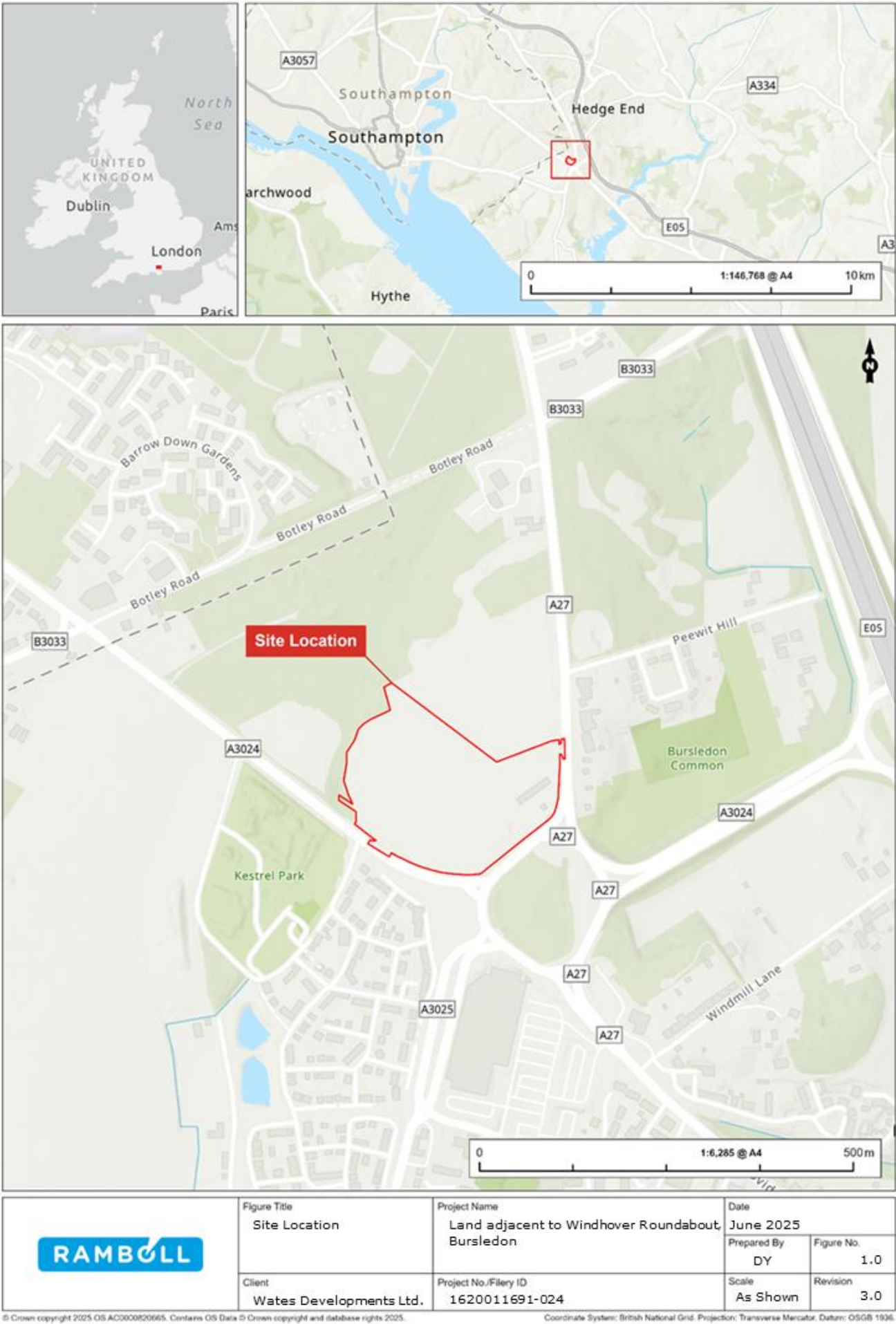


Figure 1: Site Location.

2.

Introduction and Approach

Introduction

Report Introduction

This Whole Life Carbon Assessment & BREEAM Mat01 LCA has been prepared by Ramboll in relation to the planned construction at Land adjacent to Windhover Roundabout, Bursledon. It should be read alongside the full suite of design and technical reports that have been prepared and submitted as part of the outline planning application.

This report focuses on Whole Life Carbon and the LCA of the Proposed Development aligned with BREEAM and RICS guidance. At Outline Planning stage, the key output of the LCA is to establish total embodied carbon for the proposed design, identify carbon hotspots and opportunities to reduce the carbon footprint of the design that can be carried forward into the detailed design. Additionally, a BREEAM Mat01 study is undertaken to satisfy the requirements of the BREEAM NC version 6.0 issue Materials 01 (Mat 01).

Site Location

The Site is located on the Land adjacent to Windhover Roundabout and between Bursledon Road (A3024) and West End Road (A27), Bursledon, Hants, SO31 8BN. The Site is located within Eastleigh Borough.

The Site is circa 4.63ha (11.4 acres) and comprises predominantly undeveloped agricultural pasture land, but with potential for some Made Ground to be present in limited areas of the Site. The Site takes the form of two connected grassland fields with a patch of tall ruderals and a wet flush along its eastern edge. The Site also includes a small collection of agricultural-type buildings sited on an area of hard standing within its south eastern part. Topographically the Site falls to its south-west towards Bursledon Road, and rises north-east towards West End Road.

Project Description

The Proposed Development consists of an outline planning application (all matters reserved except for access) for employment development (Use Class B2/B8) of up to 18,580 square metres together with ancillary offices (Use Class E(g)(iii)) and other ancillary buildings, structures, parking, servicing and manoeuvring areas, landscaping and sustainable urban drainage features, following demolition of existing buildings.



Figure 2: Land adjacent to Windhover Roundabout, Bursledon Illustrative Masterplan (credit: Terence O'Rourke 2025 – 276504-TOR-XX-ZZ-DR-A-P102_Illustrative Masterplan-D)

Space Uses	GIA
Unit 1	9,586 m ²
Unit 2	7,209 m ²
TOTAL GIA	16,795 m ²

Carbon is the number. Life Cycle Assessment is the calculator.

Carbon Emissions and Life Cycle Assessment

With 49 % of the total Green House Gas emissions produced in the UK being attributed to the construction and operation of the built environment, it is evident that the building sector has a significant role to play in reducing carbon emissions and responding to the climate emergency. Carbon emissions associated with the operation of buildings have been the subject of regulation and until recently, the primary focus for reducing the environmental impact of buildings. With increasing building energy efficiency and increasing decarbonisation of electricity supply, building operational carbon emissions are acknowledged to be rapidly reducing. While we must continue to focus on reducing operational carbon, there must also be increased efforts to address the embodied carbon emissions.

Embodied carbon emissions are all emissions associated with the manufacturing, transportation, construction, and end of life (EoL) stages of all built assets and contribute around 11 % of all global carbon emissions and can be quantified by undertaking a LCA study.

LCA is an established method of assessing the cumulative environmental impacts associated with all lifecycle stages of a product, process, or a whole construction project. An LCA can help inform decision making not only in terms of identifying measures to reduce carbon emissions, but also in relation to other environmental indicators such as material, water and energy use across the whole life cycle.

Whole Life Carbon Assessment (WLCA) takes the methodology of LCA and applies it specifically to measuring carbon emissions (a.k.a. Global Warming Potential or GWP) of assets in the built environment.

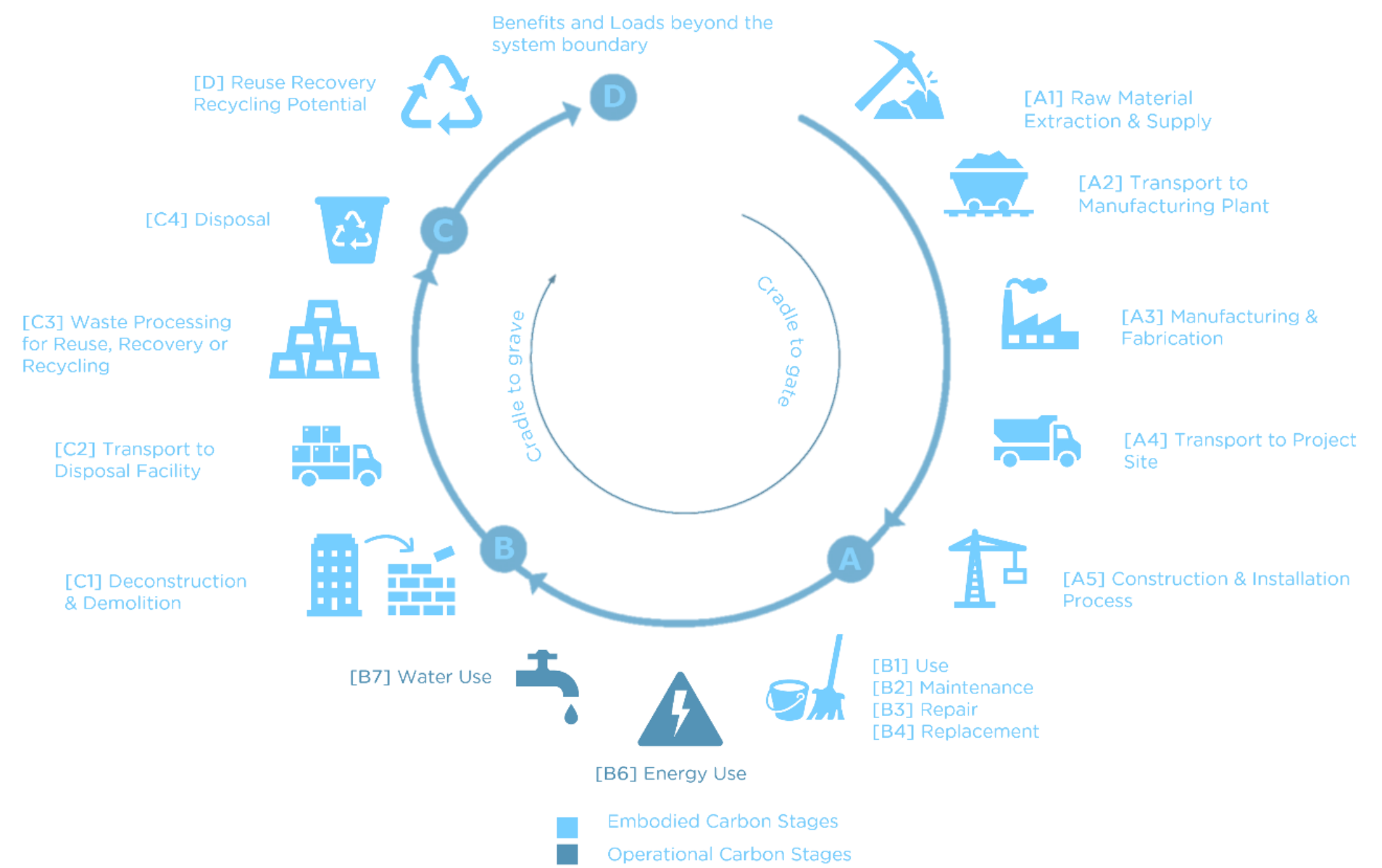


Figure 3: Life Cycle Stages to EN15978

Reported carbon values will differ between methodologies.

Detailed descriptions of each methodology and assumptions can be found in the supporting appendices

RICS Professional Statement 2nd Edition (RICS)

The RICS Whole Life Carbon Assessment PS is considered the standard approach to undertaking building WLCA in the UK. This is the most up to date guidance and ensures like for like comparisons can be made with other projects.

Life Cycles Stages

Following RICS guidance, a complete WLCA undertaken in compliance with this standard must account for carbon removals and emissions arising over the entire life cycle of a built asset (modules A–C).

It must also separately account for the loads and benefits beyond the system boundary considered in module D.

Building Elements

Building elements are broken down using RICS New Rules of Measurement (NRM) classification. Granularity is reflective of the progression of the design, with level 2 classification expected for RIBA stage 2.

All relevant building elements are included based on details provided by the project team.

Reference Study Period (RSP)

A 60-year RSP is used following this assessment methodology.

Contingency and Uncertainty

Following RICS guidance, an allowance of 15% uplift has been applied as the project is at early design stage.

BREEAM NC Materials 01 (Mat01)

The LCA has also been completed to satisfy requirements of the BREEAM NC version 6.0 issue Materials 01 (Mat 01) ‘Environmental impacts from construction products - Building life cycle assessment (LCA)’. This includes seven credits (Criteria 1 to 7) and three exemplary credits (Criteria 8 to 18).

3No. credits relevant to the LCA are targeted at concept design

Targeted Credits

Superstructure:

Criterion 1 - Comparison with the BREEAM LCA benchmark during Concept Design: (office, industrial and retail buildings only) – Included but not targeted

Criteria 3, 4 – Options appraisal during Concept Design: Carry out building LCA options appraisal of 2 to 4 significantly different superstructure design options - Targeted

Substructure and Hard Landscaping:

Criteria 6 and 7 – Substructure and hard landscaping options appraisal during Concept Design – Targeted

Life Cycles Stages

Following BREEAM guidance, the assessment must consider Stages A1-A3, with A4, A5 included if possible, with the LCA tool. Similarly, all stages in B and C are included where the tool calculates them. OneClick LCA provides calculation for all stages, so all have been included in the study where relevant.

Building Elements

Building elements are broken down using RICS New Rules of Measurement (NRM) classification, with a detailed scope of included elements relevant to each credit provided in the BREEAM guidance.

Reference Study Period

A 60-year RSP is used following this assessment methodology.

Contingency and Uncertainty

No contingency or uplift is applied to the results.



Figure 4: RICS Professional Statement 2nd Edition (RICS)



Figure 5: BREEAM NC v6.0 Materials 01 (Mat01)

3.

RICS Results

The Concept Stage Embodied Carbon Summary

RICS Whole Life Embodied & Operational Carbon

The concept stage design has been analysed in line with RICS v2 2023 guidance to provide an estimate of both embodied and operational carbon emissions throughout the building's lifecycle.

Upfront Carbon Emissions

Upfront carbon emissions are particularly challenging to reduce due to their association with material production and construction activities (stages A0-A5). The design does not currently have targets for embodied carbon.

In-Use and End of Life

In-use and end-of-life carbon emissions (stages B1-B5, C1-C4) also play a critical role in the building's total carbon footprint. The 596 kgCO₂e/m² emissions could be reduced through the design using durable materials adopting a building in layers approach to enable low impact refurbishment.

Operational Carbon

Operational carbon (stages B6, B7) primarily involves emissions from energy use during the building's operation. At this stage the Mechanical, Electrical and Public Health (MEP) design is not developed enough to enable accurate results and therefore has not been included in this study. For a complete WLCA of the building, this could be need to be included at a later design stage once the MEP design is more developed.

15% contingency allowance at RIBA Stage 2

Applied to the stated values in this report. It is recommended if using this assessment to set carbon budgets or contractual targets that this additional uplift should be added to all values to account for uncertainty in the design and assessment at this stage (RICS).

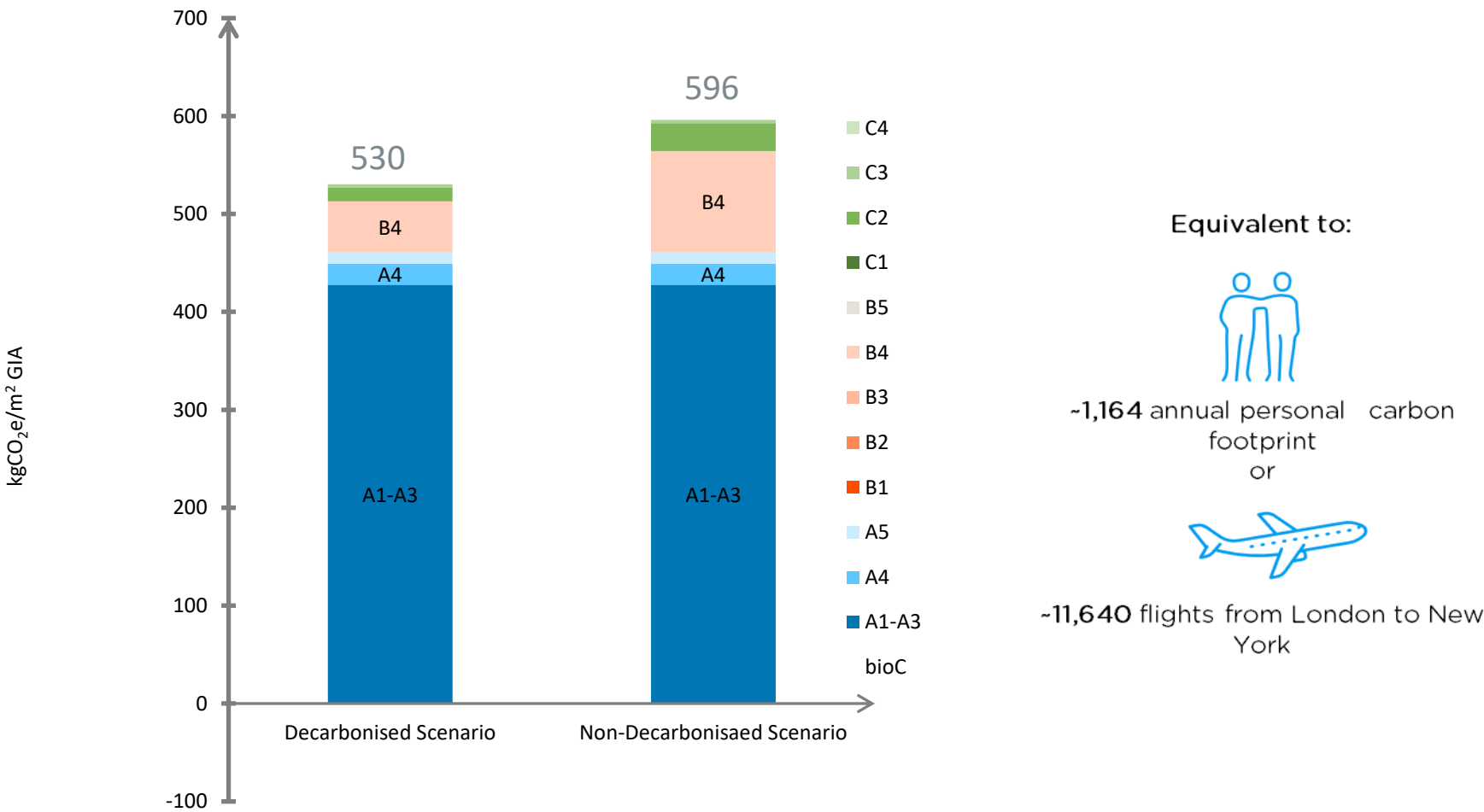


Figure 6: Whole life carbon for Decarbonised and Non-Decarbonised scenarios and equivalent emissions

Embodied Carbon Summary		
Stage	Decarbonised Scenario kgCO ₂ e/m ²	Non-Decarbonised Scenario kgCO ₂ e/m ²
A1-A5	461	461
B-C	69	135
BioC	- 0	- 0
Total	530	596

Table 1: Embodied Carbon Summary for A1-A5, B-C and total Emissions

Embodied Carbon (A-C) by element

RICS results by element and discipline

The analysis of embodied carbon emissions reveals the elements of the building that contribute the most to the buildings embodied carbon value. The accompanying bar charts detail the breakdown of emissions by RICS element category and gives a percentage the split of structural, architectural and landscaping elements that contribute to the Embodied Carbon emissions of the design.

Key contributors to embodied carbon include the Frame (184 kg CO₂e/m²) finishes (144 kg CO₂e/m²), Substructure (85 kg CO₂e/m² and Upper Floors (52 kg CO₂e/m²), indicating significant opportunities for improvement in these areas.

Recommendations:

- Architectural design: Focus on material efficiency and select low-carbon materials for the External Envelope.
- C&S Engineering: Improve structural design to minimise material usage in frame, foundations and upper floors.
- MEP Systems: This has not been included at this stage but once design progresses a study of the embodied and operation carbon associated with MEP should be undertaken.

These recommendations are to be incorporated by the design team in the next stage of design. By targeting these key areas and enhancing collaboration across disciplines, the project can achieve more substantial reductions in embodied carbon emissions.

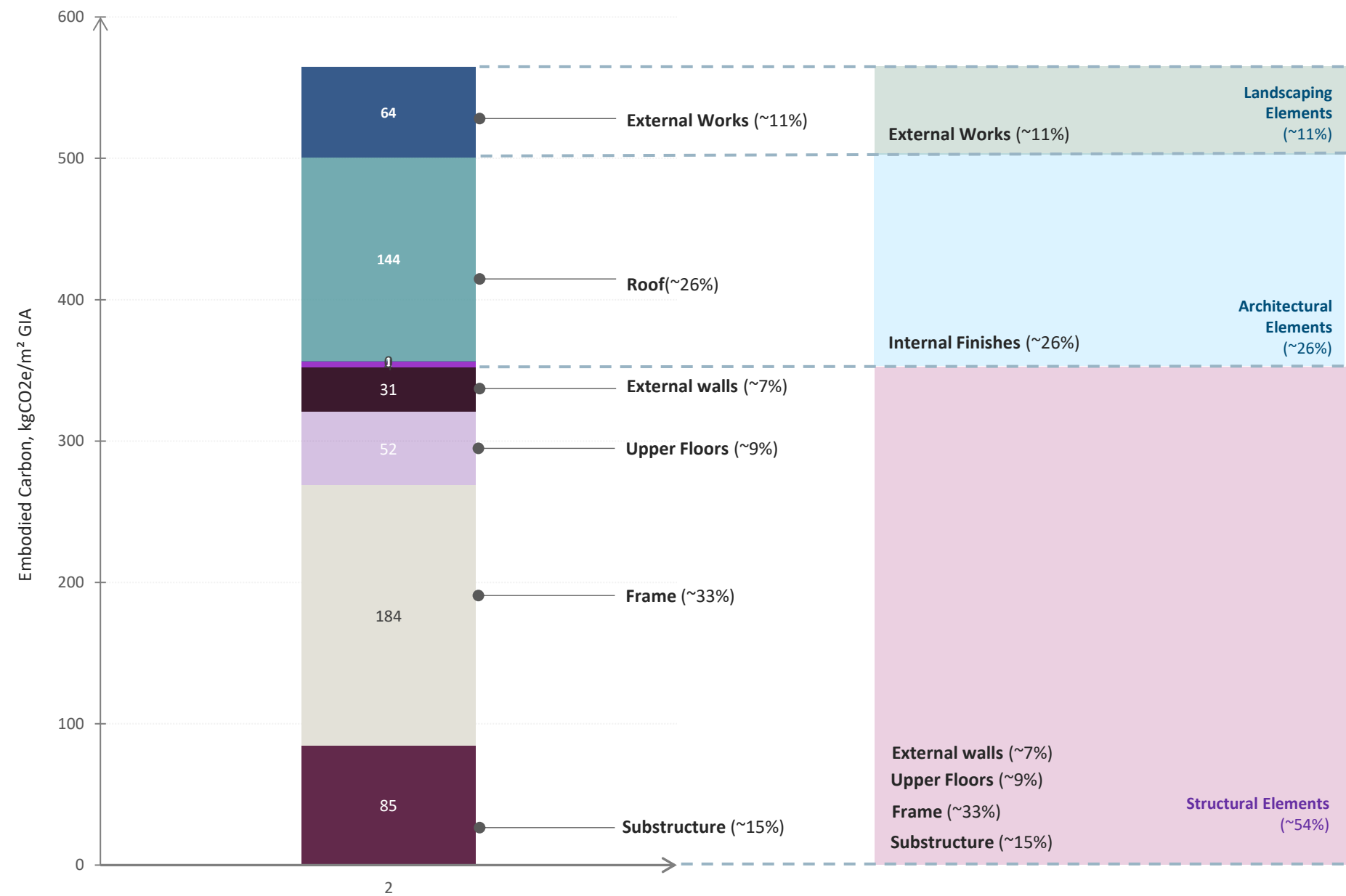


Figure 7: Embodied Carbon (A-C) by building element and responsible discipline.

Some building elements have high upfront carbon, others high future carbon

RICS results by element category and LCA stage

The carbon emissions of building components over a 60-year life span are crucial in a LCA. The chart on the right shows the most carbon-intensive elements categorised by WLCA stages.

Frame

The Frame is the largest contributor of the total emissions. This is due to the carbon intensive nature of the Steel columns and steel rafters which have high product stage emissions (A1-A3).

Roof Structure and Coverings

The Roof elements are the second largest contributor due to the high carbon impact of the assumed insulated roof steel roof panel. While these panels have significant benefits in terms of construction speed and modularity, the carbon impact is higher than other less complex roof build ups.

Substructure

The high carbon content and large concrete volume of the pad foundations and first floor slab contribute significantly to the product stage emissions of the substructure; the third largest contributor to overall emissions.

Upper Floors

The carbon intensive nature of the concrete and steel in the Comflor deck for the mezzanine primarily have large emissions at product stage (A1-A3).

External Walls

The external walls include the Kingspan Quadcore AWP* Longspan panels consisting of steel layers with insulation sandwiched in between. This values also includes the lower façade brick layer. Both the AWP panels and brick have larger emissions at product stage (A1-A3) . These are based off current product assumption which may be subject to change as the design progresses.

*AWP stands for Architectural Wall Panel

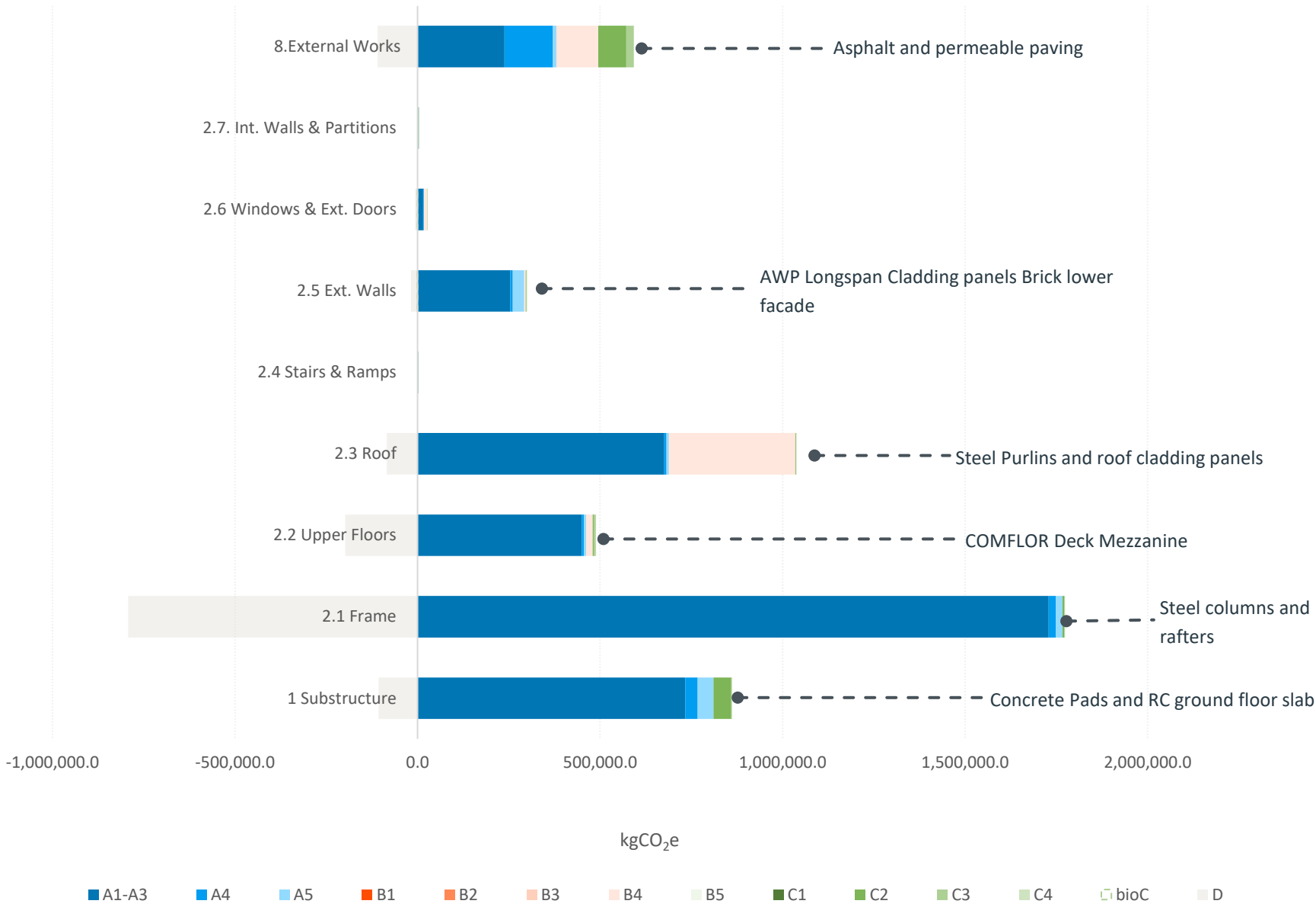


Figure 8: Carbon-intensive elements categorized by LCA stages

A few key materials make up the majority of upfront emissions

Carbon by resource type and material

This section provides a detailed analysis of upfront carbon emissions (A1-A5), broken down by resource type and material. The accompanying tree graph illustrates these emissions.

Structural Steel and Steel Profiles

Structural steel and steel profiles components contribute 50% of upfront emissions. This is due to the large volume of steel used across sites and the high carbon intensity of the material.

Steel Sandwich Panels

The steel within the sandwich panels in the baseline façade design and roof panels contribute 20% to upfront emissions. This is due to the large volume of steel used in the façade and roof cladding and the high carbon intensity of the material, like the structural steel and steel profiles.

Concrete and Reinforcement Steel

Concrete and steel reinforcement contributes a total of 20% to upfront carbon emissions. Ready-mix concrete for lowest floor slab contributes 17%, while concrete slabs (hollow and solid) in the mezzanine floors contribute 2% due to the smaller mezzanine area. Reinforcement steel contributes 1% which is a much smaller percentage than the structural steel and combined concrete volumes highlighting the significant impact of concrete and structural steel in construction emissions.

Asphalt and Sand, Soil and Gravel

The Asphalt and the Sand, Soil and Gravel used in the Hard Landscaping design contribute roughly 4% and 2% respectively to the upfront emissions. For the Asphalt this is due to the high carbon intensity of the material despite smaller volumes in comparison to the Sand, Soil and Gravel elements. The quantities of the Sand Soil and Gravel are significant in the hard landscaping design which had led the element to be one of the more contributing elements in the design. However, it should be noted this proportion is small relative to the contributions of concrete, structural steel and sandwich panels.

In summary, structural steel, steel sandwich panels and reinforced concrete and asphalt are the main contributors to upfront carbon emissions. Addressing these materials through efficient use, low carbon specification and alternative procurement solutions is crucial for reducing the environmental impact of building construction.

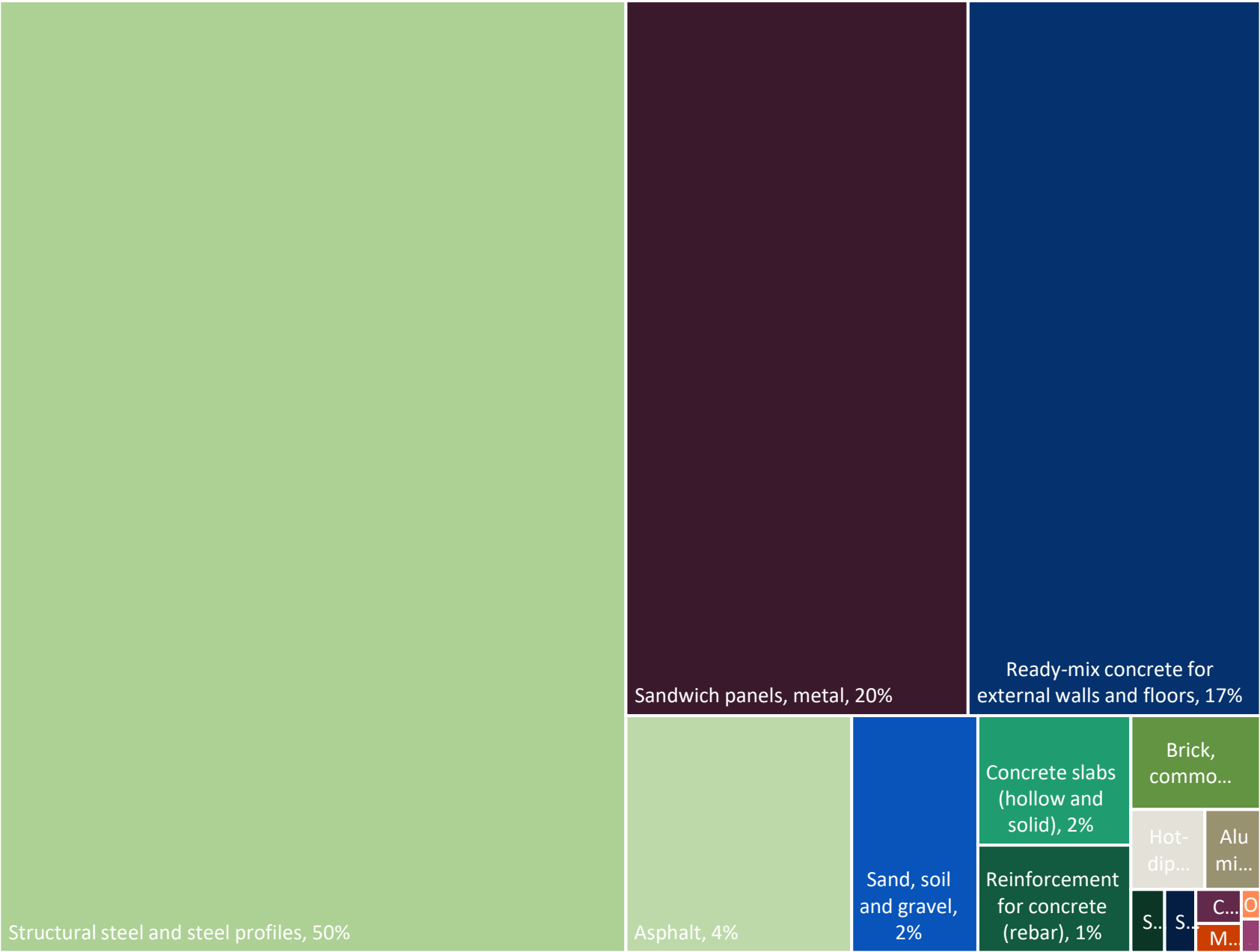


Figure 9: Upfront carbon A1-A5 by resource type (kgCO2e/m²GIA)

4.

BREEAM Mat01 Results

Various structural and façade options were considered during design

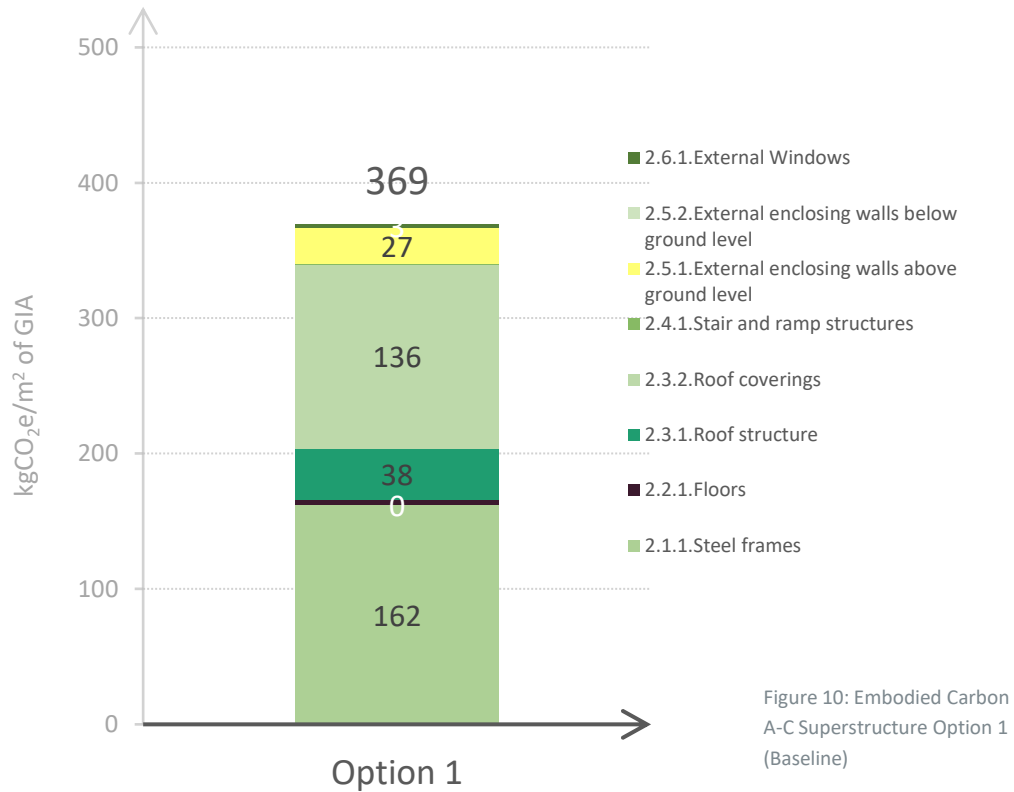
BREEAM NC Mat 01 – Superstructure Options

Baseline

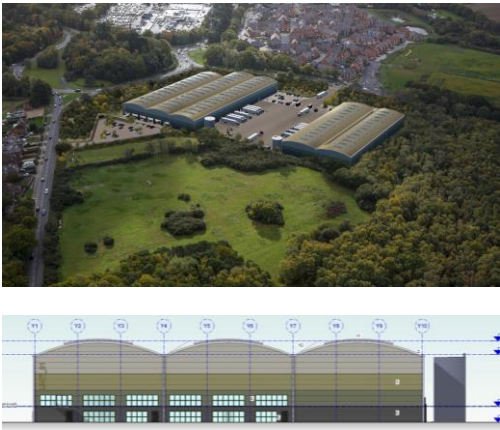
The Superstructure Baseline Option is included as the 1st option in the Mat01 Results Submission tool and is based on an illustrative masterplan. The application is for outline only and it should be noted at this stage that there could be many ways to deliver the scheme based on set parameters. This baseline option's whole life embodied carbon is broken down in Figure 10, with the structural frame being the most significant embodied carbon source, followed by the roof coverings and roof structure. They make up around 45%, 35% and 10% respectively of the whole life emissions for the building (Unit 2 is similar in design and size to Unit 1 and has therefore assumed to have similar results and findings).

Mat01 options study

From this baseline design, an options appraisal investigating lifecycle impacts associated with different design choices has been undertaken in line with the BREEAM Mat01 requirements. Three further Superstructure options are evaluated as detailed on this page which have been discussed with the Client team and Architect.



Superstructure Baseline 1



Reference: Mat01_CD_SuperS_Opt1

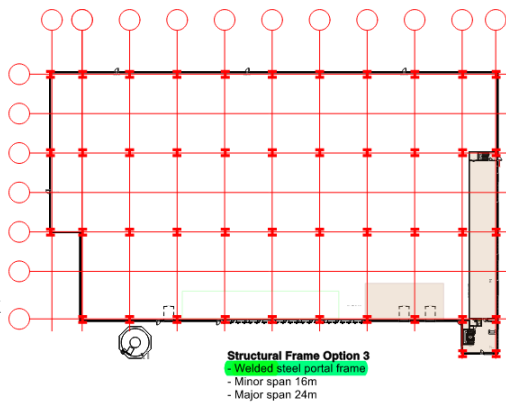
Option 1 - Baseline Design

Bolted steel portal frame, grid 8x24m. 15m height. Steel columns and rafters with Steel purlins supporting roof cladding.

480m² mezzanine floor for office use with steel Comflor deck and steel framing.

Façade option 1: lower façade of clay brick with insulation and SFS and upper façade of Steel AWP Longspan cladding panels.

Superstructure Alternative 2



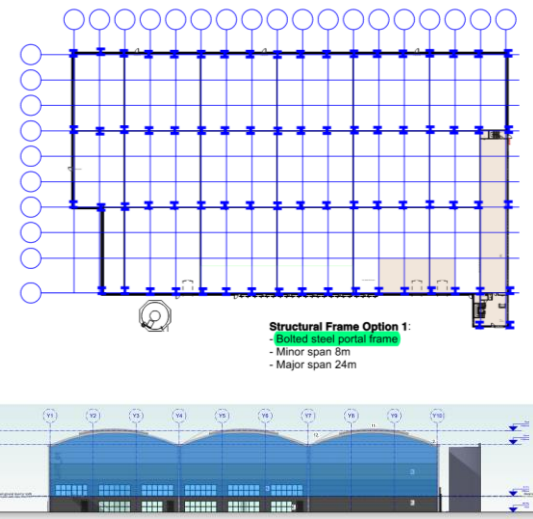
Reference: Mat01_CD_SuperS_Opt2

Option 2

As per baseline but with larger spans and welded joints of steel frame. Grid 16x24m.

Approximately 20% increase in structural steel volume compared to the baseline.

Superstructure Alternative 3



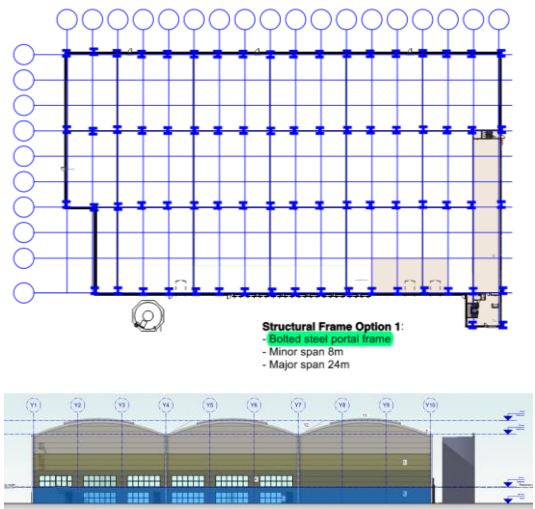
Reference: Mat01_CD_SuperS_Opt3

Option 3

As per baseline but with façade option 2: lower façade of clay brick with insulation and SFS (as baseline) and upper façade alternative of trapezoidal sheet cladding with insulation and SFS.

Approximately 10% reduction steel volume in the external walls compared to the baseline.

Superstructure Alternative 4



Reference: Mat01_CD_SuperS_Opt4

Option 4

As per baseline but with Façade option 3: lower façade alternative of concrete block with insulation and SFS and upper façade of Steel AWP Longspan cladding panels (as baseline).

The studied alternatives show an efficient structure is the priority

BREEAM NC Mat 01 – Superstructure Results

An illustrative masterplan has been used at this stage to assume a baseline design and alternative options. These designs may be subject to change at later design stages. The baseline design is characterised by a bolted steel portal frame with a grid of 8x24m. Steel purlins support the roof cladding of double steel siding with insulation and 480m² mezzanine Office floor consists of a steel Comflor deck and steel framing. The baseline façade option has a lower façade of clay brick with insulation and SFS, and an upper façade of Steel AWP Longspan cladding panels. The total embodied carbon emissions stand at 369 kgCO₂e/m².

Introducing a larger span for a 16x24m structural grid in Option 2 resulted in a slight increase in embodied carbon emissions to 407 kgCO₂e/m². This change is due to the additional structural steel to accommodate a larger grid size and is found to be more carbon intensive of all the superstructure options.

Option 3 switches to a different facade design which when compared to the baseline increased the embodied carbon to 388 kgCO₂e/m². The change of the upper façade design from AWP Longspan panels to Trapezoidal steel cladding with insulation and SFS system increased the embodied carbon of the design. This is likely due to the increased steel volume in the SFS to support the alternative cladding option.

The façade was redesigned once more in Option 4, where the lower façade was changed from clay brick to concrete blockwork. This enabled a minor decrease in embodied carbon to 368 kgCO₂e/m². The overall carbon performance remains close to the Baseline and may achieve a minor reduction in the superstructure scheme.

Figure 12 highlights impact categories where significant reductions are observed, notably:

- Option 3 significantly reduced the Ozone Depletion Potential (ODP) by ~55% and Eutrophication Potential by ~7.5%. This is due to the different in insulation types in the external walls of Option 3 where Rockwool insulation has been assumed.
- Option 4 reduced Acidification Potential by ~4%.

Note: Option 1 is the baseline option which is the current preferred concept stage choice for the superstructure but may be subject to change upon review at coordination stage.

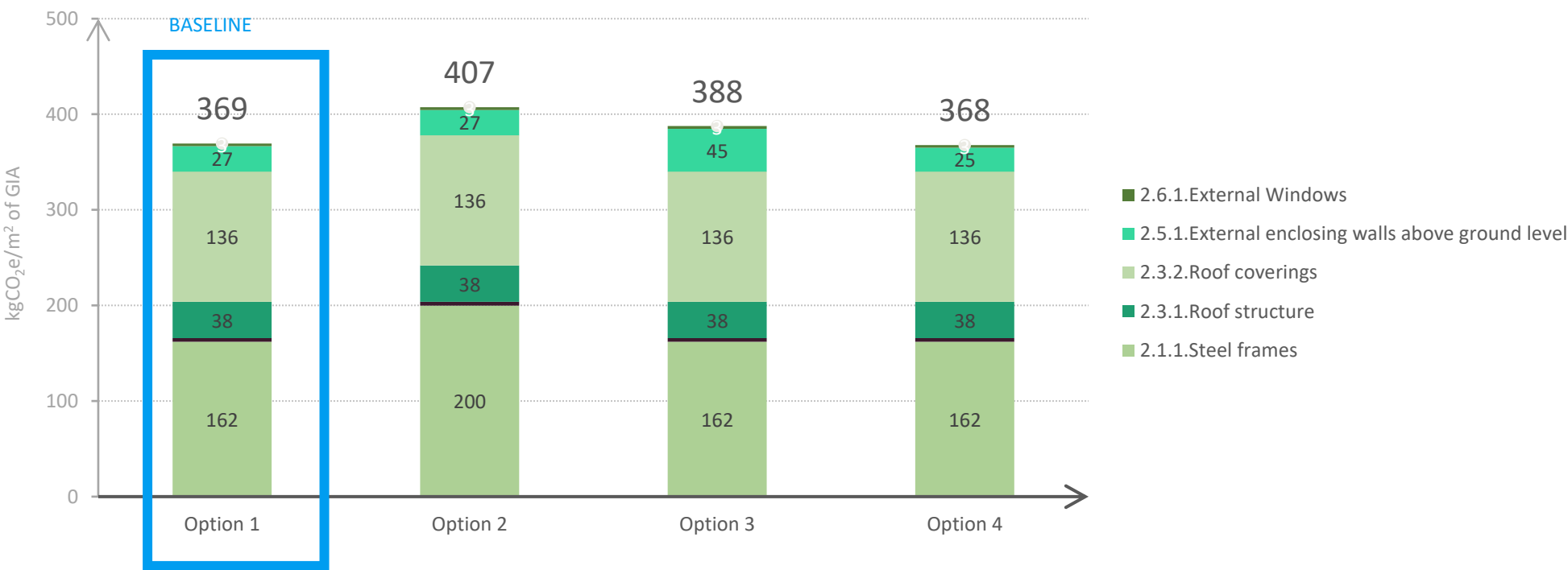


Figure 11: Embodied Carbon A-C Superstructure option comparison

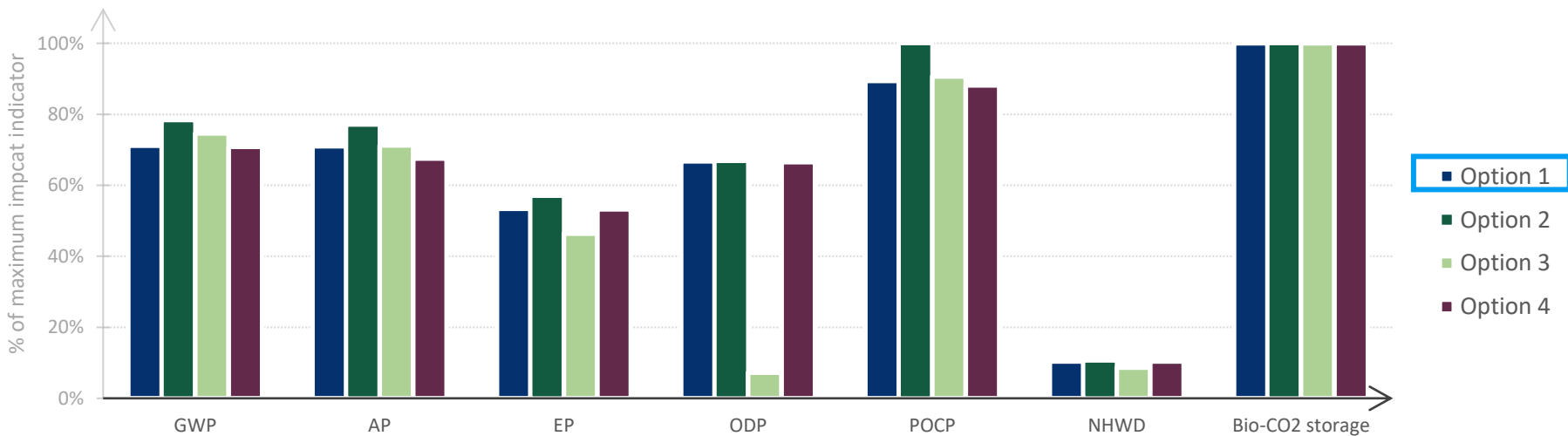


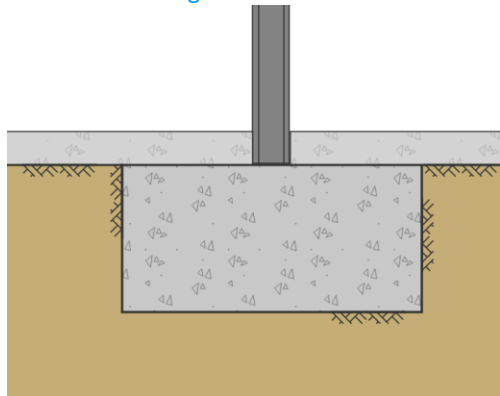
Figure 12: LCA impact categories (A-C) normalised for each Superstructure option

BREEAM NC Mat 01 – Substructure and Hard Landscaping

BREEAM NC Mat 01 – Substructure and Hard Landscaping Options

The options analysed for both the potential three substructure and three hard landscaping designs are documented below. These options for the substructure and hard landscaping have been based on an illustrative masterplan and may change as the design progresses. This has been undertaken in line with the BREEAM Mat01 requirements and used to inform lifecycle impacts associated with different design choices . The baseline and preferred choice is indicated by “Baseline Design” as detailed on this page.

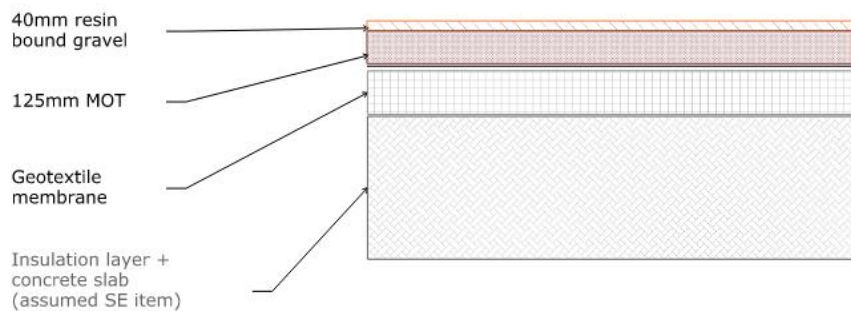
Substructure Option 1 - Baseline Design



Reference: Mat01_CD_SubS_HL_Opt1

- Pad foundations 3m3 per pad (for all foundations) 30kg/m3 rebar
- No. of pads is 73
- 225mm lowest floor slab, 30kg/m3 rebar

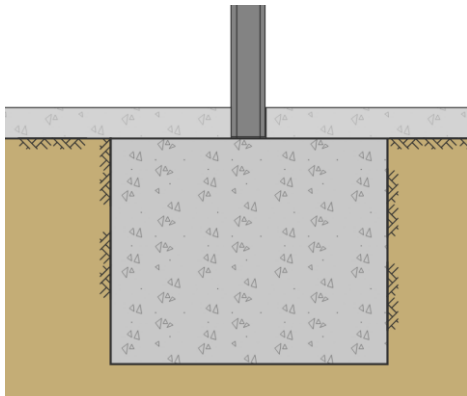
Hard Landscaping Option 1 - Alternative 1



Reference: Mat01_CD_SubS_HL_Opt2

- 40mm THK resin bound gravel with base of gravel and binder course
- Concrete paving units for paved surfaces

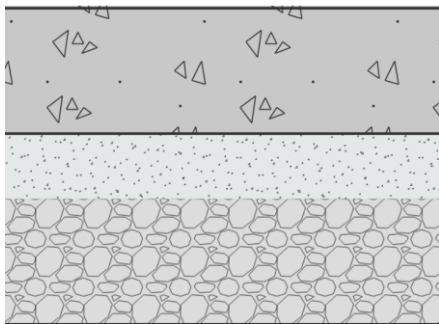
Substructure Option 2 - Alternative 1



Reference: Mat01_CD_SubS_HL_Opt3

- Pad foundations 4m3 per pad (for all foundations) 30kg/m3 rebar
- No. of pads is 45
- 225mm lowest floor slab, 30kg/m3 rebar

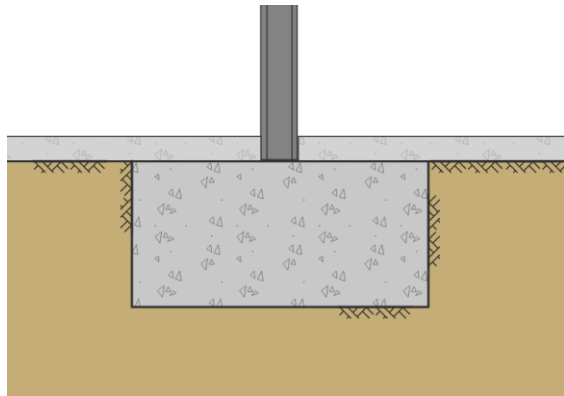
Hard Landscaping Option 2 - Alternative 2



Reference: Mat01_CD_SubS_HL_Opt4

- 150mm THK unreinforced concrete
- Concrete paving units for paved surfaces

Substructure Option 3 - Alternative 2



Reference: Mat01_CD_SubS_HL_Opt5

- Pad foundations 3m3 per pad (for all foundations) 30kg/m3 rebar
- No. of pads is 73
- 200mm lowest floor slab, 40kg/m3 rebar

Hard Landscaping Option 3 – Baseline Design



Reference: Mat01_CD_SubS_HL_Opt6

- 40mm THK Asphalt with base of gravel and binder course
- Concrete paving units for paved surfaces

BREEAM NC Mat 01 – Substructure and Hard Landscaping

BREEAM NC Mat 01 – Substructure Results

The results show minor variations in environmental impact across the three different designs.

The substructure baseline design consists of 3m³ concrete pads foundations (No.73) with a ground bearing slab of 225mm thickness with 30 kg/m³ of reinforcement. The total embodied carbon emissions stand at 82 kgCO₂e/m². Approximately 90% of this value is held in the lowest floor slab of 225mm thick reinforced concrete.

Option 2 substructure introduced fewer but larger 4m³ (45 No.) pad foundations to support a larger grid span for superstructure option 2. This resulted in a minor decrease in embodied carbon emissions to 81 kgCO₂e/m². This change is due to a slightly smaller total concrete volume for the pad foundations. Despite having a larger volume per foundation, the larger grid design requires fewer foundations. It should be noted this design would be used for the Superstructure option 2 which saw a significant increase in Embodied carbon compared to the baseline.

Option 3 tests an alternative ground floor slab of 200mm with 40 kg/m³ reinforcement. This reduced the embodied carbon to 75 kgCO₂e/m² (~8% less than the baseline option). The reduction in concrete volume for the ground slab in option 3 is the main cause of this reduction. More specifically, the lowest floor construction had ~10% lower embodied carbon than the lowest floor construction in the baseline design, leading to an overall reduction of ~8% between the two options. This demonstrates how structural optimisation can enhance sustainability without compromising performance. This option benefits from lower environmental impacts while maintaining structural integrity.

Figure 14 shows the impact categories where minor reductions are observed. These reductions were very small across between Options 1 and 2 due to similar quantities, however, Option 3 saw better performance in all categories due to lower concrete volume in the lowest floor slab. This is most notably observed in the Eutrophication Potential value with a 3% reduction compared to the baseline option.

Note: Option 1 is the baseline option which is the current preferred choice for the substructure at concept stage but may be changed after review at coordination stage.

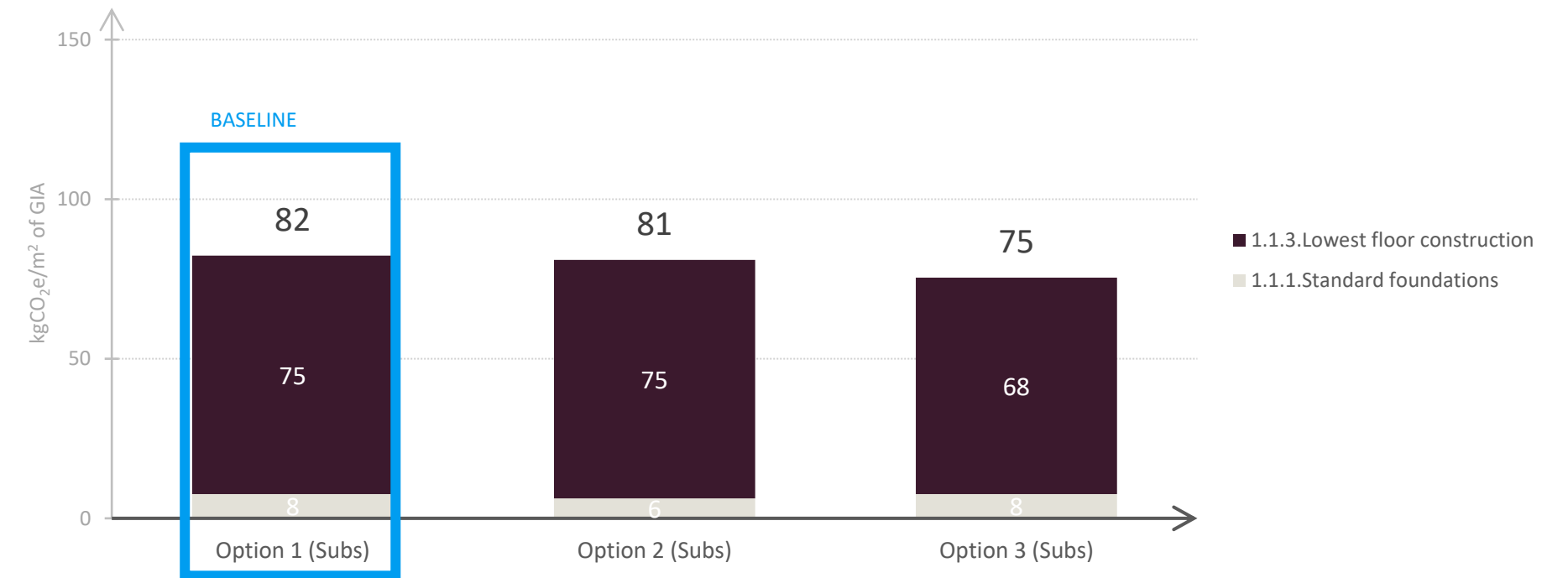


Figure 13: Embodied Carbon A-C Hard Substructure option comparison

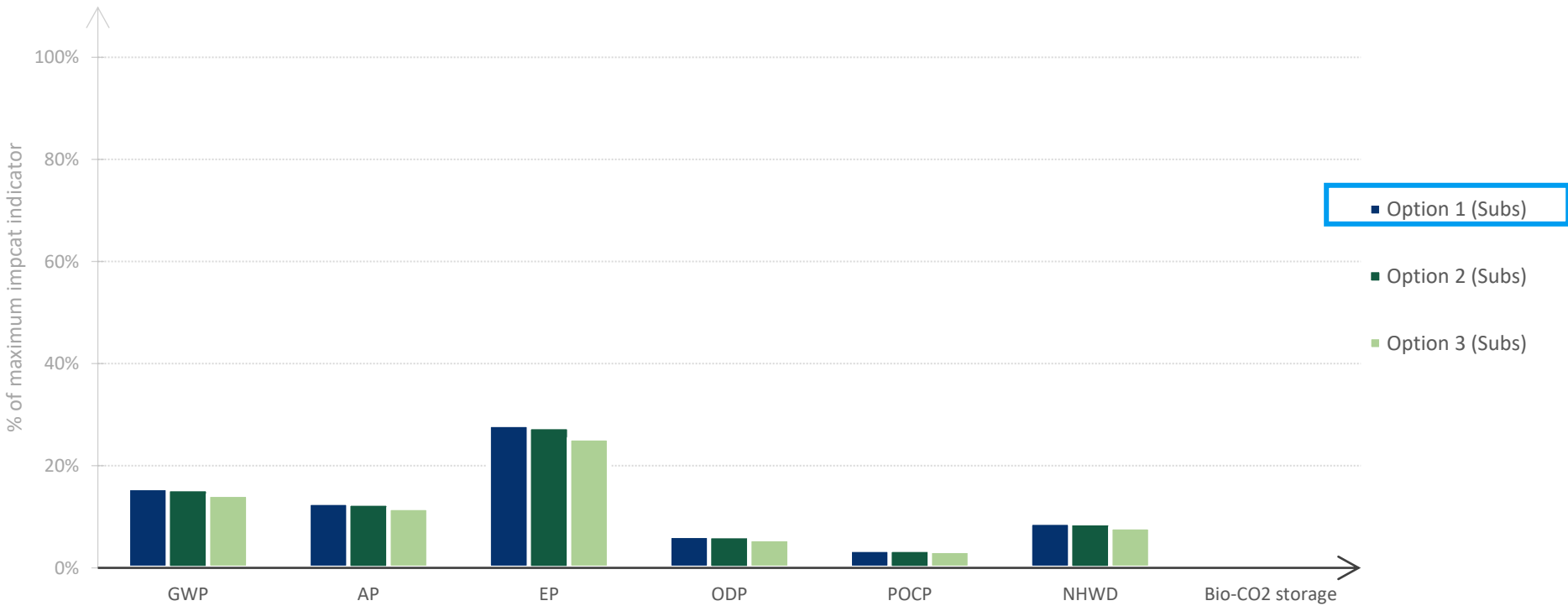


Figure 14: LCA impact categories (A-C) normalised for each Substructure option

BREEAM NC Mat 01 – Substructure and Hard Landscaping

BREEAM NC Mat 01 – Hard Landscaping Results

The figures documenting the results, indicate small changes in environmental impact across the different Hard Landscaping designs.

The Hard Landscaping baseline design of Option 3 includes asphalt and binder layers with aggregate underneath. The paving slabs have been assumed to be concrete paving units (80mm), with sand, aggregate and fill layers beneath (note paving areas are assumed to be ~25% of the total landscaping area). The total embodied carbon emissions for the baseline option stand at 70 kgCO₂e/m². It should be noted this value is per m² of GIA assumed for Unit 1.

Option 2 substructure replaces asphalt with a 150mm thick unreinforced concrete layer. This resulted in a in an increase in embodied carbon emissions to 76 kgCO₂e/m². This change is due to the additional concrete used for the roads, paths and pavings.

Option 1 involved a different build-up of resin bound gravel with epoxy resin binder and Tensar GeoGrid. This reduced the embodied carbon marginally to 69 kgCO₂e/m². This minor difference is due to the different surfaces of the design. It should be noted that the epoxy was a large contributor to the embodied carbon of the Option 1 design,.

Figure 16 highlights the impact categories where significant reductions are observed and are listed below:

- Option 1 had lower GWP, Acidification, Eutrophication and Ozone depletion values but was found to be higher in Non-Hazardous waste depletion and POCP values.
- Option 2 performed similarly to the Option 3 baseline but had notably lower Ozone depletion value than the baseline.

Note: Option 3 is the baseline option which is the current preferred choice at concept stage for the Hard Landscaping. This may be subject to change after review at detailed design stage.

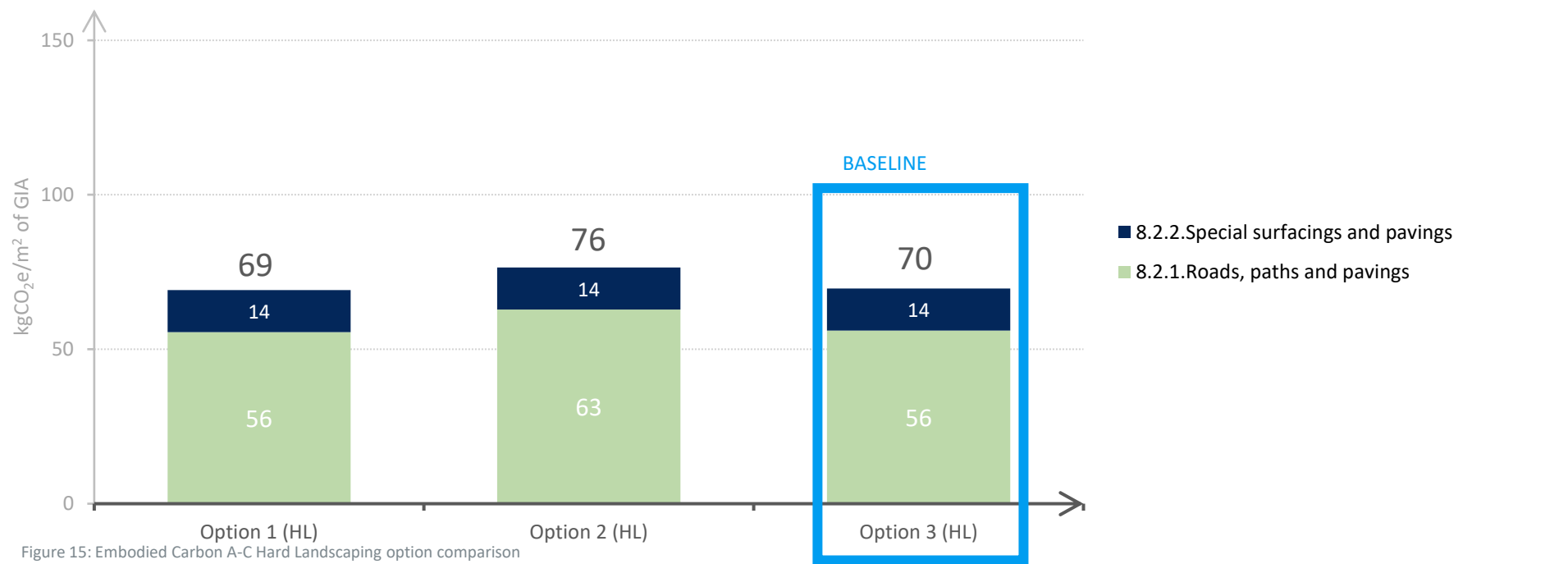


Figure 15: Embodied Carbon A-C Hard Landscaping option comparison

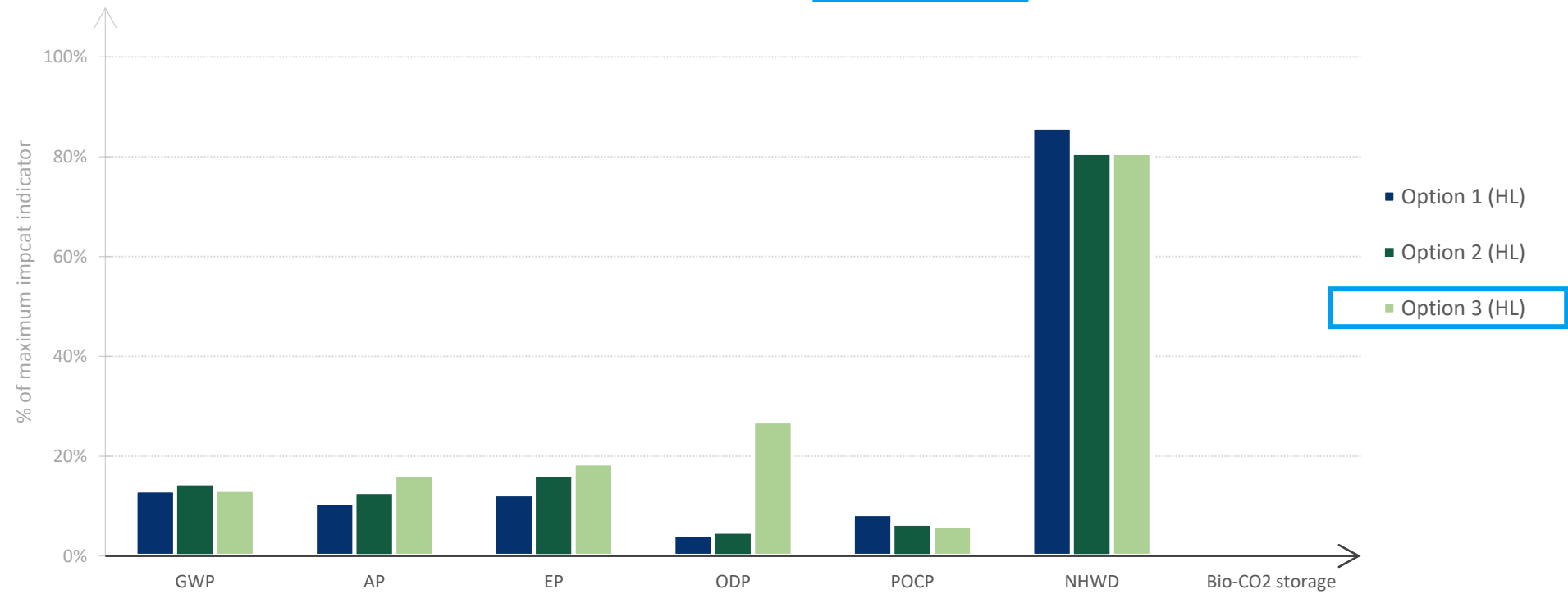


Figure 16: LCA impact categories (A-C) normalised for each Hard Landscaping option

BREEAM NC Mat 01 – Superstructure, Substructure and Hard Landscaping

BREEAM NC Mat 01 – Conclusion

An illustrative masterplan has been used to base option studies for the Superstructure, Substructure and Hard Landscaping for the project at concept stage. The baseline options are the preferred options at this stage but may be subject to change as the design progresses.

The current baseline assumptions are:

Superstructure (option 1):

- Bolted steel portal frame with a grid of 8x24m. Steel purlins support the roof cladding of double steel siding with insulation. Mezzanine Office floor consisting of Comflor deck and steel framing. The baseline façade option has a lower façade of clay brick with insulation and SFS, and an upper façade of Steel AWP Longspan cladding panels.
- The total embodied carbon emissions stand at 369 kgCO₂e/m².
- Superstructure option 4 was the only option with slightly lower emissions indicating that a change in façade type could reduce the superstructure emissions.

Substructure (option 1):

- 3m³ concrete pads foundations (No.73) with a ground bearing slab of 225mm thickness with 30 kg/m³ of reinforcement.
- The total embodied carbon emissions stand at 82 kgCO₂e/m². Approximately 90% of this value is held in the lowest floor slab of 225mm thick reinforced concrete.
- The alternative option of substructure option 3 uses a thinner slab with more dense reinforcement which could reduce emissions by ~8%

Hard Landscaping (option 3):

- Asphalt and binder layers with aggregate underneath. This is accompanied by paving slabs have been assumed to be concrete paving units (80mm), with sand, aggregate and fill layers beneath (note paving areas are assumed to be ~25% of the total landscaping area).
- The total embodied carbon emissions for the baseline option stand at 70 kgCO₂e/m². It should be noted this value is per m² of GIA assumed for Unit 1.
- There were marginal difference between options for the hard landscaping in terms of embodied carbon but changing to a Gravel resin option could reduce the embodied carbon value to 69 kgCO₂e/m² and have reductions in some of the impact categories such as Ozone Depletion Potential (ODP)

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Appendix A

Input Data – LCI & Data Sources

2.1 FRAME												
Baseline Option 1												
RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
2.1.1.Steel frames	Steel Columns assumed 15kg/m2 deck assumed 11.35 kg/m2 assumed 9586m2 total area	143,790	KG	1	Steel	Structural steel sections and plate	Assumed hot rolled sections (UK & Global Plate)	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)		EPD	Provide kg or m3
2.1.1.Steel frames	Steel Rafters assumed 45kg/m2 assumed 9586m2 total area	431,370	KG	1	Steel	Structural steel sections and plate	Assumed hot rolled sections (UK & Global Plate)	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)		EPD	Provide kg or m3
2.1.1.Steel frames	Mezzanine Steel Columns assumed 15kg/m2 assumed 480m2 total area	7,200	KG	1	Steel	Structural steel sections and plate	Assumed hot rolled sections (UK & Global Plate)	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)		EPD	Provide kg or m3
2.1.1.Steel frames	Mezzanine Steel beams assumed 65kg/m2 assumed 480m2 total area	31,200	KG	1	Steel	Structural steel sections and plate	Assumed hot rolled sections (UK & Global Plate)	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)		EPD	Provide kg or m3

2.2 UPPER FLOORS												
RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
2.2.1.Floors	Mezzanine Floors COMFLOR steel deck assumed 11.35 kg/m2 assumed 480m2 total area assumed COMFLOR 80	6,240	kg	1	Steel	Profiled sheet for decking	Assumed profiled steel decking part of composite floor slab (UK)	IstructE	Profiled steel decking for composite floor slabs/decking, 0.9mm sheet thickness, 11.35kg/m2, ComFlor 80 0.9mm steel structural floor deck (Tata Steel)		EPD	Provide m2/kg/m3
2.2.1.Floors	Mezzanine Floors COMFLOR concrete assumed 110THK assumed 480m2 total area	53	M3	1	Concrete	Superstructure C32/40, 25% GGBS (ICE)	Assumed C32/40, 25% Cement Replacement	IstructE	Ready-mix concrete, RC 32/40 (32/40 MPa), 25% Cement replacement with blast furnace slag (GGBS)		ICE	Provide m3
2.2.1.Floors	Mezzanine Floors COMFLOR concrete reinforcement assumed 110THK assumed 480m2 total area. Reinforcement assumed 60 kg/m3	3,168	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))		EPD	Provide kg/m3

2.3 ROOFS												
RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
2.3.1.Roof structure	Roof Floor Structure. Steel Purlins assumed 15 kg/m2 assumed 9586m2 total area	143790	KG	1	Steel	Structural steel sections and plate	Assumed hot rolled sections (UK & Global Plate)	IstructE	Hot rolled steel sections, steel rails for railway and rolled billet (Tata Steel)		EPD	Provide kg or m3
2.3.2.Roof covering	Roof Covered with Twin Therm cladding panels, double steel siding with insulation assumed 320mm THK assumed 9586m2 total area	15337.6	M2	2	Steel	Bursledon Roof Panel - double steel siding with insulation 200mm THK	Twin Therm Sandwich Panel, double steel siding with insulation 200mm THK	EPD	Steel roof cladding system with glass mineral wool insulation, U = 0.23W/m2K, 0.70 mm (Outer sheet), 0.40 mm (Liner sheet), 180 mm (Insulation), 12.64 kg/m2, Twin-Therm® roof (Tata Steel and CA Building Products)		OC	Provide area in m2

2.4 STAIRS AND RAMPS												
RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
Select	Stairs to the mezzanine level? We can probably assume a steel flight		Select	Select	Select	Select	N/A	N/A	N/A		N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A		N/A	N/A
2.4.1.Stair and ramp structure	Steel staircase assumed 3m long in plan. GF to Mez assumed 2m high. Width assumed 1.5m	5.41	M2	Ramboll	Steel	Steel Staircase straight	Galvanised steel straight staircase	Ramboll	Galvanized steel staircase, straight, 207.21 kg/m2		EPD	Provide area in m2

2.5 EXTERNAL WALLS												
RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data		Carbon Source	Notes/Assumptions
2.5.1.External enclosing walls above ground level	total façade area for unit 1 = 5220 m2 Lower Façade type 2a: Clay Engineering brick assumed 20% of Façade. Assumed 107.5 THK	107.01	M3	2	Clay	Clay Bricks - Façade	Assumed red brick, average production	Ramboll	Red brick, average production, UK, 215 mm x 102.5 mm x 65 mm, 2.13 kg/unit, 1485 kg/m3 (Brick Development Association (BDA) Ltd (2019))		EPD	Provide m3
2.5.1.External enclosing walls above ground level	Lower Façade type 2a: Clay Engineering brick, mortar assumed 20% of façade and 15% volume of concrete block and 1600 kg/m3	25682.4	KG	2	Mortar	Masonry/Bricklaying Mortar (BREEAM/LEED)	Cement based mortar for bricklaying	Ramboll	Masonry mortars (CPI Mortars Ltd (2024))		EPD	Provide kg/ton Assuming density 1600kg/m3 - Calculating quantity Assuming 15% of brickwork (6% for blockwork) elevation area (m2) x 102.5mm (brick or block thickness)
2.5.1.External enclosing walls above ground level	Steel SFS system to support cladding panels assumed across 20% of façade and 4.75 kg/m2	4959	KG	2	Steel	SFS - 100.50.12 @ 600mm centres	Assumed Galvanised steel, 20% Recycled Content	RICS	Steel sheets, generic, 20% recycled content, S235, S275 and S355		OC	Assuming 4.75 kg/m2 of elevation (including vertical and horizontal studs)
2.5.1.External enclosing walls above ground level	External wall insulation assumed 100mm Thickness assumed across 20% of façade	104.4	M3	2	Insulation	Ext. Walls - Rainscreen - Rockwool	Rockwool	Ramboll	Rock wool insulation panels, L=0.035 W/mK, R=4.29 m2K/W, 150 mm, 9 kg/m2, 60 kg/m3, Lambda=0.035 W/(m.K), Rainscreen Duo Slab 150mm (ROCKWOOL, UK plant)		EPD	Provide m3
2.5.1.External enclosing walls above ground level	Vapour Permeable Membrane (VPM) Vapour Permeable Membrane system assumed 0.38mm THK assumed across 20% of façade and 14 m2/m3	146.16	KG	2	Membrane	External Walls vapour-proof	Assumed Vapour-proof membrane	Ramboll	Vapour-proof membrane, 0.15 mm, 140 g/m2, Baca Dampsperrre (Baca Plastindustri)		EPD	Assuming 0.14kg/m2 (0.15mm thick membrane)

2.5.1.External enclosing walls above ground level	Plasterboard assumed 15mm assumed across 20% of facade	15.66	M3	2	Plasterboard	Ext.Walls/Partitioning/Ceiling - Fermacell	Gypsum fibreboard (plaster and cellulose fibres)	Ramboll	Fiber-gypsum board, 12.5 mm, 15 kg/m2, 1200 kg/m3, Fermacell (JAMES HARDIE FRANCE SAS)	EPD	Assuming 15kg/m2 (12.5mm thick)
					Insulation	Roof - RockWool	Rockwool	Ramboll	Rock wool/mineral wool insulation, L = 0.035-0.037 W/mK, 33-45 kg/m3, Fire resistance class = A1 (Knauf Insulation (2019))	EPD	Provide m3
2.5.1.External enclosing walls above ground level	Upper Facade type 1a: Steel Sheet cladding system, sandwich panel with insulation assumed 80% of facade	4176	M2	2	Steel	Bursledon Cladding Panel - Kingspan Insulated Panels AWP	QuadCore AWP Wall Panel (Kingspan Insulated Panels)	EPD	Sandwich panel with insulation foam core and double steel siding, L = 0.18 W/m2K, 100 mm, 10.84 kg/m2, QuadCore AWP Wall Panel (Kingspan Insulated Panels)	OC	Provide area in m2

2.6 EXTERNAL WINDOWS

RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Select	Any windows to be added - assume there is some to the office space?		Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
2.6.1.External Windows	No. 10 windows in facade, aluminium frames assumed 9 @12.2m2 and 2 @ 8.1m2	126	M2	Ramboll	Aluminium	Window double-glazed - Average	Assumed Aluminium frame double glazing	Ramboll	Aluminium frame window, size: 1.23 x 1.48m, 27.69 kg/m2, double glazing, SUPREME S77 (Alumil)	EPD	Provide area in m2

2.7 INTERNAL WALLS AND PARTITIONS

RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Select	do we have any for this design? Around mezzanine space	174.00	M2	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Steel	Select	N/A	N/A	N/A	N/A	N/A
2.7.Internal walls and partitions	Plasterboard Outer layer assumed 12.5mm and 15kg/m2	2610.00	KG	Ramboll	Plasterboard	Ext.Walls/Partitioning/Ceiling - Fermacell	Gypsum fibreboard (plaster and cellulose fibres)	Ramboll	Fiber-gypsum board, 12.5 mm, 15 kg/m2, 1200 kg/m3, Fermacell (JAMES HARDIE FRANCE SAS)	EPD	Assuming 15kg/m2 (12.5mm thick)
2.7.Internal walls and partitions	70mm S stud assumed 1.4 kg/m2	244	KG	Ramboll	Steel	Metal framing components - Gypframe 70 S 50 Studs	Assumed hot-dip galvanized sheet steel - light gauge profiles	Ramboll	Metal framing components for gypsum plasterboard, 7750 kg/m3, Gyprframe (British Gypsum Saint Gobain (2021))	EPD	Assuming Gypframe® 70 S 50 AcouStud 1.4kg/m2 @600mm centres (0.61kg/linear meter)
2.7.Internal walls and partitions	APR 1200 insulation assumed 50mm THK	9	M3	Ramboll	Insulation	Internal Walls - Glass wool	Glass wool - Isover	Ramboll	Glass wool/mineral wool insulation, acoustic partition roll, L = 0.039W/mK, T: 50-65 mm, 18 kg/m3, APR1200 (Isover)	EPD	Assuming 0.9kg/m2 (50mm thick)
2.7.Internal walls and partitions	Plasterboard inner layer assumed 12.5mm and 15 kg/m2	2610.00	KG	Ramboll	Plasterboard	Ext.Walls/Partitioning/Ceiling - Fermacell	Gypsum fibreboard (plaster and cellulose fibres)	Ramboll	Fiber-gypsum board, 12.5 mm, 15 kg/m2, 1200 kg/m3, Fermacell (JAMES HARDIE FRANCE SAS)	EPD	Assuming 15kg/m2 (12.5mm thick)

2.8 INTERNAL DOORS

RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Select	do we have any for this design? Around mezzanine space		Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
2.8.Internal Doors	Internal Timber Doors assumed 2.1m x 0.85m and No.5 units	9	M2	Ramboll	Timber	Timber door	Assumed interior door	Ramboll	Wooden and engineered wood interior doors, 1,23 m x 2,18 m, 72.8 kg/m2 (VHI)	EPD	Provide area in m2

3. INTERNAL FINISHES

RICS category ▼	Material Description ⓘ	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
Select	Internal office area:	480	Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
Select			Select	Select	Select	Select	N/A	N/A	N/A	N/A	N/A
3.3.Ceiling finishes	Carpet tiles in office space	480	M2	Ramboll	Carpet	Carpet Tiles	Assumed carpet tiles with 50% recycled content and 1100 g/m² pile weig	Ramboll	modular carpet tiles, tufted, 0.8 kg/m2, pile material of polyamide (PA) 6.6, max. 1.1 kg/m2, with a bitumen backing, Graphlex (Interface Europe Manufacturing B.V.)	EPD	Provide area in m2
3.3.Ceiling finishes	Suspended Ceiling with steel frame assumed 1.52kg/m2	729.6	KG	Ramboll	Steel	Suspended Ceiling - Metal frame only (British Gypsum - CasoLine MF)	Assumed Galvanised steel, 15% Recycled Content	RICS	Metal framing components for gypsum plasterboard, 7750 kg/m3, Gyprframe (Brit EPD	EPD	Assumed 1.52kg/m2 of ceiling area
3.3.Ceiling finishes	Mineral fibre suspended ceiling tile, 12 mm width, 2.7 kg/m2, B, A2-s1, d0, E1, Atlas (Zentia)	1296	KG	Ramboll	Plaster Gypsum	Interior Applications	Gypsum Plaster	Ramboll	Gypsum-based plaster, for most internal backgrounds, 94.6% gypsum, 5.4% add	EPD	2.6 kg for 3mm thick coat, 4.3kg/m2 for 5mm thick coat, 8.6kg/m2 for 10mm thick coat

8. External Works											
HL Option 3 - Baseline											
RICS category ▼	Material Description	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
	Area of Roads and Carparks estimated from drawings	6944	M2	2							
	Area of Paths / paving estimated from drawings	1962	M2	2							
8.2.1.Roads, paths and pavings	Asphalt assumed 40mm THK 94kg/m2	652,736	KG	Ramboll	Asphalt	Asphalt roads and footways	Assumed 2350 kg/m3 density	Ramboll	Asphalt, generic, compacted, 5/95% bitumen-aggregate ratio, 2350 kg/m3	OC	Assuming 290kg/m2 (125mm thick), 188kg/m2 (80mm thick)
8.2.1.Roads, paths and pavings	80mm binder course assumed 188 kg/m2	1,305,472	KG	Ramboll	Asphalt	Asphalt roads and footways	Assumed 2350 kg/m3 density	Ramboll	Asphalt, generic, compacted, 5/95% bitumen-aggregate ratio, 2350 kg/m3	OC	Assuming 290kg/m2 (125mm thick), 188kg/m2 (80mm thick)
8.2.1.Roads, paths and pavings	150mm base crushed aggregate 240kg/m2	1,666,560	KG	Ramboll	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	OC	Provide m3 or kg - Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
8.2.1.Roads, paths and pavings	Subbase Crushed Aggregate 300mm 480kg/m2	3,333,120	KG	Ramboll	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	OC	Provide m3 or kg - Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
8.2.2.Special surfacings and pavings	Concrete Paving Units (80mm) 192 kg/m2	376,704	KG	Ramboll	Concrete	Precast Concrete Paving	Assumed Precast concrete	Ramboll	Precast concrete paving products, 2350 kg/m3 (BPCF)	EPD	Provide m3 or kgs, Assuming 72kg/m2 (30mm thick), 192kg/m2 (80mm thick)
8.2.2.Special surfacings and pavings	Sand (30mm)	59	M3	Ramboll	Sand	Sand, soil and gravel	Generic earth mass	Ramboll	Sand, compacted dry density, 1682 kg/m3	OC	Provide m3 or kg
8.2.2.Special surfacings and pavings	Base of Crushed Aggregate (100mm) 160kg /m2	313,920	KG	Ramboll	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	OC	Provide m3 or kg - Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
8.2.2.Special surfacings and pavings	Subbase Crushed Aggregate 150mm 240 kg/m2	470,880	KG	Ramboll	Aggregate	Crushed gravel	Assumed aggregate (crushed gravel), generic	Ramboll	Aggregate (crushed gravel), generic, dry bulk density, 1600 kg/m3	OC	Provide m3 or kg - Assuming 640kg/m2 (400mm thick), 160kg/m2 (100mm thick), 128kg/m2 (80mm thick)
8.2.2.Special surfacings and pavings	Fill assumed F1/2 (370mm) 451.4 kg/m2	885,647	KG	Ramboll	Soil	Loose soil for infill	Loose soil	Ramboll	Soil, loose dry density, 1220 kg/m3	OC	Assuming 366 kg/m2 (300mm thick), 122kg/m2 (100mm thick), 183kg/m2 (150mm thick)

1 SUBSTRUCTURE											
Substructure Option 1 Baseline											
RICS category ▼	Material Description 	Quantity	Units ▼	Source ▼	Material ▼	Details ▼	Specification	Spec. Source	Carbon Data	Carbon Source	Notes/Assumptions
1.1.1.Standard foundations	Concrete Pad foundations, 3m3 per pad. Assumed No. 73 pads	219	M3	1	Concrete	Substructure C32/40, 20% GGBS (BREEAM/LEED)	Assumed C32/40, 20% Cement Replacement	Ramboll	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% GGBS content in cement (300 kg/m3; 1R 7 lbs/ft3 total cement) (One Click LCA 2022)	OC	Provide m3
1.1.1.Standard foundations	Concrete Pad foundations Reinforcement, 3m3 per pad. Assumed No. 73 pads assumed 30kg/m3	6570	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3
1.1.3.Lowest floor construction	225mm THK Concrete ground bearing slab, assumed 9586m2 area	2157	M3	1	Concrete	Substructure C32/40, 20% GGBS (BREEAM/LEED)	Assumed C32/40, 20% Cement Replacement	Ramboll	Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 20% GGBS content in cement (300 kg/m3; 1R 7 lbs/ft3 total cement) (One Click LCA 2022)	OC	Provide m3
1.1.3.Lowest floor construction	Reinforcement 225mm THK Concrete ground bearing slab, assumed 9586m2 area assumed 30kg/m3	64706	KG	1	Steel	Reinforcement bars	Assumed reinforcement support for concrete (UK)	IstructE	Carbon steel reinforcing bar (secondary production route – scrap), 7850 kg/m3, 96% recycled steel (UK Cares (2020))	EPD	Provide kg/m3

Appendix B

RICS 2023 Methodology

Scope of Assessment

RICS 2023 WLCA

Building Elements

The assessment covers all building elements where relevant. The assessment has been undertaken following the RICS PS 2nd edition methodology as a baseline, with updates to meet the requirements of GLA and BREEAM which still follow the RICS PS 1st edition conventions on life cycle stage and building element categorisation.

Table 3: Scope of assessment, Building elements as per RICS 2023 classifications

Building part / Element group	Building element (NRM level 2)	Included in LCA?	Comments & further details
0. Demolition & Facilitating works	0.1 Toxic/hazardous/contaminated material treatment	Excluded	
	0.2 Major demolition works		
	0.3 & 0.5 Temporary/enabling works		
	0.4. Specialist groundworks		
1. Substructure	1.1 Substructure	Included	
2. Superstructure	2.1 Frame	Included	
	2.2 Upper floors incl. Balconies		
	2.3 Roof		
	2.4 Stairs, ramps and safety guarding		
	2.5 External envelope including roof finishes	Included	
	2.6 Windows and External doors		
	2.7 Internal walls and Partitions		
	2.8 Internal doors		
3. Finishes	3.1 Wall finishes	Included	
	3.2 Floor finishes		
	3.3 Ceiling finishes		
4. Fittings, furnishings, and equipment (FF&E)	4.1 Fittings, Furnishings & Equipment incl. building related and non-building related	Excluded	Excluded at this stage due to lack of data and relatively minor carbon impact
5. Building services/MEP	5.1 Public Health	Excluded	Excluded at this stage due to lack of data
	5.2 Heating, Ventilation and Cooling (HVAC)	Excluded	Excluded at this stage due to lack of data
	5.3 Electrical installations	Excluded	Excluded at this stage due to lack of data
	5.4 On site renewable energy generation	Excluded	Excluded at this stage due to lack of data
	5.5 Systems including Life safety, Fuel installations, Lift and conveyor installations, Services equipment, Disposal installations, Specialist installations, Builders work in connection with services	Excluded	Excluded at this stage due to lack of data
6. Prefabricated buildings and building units	6.1 Prefabricated buildings and building units	N/A	None in project
7. Work to existing buildings	7.1 Minor demolition and Alteration works	N/A	None in project
8. External works	8.1 Roads, paths, paving, surfaces, Fencing, railings, walls, External fixtures	Included	

Coverage and Contingency

RICS 2023 WLCA

Contingency Factor

To account for uncertainties and design development at RIBA Stage 2, a contingency factor of 15% should be applied to all life cycle stages and modules (RICS PS, 2023). Please note that this contingency is not applied to the B6 module and benchmark figures used. Currently results are reported without the additional 15% contingency included, but it is recommended to apply this if the figures provided in this report are used for budgets or target setting going forward.

Table 4: Coverage adjustment, Building elements as per RICS 2023 classifications

Building part / Element group	Building element (NRM level 2)	Contingency factor	Comments & further details
0. Demolition & Facilitating works	0.1 Toxic/hazardous/contaminated material treatment	1.15	
	0.2 Major demolition works		
	0.3 & 0.5 Temporary/enabling works		
	0.4. Specialist groundworks		
1. Substructure	1.1 Substructure	1.15	
2. Superstructure	2.1 Frame	1.15	
	2.2 Upper floors incl. Balconies		
	2.3 Roof		
	2.4 Stairs, ramps and safety guarding		
	2.5 External envelope including roof finishes	1.15	
	2.6 Windows and External doors	1.15	
	2.7 Internal walls and Partitions		
	2.8 Internal doors		
3. Finishes	3.1 Wall finishes	1.15	
	3.2 Floor finishes		
	3.3 Ceiling finishes		
4. Fittings, furnishings, and equipment (FF&E)	4.1 Fittings, Furnishings & Equipment incl. building related and non-building related	N/A	
5. Building services/MEP	5.1 Public Health	N/A	
	5.2 Heating, Ventilation and Cooling (HVAC)		
	5.3 Electrical installations		
	5.4 On site renewable energy generation		
	5.5 Systems including Life safety, Fuel installations, Lift and conveyor installations, Services equipment, Disposal installations, Specialist installations, Builders work in connection with services		
6. Prefabricated buildings and building units	6.1 Prefabricated buildings and building units	N/A	
7. Work to existing buildings	7.1 Minor demolition and Alteration works	N/A	
8. External works	8.1 Roads, paths, paving, surfaces, Fencing, railings, walls, External fixtures	1.15	

Material Inputs

RICS 2023 WLCA

Material Key Inputs and Assumptions

The table right shows the key information regarding materials for each building element.

Table 5: Key materials and assumptions, Building elements as per RICS 2023 classifications

Building part / Element group	Building element (NRM level 2)	Baseline Key materials & Assumptions
0. Demolition & Facilitating works	0. Demolition & Facilitating works	No major demolition activities, site construction based on benchmarks
1. Substructure	1.1 Substructure	Foundations: 3m3 Pad foundations Lowest Floor Slab: 225mm Concrete slab with 30kg/m3 Reinforcement
2. Superstructure	2.1 – 2.4 Frame & upper floors	Frame: Steel columns with Steel Rafters Mezzanine floors: Comflor deck with Steel frame Roof: Steel Purlins roof structure with CA Twin Therm Cladding panels. Stairs: Steel Staircase
	2.5 – 2.6 External envelope including roof finishes	Lower Façade: Clay engineered brick, mortar, SFS system with insulation and Vapour Permeable Membrane Upper Façade: Kingspan AWP Longspan Steel Sheet cladding system (sandwich panel with insulation) External Windows: Double glazed with aluminium frames
	2.7-2.8 Internal walls and doors	Internal walls and doors: Internal Timber doors and stud walls
3. Finishes	3.1 Wall finishes	Walls: Insulation, with Plasterboard inner and outer lining; Floors: Carpet tiles; Ceilings: with steel frame suspended ceiling and mineral fibre ceiling tiles
	3.2 Floor finishes	
	3.3 Ceiling finishes	
4. Fittings, furnishings, and equipment (FF&E)	4.1 Fittings, Furnishings & Equipment incl. building related and non-building related	Excluded at this stage
5. Building services/MEP	5.1 – 5.5 MEP	Excluded at this stage
6. Prefabricated buildings and building units	6.1 Prefabricated buildings and building units	None in project
7. Work to existing buildings	7.1 Minor demolition and Alteration works	None in project
8. External works	8.1 Roads, paths, paving, surfaces, Fencing, railings, walls, External fixtures	Roads and carparks: 40mm Asphalt with 80mm Binder course and 150mm base and 300mm subbase crushed aggregate. Paths and Hard landscaping: 80mm concrete paving units with 30mm Sand layer, 100mm base and 150mm subbase crushed aggregate and 370mm Fill layer

Scope of Assessment

RICS 2023 WLCA

Life Cycle Stages

The assessment of the scheme’s life cycle emissions includes the embodied carbon emissions and operational carbon emissions (regulated and unregulated) reflecting RIBA Stage 3 design. A more detailed explanation of what the Stages A - C and module D cover is provided in the table on the right.

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

Below highlights the scope of assessment regarding life cycle stages included in the WLCA.

Included in the LCA - Embodied Carbon (A1-A5, B4 & C1-C4)
Excluded from the LCA – Operational Carbon (B6 & B7)
Included in the LCA – Circularity reported separately (D1 & D2)
Excluded from the LCA – B1-B3, B5-B8

Table 6: Life cycle stages and scope of assessment in line with BS EN 15978: 2011 and RICS 2023

WHOLE LIFE CARBON ASSESSMENT INFORMATION															
WHOLE LIFE CARBON SYSTEM BOUNDARY														BEYOND LIFE CYCLE, CIRCULARITY	
A0 PRE-CONSTRUCT	A1 – A3 PRODUCT STAGE			A4 – A5 CONSTRUCTION PROCESS STAGE		B1 – B7 USE STAGE					C1 – C4 END OF LIFE STAGE				D BENEFITS AND LOADS
A0 - NONPHYSICAL PROCESS BEFORE CONSTRUCTION, PRELIMINARY STUDIES, TESTS AND DESIGN	A1 - RAW MATERIAL EXTRACTION AND SUPPLY	A2 - TRANSPORT TO MANUFACTURING PLANT	A3 - MANUFACTURING AND FABRICATION	A4 - TRANSPORT TO PROJECT SITE	A5 - CONSTRUCTION AND INSTALLATION PROCESS	B1 - USE	B2 - MAINTENANCE	B3 - REPAIR	B4 - REPLACEMENT	B5 - REFURBISHMENT	C1 – DECONSTRUCTION & DEMOLITION	C2 - TRANSPORT TO DISPOSAL FACILITY	C3 - WASTE PROCESSING	C4 - DISPOSAL	D1 - REUSE, RECOVERY, RECYCLING POTENTIAL
															D2 - EXPORTED UTILITIES
UPFRONT BIOGENIC CARBON						BIOGENIC CARBON					BIOGENIC CARBON				BIOGENIC CARBON
						B6 – OPERATIONAL ENERGY USE									
						B7 – OPERATIONAL WATER USE									
						B8 – USER CARBON									

LCA Inputs

RICS 2023 WLCA

Life Cycle Assessment Key Inputs and Assumptions

These tables summarise the inputs and assumptions made for all Life Cycle Stages of the study.

Table 7: A1-A5 Upfront Carbon data sources and key assumptions

Life Cycle Stage	Data sources and assumptions
A1 – A3 Construction materials	Material quantities and material description provided as noted in section “Material Key Inputs and Assumptions”. Where details on the material specification were not provided, appropriate assumptions have been made and the default specifications included within the RICS guidance ‘Whole life carbon assessment for the built environment, September 2023’, Table 16 has been used.
A4 Transportation to site	With regards to (A4) emissions, the following assumptions have been made for transport distances in alignment with Table 17 of RICS guidance ‘Whole life carbon assessment for the built environment, September 2023’: Materials locally manufactured (20km transport distance assumed – road transport): ready-mixed concrete and mortar. Materials locally manufactured general (50km transport distance assumed – road transport): aggregate and asphalt. Materials regionally manufactured general (80km transport distance assumed – road transport): blockwork, brick, carpet tiles, plasterboard, mineral wool. Materials nationally manufactured (120km transport distance by road assumed): structural steel, reinforcement, steel doors, metal framing components for dry lining partitions and suspended ceilings, concrete for landscaping. Materials sourced from Europe (1500km transport distances by road assumed and 100km by sea): Timber cladding, Aluminium curtain walls and windows, membranes, aluminium standing seam, ceramic tiles, vinyl tiles, epoxy floor, timber doors, aluminium copings, MEP components. Means of transport assumed: - Road – HGV (all diesel), all rigids – average laden – 0.24 kgCO₂e/tonkm - Cargo ship – Container ship average – 0.0161 kgCO₂e/tonkm
A5 Construction and installation process	Pre-Construction Demolition Emissions (A5.1) (applicable to buildings) associated with pre-construction demolition, transporting and disposal of waste. Excluded as this is not applicable to this study. Construction Activity Emissions (A5.2) associated with any construction and installation processes on-site, including site preparation, ground works, energy consumption for site accommodation and use of plant. Since site specific data are not available a default figure of 40 kgCO ₂ e/m ² GIA has been applied to cover the excavation works emissions (RICS 2 nd edition, Sept. 2023). A default figure of 0.26 kgCO ₂ e/m ³ of excavated soil (OneClick LCA dataset, 2024) is adopted to cover for the excavation works emissions (Energy Used on Site). Waste emissions (A5.3) associated with the embodied carbon from the production and transport of products that will be wasted. Regarding Soil waste generated on site, a default value of 0.0078 kgCO ₂ e/kg of excavated soil is adopted (One Click LCA dataset, 2015). Default assumptions for the on-site Waste rates of materials have been made based on the standard wastage rates provided by RICS (Table 18, PS 2023), WRAP, IstructE and OneClick LCA. See below waste rate assumptions for the new elements/materials added (Table 6).

Table 8: A5.3 Material waste rate assumptions

Material	Waste rate assumed (%)
Concrete	5
Reinforcement	5
Blockwork	10
Brickwork	6
Plasterboard	4
Aluminium windows and curtain walls	2.5
Vinyl tiles/Carpet tiles	6
Insulation	7
Membranes	10
Doors	2.5

LCA Inputs

RICS 2023 WLCA

Table 9: B1-B5 In-use and End of Life data sources and key assumptions

Life Cycle Stage	Data sources and assumptions
B1 In-use emissions	Refrigerant emissions (B1) have been included based on the data provided by MEP engineers for the current RIBA stage. Leakage scenarios have been assumed based on TM65 methodology “Embodied carbon in building services: a calculation methodology, CIBSE TM65:2021”. In-use emissions (B1) have not been included in this study.
B2 Maintenance emissions	Maintenance impacts (B2) arising from activities relating to maintenance processes, including cleaning, as well as any relevant products used, and waste produced over the building’s service life. Maintenance (B2) emissions have not been accounted for at this stage of concept design.
B3 Repair emissions	Repair impacts (B3) arise from all activities that relate to repair processes, and any products used, and waste produced over the RSP. In the absence of project specific data at this stage, repair impacts have not been included at this stage.
B4 Replacement emissions	Replacement impacts (B4) arising from like-for-like replacement of products, components and systems as required over the reference study period. Material and component lifespans as per Table 20 of the RICS PS 2023 guidance and CIBSE Guide M have been used. Lifespans used in the assessment are presented in the tables right.
B5 Refurbishment emissions	Refurbishment emissions (B5) arise from all activities that relate to planned alterations or improvements to the physical characteristics and/or performance of the built asset during the service life of the project. At the point of assessment there are not any planned alterations, or predetermined changes that will occur during the RSP of the project (e.g., extension, alternation or change of use, change to the number of storeys, change of technical systems planned to occur in the future). Thus, B5 module is not relevant/applicable to this study and has been excluded.

Table 10: B1 Refrigerant assumptions

Systems using refrigerants	Total refrigerant charge (kg)	Type of refrigerant	Refrigerant leakage scenario (from TM65 Table 4.4)
N/A	N/A	N/A	N/A

Table 11: B4 Replacement cycles / Service life assumptions from RICS

Material group	Service life (years)
Substructure	60
Concrete	60
Aggregates	60
Asphalt	30
Rebar	60
Blockwork	60
Brick	60
Bricklaying mortar	60
Paint	10
Plasterboard	30
Aluminium cladding panels	30
Timber cladding	30
Carpet tiles/Vinyl tiles	15
Single-ply membrane	30
Dry lining partitions	30

Table 12: B4 Replacement cycles / Service life assumptions from CIBSE

Systems group	Service life (years)
Electricity distribution system	30
Lighting system	20
Lightning protection system	25
Fire alarm system	15
Public Address system	30
PV Panels	25
PV Isolator	5
LED lighting	30
ASHP	15
Buffer vessel	30
Expansion vessel	15
MVHR	15
Water distribution network	60
Rainwater and cold water storage tanks	30
Washing machine	10
Lift and lift elements	20

LCA Inputs

RICS 2023 WLCA

Table 13: B6-B8 Operational Carbon data sources and key assumptions

Life Cycle Stage	Data sources and assumptions
B6 Operational energy use	Operational energy (B6) related emissions from the electricity use in the building are based on the MEP consultant energy use intensity estimates. B6 has been excluded from this assessment due to insufficient data at this stage.
B7 Operational water use	Operational water use (B7) emissions cover the impacts related to water consumption (e.g., treated water, ground water, grey water etc.) B7 has not been included at this stage.
B8 User Carbon	Carbon associated with user activities within a building are optional under RICS 2023. They could include user mobility such as commuting, charging of electric vehicles on site, and building use such as embodied impacts of consumables within building operation. These are all excluded from the current assessment.

Table 14: C-D End of Life and Circularity data sources and key assumptions

Life Cycle Stage	Data sources and assumptions
C1 - C4 End-of-Life (EoL) stages	Deconstruction and demolition emissions (C1) include the carbon emissions arising from any on or off-site deconstruction and demolition activities, including any energy consumption for site accommodation and plant use. In the absence of more specific information, a RICS business as usual scenario has been applied at 25% of A5.2 equating to a baseline of 10 kgCO2e/m² GIA. End-of-life scenarios for Stages (C2-C4) for key material groups are presented in the table below.
D1-D2 Benefits and loads beyond the system boundary	Module D1 potential benefits and loads have been calculated using the below end-of life scenarios, which follow the EN 15978 standard. Module D2 exported utilities benefits have been excluded.

Material Decarbonisation Assumptions

Alongside grid decarbonisation, it is expected that extraction, transportation, and manufacturing processes will also decarbonise. Therefore, it is important to consider their decarbonisation as an additional part of the Whole Life Carbon Assessment (WLCA). The decarbonised scenarios are summarised in the table below, in line with the RICS PS September 2023.

Table 15: B6 Operational Energy data used in LCA

Energy usage	kWh/m²GIA/yr
Estimated Annual Energy Consumption	N/A
Photovoltaic Panel Electricity Generation	N/A
Estimated Annual Grid Energy	N/A

Table 16: C2-C4, D1 End-of-life scenarios for key material groups

Material group	End-of-Life scenario (C2-C4)
Concrete	Crushed into aggregates
Steel	Recycling
Concrete Reinforcement	Steel recycling
Blockwork	Recycling
Clay Bricks	Crushed to aggregates
Paint	Landfilling
Wood & Plastics	Incineration

Table 17: Decarbonisation scenarios for embodied carbon impacts (RICS PS Sept. 2023, Table 15)

Life Cycle Module	Decarbonisation scenario
A0-A5	No decarbonisation.
B1.2 (fugitive refrigerant emissions)	50% decarbonisation for all predicted impacts
B2–B4	50% decarbonisation for all predicted impacts.
C2	50% decarbonisation for all predicted impacts.
C3-C4	No decarbonisation.
D1	50% decarbonisation for all predicted impacts.

Appendix C

BREEAM NC v6.0

Mat01 Methodology

Credits Targeted & Achieved

Concept Design

BREEAM UK NC v6.0 – Mat 01 Requirements

Mat01 issue 'Environmental impacts from construction products - Building life cycle assessment (LCA)' (Mat01) includes seven credits (Criteria 1 to 7) and three exemplary credits (Criteria 8 to 10) are available. Criteria 1 and 2 that require a comparison with the BREEAM LCA benchmark during Concept Design and Technical Design respectively, available for office, industrial and retail buildings. In total, 3No. credits are targeted for Bursledon at Concept Design Stage.

Overall, 4no. Superstructure options have been assessed to achieve the maximum number of credits available under Criteria 3 & 4 at the Concept Design stage, 3No. Substructure and 3No. HL options have been considered to satisfy Criteria 6 & 7.

Targeted Concept Design Credits

Superstructure Criteria

- Criterion 1 - Comparison with the BREEAM LCA benchmark during Concept Design: (office, industrial and retail buildings only) - Completed but not targeted
- Criteria 3, 4 – Options appraisal during Concept Design: Carry out building LCA options appraisal of 2 to 4 significantly different superstructure design options - Targeted

Substructure Criteria

- Criteria 6 and 7 – Substructure and hard landscaping options appraisal during Concept Design - Targeted

Exemplary Criteria

- Criteria 8 to 10: Not targeted

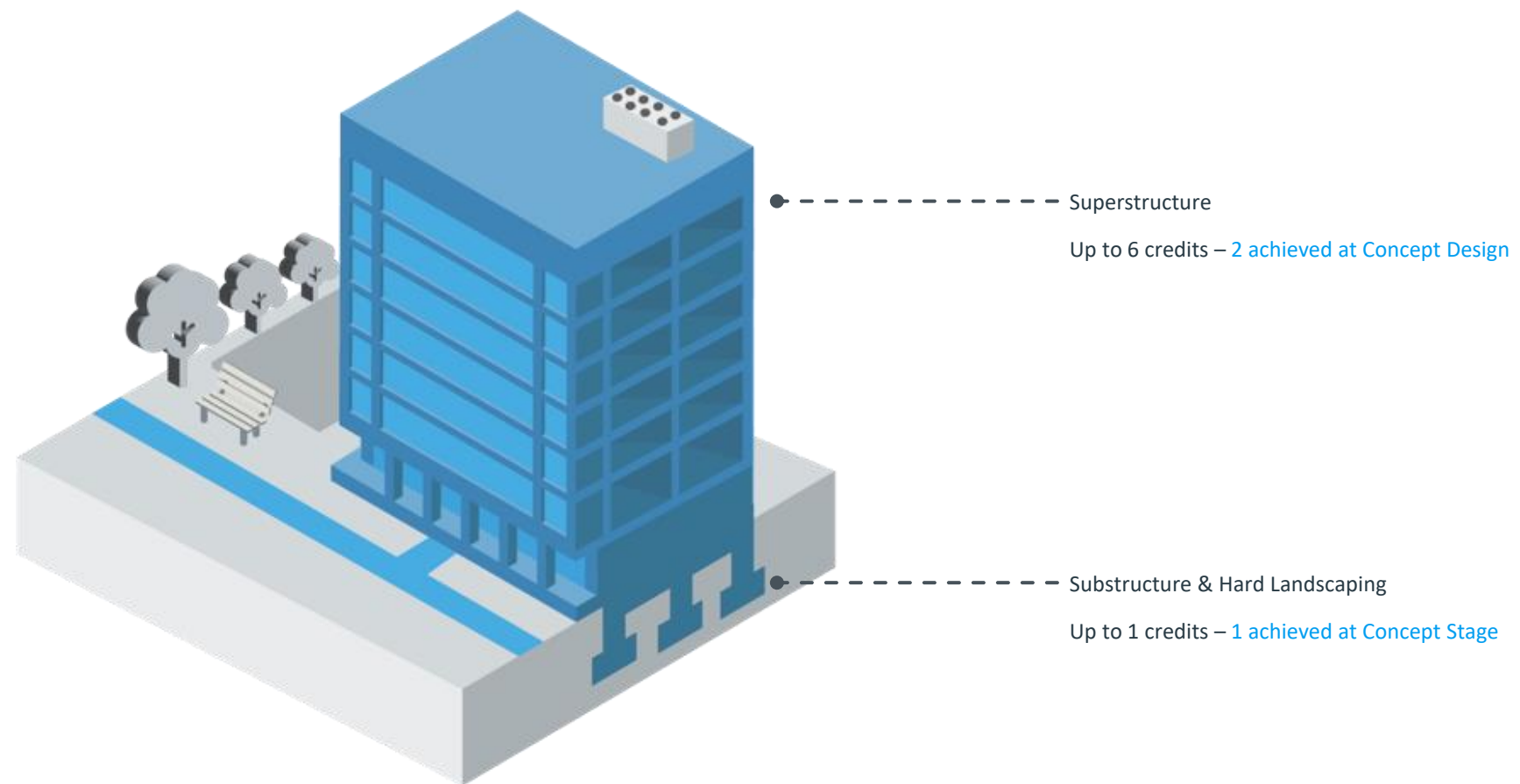


Figure 18: BREEAM credits Targeted and Achieved

Scope of Assessment

BREEAM New Construction v6.0 Mat01

Building Elements

The scope requirements for Mat01 are narrower than RICS 2023.

The LCA analysis will cover the Superstructure elements. The table on the right indicates the in-scope elements and sub-elements, as per BREEAM UK v6.0 Mat01 requirements (Tables 9.1, 9.2, 9.5 and 9.6 of the BREEAM manual).

Table 18: Superstructure elements in scope of assessment as per RICS NRM classifications in BREEAM Mat01

Level 1 Group element	Level 2 Element	Level 3 Sub-element	Comments & further details
2. Superstructure	1.Frame	1.Steel frames 2.Space decks 3.Concrete casings to steel frames 4.Concrete frames 5.Timber frames 6.Other frame systems	
	2.Upper floors	1.Floors	
	3.Roof	1.Roof structure 2.Roof coverings 3.Specialist roof systems 5.Rooflights, skylights and openings	
	4.Stairs and ramps	1.Stair or ramp structures	
	5.External walls	1.External enclosing walls above ground floor level 2.External enclosing walls below ground level 3.Solar or rain screening	
	6.Windows and external doors	1.External windows	
	7.Internal Walls and Partitions	N/A	Excluded from this study

Scope of Assessment

BREEAM New Construction v6.0 Mat01

Life Cycle Stages

Not all stages covered in RICS 2023 are included in the Mat01 compliant analysis.

According to BREEAM UK v6.0, Mat01 requirements the LCA assessment should cover the following life cycle stages:

- Stages A1-A3
- Stages A4 and A5, where possible in the building LCA tool
- Stages B-C, each module possible in the building LCA tool used

Included in the LCA - Embodied Carbon (A1-A5, B1-B4 & C1-C4)
Excluded from the LCA – Operational Carbon (B6 & B7)
Excluded from the LCA – A0, B1-B3, B5, B7-B8, D1-D2

Table 19: Life cycle stages and scope of assessment in line with BS EN 15978: 2011 and RICS 2023

WHOLE LIFE CARBON ASSESSMENT INFORMATION																
WHOLE LIFE CARBON SYSTEM BOUNDARY														BEYOND LIFE CYCLE, CIRCULARITY		
A0 PRE-CONSTRUCT	A1 – A3 PRODUCT STAGE			A4 – A5 CONSTRUCTION PROCESS STAGE		B1 – B7 USE STAGE					C1 – C4 END OF LIFE STAGE				D BENEFITS AND LOADS	
A0 - NONPHYSICAL PROCESS BEFORE CONSTRUCTION, PRELIMINARY STUDIES, TESTS AND DESIGN	A1 - RAW MATERIAL EXTRACTION AND SUPPLY	A2 - TRANSPORT TO MANUFACTURING PLANT	A3 - MANUFACTURING AND FABRICATION	A4 - TRNSPORT TO PROJECT SITE	A5 - CONSTRUCTION AND INSTALLATION PROCESS	B1 - USE	B2 - MAINTENANCE	B3 - REPAIR	B4 - REPLACEMENT	B5 - REFURBISHMENT	C1 – DECONSTRUCTION & DEMOLITON	C2 - TRANSPORT TO DISPOSAL FACILITY	C3 - WASTE PROCESSING	C4 - DISPOSAL	D1 - REUSE, RECOVERY, RECYCLING POTENTIAL	D2 - EXPORTED UTILITIES
UPFRONT BIOGENIC CARBON						BIOGENIC CARBON					BIOGENIC CARBON				BIOGENIC CARBON	
						B6 – OPERATIONAL ENERGY USE										
						B7 – OPERATIONAL WATER USE										
						B8 – USER CARBON										

Environmental Impact Categories

BREEAM New Construction v6.0 Mat01

The most common impact category covered by LCA is the global warming potential which quantifies the impact of greenhouse gases heating the planet. Other common impact categories are ozone depletion, acidification, eutrophication, and Non-hazardous waste disposed.

The BREEAM Mat01 template for OneClickLCA also considers these environmental indicators as described in the table right.

Table 20: Description of environmental indicators considered

Impact category	Unit(s)	Description
Global warming potential (GWP)	kg CO ₂ e	Describes changes in local, regional, or global surface temperatures caused by an increased concentration of greenhouse gases in the atmosphere. Often referred to as "carbon footprint".
Acidification potential (AP)	kg SO ₂ e	Describes the acidifying effect of substances in the environment. Substances such as sulfur dioxide and nitrogen oxides can lead to acid deposition, potentially damaging ecosystems.
Eutrophication potential (EP)	kg PO ₄ e	Describes the effect of adding mineral nutrients to soil or water, which can lead to excessive growth of algae and plants, potentially causing oxygen depletion and ecosystem imbalance.
Ozone depletion potential (ODP)	kg CFC11e	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 ("tropospheric") (POCP)	kg Ethenee	Describes the effect of substances in the atmosphere to create photochemical smog. Also known as summer smog.
Non-hazardous waste disposed (NHWD)	kg	The amount of waste disposed that is arising from product raw material extraction, manufacturing, and supply processes as well as end of life processing.
Biogenic carbon storage	kg CO ₂ e bio	Represents the amount of carbon dioxide equivalent stored in biological materials, such as wood or other plant-based products.
Energy	kWh	Measures the total energy consumption throughout the product's life cycle.
Water consumption	m ³	Quantifies the total volume of water used or consumed during the product's life cycle.
Mass of raw materials	kg	Represents the total mass of raw materials used in the production of the product.
Fuel consumption	litres	Measures the volume of fuel consumed during the product's life cycle, particularly relevant for transportation and energy-intensive processes.
Distance traveled	km	Quantifies the total distance travelled during transportation phases of the product's life cycle.

Other LCA Details

BREEAM New Construction v6.0 Mat01

LCA data sources and assumptions

The One Click LCA ‘LCA for BREEAM UK’ tool includes a large database of Environmental Product Declarations (EPDs) and generic material data. Environmental Product Declarations (EPDs) are documents that quantify the environmental impacts of materials or products. According to the RICS professional statement ‘Whole life carbon assessment for the built environment, November 2017’ the following data sources are allowable for use in whole life carbon assessments:

- Type III environmental declarations (EPDs and equivalent) in accordance with EN 15804, ISO 21930, ISO 14067, PAS 2050.
- EPDs in accordance with ISO 14025, 14040 and 14044.
- Where there is no specific qualifying carbon data for items included in the assessment, then allowable carbon information available for equivalent or closely similar products, that complies with the above requirements, should be used. The most recent geographically and technologically appropriate data should be selected depending on project location and subject to anticipated supply chains.

According to Mat01 requirements, elemental construction quantities at the Concept Design stage are required to be input as +/-10% of quantities shown in design documents. During Concept Design stage generic or manufacturer-specific data can be used, using the closest matching data in the tool. Regarding product quantities, typical or generic values (non-project specific elemental constructions) may be used, where data is not available.

Where possible EPDs for equivalent or closely similar products have been used to extract the material embodied carbon emissions, as these represent the most accurate source of information. All EPD and generic data used in the LCA analysis comply with the EN 15804 requirements and is drawn from the OneClick LCA database, which has been approved following the BRE-verified data qualification methodology by LCA data specialists.

A detailed list of the environmental data sources used for this assessment is presented in Appendix A.

Reference Study Period

The study period of the LCA will be 60 years, which is in line with BREEAM Mat01 requirements.

LCA Software

The LCA assessment and options appraisal has been undertaken using the Bionova Ltd. ‘OneClick LCA’ software. OneClick LCA is approved as IMPACT-compliant by BRE and has been developed to comply with the BS EN 15978: 2011 – Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method requirements.

OneClick LCA for BREEAM UK tool is also included in the ‘Building LCA tools recognised by BREEAM’ list, approved for the Superstructure, Substructure and Hard Landscaping options appraisal, as per Knowledge Base note KBCN1118.

Alignment with BREEAM UKNC2018_Mat0102_ResultsSubmissionTool_V2.2

As the options are required to be inputted to the submission tool in a particular order, the table below provides clarification on the naming using in this report and the with BREEAM UKNC2018_Mat0102_ResultsSubmissionTool_V2.2. The substructure and hard landscaping options have been reordered in the report to make results easier to interpret, while in the Submission tool they follow the required order.

Table 21: Options studied and equivalent .xlsx file submitted to the BRE

Report Option Name	BREEAM Submission tool file
SuperS Option 1 - Baseline	Mat01_CD_SuperS_Opt1.xlsx
SuperS Option 2	Mat01_CD_SuperS_Opt2.xlsx
SuperS Option 3	Mat01_CD_SuperS_Opt3.xlsx
SuperS Option 4	Mat01_CD_SuperS_Opt4.xlsx
SubS Option 1 – Baseline	Mat01_CD_SubS_HL_Opt1.xlsx
SubS Option 2	Mat01_CD_SubS_HL_Opt3.xlsx
SubS Option 3	Mat01_CD_SubS_HL_Opt5.xlsx
HL Option 1	Mat01_CD_SubS_HL_Opt2.xlsx
HL Option 2	Mat01_CD_SubS_HL_Opt4.xlsx
HL Option 3 – Baseline	Mat01_CD_SubS_HL_Opt6.xlsx

Bright
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