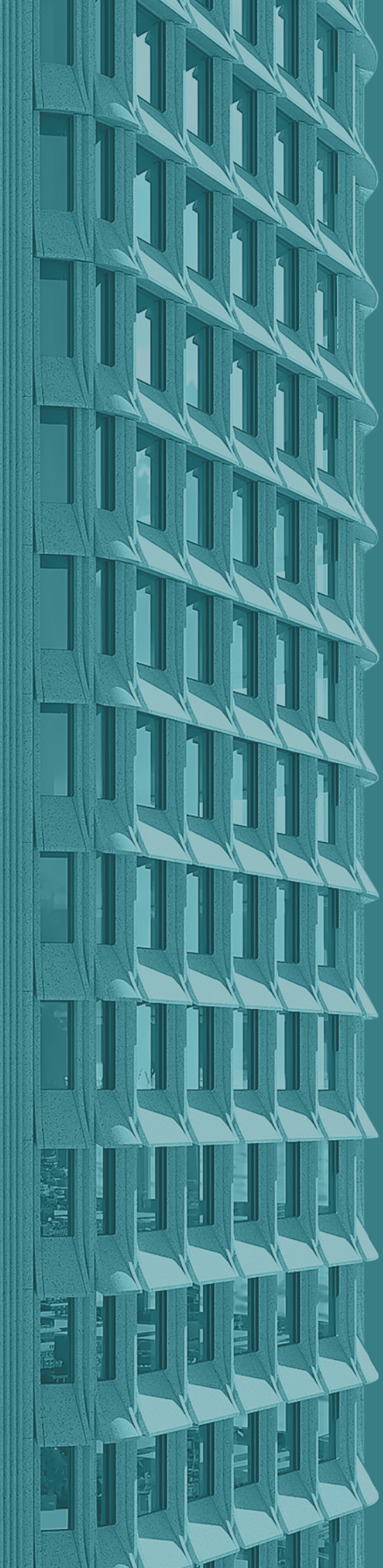


EUSTON TOWER

Whole Life Carbon Assessment

December 2024

British Land

WLCA – Method Statement

10th December 2024
RIBA 2

Euston Tower

RIBA Stage 2 Whole Life Carbon assessment note.

This Whole Life Carbon Assessment (WLCA) update summarises the revisions made to the pending strategic application for Full Planning Permission (ref. 23/5240/P), submitted in December 2023 for the Proposed Development at Euston Tower (286 Euston Road, London).

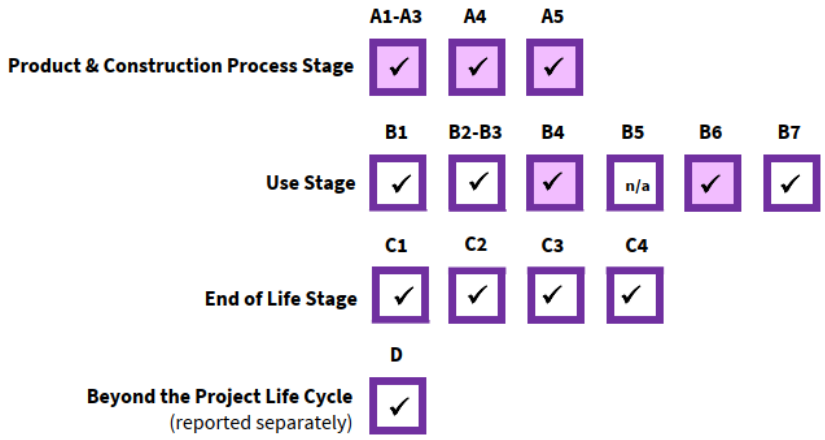
The Applicant has undertaken extensive consultation during both the pre-application and determination stages of the Proposed Development and has sought to respond positively to the responses received. The scheme has been revised in response to feedback from Officers, local stakeholders and residents, including the Regents Park Conservation Area Advisory Committee and statutory consultees, including Historic England and the Greater London Authority.

This WLCA has been prepared detailing the revisions to the pending scheme (the "Proposed Development"). For the avoidance of doubt, the WLCA which accompanied the December 2023 Submission is considered superseded by this WLCA which considers the revised Proposed Development. This report also clarifies and provides further details responding to consultation responses received since the submission of the application for Full Planning Permission in December 2023.

This Method Statement is constructed to accord with the methodological requirements of the RICS Professional Statement Whole life carbon analysis for the built environment (2017) publication.

EN 15978 Module Coverage

As per the requirements of the RICS PS 1st Edition Table 2, a WLCA must cover core modules of EN 15978:2011, typically representing where the majority of WLC impacts fall. As an absolute minimum, a Sweco WLCA assessment will cover these modules in full. Sweco look to include all possible EN 15978:2011 modules, subject to the limitations of the One Click LCA tool, the RIBA stage/timing of the assessment and the availability of data/scenario information from the industry at the time of writing. The below demonstrates which modules have been included in this study.



Reference Study Period

The RICS Professional Statement has set requirements for the reference study period (RSP) which must be used for the WLC assessment process. For domestic and non-domestic projects, the RSP is **60 years**. The RSPs are fixed to provide a level of comparability between WLC results for different projects, and to enable better future interrogation and interpretation of results.

Building Elements Coverage

The table presented below shows the percentage of costs covered by the G&T Cost Plan for each elemental category. In cases where the coverage is less than 100%, an adjustment factor was applied to provide an allowance for the carbon impacts of the missing elements or components as per the RICS WLCA PS 1st Edition recommendation. For instance, if the coverage is 95%, then the adjustment factor for carbon of those elements quantified in that category would be 1.05.

For certain building element categories, based on the current stage in design and availability of information, benchmarked carbon values were used on a per m^2 basis. These categories are indicated below.

Table 1.0: Building elements coverage for ET at RIBA 2.

	Building parts/ Element groups	Building Elements	Coverage (%)
0	Facilitating works	0.1 Temporary/Enabling works/ Preliminaries	Benchmarked Value
		0.2 Specialist groundworks	N/A
1	Substructure	1.1 Substructure	95%
2	Superstructure	2.1 Frame 2.2 Upper floors incl. balconies 2.3 Roof 2.4 Stairs and ramps	99%
	Superstructure	2.5 External Walls 2.6 Windows and External Doors	100% (Contingency factors added separately as part of CWCT process)
	Superstructure	2.7 Internal Walls and Partitions 2.8 Internal Doors	100%
3	Finishes	3.1 Wall finishes 3.2 Floor finishes 3.3 Ceiling finishes	97%
4	Fittings, furnishings, and equipment (FF&E)	Building-related Non-building-related	59%
5	Building services / MEP	5.1 - 5.14 Building-related services	75%
		Non-building-related	N/A
6	Prefabricated Buildings and Building Units	6.1 Prefabricated Buildings and Building Units	N/A
7	Work to Existing Building	7.1 Minor Demolition and Alteration Works	Benchmarked Value

	Building parts/ Element groups	Building Elements	Coverage (%)
8	External works	8.1 Site preparation works 8.2 Roads, Paths, Paving and Surfacing 8.3 Soft landscaping, Planting, and Irrigation Systems 8.4 Fencing, Railings and Walls 8.5 External fixtures 8.6 External drainage 8.7 External Services 8.8 Minor Building Works and Ancillary Buildings	Benchmarked Value

Measurement Source References

Table 2.0: Key material quantities data sources (non-exhaustive).

Data Source	Data Source Type	Comments
Euston Tower - Cost Plan (29.10.24)	Cost Plan	Source for majority of quantities.
241018 Material Quantities - Arup	Structural Material Quantity Breakdown and carbon factors	Informed carbon factors where not already confirmed
Euston Tower Planning Area Schedule (16.10.24)	Area Schedule	Latest area schedule provided by G&T.
ARUP Structures correspondence	Emails	Further clarifications on structural material carbon factors and reduction opportunities.
CWCT Façade Calculations	Excel data sheet	CWCT compliance calculations for façades provided by 3XN.
WLCA Main Mech Plant Weights – 24.10.2410.24	Excel data sheet.	Arup MEP provided a provisional/high level equipment schedule that formed the basis of their initial Stage 2 Design.
Arup Operational Energy Prediction Figures – 25.11.24	Email	Used to inform B6 module. Aligned with the submitted Energy Statement Be Seen TM54 results for the Baseline Office/Lab scenario.
65206043_VT_Equipment_Summary_Schedule_Rev02WIP Euston Tower, Lifting Strategy Diagrammatic, Rev P04	Schedule and diagrammatic	Informed the number of lifts, escalators and travel heights.
241024 Euston Tower - WLCA - B1 Refrigerant Calc	Excel data sheet.	Arup MEP filled in refrigerant schedule based on initial Stage 2 Design.

Product and Construction Process Stage

At Stage 2, there was insufficient design information in certain categories to derive reliable quantities from the cost plan of material specifications from other reference material. In these cases, an overall carbon rate per m² GIA, that was established earlier in the design, was applied as a placeholder allowance. This is relevant to the following elemental categories:

- Demolition impacts of existing building: **20 $kgCO_2e/m^2$ GIA.**
- Temporary works (which included Works to Existing Building): **15 $kgCO_2e/m^2$GIA.**
- Site activities: **26 $kgCO_2e/m^2$ GIA.**
- External works: **20 $kgCO_2e/m^2$ GIA.** For this elemental category specifically, a combined approach was used. The materials that could be quantified from the cost plan were included in the assessment, however due to uncertainties at this stage as to sufficient detail for external works, the carbon reporting still uplifted the overall impact to this benchmarked rate.

Carbon factors used (A1-A3)

Structural Components

The baseline carbon factors for structural materials were confirmed to Sweco as follows:

- **Structural steel:** steel truss, bracing, columns, floors, bolt on podium structure and roof – a blended rate of 30:70 electric arc furnace (EAF): ArcelorMittal's (AM) XCarb product with the respective A1-A3 carbon factors of **0.84: 0.33 $kgCO_2e/kg$.**
- **Specials allowance** – Blended rate of 56:44 basic oxygen furnace (BOF): EAF – combined factor of **1.74 $kgCO_2e/kg$.**
- **Structural steel:** Connections– **2.45 $kgCO_2e/kg$ –** BOF UK typical.
- **Steel reinforcement**: 0.3 $kgCO_2e/kg$ – AM XCarb Rebar product.
- **Piles, concrete liner wall to sheet wall concrete carbon factor:** RC 32/40 50% GGBS - 0.0888 $kgCO_2e/kg$.
- **Basement slabs, pile caps, concrete encasement to steel columns, RC Walls, columns, upper floors concrete carbon factor:** RC 32/40 25% GGBS – 0.12 $kgCO_2e/kg$.
- **Composite steel decking concrete carbon factor:** RC 32/40 25% GGBS – 0.12 $kgCO_2e/kg$.
- **Composite steel decking steel carbon factor**
    - **Labs:** 31.7 $kgCO_2e/m^2$ Kingspan Multideck 50
    - **Offices:** 23.1 $kgCO_2e/m^2$ blended rate of 80: 20 AM XCarb + magnelis coating: BOF.
- Arup structures provided structural steel intumescent paint rate of 9.22 m^2/tonne of steel at 1mm thick.
- **Basement slab waterproofing**: Sweco material library default input polyethene membrane.
- **Basement slab:** Sweco material library default input **150mm EPS.**
- **Precast stair reinforcement** rate assumed at **130 kg/m^3.**

Facades

- **BMU** – only 'number of' highlighted in Cost Plan – generic Sweco input used for this with material weights. BMU track materials measured from roof plan.
- **Internal lining of external wall** assumed as 2 x 15mm plasterboard with steel studwork at 1.3kg/m². Applied to opaque area of external façades.

CWCT calculations provided by 3XN. Some key notes and assumptions from these calculations:

- The carbon performance of the **Podium Façade** was modelled as per the same impact of the Typical Bay at this stage in design.
- A **5% material scale up** factor was applied to all material components, then a separate **façade scale up factor of 5%** was also applied.
- The facades were assumed to be assembled **offsite in European factory.**
- **The aluminium extrusions** were based on the **Hydro Reduxa EPD** value for billet only at **4 $kgCO_2e/kg$** plus a placeholder allowance for extruding (**0.5 $kgCO_2e/kg$**), pre anodisation (**2.24 $kgCO_2e/kg$**) and PPC coating (**0.13 $kgCO_2e/kg$**).
- An allowance of **263 $kgCO_2e/m^2$ FSA (A1-A5)** was assumed for the **soffits** with the area for this element being taken from the Cost Plan.

The performance of the other façade types, including all contingencies (i.e., material and overall façade scale up) for modules A1-A5:

- **Typical Bay:** 477 $kgCO_2e/m^2$ FSA
- **Spine:** 705 $kgCO_2e/m^2$ FSA
- **Podium Façade:** 447$kgCO_2e/m^2$ FSA (as per Typical Bay)
- **Amenity:** 527 $kgCO_2e/m^2$ FSA

Internal Walls, Finishes & Fittings

- Sweco material library defaults for **drylining build-ups** in model i.e., **plasterboard, acoustic insulation and metal studwork.**
- Sweco material library defaults for **bike racks and lockers.** Number of units taken from Cost Plan.
- **Internal doors:** allowance in cost plan on a cost per m² GIA basis rather than the number of doors itemised. Therefore, Sweco looked at the number of internal doors per m² GIA on other office developments and used this as a means to estimate the number of doors in Euston Tower.
- **Reused RAF for S&C areas** (excluding the WC's) – input based on RMF e-coated (0.71 $kgCO_2e/m^2$) with pedestals assumed 4kg/m² of material.
- **RAF for WC's and office CAT A** - input based on Kingspan RMG 600 (40.56 $kgCO_2e/m^2$) in first instance (worst case) with pedestals assumed 4kg/m² of material.
- **Screed**
    - Basement Areas: 50mm thick.
    - 80mm thick to terraces.

    - 80mm thick to podium floor.
    - 80mm thick to proportion of laboratory upper floor plate where equipment could be allocated.
- **Metal decking edge trim**: assumed 400mm high, 2mm thick, drawings used to measure perimeter on each floor plate.
- **Metal decking shear studs:** assumed 1.2kg per m^2 of upper floor.

Where not directly provided in architectural responses following assumptions made to finishes:

- **Void formers** at 100mm.
- **Ceramic floor tiles** at 10mm thick and associated adhesive at 10mm thick.
- **0.4mm epoxy resin** finish to **plant and bike store areas.**
- **Natural stone** 10mm thick and associated adhesive at 10mm thick for enhanced finishes to **lifts.**
- **Raised access Floor pedestals:** 4 kg/m^2.

Building Services

Main plant items as per the basis of design in ARUP indicative MEP schedule.

- **Distribution MEP materials** in base build areas based on per m^2 inputs i.e. pipework, ductwork and containment.
- **Rule of thumb inputs** informed by Stage 4 level information (scaled on GIA) from another commercial project in Sweco's portfolio with a similar HVAC strategy used for buffer vessels, water treatment, pump systems, water treatment, thermal stores and busbars.
- **200 m^2 of PV** confirmed in cost plan.

CAT A fit out assumptions:

- CAT A office areas: **floor area** from latest cost plan **(4 floors).**
- CAT A for office and Lab **specific equipment** based on **per m^2 inputs** for areas above e.g., **ductwork, cabling, lighting, sprinklers, containment**.
- **No localised building services** materials assumed in Office or lab enabled tenant areas that are to be fitted to **shell and core** specification.
- No level of fitout beyond base build has been assumed for the lab enabled floors (3-11)

Assumptions for Transportation Distances (A4)

For the vast majority of modelling inputs, the transport distances have been based on the RICS WLCA PS defaults. A summary of these assumptions are provided in the table below.

Table 3.0: RICS WLCA PS (2017) Default transport distances.

Assumed Transport Distance (km)	Product group/material in project WLC analysis
50 (local)	Concrete, screed, aggregates
300 (UK)	Formwork, steel deck, timber terrace decking, pavers, balustrades & handrails, stone pavers, resin-bonded gravel, internal timber doors, blockwork, cement mortar, plasterboard, acrylic paint, carpet, vinyl flooring, RAF, suspended metal ceiling, baffle ceiling, ceramic tiles, concrete sealant, terrazzo.
1500 (EU)	Insulation, bitumen membranes, pedestals, sanitaryware, steel studwork, pipe/duct insulation, lighting, waterproofing membranes for structure, rebar, riser doors, revolving door sets, aluminium/glass internal doors, stair core doors, glazed internal screens, cycle racks & lockers, ductwork & pipework, all other building services items not assumed in UK (300km) list above.

An exception to this is the precast concrete elements (i.e. stairs), where two transport distances have been applied (300 km x2 concrete and 1500 km + 300 km for rebar). These additional distances provide an allowance for to account for upstream transportation movements prior to leaving the factory to site i.e., it avoids the underestimation of transport impacts where A2 impacts are lacking from the EPD used.

In a similar vein, any building services product or system that has been built up by Sweco from individual materials, and not taken directly from a product EPD, two transport distances have again been provided to make an allowance for movements of raw materials/products to the factory, and then from factory to site (1500 km x 2).

As noted in previous sections, some elemental categories at this stage have been based on benchmarked A1-A5 carbon intensity values. Therefore, the transport impacts are included within this benchmarked figure. However, as the majority of the data that underpins the intensity allocations came from internal portfolios (particularly from Sweco), based on design information from other projects, it is reasonable to state that all values for transport are in accordance with the design values set out within the RICS PS WLCA (2017) methodology.

Predicted Construction Site Energy Use and Waste (A5)

This section can be separated into two parts: construction site emissions (A5s) and construction site waste (A5w). The methodology for each is set out below.

The emission rate of 26 $kgCO_2e/m^2$ GIA for A5s it was suggested by Sweco based on a target rate for a 100% new build and the modification was made based on the difference in construction program length between the 'Retain the Core' option being proposed for planning and a hypothetical new build. It's important to note that this emission rate only takes into account site emissions and doesn't include waste.

The A5w data uses default WRAP waste values as applied within software such as One Click and is included within reported A1-A5 values. Again, for those elements based on benchmarked values the same default rates are included in the A1-A5 value in the sense that the same methodology was used in the projects that provided these benchmarked values.

Use Stage

Assumption for Refrigerants (B1)

The refrigerant information was provided by ARUP, while the annual and end-of-life leakage rates have been taken from the CIBSE TM65 Table 4.13 values for the relevant systems, as set out below.

Table 4.0: Systems & refrigerants used in WLCA Stage 2 baseline.

System	Refrigerant Type	GWP ($kgCO_2e/kg$)	Service Life (yrs.)	Total Charge (kg)	Annual Leakage Rate (%)	EoL Leakage Rate (%)
ASHP	R513A	656.45	15	2,760	2	1
Chillers	R513A	656.45	15	1,000	2	1
DX Units	R-32	675	15	315	6	3

Assumptions for Maintenance and Repair (B2 & B3)

Modules B2 and B3 includes the embodied carbon associated with maintenance and repairs over the duration of the building's RSP. Greater London Authority (GLA) updated "London Plan Guidance – Whole Life-Carbon Assessments" publication, released in March 2022 provides some guidance on assumptions for Modules B2 and B3 when they are unknown at an early stage within section 2.5.15, and to encourage some assessment of the impact of these modules provides the following guidance:

"…for module B2 emissions, a total figure of 10 kgCO2e/m2 gross internal area (GIA) may be used to cover all building element categories, or 1 per cent of modules A1-A5, whichever is greater. For module B3 emissions, these may be estimated as 25 per cent of module B2, as per the RICS PS (item 3.5.3.3). "

These additions are not added between all buildings parts as some will require either minor maintenance and repairs only during its life span, or no maintenance/repairs at all. The following categories are used for the additions as stated in RICS PS section 3.5.3.2; roof, façade and external doors, finishes, and services.

Assumptions for Lifecycles of materials (B4)

The assumptions for life cycle replacement of materials have been made in accordance with RICS PS, except for building services, which adheres to CIBSE Guide M, and for the facade, which follows the CWCT methodology.

Assumption for Operational Energy and Water (B6 & B7)

The predicted energy consumption for Euston Tower was provided by ARUP, and are provided in Table 5.0 below.

Table 5.0: Predicted Energy Consumption for ET.

Baseline Office/Lab	Predicted Energy Consumption (MWh/year)		
	Base Build	Tenant	Total
	6,001,507	5,364,385	11,365,891

For the baseline water consumption calculation, Sweco have used the Better Building Partnership's 2020 Real Estate Energy Benchmarking (REEB) publication, released in August 2021. The 'Typical Practice' water use intensity (WUI) for offices of 636 (litres/m2 NLA/year) was used, in the absence of more specific data. The emissions factors associated with water use and treatment are derived from Thames Water, and the consequent emissions factors, published in 2023/2024, are 0.199 $kgCO_2e/m^3$ for water supply, and 0.212 $kgCO_2e/m^3$ for water treatment (assuming 90% of potable water ends up going to sewer).

End of Life Stage

Assumption for End of Life (C1-C4)

The end-of-life waste streams, and their associated C1-C4 impact, is based on the pre-set typical practice UK scenarios for each material type.

Results

The A1-A3 section summarises the key assumptions made within each building element category. However, prior to presenting the results it is worth reiterating the specific carbon reducing intervention measures that are included in these results as it relates to material specifications. These specifications have been committed to by the client for inclusion in the Baseline position. These specific intervention measures are listed as follows:

- The rolled or standard steel sections (6,887 tonnes) comprising: steel truss, bracing, columns, floors, bolt on podium structure and roof – have been modelled as 30:70 electric arc furnace (EAF): ArcelorMittal's (AM) XCarb product with the respective A1-A3 carbon factors of 0.84: 0.33 $kgCO_2e/kg$.
- AM XCarb rebar has also been included for steel reinforcement within the associate concrete elements within the substructure and superstructure.
- The base build raised access flooring (RAF) (19,808 m^2), which excludes WC areas, is based on the RMF Eco range tiles.
- Concrete elements are based on the GGBS proportions, and associated carbon factors, as confirmed to Sweco and set out in the A1-A3 inputs section earlier in this note.

Table 6.0 below shows the performance, provided at three levels – whole life carbon (A-C including B6 & B7), life cycle embodied carbon (A-C excluding B6 & B7) and upfront embodied carbon (A1-A5).

Table 6.0: Summary of Baseline RIBA Stage 2 WLC performance of ET at the three levels of detail, with all values as intensity ($kgCO_2e/m^2$ GIA) according to GLA.

EN 15978:2011 Modules	Whole Building (inc. contingencies) $kgCO_2e/m^2$ GIA
Whole Life Carbon (A-C inc. B6 & B7) **Including sequestration**	**2,397**
Life Cycle Embodied (A-C ex. B6 & B7) **Including sequestration**	**1,225**
Upfront Carbon (A1-A5)	**703**

Contingencies

As this assessment is still at an early design stage, suitable contingencies have been allowed for in the results. However, there are different types of contingencies applied, and these contingencies are only applicable to specific elements. For transparency, Table 7.0 below sets out the results across the various building elements, in intensity terms, and segregates the various contingencies applied. All of these contingencies then culminate in the total A1-A5 figures.

The façade scale-up factors are in line with CWCT guidance. The cost coverage factors reflect the coverage of building elements, as stated at the start of this note. Additionally, a 15% contingency is applied to account for early-stage design, which is deemed by the assessor an appropriate contingency to use at this stage.

This last contingency applies to all elements except for those elements where either separate contingencies have been applied (e.g. CWCT approach for façades), benchmarked data (e.g. external works, site activities and temporary works) and finally demolition of the existing building materials where a 10% contingency has been applied. This slightly reduced contingency applied to demolition is deemed appropriate as a thorough Pre-Refurbishment/Demolition Audit has been carried out during the initial design stages.

Table 7.0: A1-A5 results intensity ($kgCO_2e/m^2$ GIA) segregated out to highlight the various contingencies including in the reporting.

Building Element	Stage 2 - A1-A5 ($kgCO_2e/m^2$)					
	Results Intensity	Façade Scale up Factors (CWCT)		Cost Plan Coverage Factors	15% Contingency *	Total Intensity with Contingencies
Demolition	20			0	2	22
Substructure	22			1	3	26
Superstructure	216			2	33	250
External walls, windows & doors	145	7	7	0	0.6	160
Internal Walls & Doors	18			0	3	20
Finishes	23			1	4	28
Fittings	3			1	0	4
Building Services	109			27	20	157
External Works	17			0	0	17
Site Activities	26			0	0	26
Temporary Works	15			0	0	15
Total	**613**	**7**	**7**	**32**	**66**	**725**

*excludes: demolition, CWCT façade, external works, site activities and temporary works.

Reduction Opportunities

Further opportunities to reduce the upfront embodied carbon impact of the Proposed Development have been presented in the waterfall below. They cover modules A1-A5 only at this stage, given the current industry focus on upfront embodied carbon. All reductions are in intensity ($kgCO_2e/m^2$ GIA) and are measured against the base specification material.

The table below provides an estimated quantification of these further reductions in A1-A5 intensity terms. They are also illustrated in the subsequent waterfall chart. It should be noted that in a number of cases these reductions reported are cumulative i.e., the quantified reduction cannot be taken separately from the other associated reductions before it.

Material use efficiencies.

Material specification.

Site activities.

Table 8.0: Cumulative reduction opportunities for upfront carbon with estimated reduction quantities provided in A1-A5 intensity.

Item	Reduction Measure (Description)	Intensity Reduction $kgCO_2e$ A1-A5
1	High recycle content for substructures elements - in-situ concrete - Piles 70% GGBS (137.3 $kgCO_2e/m^3$ A1-A5). Other elements - 50% GGBS (206 $kgCO_2e/m^3$).	**-4.3**
2	High recycled content superstructure - in-situ concrete-50% GGBS (206 $kgCO_2e/m^3$).	**-13.8**
3	Optimise column grid - Reduce to a 9x6 Grid instead of 9x12	**-8.4**
4	Cantilever reduction	**-1.7**
5	Residual moment connection - this would allow a reduction in steel weight	**-1.7**
6	Review of the floor to ceiling height - cable trays under the beam implies no rectangular openings into beams	**-1.7**
7	Columns - CFT columns instead of S460	**-1.7**
8	Steel design optimisation (omit 10%) from the new tonnage excluding connections and specials allowances	**-3.6**
9	10% of steel tonnage as per reused steel specification (e.g. EMR Steel)	**-1.2**
10	Office Metal Decking 100% XCarb + Magnelis	**-5.2**
11	Metal Decking - Optimisation of concrete and rebar quantity	**-8.0**

Item	Reduction Measure (Description)	Intensity Reduction $kgCO_2e$ A1-A5
12	Extrusions made with high recycled content (Hydro Circal75 billet)	-5.6
13	RAF - RMG600+ at WC'S and CAT A areas	-1.3
14	Lendlease Data - electrified site apart from HVO concrete pumps	-17.9

- **Items 3,4,5,6 and 7** – provided by ARUP.
- **Item 14**– provided by Lendlease.
- Other items calculated by Sweco.

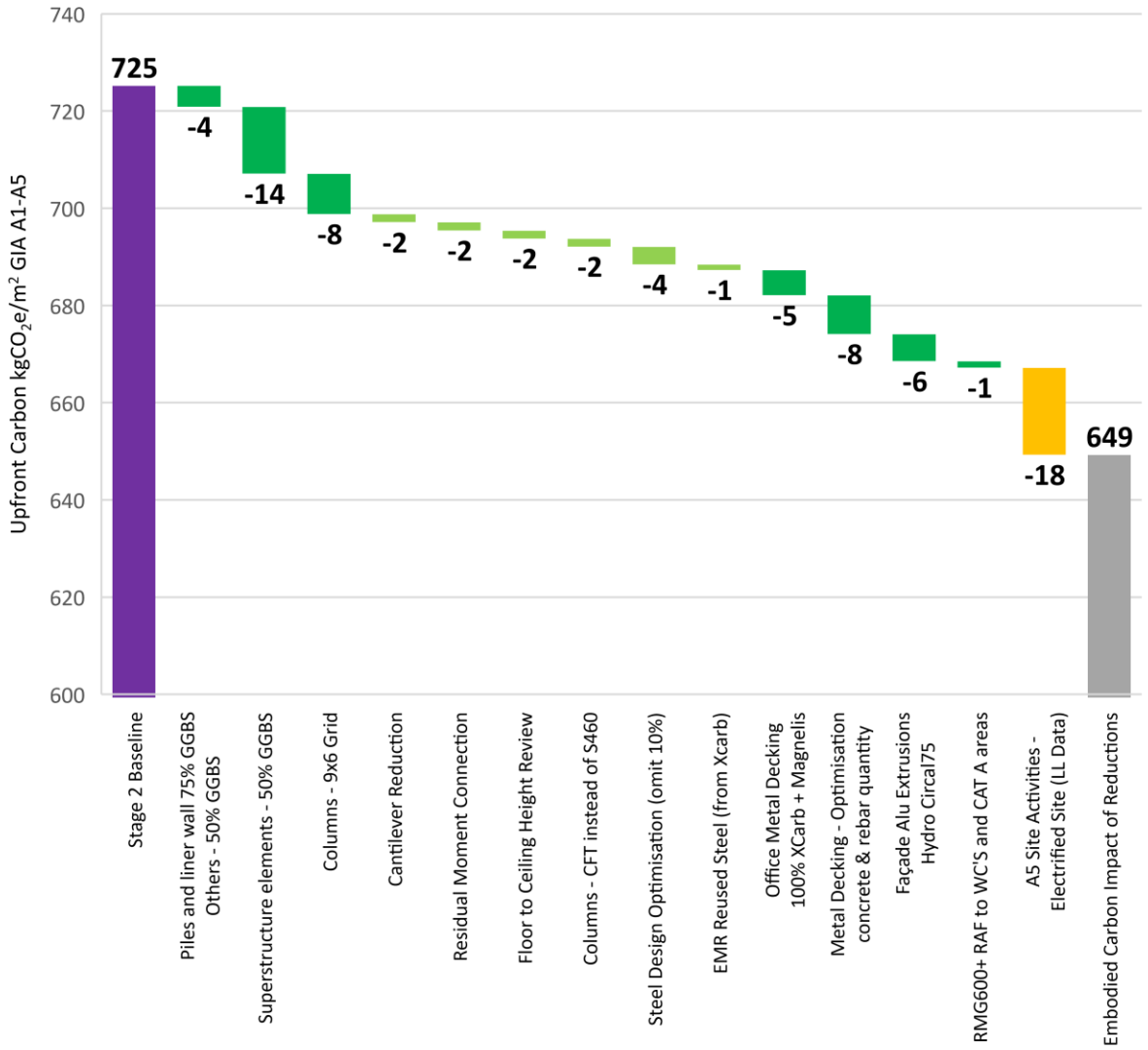


Figure 1.0: Cumulative waterfall chart with further reduction opportunities for upfront carbon with estimated reduction quantities provided in A1-A5 intensity. Y axis starts at 600 $kgCO_2e/m^2$ GIA to make reductions easier for the reader to view.

All of the reduction opportunities above are based on information available at this stage in the design. However, is worth noting that they will need to be re validated with updated information as the design progresses and more detail is known for certain elements i.e., there is no guarantee that these quantified reductions will remain static throughout the design stages. They should instead be seen as indicative opportunities to be reviewed and revisited as the project moves through the design stages and a greater granularity in detail is available. It is also worth reiterating that the reductions shown in Table 8 and Figure 1 are cumulative, and in some instances the specific reduction figure calculated is dependent upon, or influenced by, the reduction measures that precede it in the list. For example, item 9 would change if items 4-8 were not realised, as this would impact on the resulting steel tonnage where the 10% reduction is then calculated.

It is worth highlighting current industry shifts in relation to the use of GGBS as a means to reduce carbon emissions in concrete. Firstly, Sweco has been made aware of forthcoming increase to the carbon content of GGBS, based on a reallocation of its status as a coproduct, rather than a biproduct, in the steel manufacturing process.

Secondly there is a general understanding that, as a constrained or limited resource, the over specification of GGBS in one project may limit its availability in others. Hence a question is raised over its effectiveness to reduce greenhouse gas (GHG) emissions at a global scale. This is all to say that the reductions above, which are based on GGBS percentages currently, may be better understood in terms of their respective carbon factors rather than stated GGBS percentages. That way emerging cement replacement technologies i.e., alternatives to GGBS, can be considered in the context of delivering the same carbon factor. This is an aspect that would be closely monitored throughout progressed design stages.

This chapter has reported on the WLCA for the Proposed Development as part of the Applicant's planning submission. Monitoring, predicting, and striving to optimise operational and embodied carbon has been a key part of the clients brief for the Proposed Development from the outset, and this has therefore underpinned the design of the development up until this application submission. This statement is evidenced by the significant number of low carbon material optimisation measures that are described and reported in this chapter. This same impetus will continue to be the focus for the scheme moving forwards into more progressed stages in design.