

Room2, Hometel Manchester Piccadilly

Structural Engineering
Planning Report

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1 Introduction

This report has been prepared by Price & Myers (P&M) on behalf of Northside (Manchester) Ltd (trading name – Lamington Group) to support a full planning application for an aparthotel development (hereafter referred to as the ‘Proposed Development’) at 12-16 Manchester Piccadilly, Manchester M1 3AN (hereafter referred to as ‘the Site’).

Lamington Group are the developer behind the Room2 Homotel provider. Room2 Homotel strive to create places to live, not just to stay. They are committed to delivering a landmark building, which will achieve a whole of life, net-zero carbon development, and to deliver the UK’s first net zero tower. Room2 Homotel, are a hotel provider who have hotels in London (Chiswick, Hammersmith), Southampton and Belfast and are looking to expand into the north of England with their first northern hotel to be located in Manchester.

The consultant team includes:

- Bennetts Associates (Architects)
- Waterman Group (M&E Engineers)
- Equals Consulting (Project Manager and Cost Consultant)
- Buro Happold (Fire Engineering)
- Avison Young (Planning Consultant)
- JLL (Carbon Consultant)

2 Project Description

The proposal comprises of a 34 storey building (land at no. 14-16 Piccadilly) and conversion of adjacent building (no.12 Piccadilly) (basement to fourth floor) to create an aparthotel, including a ground floor cafe (Use Class E (b)), first floor exhibition hall (Use Class F1) and a rooftop bar and restaurant (Use Class E (b)), and associated works.

Room2 Homotel will be a landmark building, achieving Whole Life Net Zero Carbon. The scheme will integrate a range of sustainable design features and demonstrate leadership and inspiring action to create a sustainable future.

New public amenities will be included as part of the scheme, including a Net Zero Exhibition, Events Spaces, Fair Cost Café, Rooftop Bar, Restaurant and terraces; creating a new destination and offering something back to the city and the local community.

The proposal will bring the former Grade II listed Union Bank building back into active use. A heritage led design strategy has been incorporated into the scheme including a balanced approach to refurbishment, restoration and strategic removal of low significance existing fabric. The unique new development will showcase the original listed building, with sensitive connection to the new tower.



Figure 1: Street view capturing the full height of the building in context

3 The Site

Site Location

The site is located within the Manchester City Centre on the west side of Piccadilly, to the south of Piccadilly Gardens and north of Piccadilly train station. The site is located at 12 – 16 Piccadilly, Manchester M1 3AN.

The site encompasses the vacant Grade II Listed former Union Bank building and adjacent vacant land; the Waldorf Public House and Indemnity House (no, 7 Chatham St) immediately adjoin the site but do not form part of the proposal. The site itself is bound by Piccadilly, Gore Street and Chatham Street.

The land adjacent to the Listed Building is currently a vacant and derelict site, offering adverse visual impacts to the urban block and has an adverse impact on the streetscape given the lack of enclosure. The site is in a key, prominent, city centre location. In addition, the setting of the Listed Building is adversely affected by the presence of a gap site immediately adjacent to it.

The site is within close proximity to Piccadilly Railway Station and has a frontage onto Piccadilly, which is an important city centre street and key gateway pedestrian pathway for those entering or exiting the railway station and wishing to connect to Manchester primary retailing and central commercial areas in particular. Market Street, which is at the heart of Manchester’s Primary Retail Area, merges with Piccadilly at its western end. Just to the south of Market Street is Manchester’s established commercial core. Stevenson Square Conservation Area runs parallel to the Site along the east side of Piccadilly.

The site has high levels of accessibility in terms of its location, boasting immediate access to a variety of public and private transport modes. In location terms, the site is situated within easy walking and cycling distance to a number of key services and facilities within Manchester City Centre. The site is located in the heart of the city and is well connected to surrounding areas by a comprehensive network of illuminated pedestrian routes.

There is a major bus interchange hub located at Piccadilly Gardens, approximately 330m from the Site, which is served by more than 85 bus services connecting the majority of the Greater Manchester area. The nearest bus stops are located adjacent to the proposed development along A6 Piccadilly, approximately 40 meters from the Site.

The topographical survey carried out for the site shows that the site falls from north-west to south-east, with ground levels varying from 45.68m AOD to 44.90m AOD. A site location plan is included as Figure 2.

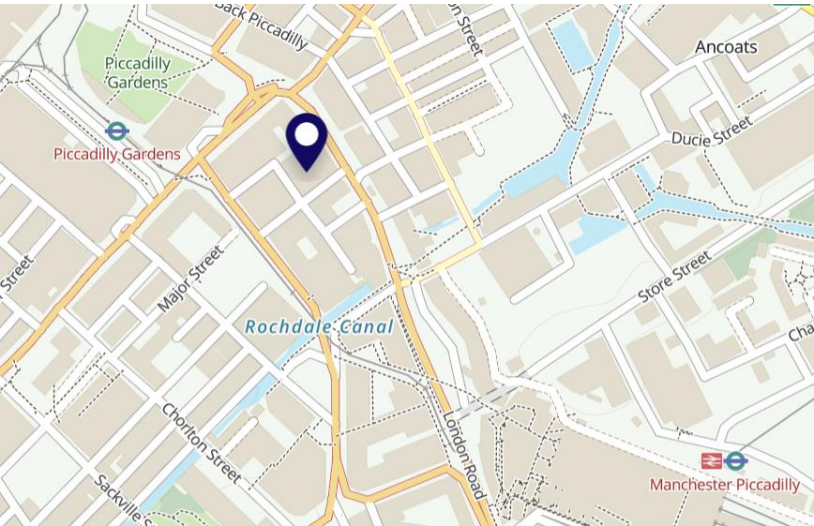


Figure 2: Site Location Plan (OS Maps)



Figure 3: Site location in context (Google Maps)

Site History

Historical mapping indicates that, in 1851, the site was predominantly covered by structures, with the building in the southern part of the site shown as a wire works. The site has since been redeveloped a number of times over the past 150 years and appears to have been in its current layout since the mid-1980s.

The former Union Bank was built in 1911 and designed by Architect Thomas Worthington and Son. The building has been empty since 2006 when Barclays Bank vacated the site. The building has deteriorated in recent years and some areas are therefore in need of repair and restoration to brought back into active use.

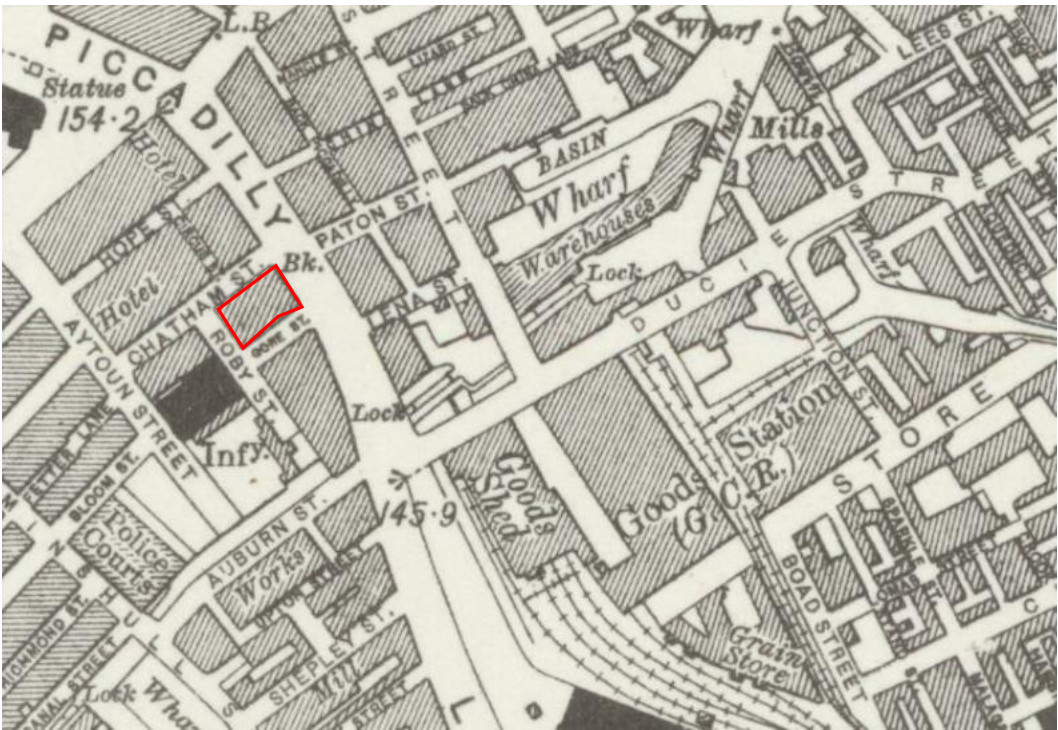


Figure 4: Historical Map from 1915 showing site location in red (Ordnance Survey)

Surrounding buildings

Adjacent site uses include: a hotel and public house to the east; multi-storey car park to the north; hotel to the south and YMCA training centre / public house to the west.

The location of services close to the site are as follows:

- Low pressure gas main running along Gore Street, Roby Street and Chatham Street;
- Public sewers and water mains running along the roads on all sides of the site; and,
- Electricity cables running along all the site boundaries with the pavement.

4 Ground Conditions

Geology

The British Geological Survey (BGS) map for the site, indicates that the site is underlain by superficial Glacial Till deposits, which are underlain by solid strata of the Chester Formation. Historical borehole logs from the BGS typically recording firm to very stiff sandy gravelly clays with boulders to depths of between 11.8m (32.7mOD) to 13.8m (31.1mOD), underlain by very dense clayey sands (weathered sandstone).

A site investigation carried out by REC in September 2013 (Report Ref: 44934p2r0) identified significant made ground deposits ranging from 2.45m to 4.0m in thickness across the site. Made ground generally comprised asphalt of concrete underlain by sandy gravel with frequent cobbles of brick and concrete. A concrete slab (presumed to be a former basement floor) was encountered across the central areas of the existing car park area at circa 2.50 – 2.60m bgl. Drift generally comprised Glacial Till between 3.00m and 4.00m. Weathered sandstone was met at 22.00m bgl with more competent deposits encountered between 27.20m and 28.00m. Perched groundwater was identified at 2.8mbgl.

Ground Water

During the previous ground investigation, a slow seepage of groundwater was encountered in WS101 at a depth of 2.80m bgl; this is considered a shallow perched aquifer confined by the former basement structure. Subsequent monitoring of groundwater indicated that all the wells were dry for their full depth.

The desk study undertaken by REC notes that the Glacial Till is classified as a Secondary (Undifferentiated) Aquifer, with the Chester Formation a Principal Aquifer. There are four historical groundwater abstractions between 251 and 500m radius of the site. The nearest local surface water body is the Rochdale Canal, located 72m southeast of the site.

Contamination

Historical maps do not indicate any previous industrial land-use and so it is expected that there are no significant contaminant sources. It is anticipated that the substantial thickness of Made Ground present beneath the site may have formed due to the extensive re-development of the site at various times over the past 150 years. The previous site investigation indicates that the potential for significant contamination to be present at the site is considered to be a low to moderate risk.

UXO

Zetica UXO risk maps indicate that the site is of moderate risk of finding unexploded ordnance. A preliminary risk assessment will be undertaken to further assess this risk at a later stage.

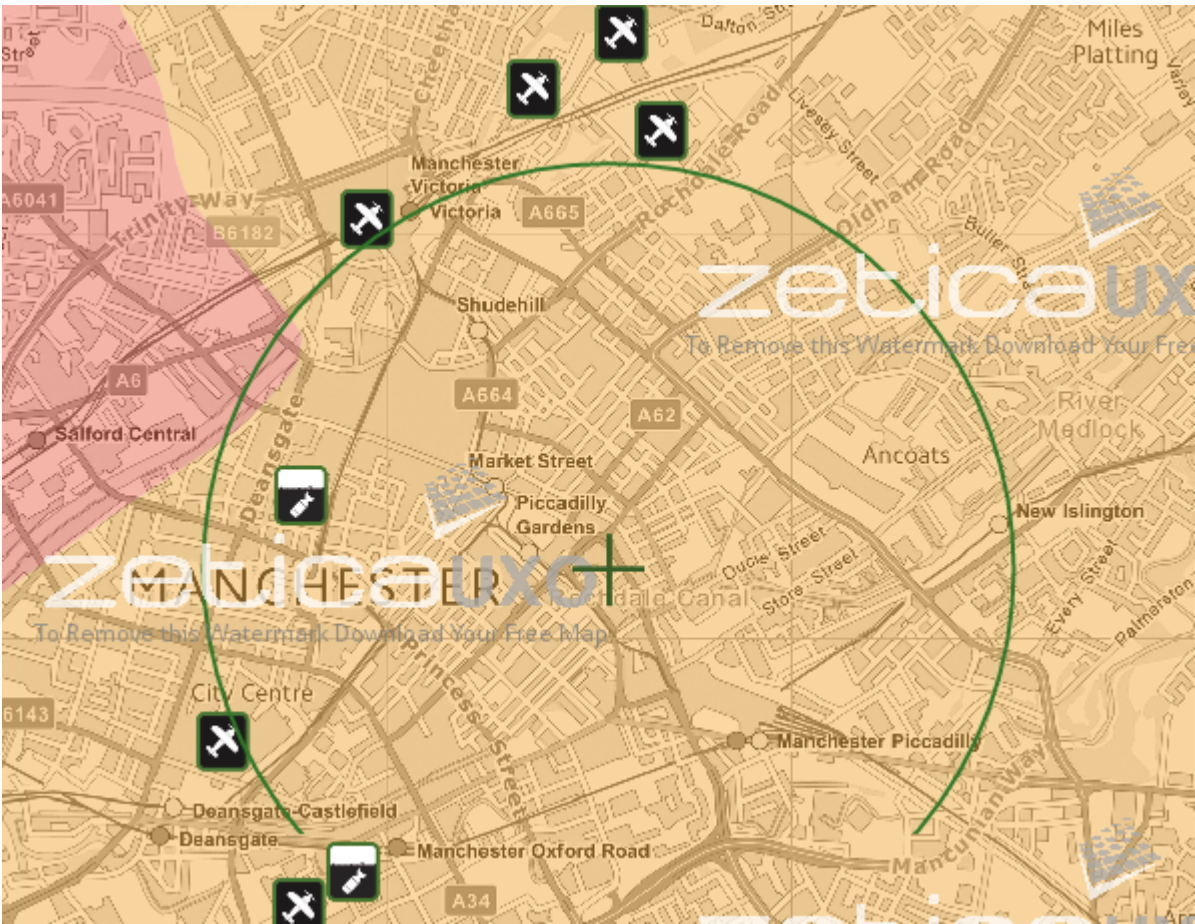


Figure 5: UXO map Zeitca

5 Existing Structure

The listed building was designed by Thomas Worthington & Son and erected in 1911. It is four-storeys high, plus, an attic and single storey basement. The building has a rectangular plan with a chamfered corner. Archive drawings suggest that the existing structure is steel frame with stone outer cladding. Localised inspection holes suggest that the floors are generally formed with closely spaced steel RSJ's and clinker infill.

The basement is constructed with thick masonry walls, shallow concrete spread foundations and what appears to be a ground bearing concrete slab.



Figure 6: Archive photography of former Union Bank building

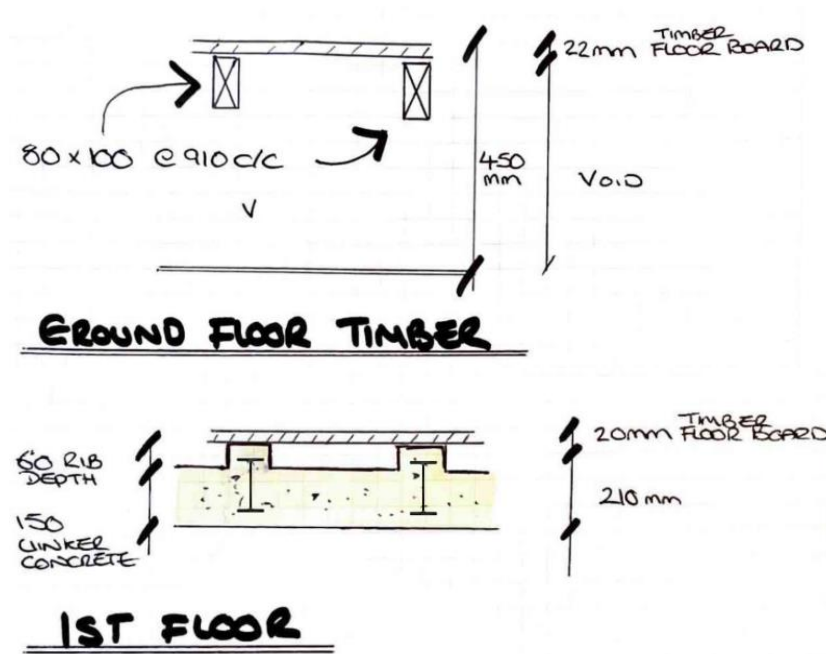


Figure 7: Sketch showing existing floor build ups from localised site inspection holes.

Proposed Alterations

The proposed structural alterations to the existing building include:

- Demolition of existing ground floor structure. This will be replaced with a new floor at lower level to create a level access with the surrounding street levels. It is currently anticipated that the new floor will be formed by steel beams spanning between existing steel columns with composite steel deck infill.
- Demolition of existing masonry infill walls at basement level. These walls are currently assumed to be non-load bearing.
- Demolition of existing modern stairway between basement and ground floor level to be replaced with new RC frame. Existing foundations will need to be grubbed out to allow for new piles.
- Demolition of main stair and side masonry walls from ground to 4th floor level. The floors and roof will need to be supported by new steel beams spanning between the existing steel frame and new RC core. Stability will be reinstated to these alterations by a new steel moment frame and connection into the new stability core.
- Removal of non-original windows to ground floor and levels 3-4.
- Removal of stained-glass windows to lightwell.

6 Proposed Structure

Summary of proposed works

The proposals for the site are to develop the existing hard standing car park area at 14-16 Piccadilly into a 32-storey mixed use hotel, as well as converting the adjacent Grade II listed building at 12 Piccadilly, from the existing basement to the 4th floor, into a hotel with a breakfast room and lobby. A new single storey basement will be constructed under the existing car park area to provide additional space for building plant.

The approximate footprint area of the building is 360m² and approximately 106m high. The superstructure is formed of an in-situ reinforced concrete frame which is stabilized by a reinforced concrete shear core. The building will be supported on new piles which transmits the loads to the underlying clay and sandstone.

- The basement box will be formed by a piled wall with RC lining wall. A final foundation solution is yet to be confirmed but piles and a piled raft are currently being considered.
- The ground floor (250-300mm thick) and upper-level floors (200mm thick) are generally formed from in-situ RC slabs.
- The mezzanine, level 01 and levels 28-31 will be formed with CLT slabs and either a steel or concrete frame.
- The walls and columns are in-situ RC in varying sizes. The columns on the upper levels are typically short ‘walls’ 1000mm long x 250mm wide. Some of the exposed columns are circular and will be approximately 600mm in diameter.

Basement

Due to the restricted nature of the site, and the high thickness of made ground a piled wall is the preferred solution to provide a combined retaining wall and perimeter foundation to the basement. The piled wall will be designed to be propped in the temporary and permanent case by a reinforced concrete capping beam. In the permanent case, the capping beam will be propped at high level by a reinforced concrete slab.

The proposed basement abuts the existing basement and so careful consideration of the construction sequence and connection will be needed to ensure that the existing Union Bank basement and local highway is protected during construction.

Foundations

The foundation selection shall consider the different ground and loading conditions present on the site. Different loading regimes for the foundations will vary from the existing 4 storey masonry bank building to the proposed multistorey hotel so the foundation solution will carefully consider this junction and resolve any anticipated differentials in ground movement.

There are provisionally three potential options for the foundations:

- Approx. 27.5m deep piles bearing on the sandstone. Based on a bearing capacity of 3000kN/m² provided in REC's report, we would anticipate this arrangement to consist of 900mm diameter piles with on average 3 or 4 piles under each column. This option would require high volumes of concrete and would be difficult to achieve due to limited available ground space on the site.

A supplementary technical note was undertaken by Card Geotechnics Limited (CGL) to evaluate and extrapolate the data provided by the original REC site investigation. The technical note provided indicative pile capacities by utilising the skin friction of the clay as well as the bearing into the rock.

- Approx. 23m deep piles utilising skin friction and end bearing in clay. The most efficient arrangement for this option would be 900diameter piles with on average 1 or 2 piles under each column, more under the core. The soil parameters used in this assessment will need to be verified by further geotechnical borehole with the geotechnical data logged.
- A third option would be to construct a piled raft slab. Due to the depth of made ground on site this wouldn’t be feasible at ground level, but a raft could be constructed at the new basement level to be supported on the clay soils and help reduce the size or number of piles. This will also help balance out the offset core without going into the existing basement further.

At basement level, the slab will either be formed as a suspended RC slab spanning between piles or a raft slab bearing on the clay soils. At ground level, the slab will be suspended and designed to span between reinforced concrete ground beams which will also be utilised to restrain single piles.

Superstructure

The structural concept at this stage reflects the aspiration of achieving a structure with low embodied carbon which is required to react to the various spatial and architectural requirements of a number of different uses proposed for the building. The materiality of structure therefore varies in height with the building to accommodate the fire requirements of each building use.

The proposed new build core from basement to roof level will be formed of reinforced concrete with a 120min fire performance. Levels 2-26 that contain hotel room accommodation will also employ a reinforced concrete frame to slabs and columns, with 90min fire separation between floor levels.

To facilitate reduced embodied carbon, CLT slab with hybrid steel or concrete frame are proposed for the non-accommodate floorplates at first floor, mezzanine, and levels 28-31. These levels will also provide a 90min fire separation performance by designing for an appropriate charring layer. Localised areas of the first-floor slab level will be formed in reinforced concrete to achieve an enhanced fire performance above proposed fire exit routes and the new substation.

The spatial grid has predominantly been proposed to suit the repeating layout of separating walls to hotel bedrooms on floors 2-26.

Various Hybrid options were also considered and provisionally scheme up. Following the design development and taking into considerations such as fire, acoustics, overall height and stability leant tower. A concrete frame with non-load bearing infill wall was taken forward. The regular column grid enabled a more efficient slab design and was able to keep the overall depths of the floor to floor to a minimum.

Precast Walls option

An option has been considered to utilise the separating walls between hotel rooms to form precast concrete load bearing walls in place of a regular grid of columns. Due to acoustic requirements of the separating walls, a dense material such as blockwork or concrete was required and so it was thought that utilising this dense material as part of the load bearing structural frame could lead to efficiencies in the structural form. The advantages and disadvantages of using this form of construction are summarised in the table below.

Pros	Cons
<ul style="list-style-type: none">- Quicker construction programme for installing precast walls modules (less curing time)- Factory controlled quality and reduced on-site H&S- Reduced waste due to factory-controlled construction- Reduce reinforcement required in slabs compared to blockwork partitions.- Simpler details (no movement joints and deflection heads)- Good acoustic and fire protection between units- Walls will contribute to stability which could lead to thinner core walls	<ul style="list-style-type: none">- Early design coordination and order with precast manufacturer- Transportation of large/heavy units- Requires compartmentalised stacked layout- Little to no flexibility for future layout changes- Difficult to incorporate late changes.- Increased commercial risk due to fewer specialist contractors.- Transfer/podium slab required at lowest level of hotel rooms

Whilst this option could allow a quicker construction programme, with some possible efficiencies in material use, a concrete frame solution was opted to be taken forward. This decision was principally led by an aim to maintain the possibility of future flexibility in layout and overall provided a lower embodied carbon option.

Stability

The existing Union Bank building is stabilised by existing masonry shear walls. Where part of the existing walls is to be demolished to form a link with the new building, stability will be reinstated by new steel moment frames and tying into the new RC frame hotel building.

The new hotel building will be stabilised by a reinforced concrete core. Wind loads applied to the outer cladding will be transferred by diaphragm action in the concrete and CLT slabs to the concrete shear walls. Whilst the core is located centrally to the building in the east-west direction, it is partially off centre in the north-south direction. Any twist generated by out of eccentric wind forces will be resolved by push-pull in the long reinforced concrete stair walls.

The Crown

The crown of the building forms levels 28-31 which house a restaurant, bar, and roof terraces. The arrangement of the terraces creates a stepped V-shape from the vertical garden to the structural core at the back. To better suit this triangular arrangement of external walls, it is necessary to adjust the column grid and so a transfer slab is proposed at level 27. Above this level, the slabs will be formed with CLT panels. The structural frame to these levels is still in development but it is likely to be either reinforced concrete or steel.

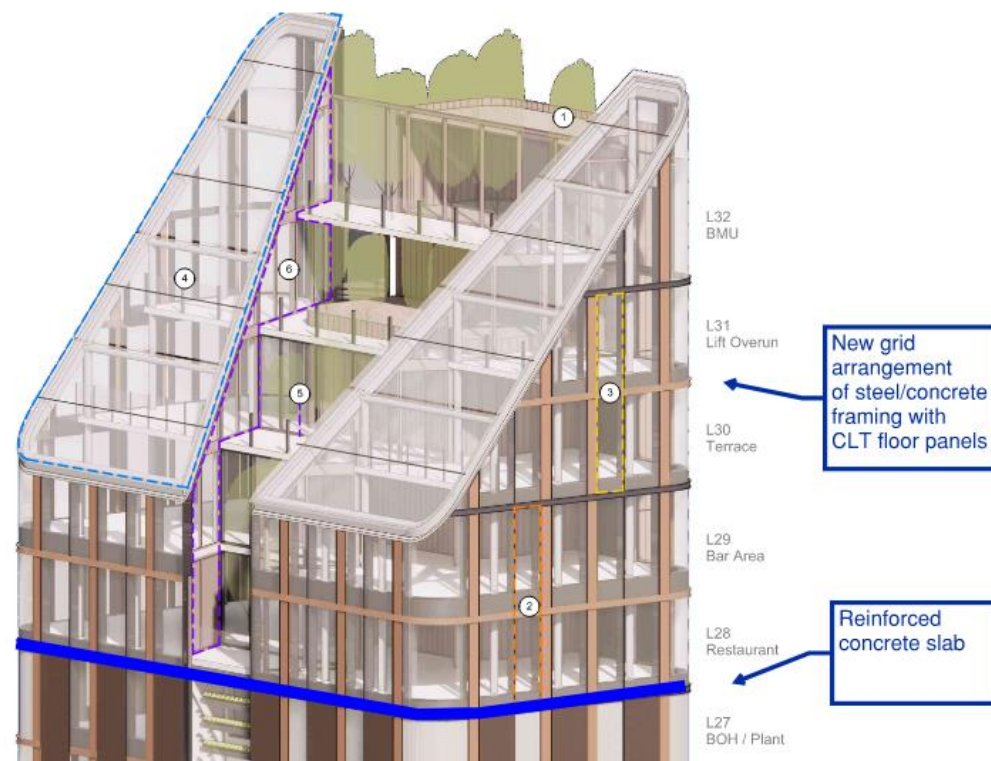


Figure 8: Upper level structural proposal.

Level 04 Cantilever

At level 04, it has been agreed that the new hotel building may over sail the existing Waldorf pub. To achieve this, the floor structure is required to cantilever by approximately 2.5m. Various options have been considered for this cantilever including using cantilever slabs at every floor level or using a thick slab or cantilever beams at 4th floor to support the columns of the floors above. At this stage, it has been decided to proceed with providing a cantilever at 4th floor only.



Figure 9: Architectural Elevation & View from Gore Street showing cantilever.

Level 02 Transfer

Second floor is the lowest level of hotel rooms and below this level the architectural layout alters to provide larger rooms for a net zero museum, hotel gym and hotel back of house. To facilitate this change in layout, some columns are required to shift in location. Several options were considered for the transfer structure including:

- Transfer slab
- Localised transfer beams
- Transfer walls

Due to a requirement for an exposed soffit to this level, in addition to the non-orthogonal arrangement of column moves, a transfer slab is currently considered to be the most efficient solution.

Façade

The façade system will vary at different levels in the building to suit the Architectural design. At the base of the building, the structural frame will be clad in masonry, whilst the upper levels and core will be clad with a unitised curtain glazing and precast cladding panels.

The structural support system for the façade is anticipated to be generally consistent with supports at each floor level by steel angle brackets designed by specialists. Brackets will be resin fixed into reinforced concrete structural elements at regular centres.

Access and Site Logistics

The site is constrained by the Chatham Street, Piccadilly, and Gore Street on the north, east and west. Piccadilly is a busy two-lane access road and so stopping for delivery of site materials will only be viable from Chatham Street and Gore Street. Once the construction of the new hotel building is underway, space for site cabins and materials storage will be limited and so the frame design will consider suitable forms of construction for limited deliveries and space.

Due to the height of building and constrained city centre site location, it is anticipated that central concrete core will be constructed ahead of the surrounding structural frame using slipform technique.

7 Embodied Carbon

What is Embodied Carbon?

Embodied carbon is the name given to carbon dioxide and equivalent gases with high global warming potential which are released into the atmosphere as a result of the production of goods & materials. In order to make direct comparisons, emissions are compiled into a single figure known as Carbon Dioxide Equivalent (CO₂e). This is measured in kgCO₂e and is standard across all industries.

Whole Life Cycle Assessments should be carried out for Cradle to Cradle, A1-D modules. Our calculations will be for the structural elements only as this is our expertise and typically accounts for approximately 65% of the total embodied carbon on typical projects.

We are living through a climate and biodiversity emergency and we urgently need to reduce carbon emissions to limit the impact of climate change. The global construction industry is responsible for around 40% of the energy related CO₂e emissions. This gives the construction industry and their clients a huge opportunity to reduce emissions through the design decisions taken on projects.

Emissions come from both the operational energy used to run buildings and the embodied energy from the production of materials, transport, construction, maintenance and demolition of buildings.

Price & Myers have developed two calculator tools. The first, Parametric and Numerical Design Assessment tool (PANDA).

The second is a carbon calculator and calculates the embodied carbon within the structure of the building over different life cycles. It’s used throughout the later stages of the project once embodied carbon targets have been set.

PANDA Study

PANDA (Parametric & Numerical Design Assessment) is a scheming tool for building structures, aimed at minimising the embodied carbon by rapidly comparing multiple options in the initial concept stages. It is the result five years of research and development by Price & Myers and the University of Cambridge on two projects part funded by Innovate UK. When used on a preliminary massing or floorplan, PANDA will provide a series of viable structural materials and grid options based on parametric inputs, enabling to understand the relative impact of design decisions on both embodied carbon and cost.

To investigate efficient structural solutions for this building, a typical hotel floor level has been studied using this software, the results are presented in the figures below. It can be observed that a number of different materials ranging from a full timber solution (glulam frame + CLT deck) to a RC flat slab have been presented as viable. These have opposing cost and embodied carbon performances. A flat slab on RC frame solution was found to be the most efficient solution when balancing cost with carbon. A typical high performing grid layout for this building shape is noted in figure 8. This was used as a starting point to review the best framing arrangement for the building.

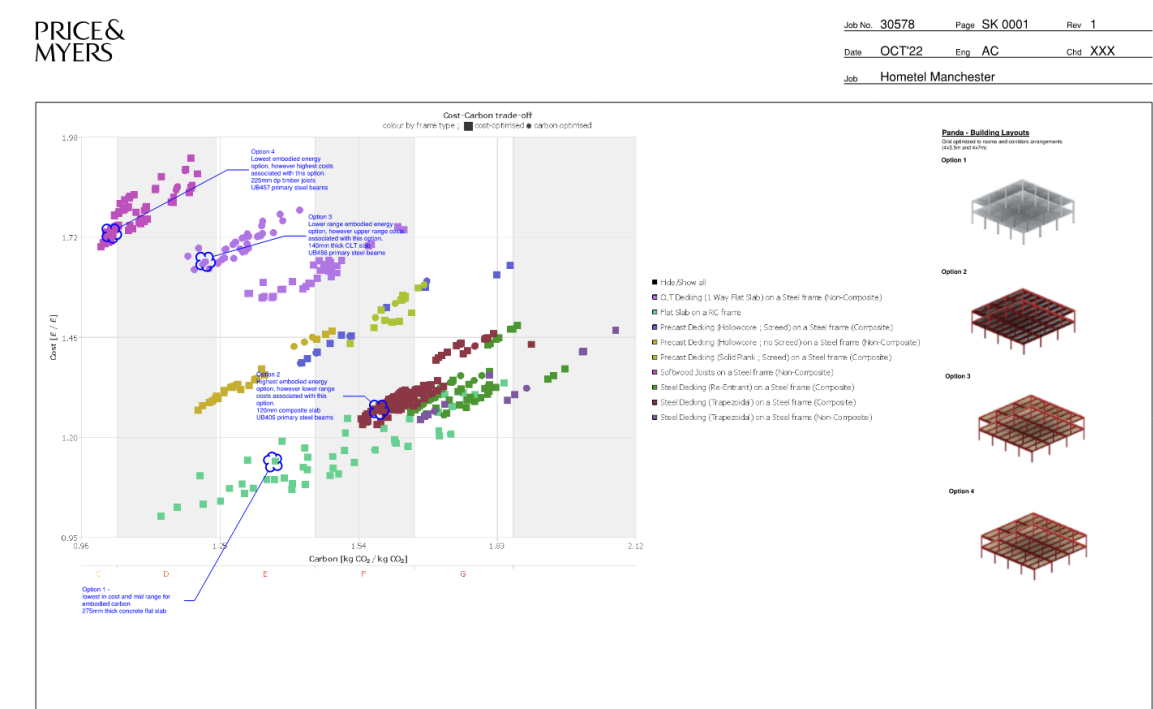


Figure 10: Output of initial Panda Study

At the early stages we have developed a software tool to help us easily compare different construction types based on architectural constraints. As the project developed we modelled the project options for the project in REVIT and export the materials into our carbon calculator to compare and monitor the embodied carbon.

The full iterations have been included in Appendix B.



Concrete is the 2nd most consumed substance in the world and contributes ~8% of the global emissions as 90% of concrete CO₂ emissions come from cement production which creates ~900kg of CO₂ per ton. So we will be looking to introduce emerging technologies like Cemfree, carbon capture, recycling materials from site to better our current specification which already offers ~30% reduction on traditional concrete.

But the volumes used in real buildings varies to suit the external factors and these can have an enormous impact on the most appropriate material to use. So sometimes the most efficient solution isn't the most obvious.

7 Design Criteria

Codes and Standards

The general structural design is being carried out in accordance with the relevant Eurocodes as referenced below:

- BS EN 1990 Basis for design
- BS EN 1991 Loading
- BS EN 1992 Reinforced Concrete
- BS EN 1993 Steelwork
- BS EN 1995 Timber
- BS EN 1996 Masonry

The head code only is listed, with appropriate sub-codes and UK national annexes also used where necessary.

Design Life

The structural frame is designed in accordance with BS EN 1992-1-1:2004, BS EN 1995-1-1:2004 and BS EN 1993-1-1:2005 which provides a design life of 50 years. The structure shall be designed such that deterioration over its design working life does not impair the performance of the structure below what intended, having due regard to its environment and the anticipated level of maintenance.

Appropriate concrete cover for concrete elements (taking into consideration sulphates, free, carbonation, chlorides, and freeze/thaw attack) and paint/galvanising systems for steel elements will be specified as required to provide adequate protection. Periodic inspection and maintenance will be required throughout the life of the building to ensure protection measures are performing adequately. External structures will require more frequent inspection and maintenance than internal structures due to more severe exposure conditions. Below-ground structures will be designed in reinforced concrete and detailed with an appropriate cover to suit the ground conditions and proposed building design life.

Where timber is proposed to be exposed or partially exposed to the weather in an external environment careful consideration should be made in regard to the maintenance regime of any applied coating.

Loadings

Loadings for the building will generally be in accordance with the relevant Eurocodes (as above) or British Standards, BS6399.

The following loads have been assumed in the structural design to date. These loadings will be further refined at later stages as the Architectural proposals develop.

Dead Loads

Typical RC Floor	Thickness (mm)	Density kN/m3	Load kN/m2
Finishes	15	20	0.30
Ceiling and Services	-	-	0.15
		Total	0.45

Typical CLT Floor	Thickness (mm)	Density kN/m3	Load kN/m2
Finishes			0.30
Insulation and Acoustics			0.15
Ceiling and Services			0.30
		Total	0.75
Brickwork Cladding	Thickness (mm)	Density kN/m3	Load kN/m2
Masonry	100	18	1.80
Insulation	-	-	0.15
SFS Stud internal lining	100	-	0.15
Plasterboard	25	9	0.23
		Total	2.33
Internal Partitions	Thickness (mm)	Density kN/m3	Load kN/m2
SFS	100	15	1.00
Plasterboard	50	9	0.45
		Total	1.45
Curtain Glazing and Precast Panels Cladding	Thickness (mm)	Density kN/m3	Load kN/m2
Precast Panels	100	25	2.50
Insulation	-	-	0.15
SFS Stud internal lining	100	-	0.15
Plasterboard	25	9	0.23
		Total	3.03

Imposed Loads

Use	Eurocode Category	Load (kN/m2)
Gallery/Corridor in Institutional Buildings	C33	4.0
Roof for Access/Maintenance	H	0.75
Hotel Rooms	A3	2.0
Museum	C39	4.0
Restaurant	C11	2.0
Storage		5.0
Plant Rooms	-	7.5

Wind Loads

A wind tunnel analysis will need to be carried out to consider nearby buildings and their impact on the wind loads applied to the new structure. In the meantime, the following loads have currently been assumed:

vb,map = 22.5 m/s
Aalt = 43.0m
calt = 1.043

qb = 0.338 kN/m2
Peak Velocity Pressure = 1.30 kN/m²

Other Loads

Soil Surcharge load = 10 kN/m2
Water Pressure = current investigations suggest that the water table will be below the proposed basement formation level.
However, 2/3 height has been assumed as an accidental load case.
Soil Pressure = clay with angle of frictional resistance $\phi' = 24$ (from CGL technical note CGE16946)

Design Fire Periods

According to Part B of the building regulations, a building used as a hotel with a top floor between 30-120m above ground will need to be designed for a minimum period of 120 minutes fire resistance. It is assumed that this structure will therefore need to be generally designed for minimum 120 minutes fire, subject to confirmation by the Fire Engineer.

It is expected that some areas such as fire escape corridors and the substation at ground floor level will require an increased fire resistance. This is to be confirmed in further detail in the next design stage.

Fire protection requirements are expected to be an important factor in driving the design of any timber element in the superstructure. Careful consideration should be made in the next stage with regards to the selection of the most appropriate method to provide members with their resistance requirements. For timber, these methods could include designing for an appropriate charring layer which will ultimately result in thicker/deeper sections, or where timber isn't exposed, to protect it with an appropriate fire boarding. Input from a Fire Engineer will be required to establish the design requirements for the structure and any input from local building regulations that might affect the use of timber across the project.

Disproportionate Collapse

In accordance with part A3 of the building regulations, the new structure will need to meet the requirements of class 3 for disproportionate collapse. The new structure is designed to meet the requirements of this classification through the provision of effective horizontal and vertical ties provided by the in-situ reinforced concrete frame and through detailing of the steel and timber structure connections. In addition to this, columns and transfer beams considered as key elements will be designed to resist an accidental action of 34kN/m2 in accordance with Approved Document A.

The existing building will continue to be independently stable in its structure from the proposed new build. The number of floors will be unchanged and so the building will remain as class 2B for disproportionate collapse. An early discussion needs to take place with Building Control to determine a suitable strategy in relation to the existing building. Any new alterations will need to consider disproportionate collapse requirements and be designed accordingly.

There are no primary movement joints designed in the primary structural frame. The new hotel frame will be structurally connected to the existing bank masonry frame building and the new RC core will provide stability to the existing building.

Secondary movement joints will be required in external finishes to be aligned with the architectural requirements.

Vertical Deflections
Vertical deflections will be based on industry standard values, given as a ratio of the span:

Span/360 for deflections induced by imposed loads only
Span/250 for deflections under total loads.

Total deflections will also be limited to a maximum of 25mm where appropriate. Checks on cumulative deflections will be carried out on CLT slabs and on transfer beams to ensure that these limits are not exceeded. Special requirements for proprietary elements (such as facades) will be considered on a specific basis as needed.

Horizontal Deflections
Horizontal deflection, or sway, induced by wind and other lateral loads will be limited to Height/300, applying to both individual storeys and the overall building.

Ground deflection
The piled wall will be installed to limit lateral ground movement when the basement is constructed. Movement monitoring should be carried out on the site and on adjacent structures. Monitoring should commence before works are started to establish a baseline of normal movements and surveying tolerances and then continue until the ground floor structure is in place.

Limits should be agreed as part of the Party Wall process, but suggested limits would be:
Amber +/- 5mm
Red +/- 10mm

If amber limits are reached, the site activities will be review, and the structures inspected visually for distress and distortion. If the movements are genuine, the pattern and rate of change of movement will be examined (by altering sequence of work, installing additional shores etc). Frequency of monitoring may have to increase.

If red limits are breached the Contractor is to stop work and review any requirements for additional temporary works or safeguarding measure. The structures should be inspected for signs of distress and remedial measures taken as necessary.

Construction Tolerances
No special requirements have been given regarding construction tolerances. It is assumed that all tolerances in the fabrication and construction of the structural elements will comply with the relevant national structural specification documents.

A notional tolerance zone of 20mm per floor should be allowed for Architecturally, to account for issues arising from vertical tolerances and deflections whilst ensuring the minimum floor-ceiling heights are achieved.

Movement and Tolerance

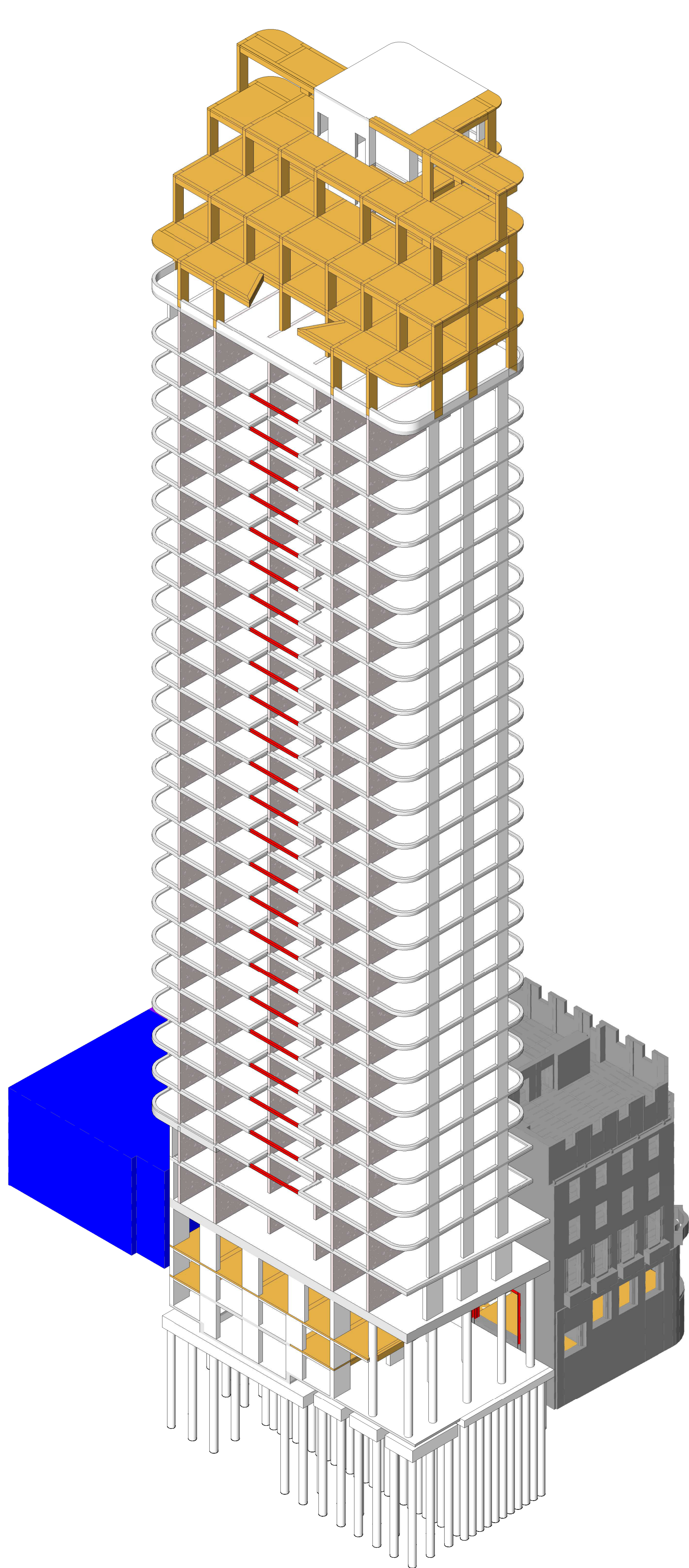
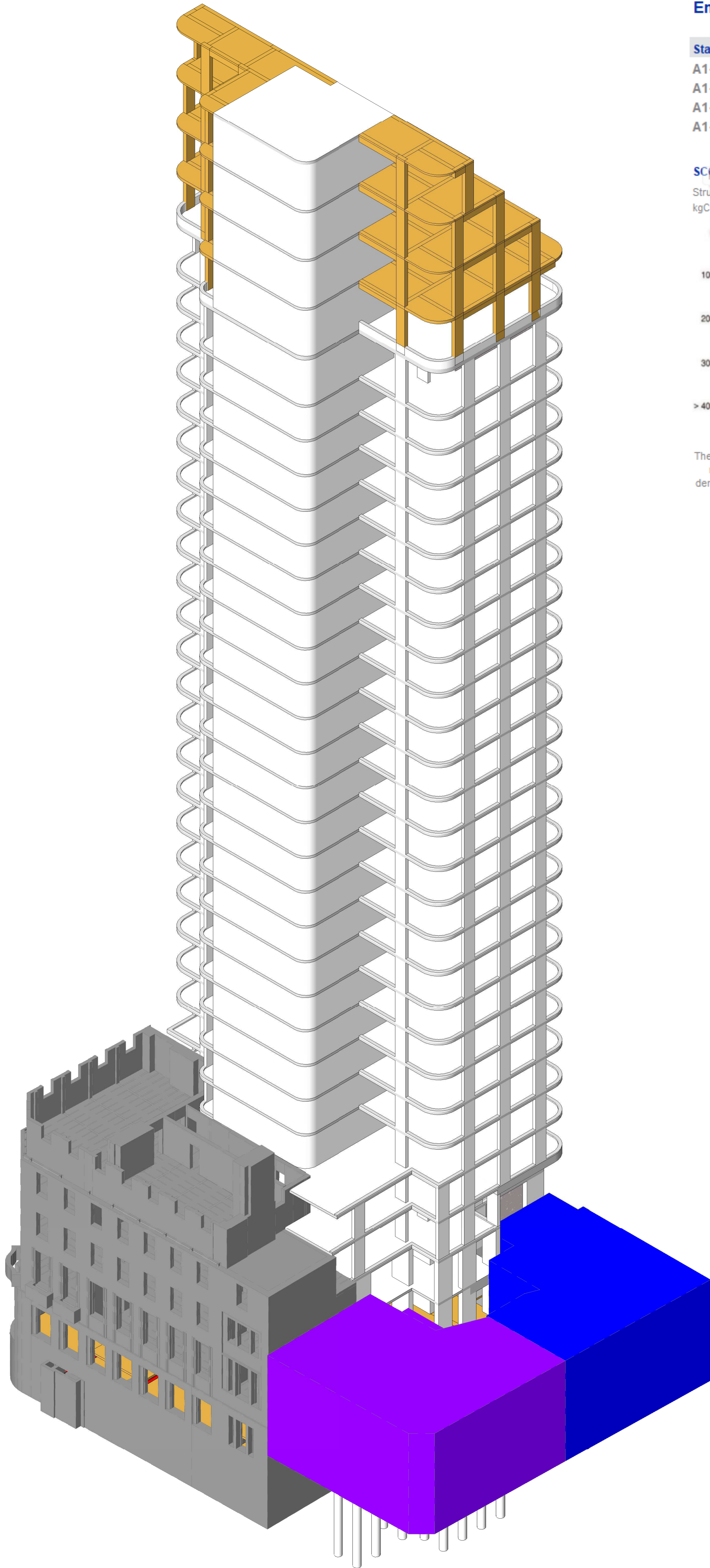
Basement Waterproofing

In accordance with BS8102:2022 the building will need to meet the requirements of waterproofing grade 3 for habitable accommodation. To meet these requirements a combination of waterproofing systems must be provided.

The waterproofing is to be designed by a waterproofing design specialist who has successfully completed the Certified Surveyor in Structural Waterproofing (CSSW) qualification as required by the NHBC. It is currently assumed that the preferred method of waterproofing will be to use an internal drained cavity system in addition to a waterproof membrane.

Appendix A

Embodied Carbon Review

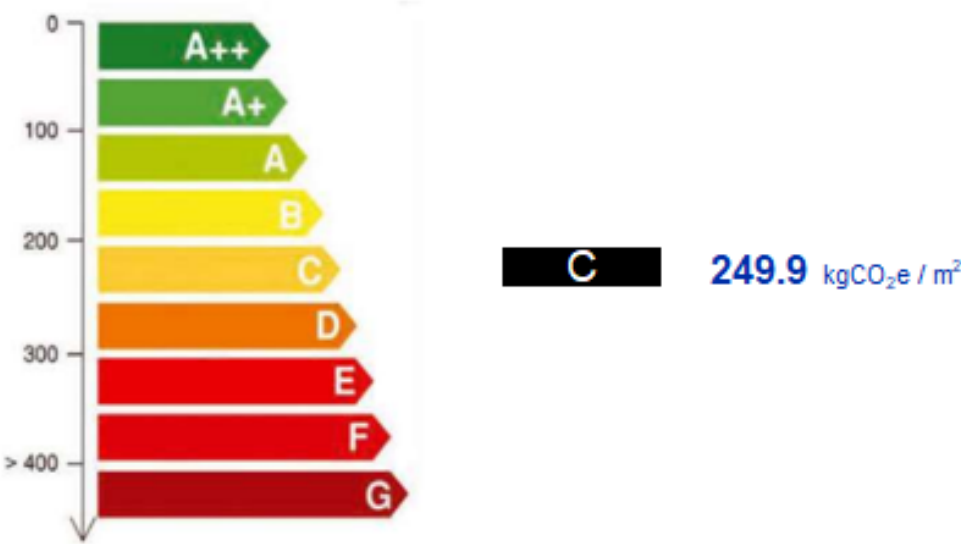


Embodied Carbon Totals Calculated for Each Lifecycle:

Stage		Total (kgCO ₂ e)	Sequestration	Total/GIA
A1-A3	Cradle to Gate	2,923,338		219
A1-A5	Cradle to Completion	3,341,104		250
A1-C4	Cradle to Grave	3,490,161	Included	261
A1-D	Cradle to Cradle	2,950,529	Included	221

SCORS Rating

Structural embodied carbon, from Cradle to Completion (A1-A5)
kgCO₂e / m² GIA



The SCORS (Structural Carbon Rating System) was proposed by the IStructE (October 2020) as a simplified means of rating embodied carbon values in buildings (modules A1-A5 only). This has been included to demonstrate where the design sits in relation to this scale, which set a benchmark of 150kgCO₂e/m² for an 'A' rating.

Calculation Parameters

Design Stage: Stage 2
Scope of Calculation: Cradle to.. Completion (A1-A5)
Postcode (District eg. W3): M4

Building Parameters

GIFA for Rating: 13371 m²
Project Construction Cost: £23.5 Million
Construction Cost is for: Whole Building

Embodied carbon calculated in accordance with the IStructE publication 'How to calculate embodied carbon'.

Estimated To

Estimated En

The value lies in an e

NOTES:										Module			
ECF = Embodied Carbon Factor Carbon = Carbon dioxide equivalent emissions for that module in kgCO ₂ e Seq = Sequestered Carbon in kgCO ₂ e										A: Product			
										A1-A3 Product Manufacture		A4 Transport	
										A5w Site Wastage			
Material	Element Description	Quantity	Units	ECF A1-A3	Carbon A1-A3	Seq ECF A1-A3	Seq A1-A3	ECF A4	Carbon A4	ECF A5w	Carbon A5w	ECF A5w	Carbon A5w
Concrete (C32/40, Av. Mix)	Upper Floors & Balconies	4,518,949	kg	0.12127	548,031			0.00533	24,063	0.00731	33,026		
Steel (Cold-Rolled Galvanised)	Upper Floors & Balconies	30853.95	kg	2.76	85,157			0.03195	986	0.31225	9,634		
Concrete (C32/40, Av. Mix)	Ground Floor Slab	159403	kg	0.12127	19,331			0.00533	849	0.00731	1,165		
Timber (Glulam,Typ)	Roof Beams & Decking	15321.23											
Concrete (C50/60, Av. Mix)	Vertical Structure	5470089	kg	0.15232	833,231			0.00533	29,128	0.00886	48,470		
Concrete (C50/60, Av. Mix)	Upper Floors & Balconies	699907.3	kg	0.15232	106,613			0.00533	3,727	0.00886	6,202		
Timber (Glulam,Typ)	Upper Floors & Balconies	137802.5											
Concrete (C32/40, Av. Mix)	Roof Beams & Decking	42928.02	kg	0.12127	5,206			0.00533	229	0.00731	314		
Concrete (C32/40, Av. Mix)	Vertical Structure	559894.3	kg	0.12127	67,901			0.00533	2,981	0.00731	4,092		
Concrete (C32/40, Av. Mix)	Foundations & Substructur	17249	kg	0.12127	2,092			0.00533	92	0.00731	126		
Steel (Cold-Rolled Galvanised)	Vertical Structure	1695,748	kg	2.76	4,680			0.03195	54	0.31225	530		
Steel (Reinforcement)	Upper Floors & Balconies	273,773	kg	1.99	544,808			0.03195	8,747	0.10738	29,399		
Steel (Reinforcement)	Ground Floor Slab	7,929	kg	1.99	15,778			0.03195	253	0.10738	851		
Steel (Reinforcement)	Roof Beams & Decking	2,135	kg	1.99	4,249			0.03195	68	0.10738	229		
Steel (Reinforcement)	Vertical Structure	343,037	kg	1.99	682,643			0.03195	10,960	0.10738	36,836		
Steel (Reinforcement)	Foundations & Substructur	1,818	kg	1.99	3,618			0.03195	58	0.10738	195		

Rev	Date	Drawn	Eng	Amendment
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ROOM2 HOMETEL
MANCHESTER PICCADILY

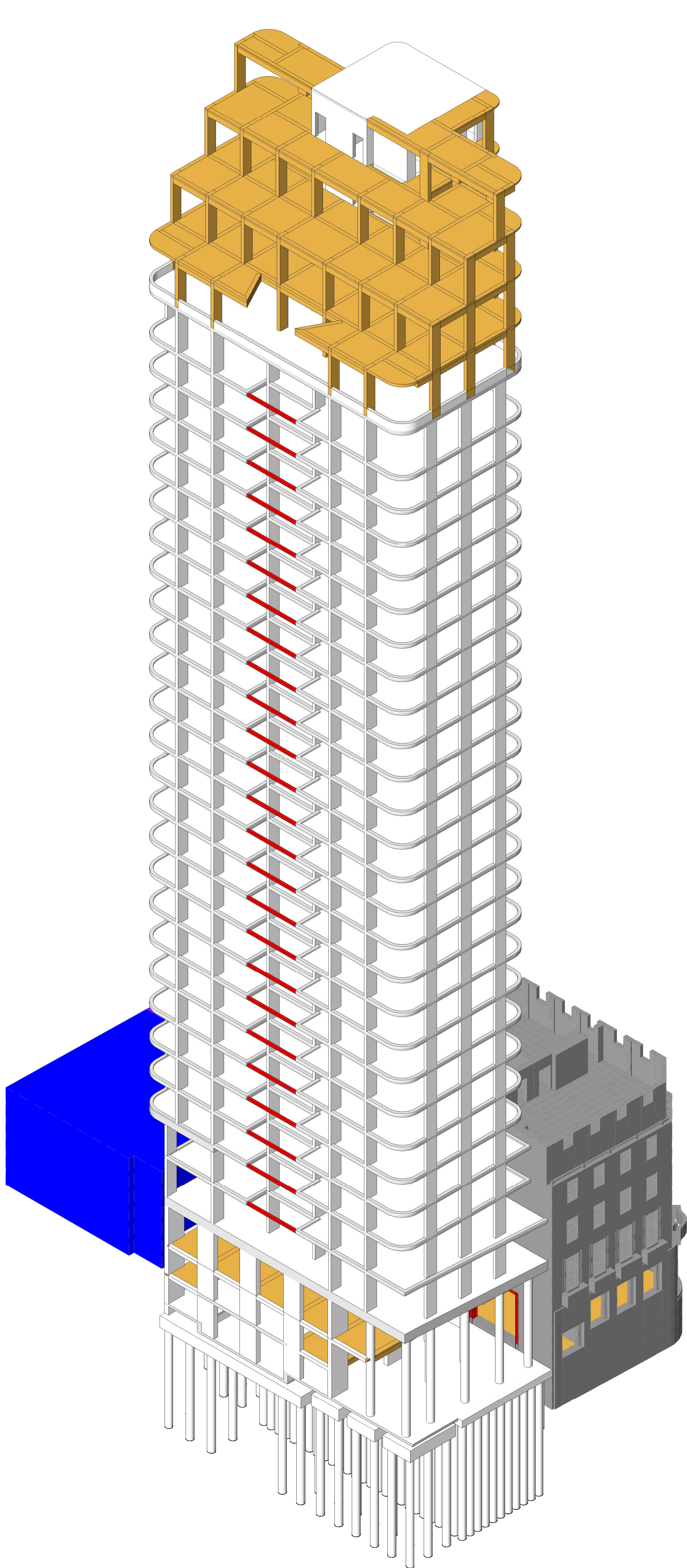
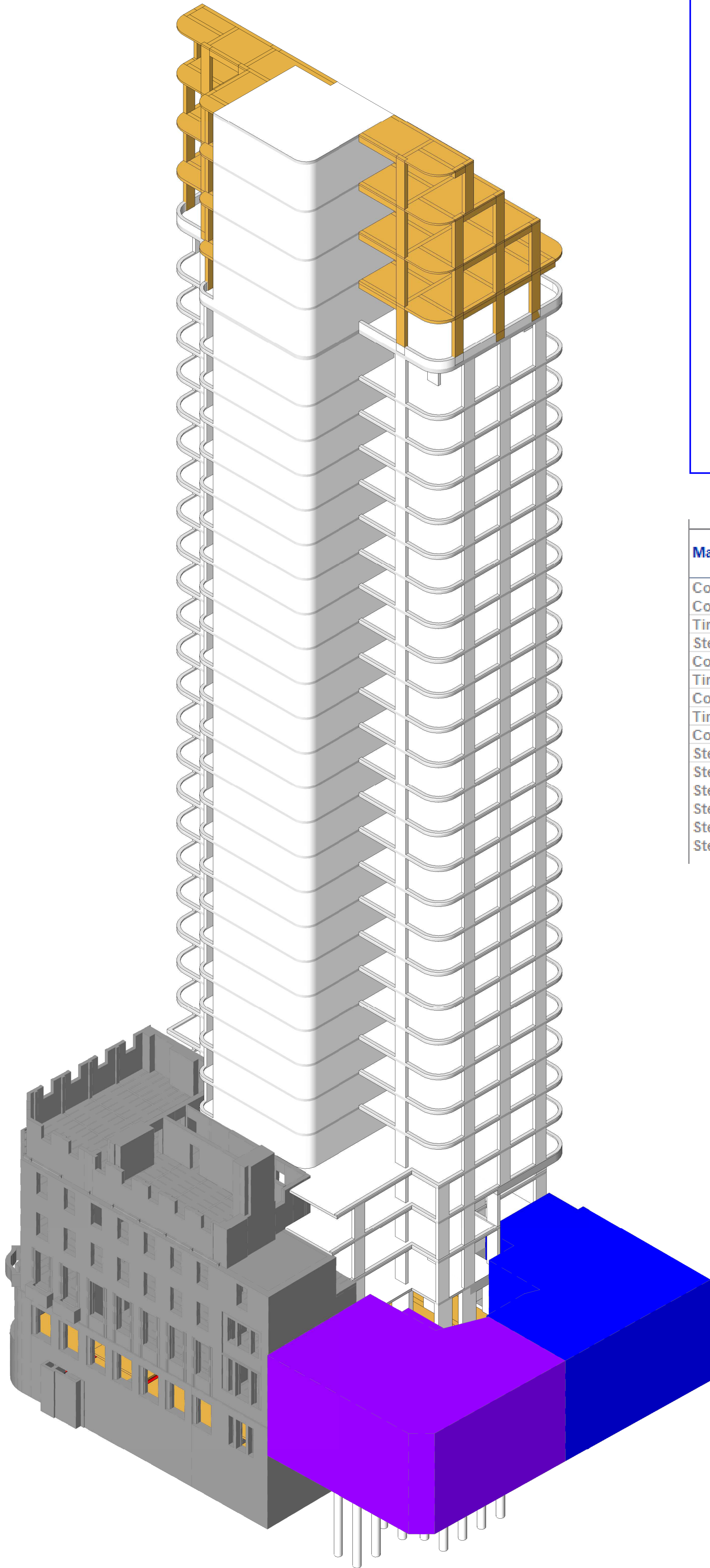
3D VIEWS

Status

Drawn	Author	Eng	Checker
Scales @A1			
Drawing No		Rev	
30578/2000			
Doc Ref.			
HMP-PAM-XX-ZZ-DR-S-2000			

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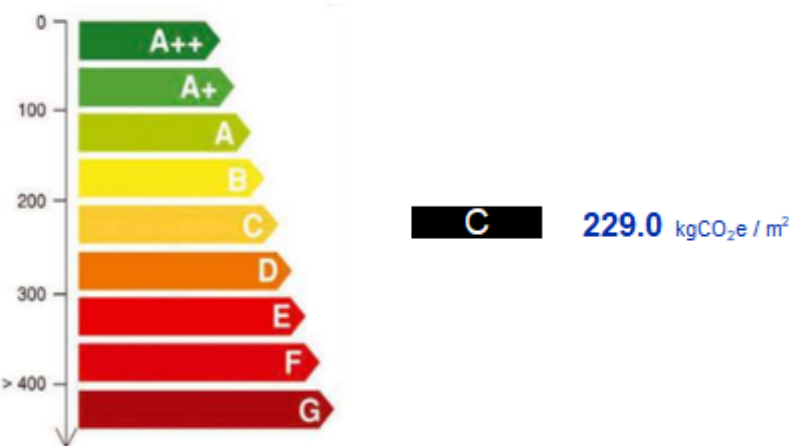


Embodied Carbon Totals Calculated for Each Lifecycle:

Stage		Total (kgCO ₂ e)	Sequestration	Total/GIA
A1-A3	Cradle to Gate	2,666,172		199
A1-A5	Cradle to Completion	3,061,396		229
A1-C4	Cradle to Grave	3,201,295	Included	239
A1-D	Cradle to Cradle	2,681,743	Included	201

SCORS Rating

Structural embodied carbon, from Cradle to Completion (A1-A5)
kgCO₂e / m² GIA



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NOTES:-

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. All dimensions are in millimetres and levels in metres. To check that this drawing has been printed to the intended scale this bar should be 50mm long @A1 or 25mm long @ A3
3. Health & Safety : All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. For general notes refer to Drawing No. 30578-0001

based on 13771 m2 AREA

Material	Element Description	Quantity	Units
Concrete (C32/40, Av. Mix)	Upper Floors & Balconies	5,261,554	kg
Concrete (C30/37, Av. Mix)	Ground Floor Slab	155247	kg
Timber (Glulam,Typ)	Roof Beams & Decking	15321.23	
Steel (Cold-Rolled Galvanised)	Upper Floors & Balconies	30853.95	kg
Concrete (C50/60, Av. Mix)	Vertical Structure	4671613	kg
Timber (Glulam,Typ)	Upper Floors & Balconies	128936.2	
Concrete (C30/37, Av. Mix)	Roof Beams & Decking	42928.02	kg
Timber (Glulam,Typ)	Vertical Structure	27417.6	
Concrete (C30/37, Av. Mix)	Foundations & Substructure	17249	kg
Steel (Cold-Rolled Galvanised)	Vertical Structure	1695.748	kg
Steel (Reinforcement)	Upper Floors & Balconies	271509.3	kg
Steel (Reinforcement)	Ground Floor Slab	7,722	kg
Steel (Reinforcement)	Roof Beams & Decking	2,135	kg
Steel (Reinforcement)	Vertical Structure	320,090	kg
Steel (Reinforcement)	Foundations & Substructure	1,818	kg

Rev	Date	Drawn	Eng	Amendment	

ROOM2 HOMETEL
MANCHESTER PICCADILY

3D VIEWS

Status

Drawn Author Eng Checker

Scales @A1

Drawing No Rev

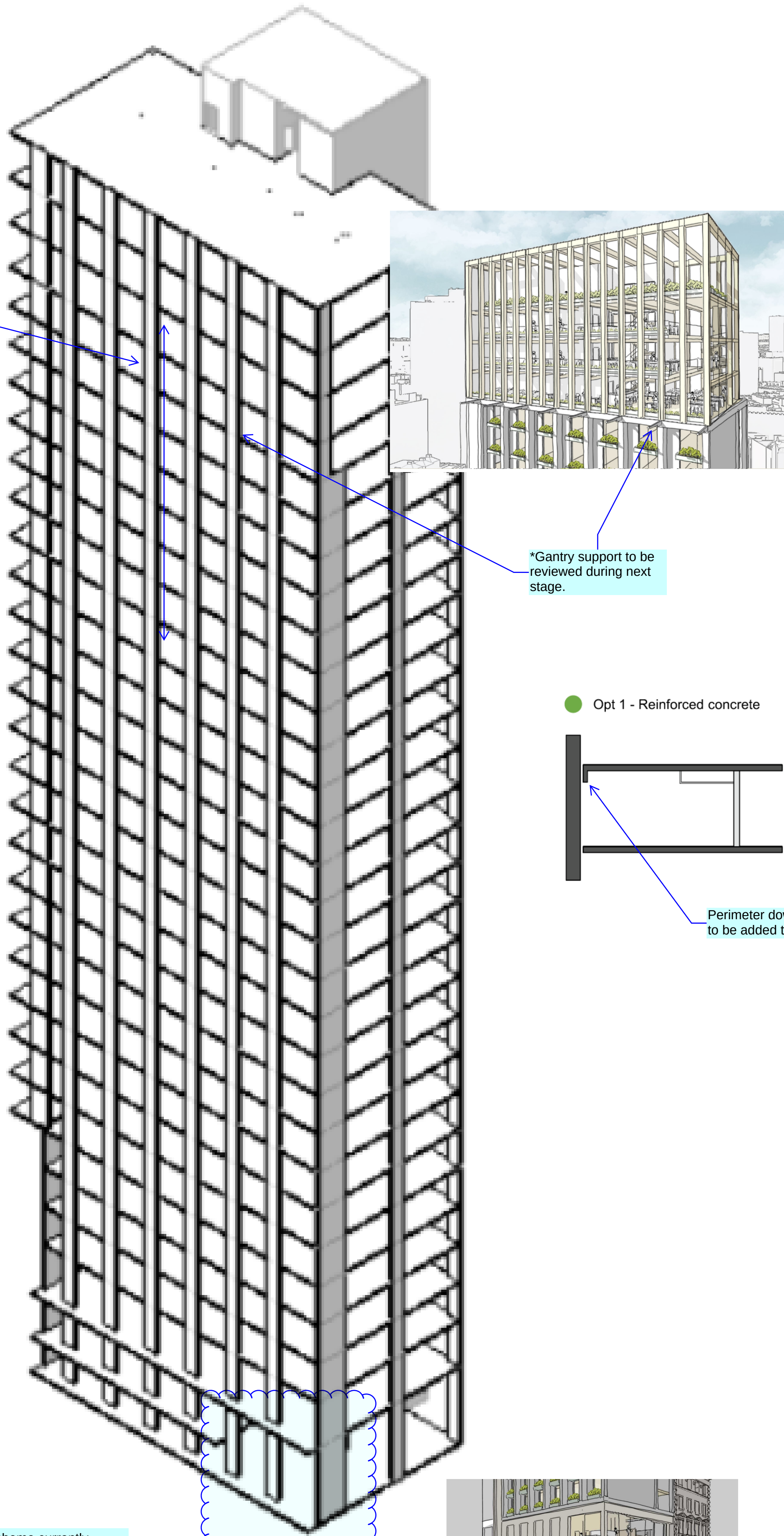
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Doc Ref.
HMP-PAM-XX-ZZ-DR-S-2000

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Stage 2 Structural Scheme design - Preliminary

Base model shown still undergoing coordination. Currently the following key items have not been accounted for in the material volumes:

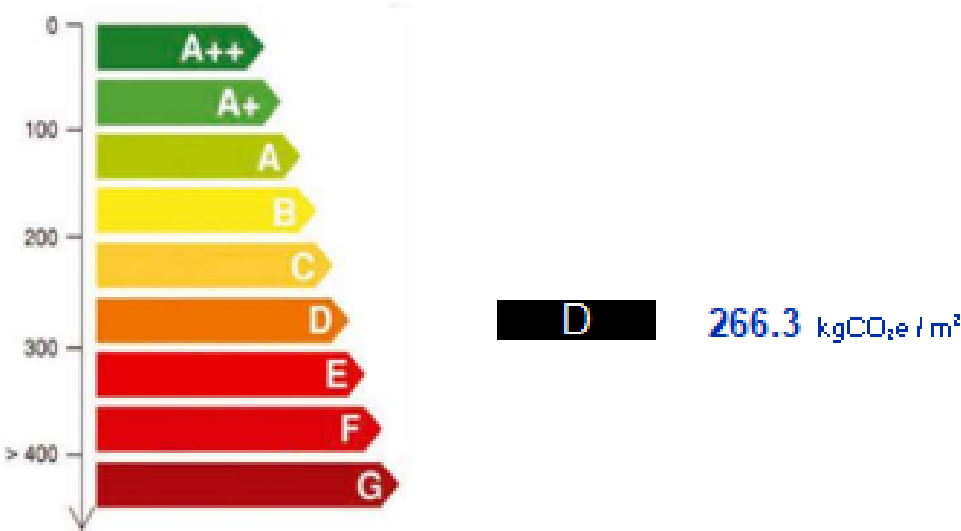
- Substructure
- Staircases
- Perimeter downstands/upstands.
- Secondary steelwork for cladding support
- Union bank works currently omitted from this study.
- Gantry steelwork support
- Thermal breaks

Embodied Carbon Totals Calculated for Each Lifecycle:

Stage	Total (kgCO ₂ e) Sequestration Total/GIA		
A1-A3	Cradle to Gate	2,484,439	231
A1-A5	Cradle to Completion	2,862,797	266
A1-C4	Cradle to Grave	2,997,574	Included 279
A1-D	Cradle to Cradle	2,514,317	Included 234

SCORS Rating

Structural embodied carbon, from Cradle to Completion (A1-A5)
 kgCO₂e / m² GIA



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Concrete mix based on a cement ratio of 20-25%.
 P&M default specification allows up to 66-80%.

NOTES:-

- This drawing is to be read in conjunction with all relevant Architects, Engineer's and specialists' drawings and specifications.
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- Health & Safety : All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
- For more information, click here



AAAA-0001

Material	Element Description	Quantity
Concrete (C40/50, Av. Mix)	Vertical Structure	4668742
Concrete (C32/40, Av. Mix)	Roof Beams & Decking	200286.8
Concrete (C32/40, Av. Mix)	Upper Floors & Balconies	4887865
Concrete (C28/35, Av. Mix)	Ground Floor Slab	177885.7
Steel (Reinforcement)	Vertical Structure	349785.4
Steel (Reinforcement)	Roof Beams & Decking	9962.257
Steel (Reinforcement)	Upper Floors & Balconies	243122.1
Steel (Reinforcement)	Ground Floor Slab	8848.028

Table 10

Cement and combination type¹

Broad designation ²	Composition	Cement/combination types (BS 8500)
CEM I	Portland cement	CEM I
SRPC	Sulfate-resisting Portland cement	SRPC
IIA	Portland cement with 6–20% of fly ash, ground granulated blastfurnace slag, limestone, or 6–10% silica fume ⁶	CEM II/A-L, CEM II/A-LL, CIA-L, CIA-LL, CEM II/A-S, CIA-S, CEM II/A-V, CIA-V, CEM II/A-D
IIB-S	Portland cement with 21–35% ground granulated blastfurnace slag	CEM II/B-S, CIIB-S
IIB-V	Portland cement with 21–35% fly ash	CEM II/B-V, CIIB-V
IIB+SR	Portland cement with 21–35% fly ash	CEM II/B-V+SR, CIIB-V+SR
IIIA ^{4,e}	Portland cement with 36–65% ground granulated blastfurnace slag	CEM III/A, CIIIA
IIIA+SR ^e	Portland cement with 36–65% ground granulated blastfurnace slag with additional requirements that enhance sulfate resistance	CEM III/A+SR ^f , CIIII/A+SR ^f
IIIB ^{4,e}	Portland cement with 66–80% ground granulated blastfurnace slag	CEM III/B, CIIIB
IIIB+SR ^e	Portland cement with 66–80% ground granulated blastfurnace slag with additional requirements that enhance sulfate resistance	CEM III/B+SR ^f , CIIIB+SR ^f
IIV-B-V	Portland cement with 36–55% fly ash	CEM IV/B(V), CIVB

Extract 2 - How to Design Concrete Structures using Eurocode 2.

Rev	Date	Drawn	Eng	Amendment

ROOM2 HOMETEL
 MANCHESTER PICCADILY

3D VIEWS

Status

Drawn KS Eng AW

Scales n.T.S

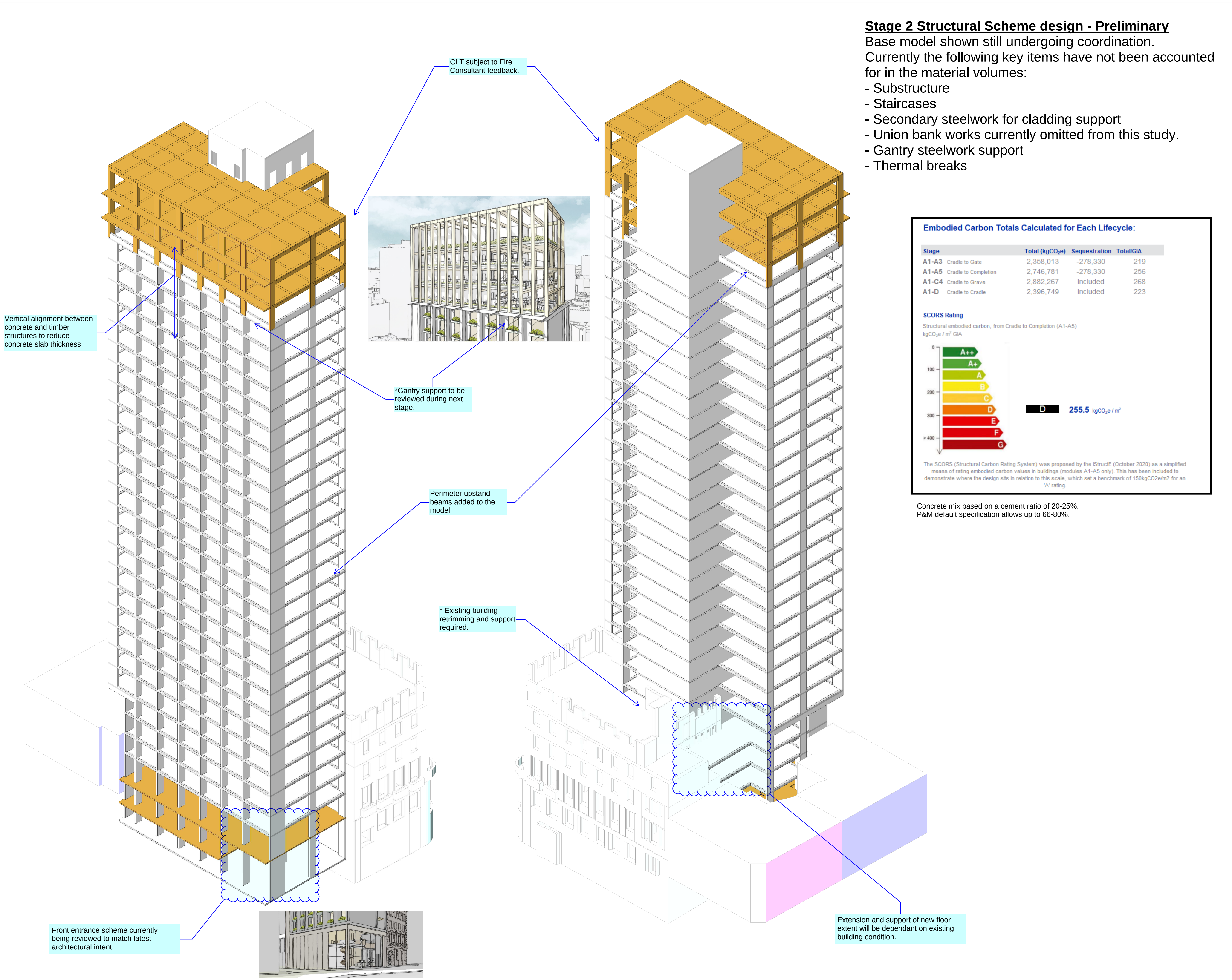
Drawing No 30578/SK0015 Rev P01

Doc Ref 30578-PAM-XX-XX-ZZ-SK-S-0015
 Preliminary embodied carbon review

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Stage 2 Structural Scheme design - Preliminary

Base model shown still undergoing coordination. Currently the following key items have not been accounted for in the material volumes:

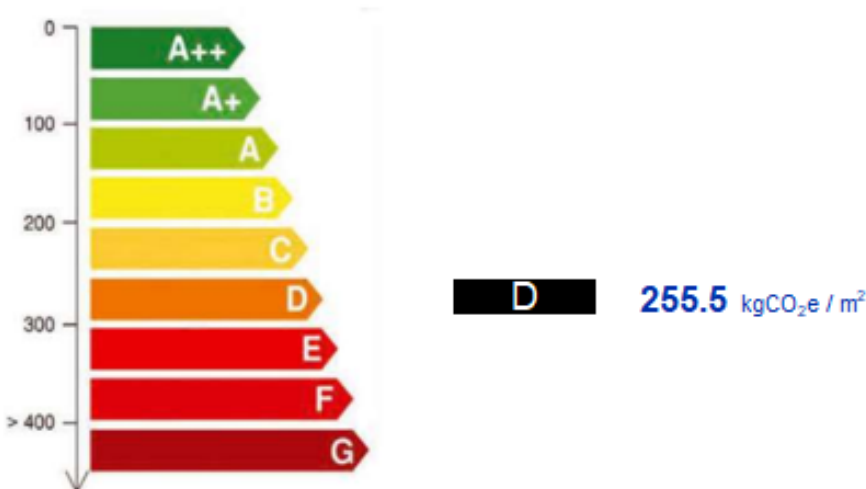
- Substructure
- Staircases
- Secondary steelwork for cladding support
- Union bank works currently omitted from this study.
- Gantry steelwork support
- Thermal breaks

Embodied Carbon Totals Calculated for Each Lifecycle:

Stage	Total (kgCO ₂ e)	Sequestration	Total/GIA
A1-A3 Cradle to Gate	2,358,013	-278,330	219
A1-A5 Cradle to Completion	2,746,781	-278,330	256
A1-C4 Cradle to Grave	2,882,267	Included	268
A1-D Cradle to Cradle	2,396,749	Included	223

SCORS Rating

Structural embodied carbon, from Cradle to Completion (A1-A5)
kgCO₂e / m² GIA



The SCORS (Structural Carbon Rating System) was proposed by the IStructE (October 2020) as a simplified means of rating embodied carbon values in buildings (modules A1-A5 only). This has been included to demonstrate where the design sits in relation to this scale, which set a benchmark of 150kgCO2e/m2 for an 'A' rating.

Concrete mix based on a cement ratio of 20-25%.
P&M default specification allows up to 66-80%.

NOTES:-

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. All dimensions are in millimetres and levels in metres.
To check that this drawing has been printed to the intended scale this bar should be 50mm long @A1 or 25mm long @ A3
3. Health & Safety :
All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. For general notes refer to Drawing No. AAAA-0001

Material	Element Description	Quantity	Units
Timber (Glulam, GL28c)	Floor Beams & Decking	32955.47	kg
Concrete (C28/35, Av. Mix)	Ground Floor Slab	178427.2	kg
Timber (Glulam, GL28c)	Vertical Structure	20260.8	kg
Timber (CLT, General Scheme)	Upper Floors & Balconies	117935.1	kg
Concrete (C32/40, Av. Mix)	Upper Floors & Balconies	4314446	kg
Concrete (C40/50, Av. Mix)	Vertical Structure	4448893	kg
Concrete (C32/40, Av. Mix)	Floor Beams & Decking	42936.07	kg
Steel (Reinforcement)	Floor Beams & Decking	2135.638	kg
Steel (Reinforcement)	Ground Floor Slab	8874.959	kg
Steel (Reinforcement)	Vertical Structure	333189.8	kg
Steel (Reinforcement)	Upper Floors & Balconies	223,800	kg

Table 10

Cement and combination type¹

Broad designation ¹	Composition	Cement/combination types (BS 8500)
CEM I	Portland cement	CEM I
SRPC	Sulfate-resisting Portland cement	SRPC
IIA	Portland cement with 6–20% of fly ash, ground granulated blastfurnace slag, limestone, or 6–10% silica fume ²	CEM II/A-L, CEM II/A-LL, CIA-L, CIA-LL, CEM II/A-S, CIA-S, CEM II/A-V, CIA-V, CEM II/A-D
IIB-S	Portland cement with 21–35% ground granulated blastfurnace slag	CEM II/B-S, CIIB-S
IIB-V	Portland cement with 21–35% fly ash	CEM II/B-V, CIIB-V
IIB+SR	Portland cement with 21–35% fly ash	CEM II/B-V+SR, CIIB-V+SR
IIIA ²	Portland cement with 36–65% ground granulated blastfurnace slag	CEM III/A, CIIIA
IIIA+SR ²	Portland cement with 36–65% ground granulated blastfurnace slag with additional requirements that enhance sulfate resistance	CEM III/A+SR ² , CIIIA+SR ²
IIB ²	Portland cement with 66–80% ground granulated blastfurnace slag	CEM II/B, CIIB
IIB+SR ²	Portland cement with 66–80% ground granulated blastfurnace slag with additional requirements that enhance sulfate resistance	CEM II/B+SR ² , CIIB+SR ²
IVB-V	Portland cement with 36–55% fly ash	CEM IV/B(V), CIVB

Extract 2 - How to Design Concrete Structures using Eurocode 2.

Rev	Date	Drawn	Eng	Amendment

ROOM2 HOMETEL
MANCHESTER PICCADILY

3D VIEWS

Status

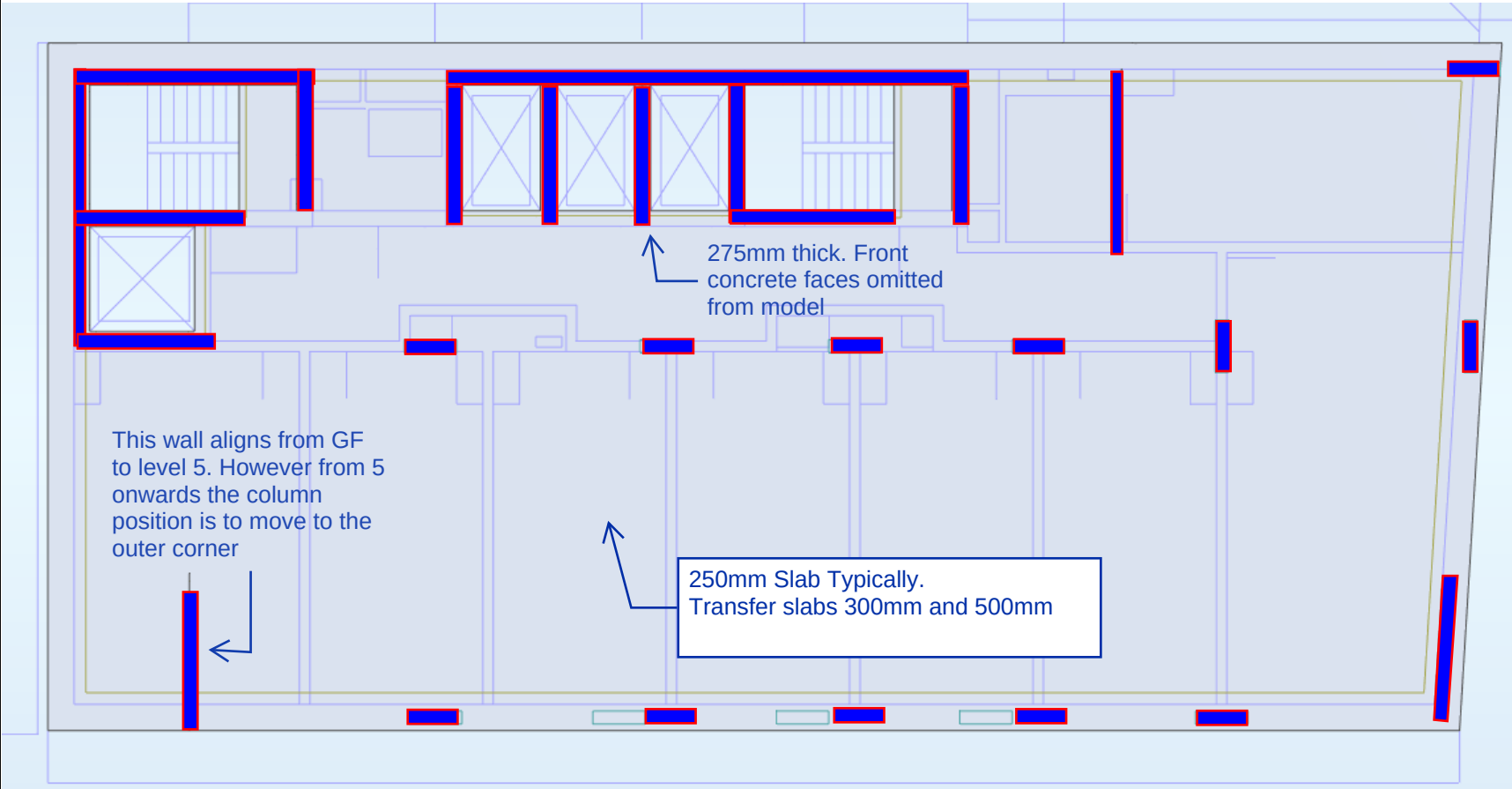
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Scales	@A1		
Drawing No	29999/2000	Rev	Unnamed
Doc Ref.	30578-PAM-XX-XX-ZZ-SK-S-0013		
2000	Preliminary embodied carbon review		

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TYPICAL FLOOR PLATE AND STRUCTURAL ARRANGEMENT



ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none">Inherent fire protectionGood for acoustic separationThermal mass can be utilised if left exposed.Great flexibility for small builder works changes via coring.Future flexibility for removing non-load bearing partitions.Column alignment can be differentQuicker lead-in times for rebar.Cladding – cast in support detailsShallower floors.	<ul style="list-style-type: none">Heavier construction = larger foundation requirements.Wet trades can lead to longer programme for installation.More frequent concrete wagon deliveries to siteHigher embodied carbon

Fire Queries:

Column vs Wall definition.
4:1 ratio

Assumptions Loadings.:

**No finishes required on slab.
Powerfloating proposed.**

DL = Finishes and services = 0.3 kN/m2

LL = 3.0 Generally for
circulation/bedrooms / Restaurants

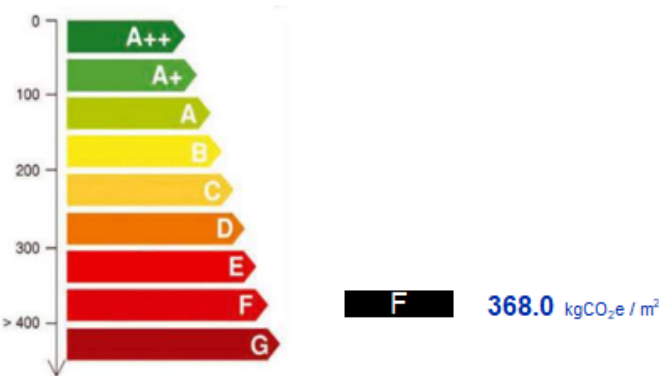
Cladding = 10 kN/m every 2 floors.

Embodied Carbon Totals Calculated for Each Lifecycle:

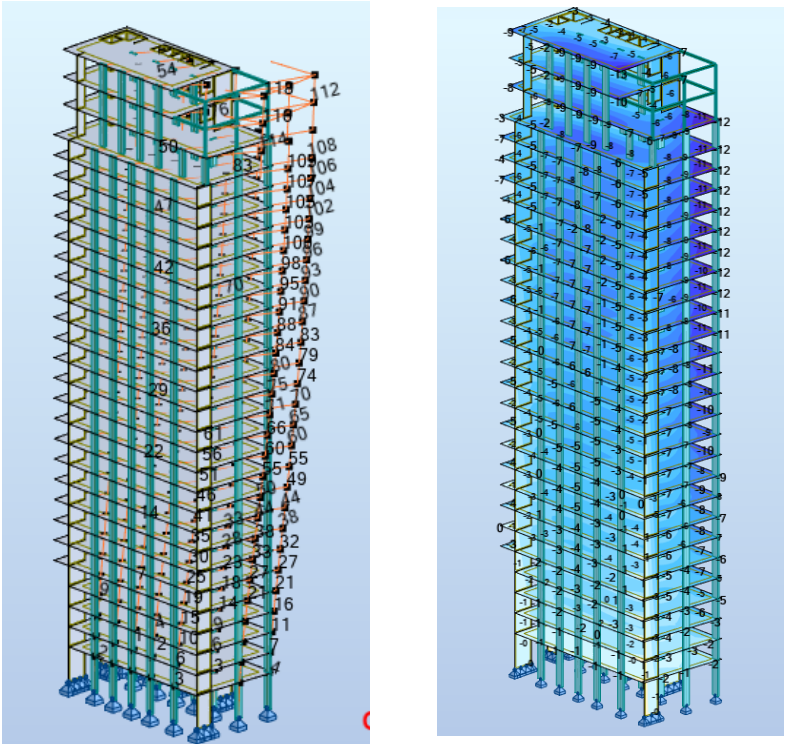
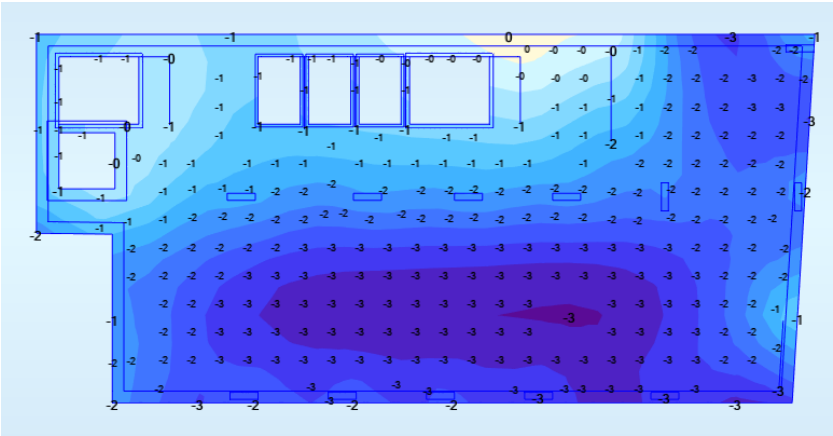
Stage	Total (kgCO ₂ e)	Sequestration	Total/GIA
A1-A3 Cradle to Gate	2,938,709		305
A1-A5 Cradle to Completion	3,543,550		368
A1-C4 Cradle to Grave	3,740,614	Included	388
A1-D Cradle to Cradle	3,388,545	Included	352

SCORS Rating

Structural embodied carbon, from Cradle to Completion (A1-A5)
kgCO₂e / m² GIA

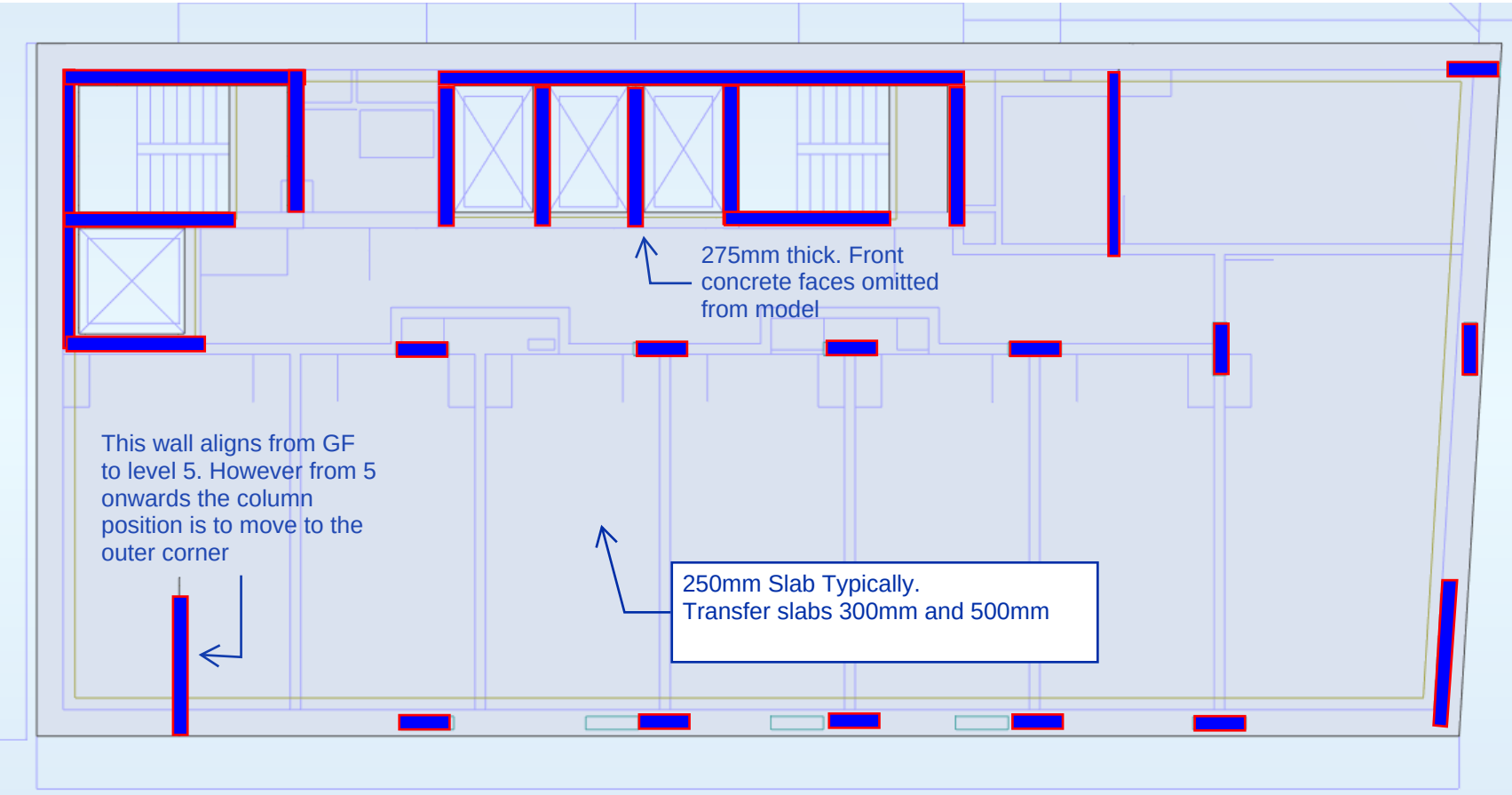
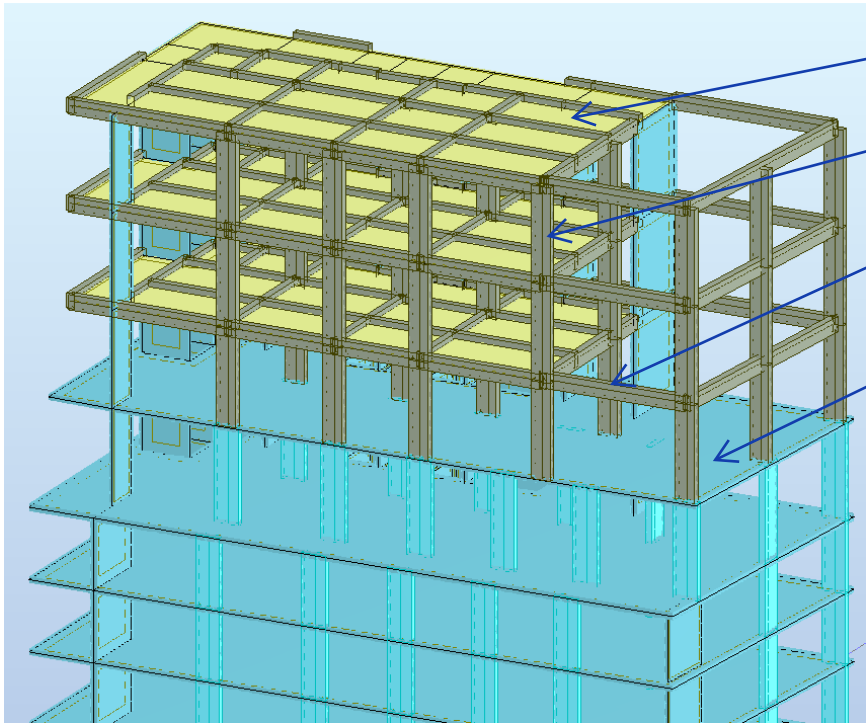


The SCORS (Structural Carbon Rating System) was proposed by the IStructE (October 2020) as a simplified means of rating embodied carbon values in buildings (modules A1-A5 only). This has been included to demonstrate where the design sits in relation to this scale, which set a benchmark of 150kgCO₂e/m² for an 'A' rating.



Concrete Scheme Option Review

TYPICAL FLOOR PLATE AND STRUCTURAL ARRANGEMENT



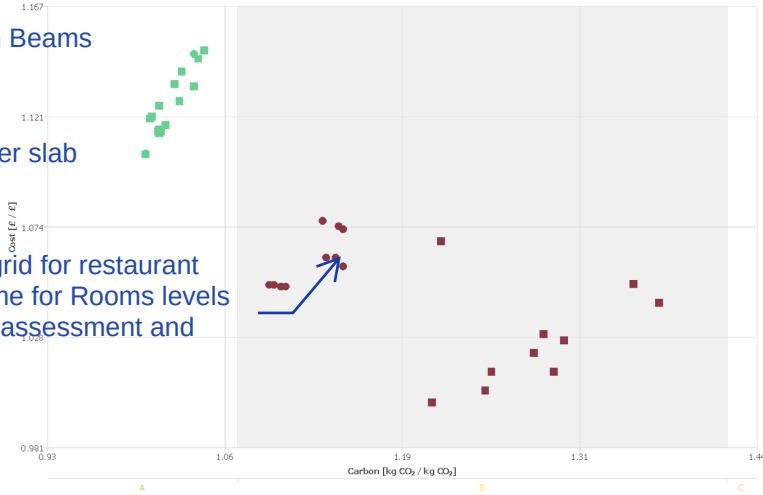
140mm thick CLT slabs.

300x800mm Glulam Columns

300x600mm dp Glulam Beams

300mm thick RC transfer slab

4.5x5.5 Glulam frame grid for restaurant and bar built of RC frame for Rooms levels
Grid based on PANDA assessment and adapted to layout



ADVANTAGES

- Inherent fire protection of concrete elements
- Good acoustic separation for rooms levels
- Thermal mass can be utilised where concrete left exposed
- Great flexibility for small builder works changes via coring
- Future flexibility for removing non-loadbearing partitions
- Column alignment only required at upper levels
- Shallower floors for rooms levels
- Weight reduction for upper levels
- Reduced embodied carbon on upper levels

Fire Queries:

Column vs Wall definition.
4:1 ratio

Timber elements fire boarded
vs designed for charring

DISADVANTAGES

- Wet trades can lead to longer programme for installation
- More frequent concrete wagon deliveries to site
- Fire proofing to upper levels
- Careful coordination required for services distribution at upper levels

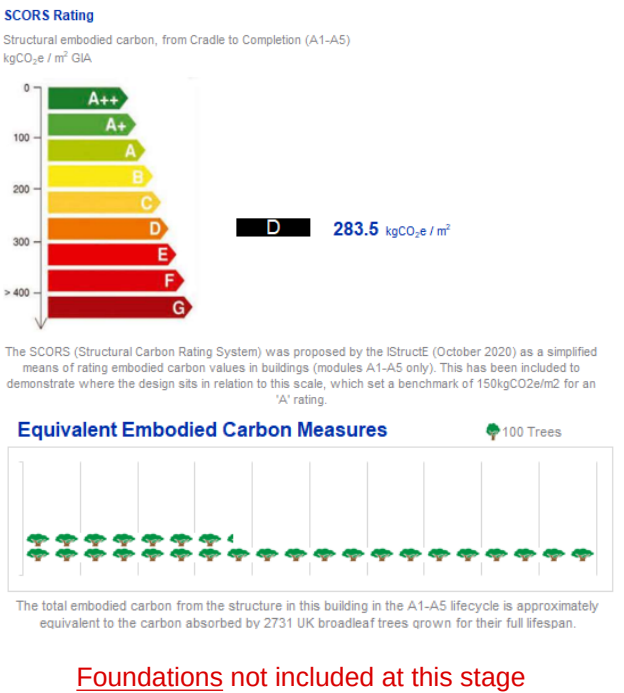
Assumptions Loadings.:

**No finishes required on concrete slab.
Powerfloating proposed.**

DL = Finishes and services = 0.3 kN/m2

LL = 3.0 Generally for
circulation/bedrooms / Restaurants

Cladding = 10 kN/m every 2 floors.



Concrete Scheme Option with CLT Roof top

TYPICAL FLOOR PLATE AND STRUCTURAL ARRANGEMENT

275mm thick. Front concrete faces omitted from model

This wall aligns from GF to level 5. However from 5 onwards the column position is to move to the outer corner

160mm Comflor Slab Typically.
Beam depths 406 UB's
Columns 357 UC's
Transfer slabs 300mm and 500mm

Braced Bays

350mm thick. Front concrete faces omitted from model

ADVANTAGES

- Quick installation
- Demountable
- Lighter foundations compared to full RC scheme.
- Fabricated off site
- Longer spans possible.
- Cleaner – operation (less wet trades)
- Future alterations easier.

DISADVANTAGES

- Secondary steel requirements for façade support
- Long lead in times.
- Fire proofing – careful detailing required.
- Poor dynamic qualities for long spans
- Careful coordination required for services distribution horizontally
- Poor acoustic properties. Careful detailing required.
- Deeper floor plate, structural zone

Fire Queries:

Beam and comflor interface. Do we need to infill between the top of beams and trapezoidal deck? Do we need to intumescent paint in these areas.

Other fire detailing considerations and expansion joints.

Assumptions Loadings.:

DL Finishes services, 50mm screed = 1.70 kN/m2

LL = 3.0 Generally for circulation/bedrooms / Restaurants

Cladding = 10 kN/m every 2 floors.

Steel & Comflor Scheme Option Review

Embodied Carbon Totals Calculated for Each Lifecycle:

Stage	Total (kgCO ₂ e)	Sequestration	Total/GIA
A1-A3 Cradle to Gate	2,235,887		232
A1-A5 Cradle to Completion	2,715,107		282
A1-C4 Cradle to Grave	2,838,830	Included	295
A1-D Cradle to Cradle	2,538,954	Included	264

SCORS Rating

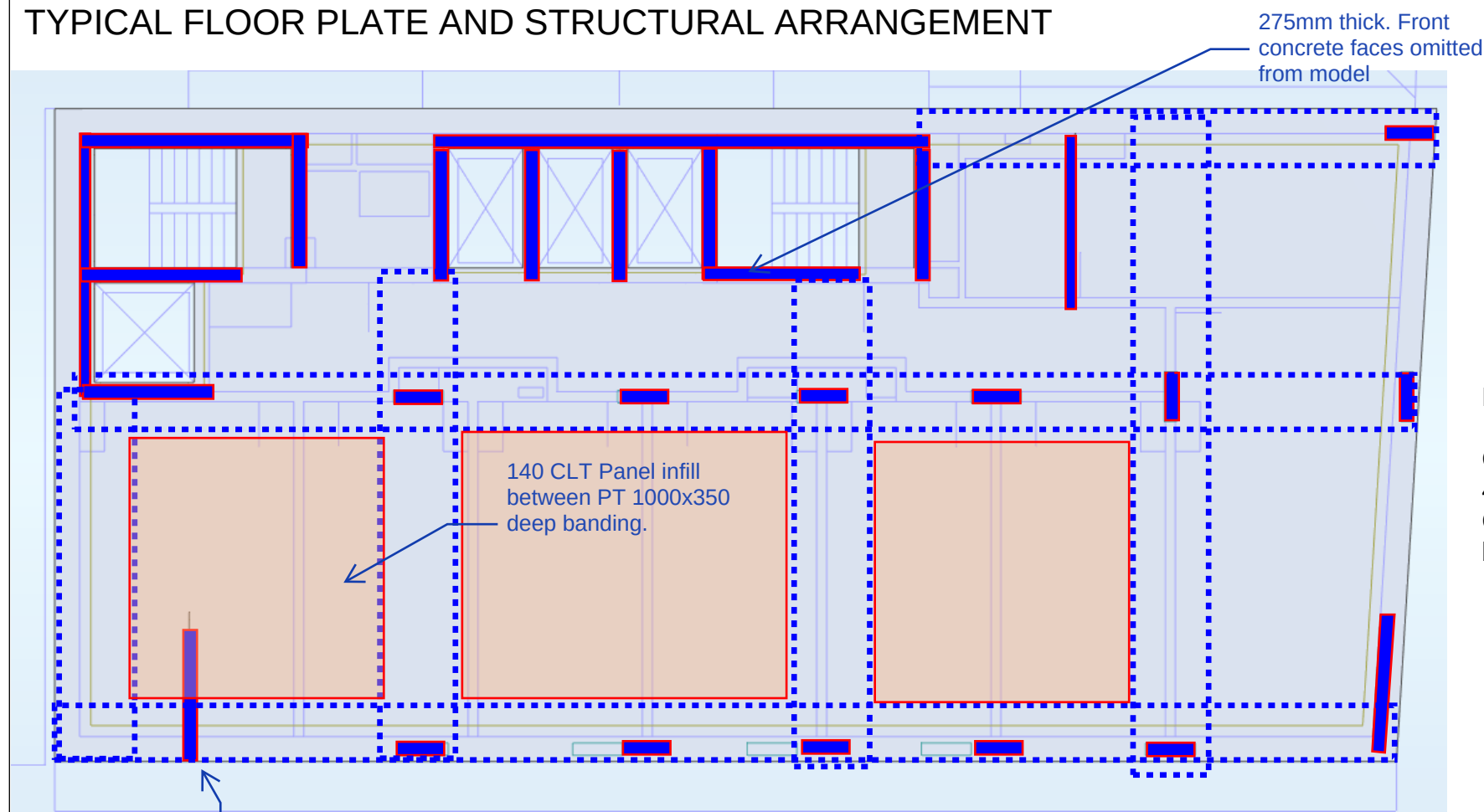
Structural embodied carbon, from Cradle to Completion (A1-A5)
kgCO₂e / m² GIA

D 281.9 kgCO₂e / m²

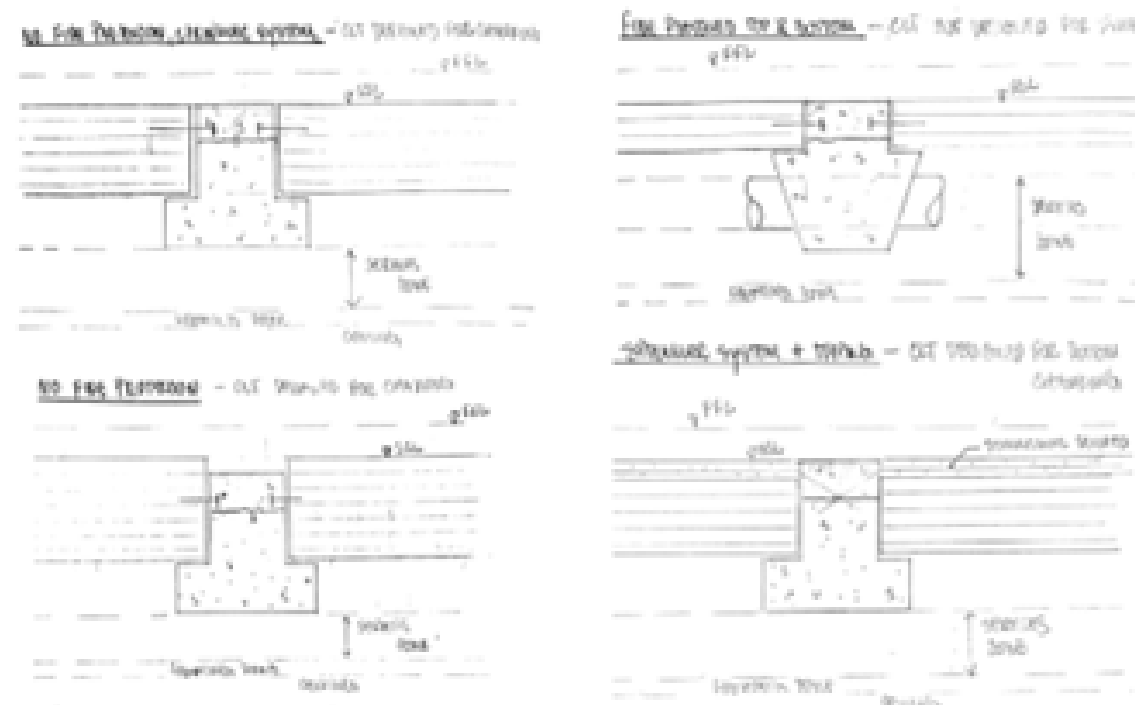
The SCORS (Structural Carbon Rating System) was proposed by the IStructE (October 2020) as a simplified means of rating embodied carbon values in buildings (modules A1-A5 only). This has been included to demonstrate where the design sits in relation to this scale, which set a benchmark of 150kgCO₂e/m² for an 'A' rating.

Foundation not yet included.

TYPICAL FLOOR PLATE AND STRUCTURAL ARRANGEMENT



This wall aligns from GF to level 5. However from 5 onwards the column position is to move to the outer corner



Fire Queries:

Column vs Wall definition.
4:1 ratio
CLT infill band on banded PT beam lines.

Assumptions Loadings.:

DL = Finishes and services = 0.3 kN/m²

LL = 3.0 Generally for circulation/bedrooms / Restaurants

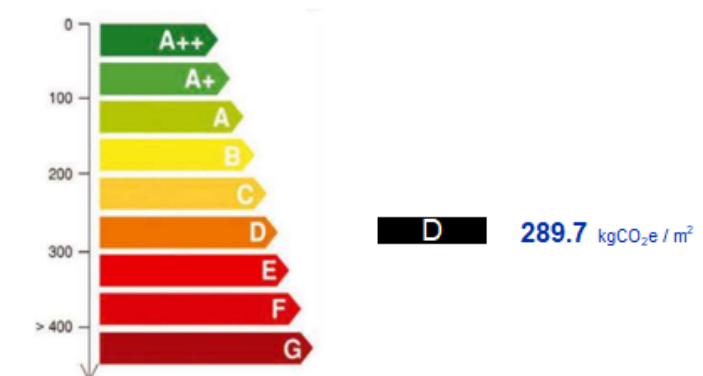
Cladding = 10 kN/m every 2 floors.

Embodied Carbon Totals Calculated for Each Lifecycle:

Stage	Total (kgCO ₂ e)	Sequestration	Total/GIA
A1-A3 Cradle to Gate	2,225,721	-305,415	231
A1-A5 Cradle to Completion	2,789,745	-305,415	290
A1-C4 Cradle to Grave	2,949,863	Included	306
A1-D Cradle to Cradle	2,653,413	Included	276

SCORS Rating

Structural embodied carbon, from Cradle to Completion (A1-A5)
kgCO₂e / m² GIA



The SCORS (Structural Carbon Rating System) was proposed by the IStructE (October 2020) as a simplified means of rating embodied carbon values in buildings (modules A1-A5 only). This has been included to demonstrate where the design sits in relation to this scale, which set a benchmark of 150kgCO₂e/m² for an 'A' rating.

Concrete Scheme & CLT Infill Review