2

Euston Tower

Strategy for the Existing Building

2.1 Circular Economy Approach

2.1.1 Working with existing buildings

The circular economy decision tree for developments with an existing building on site has been used to assist the design team in choosing the most appropriate design approach for the existing scheme. Refer to Figure 2.1.

An extensive feasibility study has been carried out, to evaluate the technical feasibility and practicality of retaining the existing building on site, and to which degree the existing building can be retained and still suit modern requirements for the proposed development. This has been independently reviewed by a third-party.

Feasibility Study Volume One, supported by a number of both intrusive and non-intrusive surveys, concludes that the existing services and facade system are no longer fit for purpose in line with current guidelines. It furthermore establishes that, despite the superstructure being in good condition, the extent of the upgrades that are required to bring the existing tower up to current building regulations and standards are extensive. The extent of upgrades required, and the quality and quantum of compromised office space delivered, would make the resulting product challenging in the leasing market and it identified that refurbishing the existing building is not a feasible option.

Feasibility Study Volume Two concludes that in order for the existing tower to support alternative uses (those other than office use) substantial structural alterations are required to deliver the necessary upgrades to accommodate modern services and lift requirements. Considering the technical challenges in providing the necessary upgrades, as well as the resulting compromised space, low quality units, and policy non-conformance, the existing tower was shown not be appropriate for alternative uses.

From the two studies it is concluded that a full retention and retrofit is not considered feasible either for continued office use or alternative uses, but that the existing substructure and parts of the superstructure could be retained.

A range of options for re-purposing and retaining the existing tower has been considered in Feasibility Study Volume Three. It has been shown that an option that retains the existing foundation and basement, as well as the central core, provides the best balance of structural retention and quality, flexibility, adaptability and buildability.

A more detailed summary of the Feasibility Study is presented in Section 2.2. The full Feasibility Study forms part of this planning application. Refer to the *Feasibility Study prepared by GXN dated November 2023*.

2.1.2 Working with disused materials

The materials that will be removed as part of the deconstruction process are captured in the Pre-demolition Audit.

The Pre-demolition Audit maps the materials' condition, and provides the business as usual and best practice recycling routes for the key deconstruction products.

The interior fit-out and finishes have already been stripped from the existing building. The Pre-demolition Audit provides details on where the stripped out materials were sent for recovery.

A detailed summary of the Pre-demolition Audit is presented in Section 2.3. The full Pre-demolition Audit forms part of this planning application and is included in Appendix A.

A material strategy has been developed to ensure that the deconstructed materials and products are retained at the highest possible value. This includes identifying materials that could be suited for direct reuse, and where this is not possible, ensuring that the materials are carefully separated and recycled at the highest value possible. It also includes several design ideas for creative upcycling of materials from the deconstruction, for use in the new development or elsewhere.

A detailed summary of the overall strategy to treating the deconstructed materials is presented in Section 2.4. The full Material Recovery Strategy forms part of this planning application and is included in Appendix B.

GLA Circular Economy Decision Tree for Existing Buildings

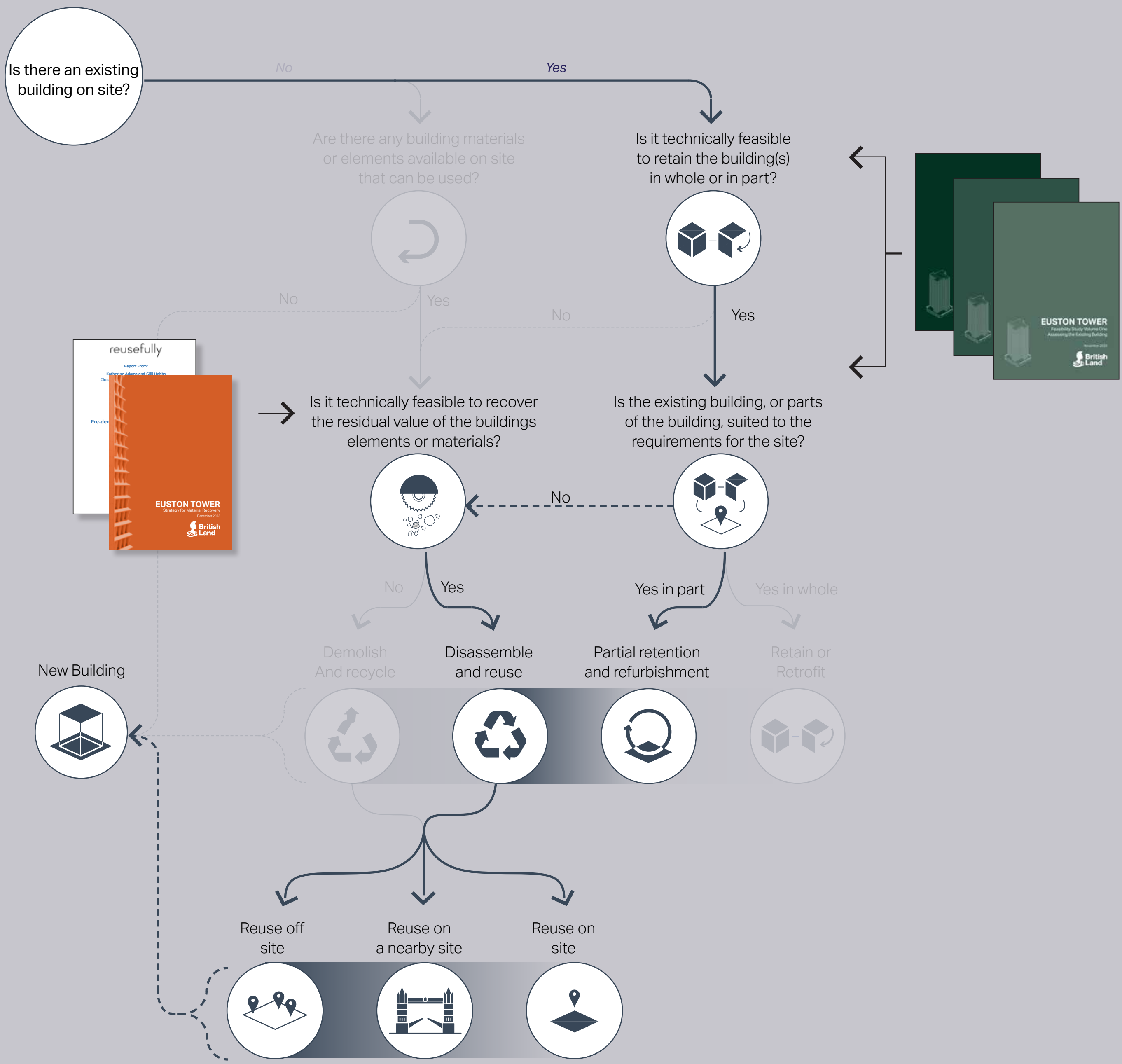


Figure 2.1 The circular economy decision tree for developments with an existing building on site from the GLA Circular Economy Guidance

2.2 Feasibility Study Summary

The feasibility study into the condition of the existing Euston Tower and opportunities for retention was prepared in response to London Plan Policies D3 and SI 7 and Camden Local Plan Policy CC1.

In the context of London Plan Policy SI 7, it satisfies the requirement for a pre-redevelopment audit that demonstrates that options for retention are fully explored before considering any demolition. In the context of Camden Local Plan Policy CC1, it satisfies the requirement for a condition and feasibility study, and options appraisal for any development proposal proposing substantial demolition.

The full feasibility study comprises three volumes (in addition to a summary known as Volume Zero), and has been third-party, independently reviewed on behalf of London Borough of Camden. The process is shown in Figure 2.2. The full feasibility study is included as part of this planning application (refer to *Feasibility Study prepared by GXN dated November 2023*), and the following provides a summary for reference.

Feasibility Study Process

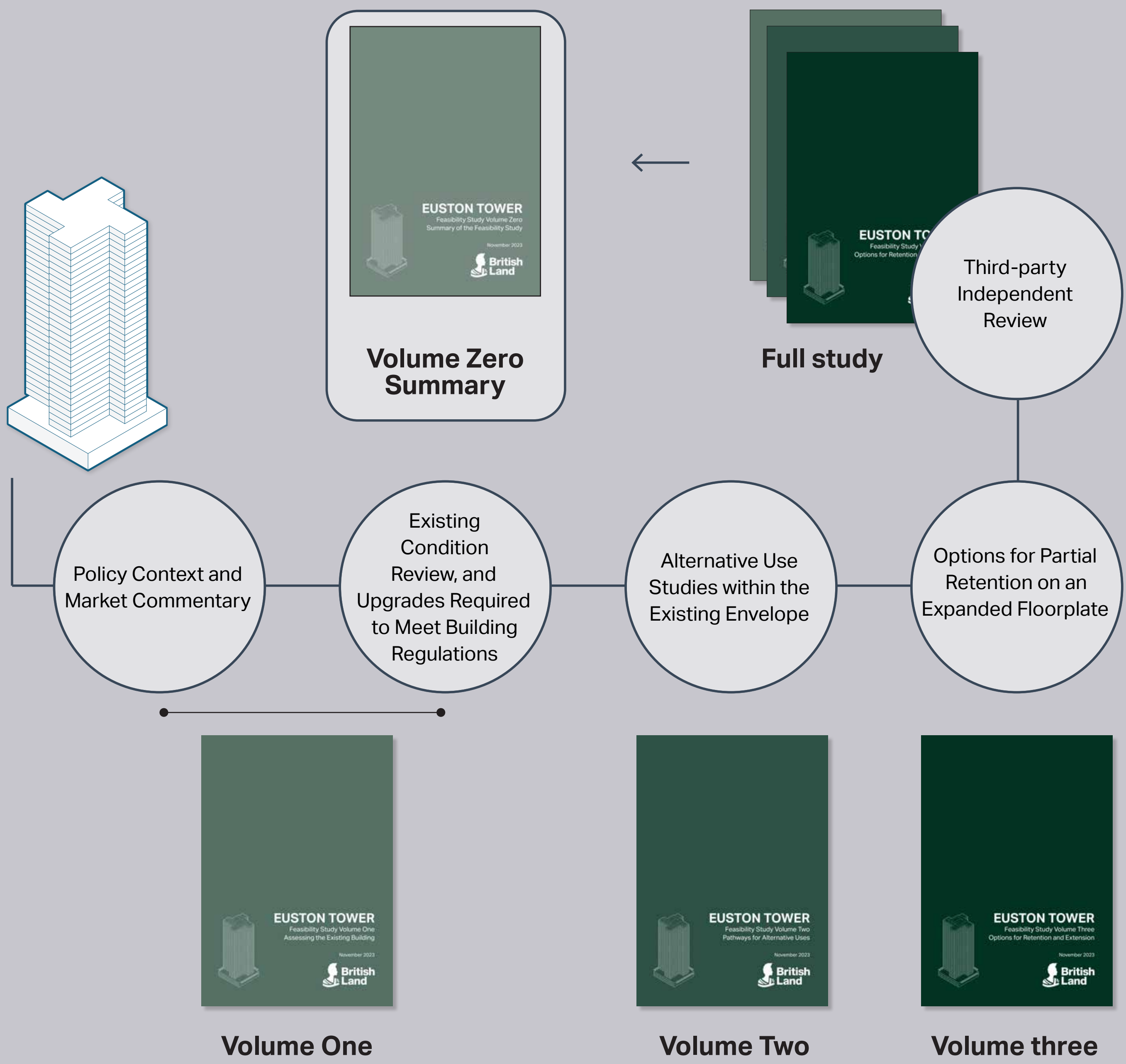


Figure 2.2 Overview of the feasibility study process

2.2.1 Volume One - Assessing the Existing Building

Volume One explored, in detail, the condition of the existing tower. It considered the planning policy relating to the future use of Euston Tower, as well as market requirements for continued commercial use of the tower. It presented an appraisal of the operation of the existing building, including an assessment of the building services. Finally, it sets out the upgrades required to comply with current legislation, based on a technical review looking at the condition of the architecture, structures, and facade.

The assessment identified the following primary points about the existing building:

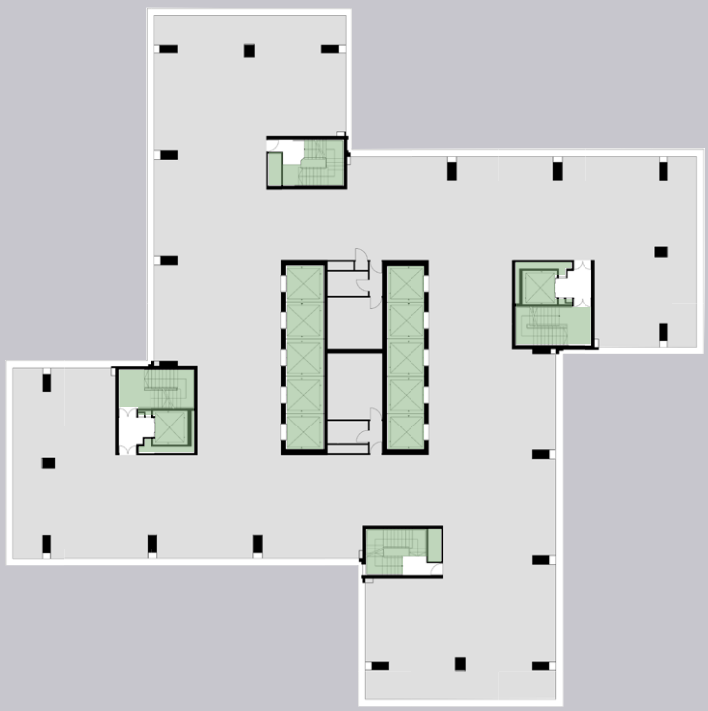
- Concrete structure is generally in a reasonable condition and able to support the current building loads
- The layout of the floorplates is disconnected meaning that the existing space hard to navigate for modern open-plan offices
- Uninviting and closed-off building with a reflective glass facade
- A facade that does not meet modern fire or energy performance requirements
- No current connection or use to local residents or the wider community
- A challenging structure to adapt and improve through minor refurbishment, due to the ribbed slab structure resulting in service penetrations being larger than they need (see Figure 2.3)
- Unattractive and undesirable to modern occupiers, and has been challenging to let since the early 2010s, and vacant since 2021
- Low floor to ceiling heights (2.38 – 2.48m depending on the upgrade strategy pursued), meaning that it would be challenging to accommodate modern occupiers' needs and servicing requirements (floor to ceiling heights of 2.6m and above) and lab-enabled commercial space fit for the future
- Services equipment is beyond its serviceable life
- Building doesn't comply with current Building Regulations and would need significant changes to make it safe and suitable for modern occupiers including fire safety measures such as sprinklers, mechanical smoke ventilation and dedicated fire fighting lifts.

Options were studied for how to address the Building Regulation non-compliances, and bring the building back into use. Where structural interventions would be required, the resulting impact on the structure is exaggerated because entire slab zones need to be removed if any portion of the existing ribbed system is overlapped by new vertical penetrations. Refer to Figure 2.3.

Ultimately, the building does not support the level of services required for a modern commercial development, particularly with regards to fire, ventilation and energy performance (Approved Documents B, F, and L respectively).

Volume One concluded that the extent of upgrades required for continued office use, and the quality and quantum of compromised space delivered, would make the resulting product challenging in the leasing market and confirmed that the refurbishment of the existing Euston Tower for commercial use was not a feasible option.

Existing Floorplan



Upgraded Floorplan

Figure 2.3 Diagram showing erosion of floor slab and exaggerated penetrations due to upgrades to meet current Building Regulations

2.2.2 Volume Two - Pathways for Alternative Uses

Notwithstanding the strong policy position which protects against losing existing office space, the following alternative uses were studied for the existing building, refer to Figure 2.4:

- **Commercial developments**
  - Commercial office only (Volume One)
  - Commercial office with laboratory (life sciences / innovation)
- **Residential-led mixed use**
  - Residential with commercial office
  - Residential with laboratory
  - Residential with hotel
- **Hotel/Student Housing developments**
  - Hotel only
  - Hotel with student housing.

For each use a thorough technical assessment was undertaken, and regardless of use, the same primary issues identified in the existing building assessment (building regulations, fire safety, performance) need to be addressed before the building can be brought back to life.

As for offices, the existing structural loading capacity was shown to be sufficient for any of the alternative uses, with the exception of laboratories which require more extensive structure. However, the dynamic response of the structure (how much it vibrates at a microscopic scale) was shown to be more challenging, especially for uses with bedrooms where users are more likely to be sensitive to vibrations.

Fire safety was identified as a challenge for mixed-uses. In addition to providing dual fire escapes, each separate use requires independent firefighting provisions and fire escape routes. Practically this precludes combining more than two distinct uses, as the efficiency of the floor layout would be severely eroded with the additional space required for the independent fire safety requirements.

The ceiling zone required to accommodate modern, energy-efficient building services for residential use was challenging to fit within the height between the existing storeys of 3.2m, while delivering the clear ceiling heights recommended by The London Plan Policy D6, and the Mayor of London's Housing Design Standards published in June 2023.

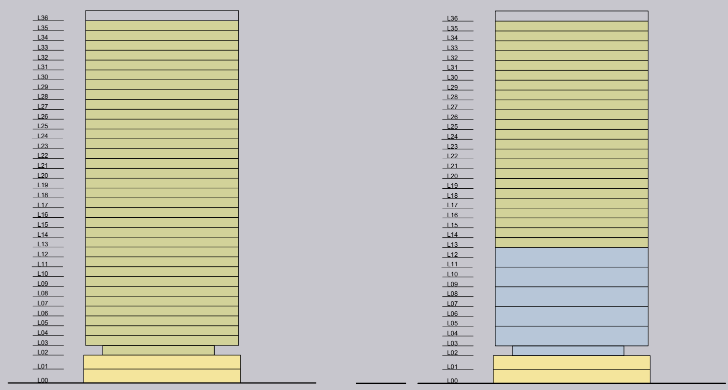
It was shown that this junction of Euston Road and Hampstead Road is also not ideal for residential accommodation, due to the relatively poor air quality and the noisy environment on the junction. An Air Quality Assessment was undertaken and recommended against having openable windows in the lower portion of the tower, which further makes delivering good quality residential apartments in this area difficult. Similarly, the noisy environment due to the 24-hour road noise and the nearby A&E department are not ideal for noise sensitive uses like residential, hotel, and student accommodation.

In addition to the issues outlined above, the resulting floor layouts for residential, hotel, and student accommodation are compromised due to the following:

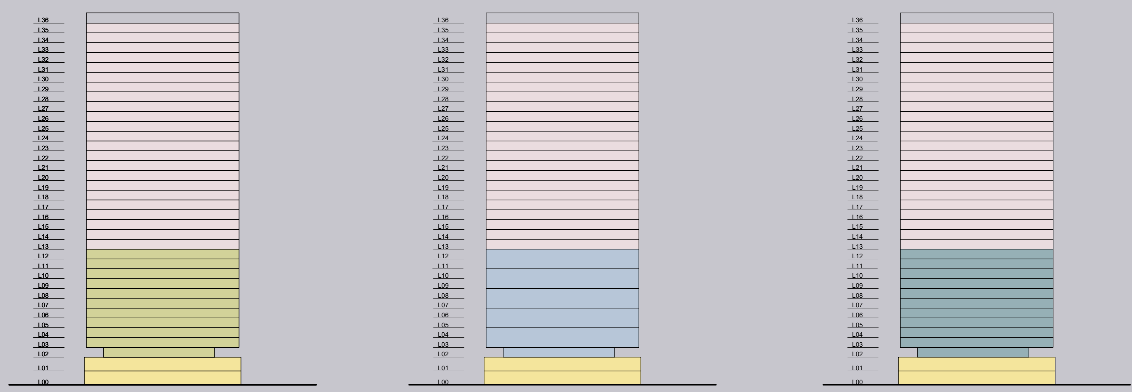
- Several single-aspect units (and some north-only facing meaning they never get direct sun)
- Some self-shaded units due to overshadowing from the shape of the existing building
- Several narrow inefficient units with lots of wasteful circulation space
- In some cases, long corridors with no daylight
- No outdoor private amenity due to wind conditions.

Notwithstanding the policy protection for commercial land use within the Central Activities Zone and the Knowledge Quarter, none of these options were ideal, and if pursued, would generally result in low quality, compromised accommodation that doesn't meet current GLA guidelines, and would be challenging to deliver cost-effectively.

COMMERCIAL-LED DEVELOPMENTS



RESIDENTIAL-LED DEVELOPMENTS



HOTEL / STUDENT HOUSING DEVELOPMENTS

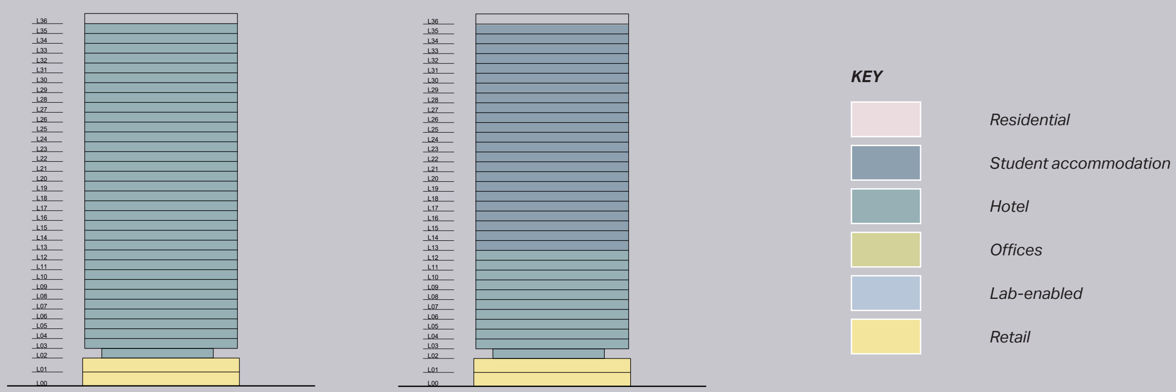


Figure 2.4 Stacking diagrams for use cases explored in Volume Two of the feasibility study

2.2.3 Volume Three - Options for Retention and Extension

It was agreed that the best use of the existing building was continued commercial use, based on the findings of Volume Two of the Feasibility Study.

The following options were studied for delivering the project vision, generating additional value, while retaining as much of the existing building as possible, refer to Figure 2.5:

- **Major Refurbishment**
- **Retention and Partial Extension (Max Retention)**
- **Retention and Extension ("Full" Retention)**
- **Partial Retention and Extension (Disassemble and Reuse)**
  - Retain consecutive slabs (office)
  - Retain consecutive slabs (office and lab-enabled)
  - Retain interstitial slabs (office)
  - Retain interstitial slabs (office and lab-enabled)
  - Retain the core
- **New Build.**

For each option a thorough technical and design assessment was undertaken. The assessments considered: how much of the existing building could be retained (in terms of material and carbon emissions), the quality of the resulting floor layouts (to be attractive to a modern user), future flexibility and adaptability (the tower must be fit for the future), and health & safety (it must be buildable in the safest way possible).

Daylighting levels were assessed, and it was shown that the areas of well-daylit space reduce materially when the size of the floor is extended, even by a small amount. The reduction in well-daylit space is alleviated by increasing the floor to floor height. Increasing the existing floor to floor height to deliver more well-daylit space is necessary to create the high quality spaces that are attractive to large tenants, who are essential to a successful letting strategy for a building of this scale, and to deliver on the environment the Knowledge Quarter is seeking to foster.

Whole Life-cycle Carbon Assessments (WLCAs) were conducted for selected options with varying degrees of existing building retention. For each option, these assessments estimated the total carbon emissions (considering deconstruction, construction, and operation of the buildings) anticipated to be emitted over the building's lifetime, assuming all office use so as to provide a clear comparative assessment. The Retain the Core option has the lowest estimated whole life-cycle carbon emissions when compared with the other options that resolve the floor to floor height issues previously described. This is in spite of the Retain the Core Option retaining 31% (by volume) of the existing structure compared to 42% (by volume) for the Retain Interstitial Slabs option.

On balance, the Retain the Core option is identified to be preferable. This is because it offers the best balance of structural retention, quality, flexibility (it does not inherit many of the limitations of the existing building risking premature obsolescence), and adaptability (a floor system that could be adapted over time and disassembled easily at its eventual end of life). And it does so with a whole life-cycle carbon position that is the lowest of the options that deliver the quality of space which is necessary for the redevelopment of Euston Tower to be successful.

2.2.4 Third-party Independent Review

Throughout the pre-application process, which began in February 2022, there has been constant dialogue and review with the London Borough of Camden.

In April 2023, Camden Council appointed third-party experts to conduct a technical review on their behalf. The full study has undergone review by the appointed third-party assessor, and their report has been issued to Camden.

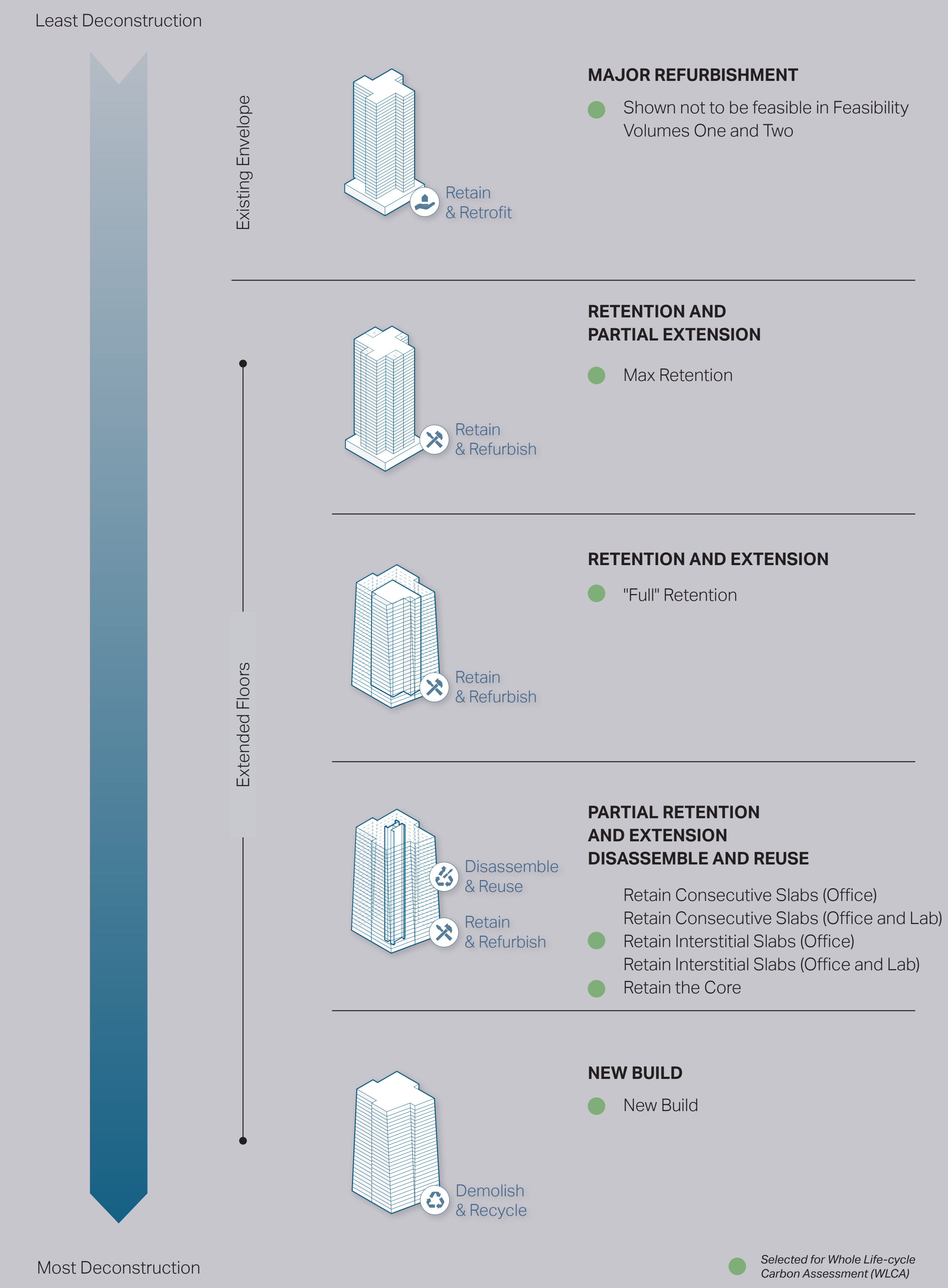


Figure 2.5 Overview of options studied

2.3 Pre-demolition Audit Summary

A Pre-demolition Audit was conducted for Euston Tower in accordance with GLA CE Statement Guidance. It details the quantities and quality of the materials in the building.

Figure 2.6 illustrates the quantity in tonnage of the various materials in the tower. The largest material quantities are concrete, steel, glass, aluminium. Concrete makes up 91% of the total 37,420 tonnes.

The majority of the interior finishes and services have already been stripped out of the existing Euston Tower. These materials are captured in the Pre-demolition Audit showing the route of treatment that the materials have taken.

The four materials in the existing building make up over 98% of all existing materials (by mass). A short description of each of these materials is provided in Figure 2.7.

The remaining materials are quantified, and a recovery route is suggested for each of the materials. From the Pre-demolition Audit it is stated that overall an estimated 98% could be diverted from landfill.

The full Pre-demolition Audit forms part of this planning application and is included in Appendix A.

Material Quantities in Existing Building (tonnes)

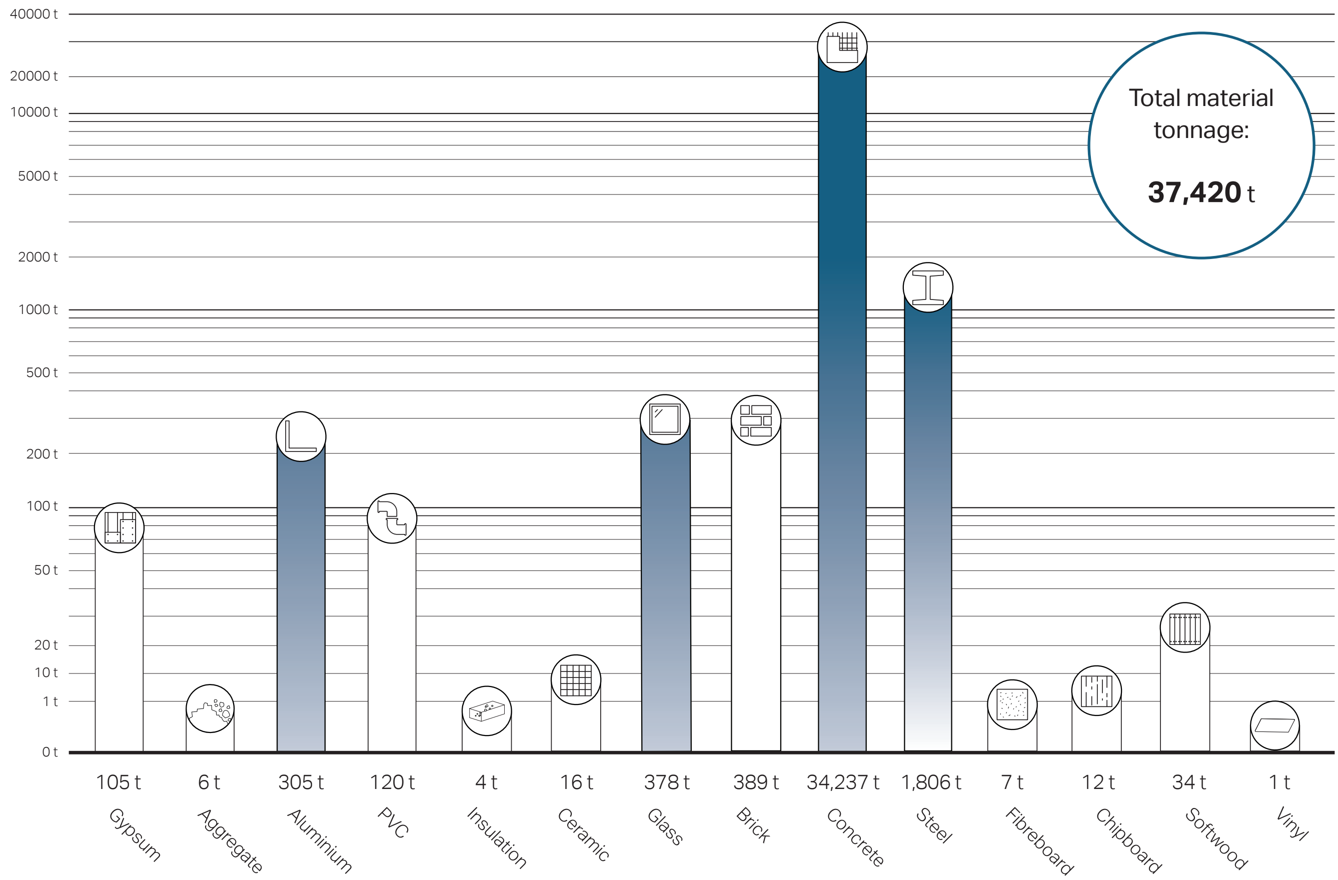


Figure 2.6 Material quantities in the existing building

Main Material Fractions from Pre-demolition Audit

Concrete

Concrete is the largest key demolition product (KDP) identified, estimated to be approximately 34,237 tonnes, equivalent to 3,534 tonnes of CO_2e. This is from a number of sources, primarily from the concrete floor slabs (16,922 tonnes), walls (6,744 tonnes), the columns (4,355 tonnes), and the beams (4,043 tonnes).

Steel

Steel accounts for 1,806 tonnes of material arising from the deconstruction. This comes from a variety of sources, the majority is as reinforcement in the concrete structure (1,717 tonnes). Reinforcing bar is difficult to reuse as it is embedded within the concrete, but it can be effectively recycled.

Glass

Glass is estimated to be 378 tonnes, the majority arising from the external facade (169 tonnes) in the tower, and the associated secondary glazing (161 tonnes). Even though glass is recyclable, current standard practice is to downcycle it to insulation or road paint.

Aluminium

There is an estimated 305 tonnes of aluminium. The mullions and transoms in the facade system make up the largest quantity of aluminium in the building. Aluminium should be prioritised as it is a carbon intensive material, and effectively recycled when segregated appropriately.

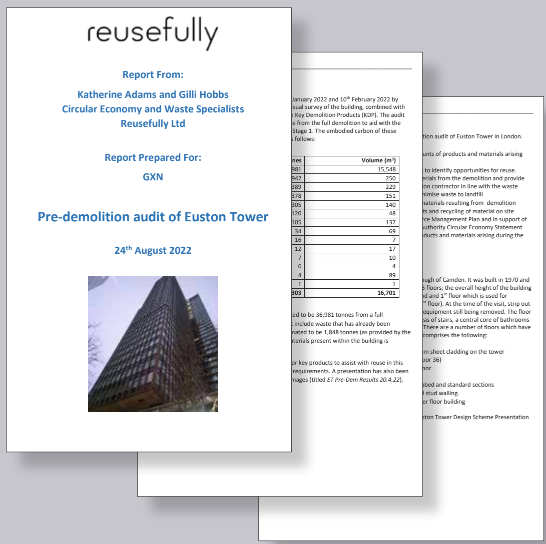


Figure 2.7 Summary of main key demolition products from the Pre-demolition Audit

2.4 Strategy for Material Recovery

2.4.1 General

A detailed existing materials strategy has been produced to compliment the Pre-demolition Audit with the intention of further investigating the implementation of listed "best practice" management of the identified materials.

The purpose of the strategy is to:

- Identify the materials in the existing building quantitatively and qualitatively
- Develop solutions that minimise waste, reduce carbon, and generally maintain or increase the value/utility of materials
- Tell a circular economy story through the reuse and upcycling of materials from the existing tower
- Establish best in class routes for handling the deconstruction materials.

The material strategy hierarchy adopted for the proposed development can be seen in Figure 2.8. Here the “Reuse some stuff” is included to specify how best to take advantage of the existing resources on site. The key deconstruction products identified in the Pre-demolition Audit are described along with potential pathways across the categories of Reuse, Recycling, Upcycling and Downcycling.

As noted in Section 2.3, most of the existing interior fitout, finishes and services have already been stripped out of the building. This has been logged on to BRE’s SmartWaste system and this is captured in the pre-demolition audit. The materials remaining in the building are therefore mainly in the substructure, structure and the facade. Accordingly, the main materials are concrete and steel in the structure, and aluminium and glass in the facade.

By focussing on the key material hotspots, those that are either large in carbon or quantity (or both, see Figure 2.9), the strategy is to move as many of these key materials up the hierarchy, as is technically, practically, and economically possible. This will ensure that the historical carbon emissions associated with these materials is not wasted, and is instead, used beneficially elsewhere.

For more information refer to the full Material Recovery Strategy which forms part of this planning application, and is included in Appendix B.

Material Reuse and Recycling Hierarchy

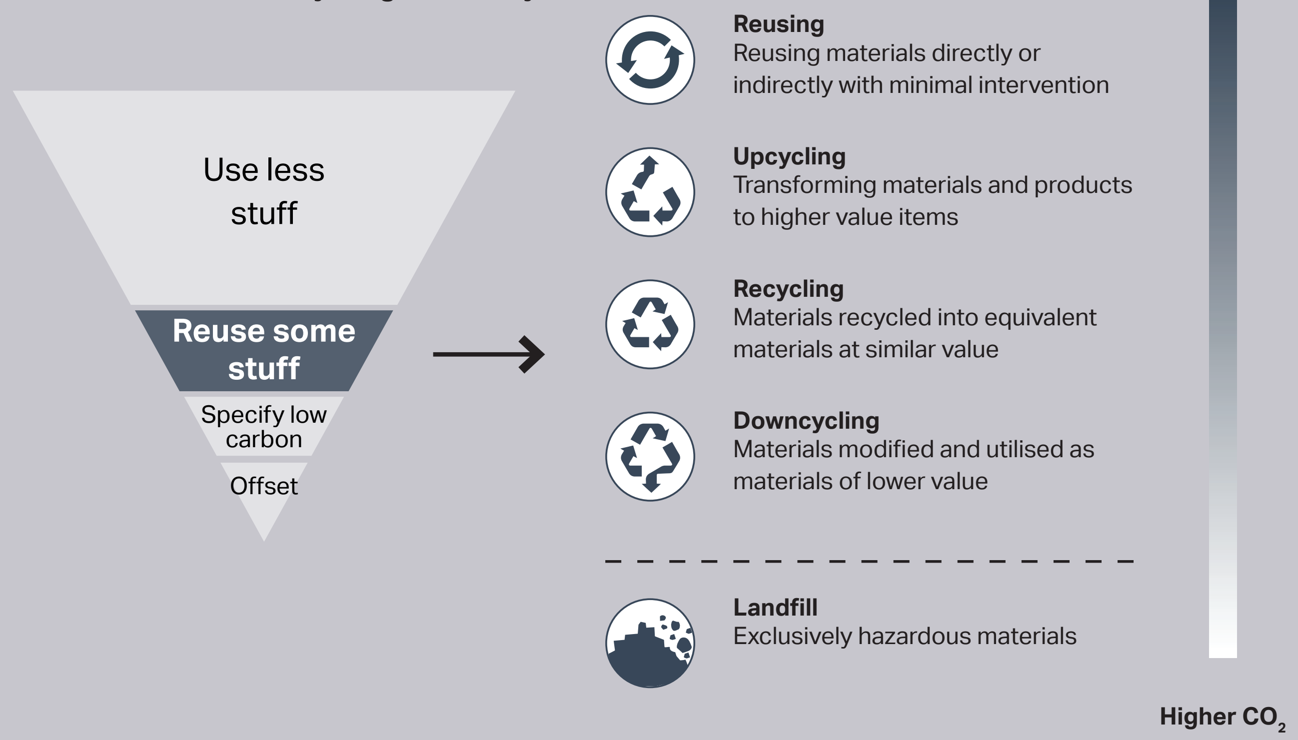


Figure 2.8 *Hierarchy for material reuse and recycling*

Most Impactful Materials for Reuse and Recycling

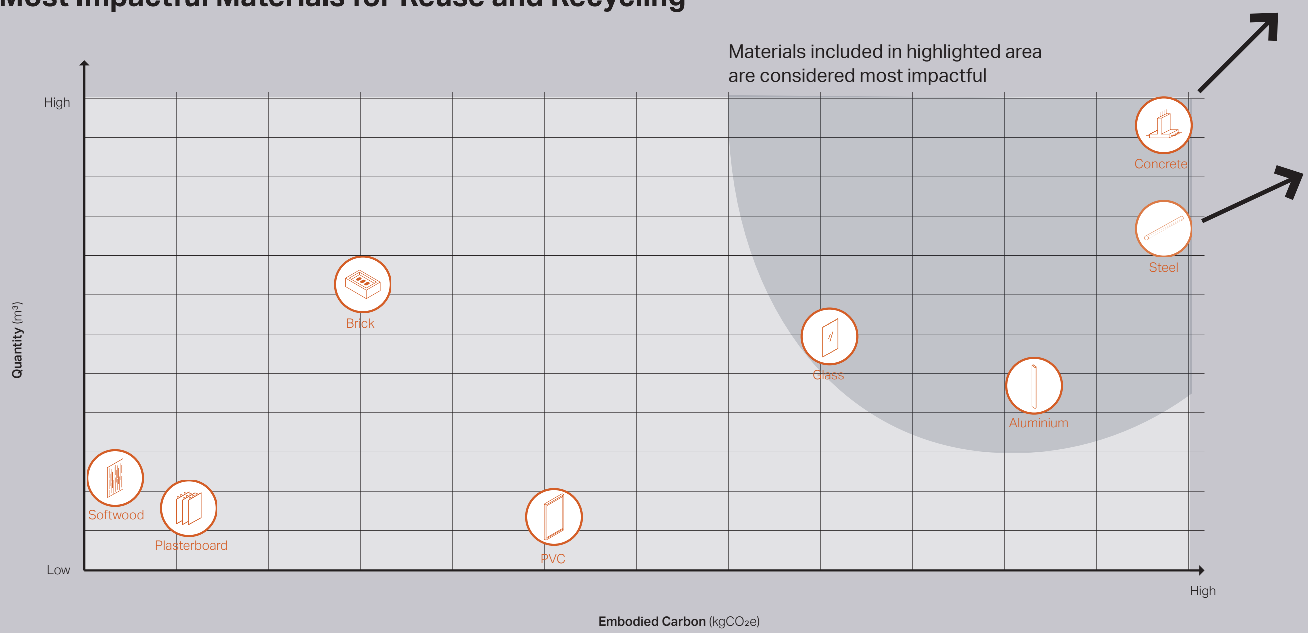


Figure 2.9 *Diagram for identifying key material recovery hotspots*

2.4.2 Prototyping innovative reuse/recycling methods

The proposed development has a pioneering approach to circular economy through prototyping innovative approaches for reuse/recycling of difficult-to-handle materials like concrete and glass from the deconstruction. The proposals are market-leading, having not been conducted previously at this scale, and aim to advance current best-practice. The proposals are in line with the proposed development's ambitions, and will be progressed as far as technically, practically, and economically possible, subject to considerations on project risks, cost and programme.

Concrete

To get the most out of the existing in-situ concrete, the ambition is to test the feasibility of cutting out and reusing the existing concrete slabs in a structural application. Physical tests will be conducted with the University of Surrey to test the feasibility of reusing the mined pieces from the ribbed floorslabs in a new structure.

A roadmap has been laid out of the steps required to enable reuse back into the structure, see Figure 2.10. Current progress is preparing the first specimen for removal and transport to the University.

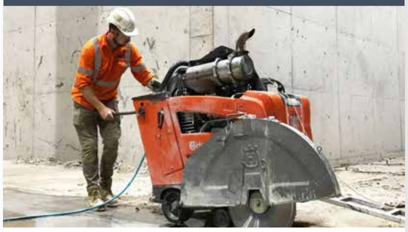
Glass

It is the ambition to get higher value out of the existing facade glass than what is standard practice (downcycling to road paint or insulation). Being the original glazing, the facade glass is unfit for direct reuse. There is an industry demand for high quality cullet (crushed glass that is used as feedstock in glass making) but almost no post consumer recovery is currently undertaken.

Based on the material quantity estimations of the glass materials at Euston Tower, there is a potential to re-manufacture up to 376 tonnes of glass back into the glass float line for use within new flat glass products. This would avoid more than 218 tonnes of CO_2e. The additional carbon implication associated with transport from a regional material dismantler is approximately 13 tonnes of CO_2e resulting in a net avoidance of 205 tonnes of CO_2e. Figure 2.10 presents the roadmap for recovering the existing facade glass.

For more information refer to Appendix B.

Concrete Reuse



Cutting out and reusing in-situ concrete ribbed slabs (reference image)

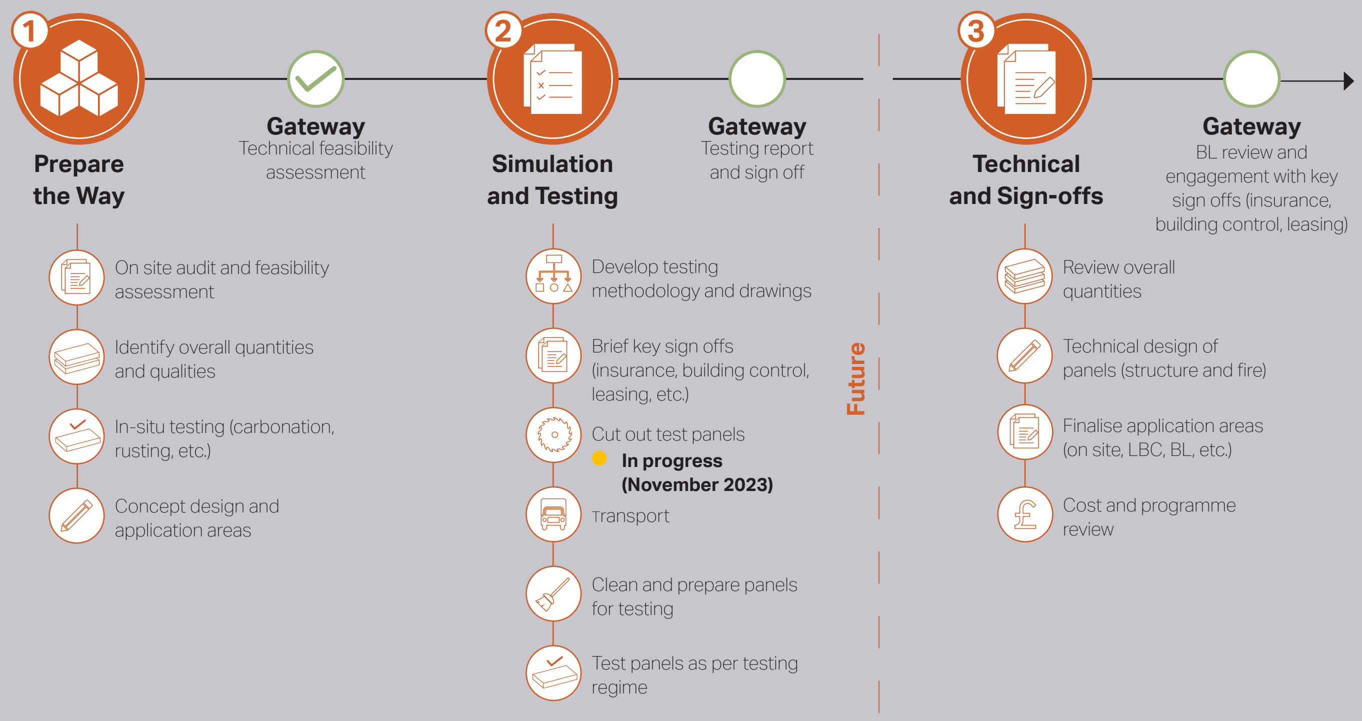
Specimen cut out for testing

Glass Recycling

Class A – clean clear glass cullet with no contamination which can be used back in the float line by re-melting.

Panels dismantled for testing

Roadmap for Reuse of Concrete Slabs



Roadmap for Recycling Facade Glass

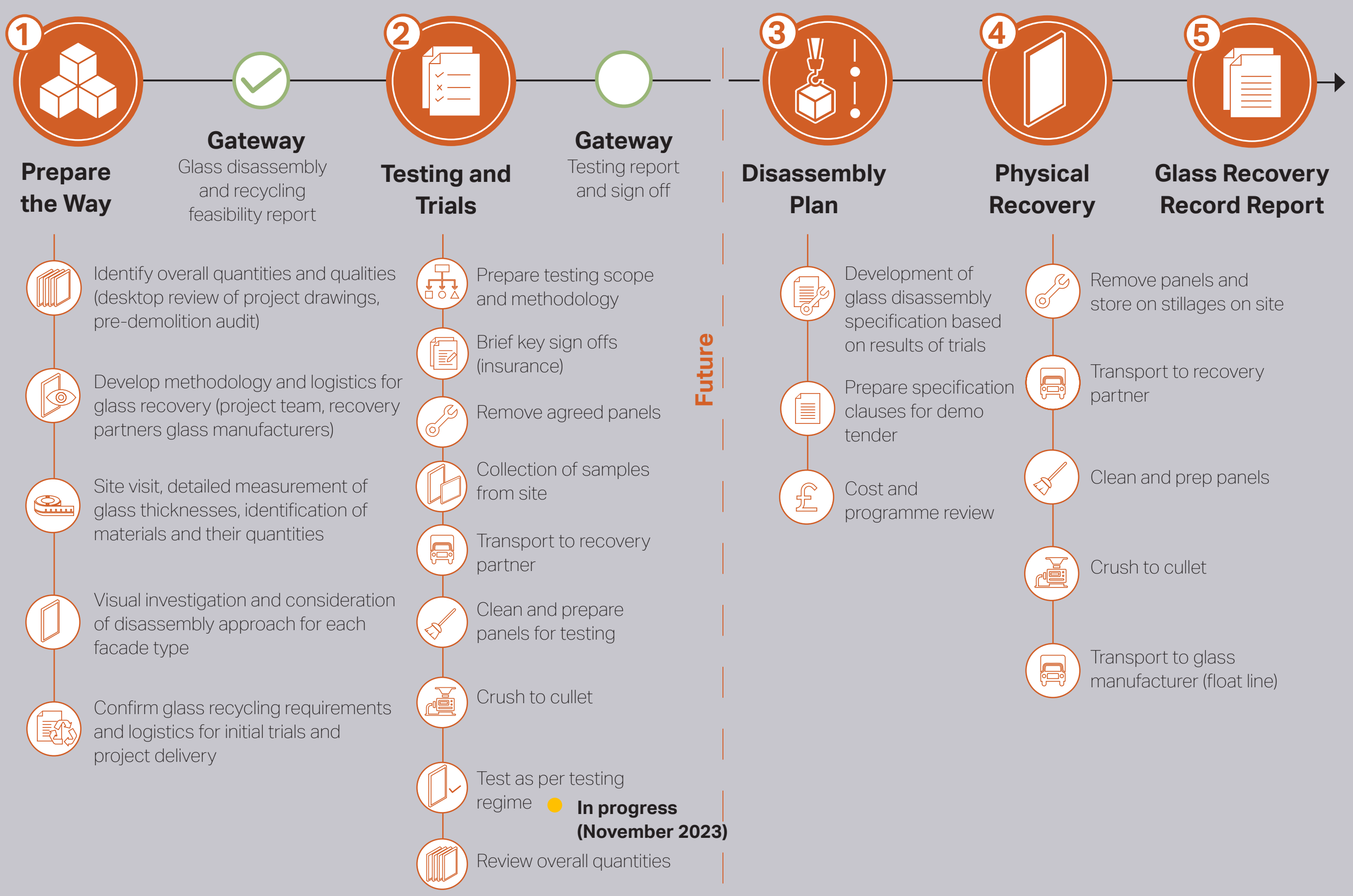


Figure 2.10 Roadmap for reuse of concrete slab (above) and glass recycling (below)

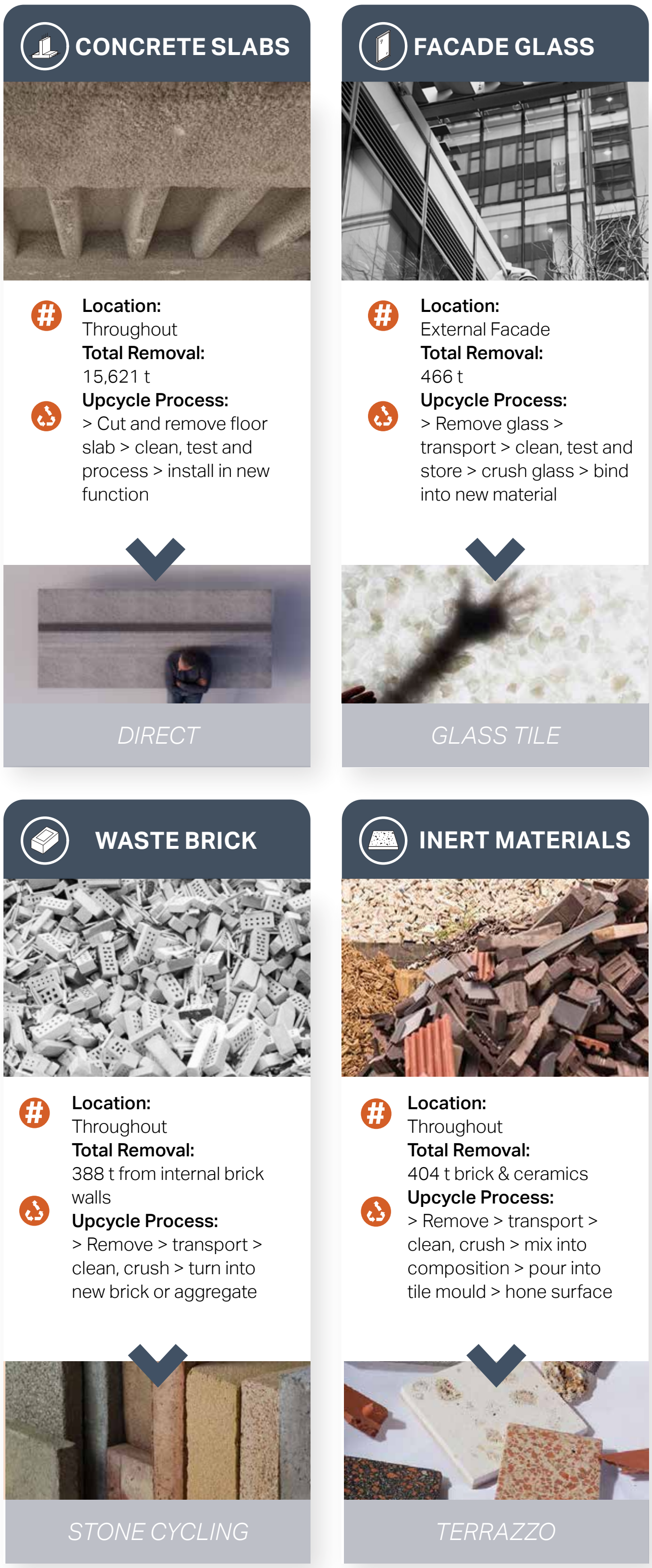
2.4.3 Upcycling opportunities

Upcycling is a strategy for recycling which entails transforming products and materials into higher quality and/or higher value products and materials. The final aim is to convert waste into new materials and products by re-manufacturing in ways that reduce demand for extracting raw materials from the natural environment.

As noted in Section 2.3, most of the existing interior fitout, finishes and services have already been stripped out of the building. The materials remaining in the building therefore mainly comprise the big material fractions such as concrete, steel, aluminium and glass.

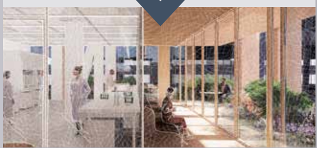
The upcycling opportunities focus on the few items still left in the building that have a potential for being reused either directly or with re-manufacturing, as well as presenting opportunities for products that can provide storytelling around the circular economy.

An overview of select upcycling opportunities are presented in Figure 2.11. For more details refer to the Material Recovery Strategy in Appendix B.



INTERNAL GLASS

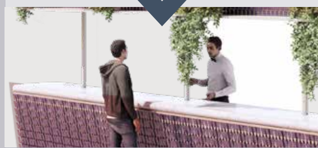
Location:
Ground Floor Level
Total Removal:
831 m^2
Upcycle Process:
> Remove glass > clean, test and store > sell to external buyer or re-install as glass partitions



GLASS PARTITIONS

PODIUM TILES

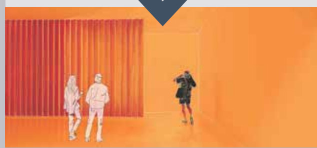
Location:
Podium Exterior Columns
Total Removal:
131 m^2
Upcycle Process:
> Remove from columns > clean, test and process > install in new function



REPURPOSED TILE

WIND CANOPIES

Location:
Wind Canopy
Total Removal:
16 t
Upcycle Process:
> Cut and remove canopy > clean and cut into fins > install in new function



CLADDING

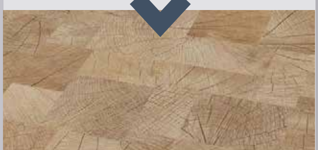
SPRINKLER PIPES

Location:
Levels 1 and 2
Total Removal:
TBC
Upcycle Process:
> Cut and pipes > clean, test and bend > bend and fix into bike racks

BIKE RACKS

TIMBER STRUTS

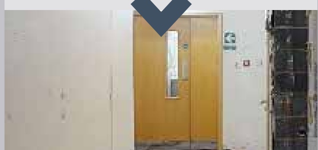
Location:
Levels 3 - 34
Total Removal:
26 t
Upcycle Process:
> Remove > clean, cut, layout in tiles > fix and sand > install



END GRAIN TIMBER

TIMBER DOORS

Location:
Throughout
Total Removal:
4 t
Upcycle Process:
Direct reuse with reuse partner



TIMBER DOORS

SOFTWOOD

Location:
Timber joinery & doors
Total Removal:
4 t
Upcycle Process:
> Remove and clean > reform into furniture > deliver to user

TIMBER FURNITURE

Figure 2.11 Select upcycling opportunities for products and materials from the existing building

3

Euston Tower

Strategy for the New Development

3.1 Circular Economy Approach

3.1.1 Design approaches for new buildings

The circular economy decision tree for design approaches for new buildings described in the GLA Circular Economy Statement Guidance has been used to assist the design team in choosing the most appropriate design approach for the new building. Refer to Figure 3.1.

One of the main circular economy drivers for the design of the proposed development is to ensure that the proposed development will not suffer the premature obsolescence experienced in the existing tower, and others of its time. The overall aim is therefore to design a tower that responds to today's demands, and can flex and be adapted to remain fit for purpose long into the future.

The proposed development is designed to deliver best-in-class office space, including the Level 03 - 11 lab-enabled storeys that can accommodate a wide range of future workspace fit-outs depending on occupier demands.

It is unlikely that the building would need to accommodate a significant future change in use/function given its location, however to ensure a tower fit for purpose for an extended lifespan, design considerations have been made to best accommodate uncertainty in the future requirements to the functionality of the proposed development.

This is primarily accounted for by incorporating adaptability and longevity principles in the design. More specifically, the substructure and superstructure are designed to allow for a range of loading regimes, and can be adapted to accommodate future changes in loading and spatial requirements in a non-destructive manner.

The remaining building layers are designed to be generally independent from the primary structure, facilitating their respective maintenance and/or replacement that does not result in damage to the structure.

GLA Circular Economy Decision Tree for New Buildings

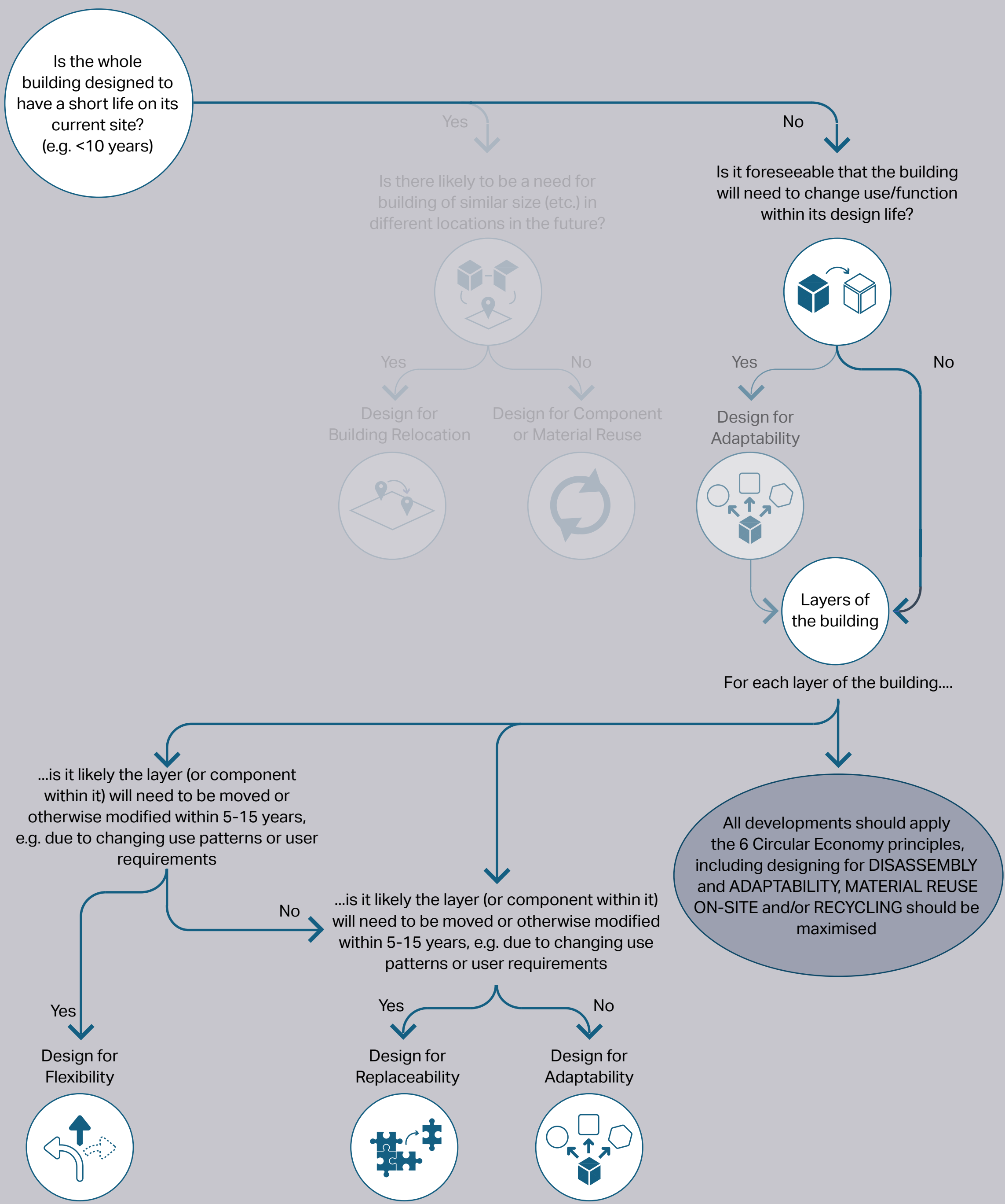


Figure 3.1 The circular economy decision approach decision tree for new buildings from the GLA Circular Economy Guidance

3.1.2 Ensuring "good bones"

The circular economy principles are considered across all of the building layers, and a particular focus has been put on ensuring "good bones" for the proposed development.

"Good bones" describes a building where the core foundational elements are well-designed, high-quality, long-lasting, and flexible.

The overall strategic design approach, as described in 3.1.1, is to design a tower for adaptability and longevity.

The longevity of the other building layers (facade, services, etc.) is predicated on the longevity of the structure. If the structure cannot be easily adapted to changing requirements, the strategies employed for the other building elements are unlikely to mitigate significant waste and avoid premature obsolescence. Therefore designing in principles for longevity and adaptability are particularly impactful in the structure.

Accordingly, the structure (and site) may be considered foundational in the circular economy approach, while the other building elements may be considered as operational.

Ensuring "good bones" gets the foundational elements right. It is clear that an adaptable structure is key to minimising waste and avoiding premature obsolescence across all building layers.

This foundational and operational approach is shown diagrammatically in Figure 3.2.

3.1.3 Structural adaptation approach

As with any change, different time horizons demand different responses for how to accommodate change. This is because we are less able to predict requirements and demands the further they are in the future. The structure has been analysed across three distinct time horizons:

- Short term <25 years
- Medium-long term 25 - 100+ years
- End of life 100+ years.

This approach is shown diagrammatically in Figure 3.2.

Short term changes are those that respond to relatively small, and possibly relatively frequent, occupier demands. These changes can occur during leases, or in between leases of different occupiers, such that they may occur several times throughout a building's lifespan, often less than 25 years. These types of changes are considered more invasive than allowing for layout flexibility, and should be accommodated in a way that minimises waste, but do not interfere with the overall building operation. These changes are likely to include structural adaptations such as:

- New double height spaces
- New stairs or other vertical connectivity
- New risers.

Medium-long term changes are those that respond to relatively major, and less frequent, geometric changes. These are unlikely to occur at a cadence of less than 25 years, and possibly only once or twice during a building's lifetime. Accommodating such change is key to preventing premature obsolescence and minimising waste. These types of changes are considered as invasive, and are likely to occur with a period of interference to the overall building operation. These changes are likely to include structural adaptations such as:

- Adding/removing terraces
- Adjusting floor to floor heights
- Change of use
- New lifts or central risers.

Strategies to address this type of change are described in under the longevity principles, see Section 3.2.4.

End of life considers solutions for maximising value when the building is no longer required. This is addressed through design for disassembly principles, see Section 3.2.6.

Designing for "Good Bones" by Enabling Structural Change

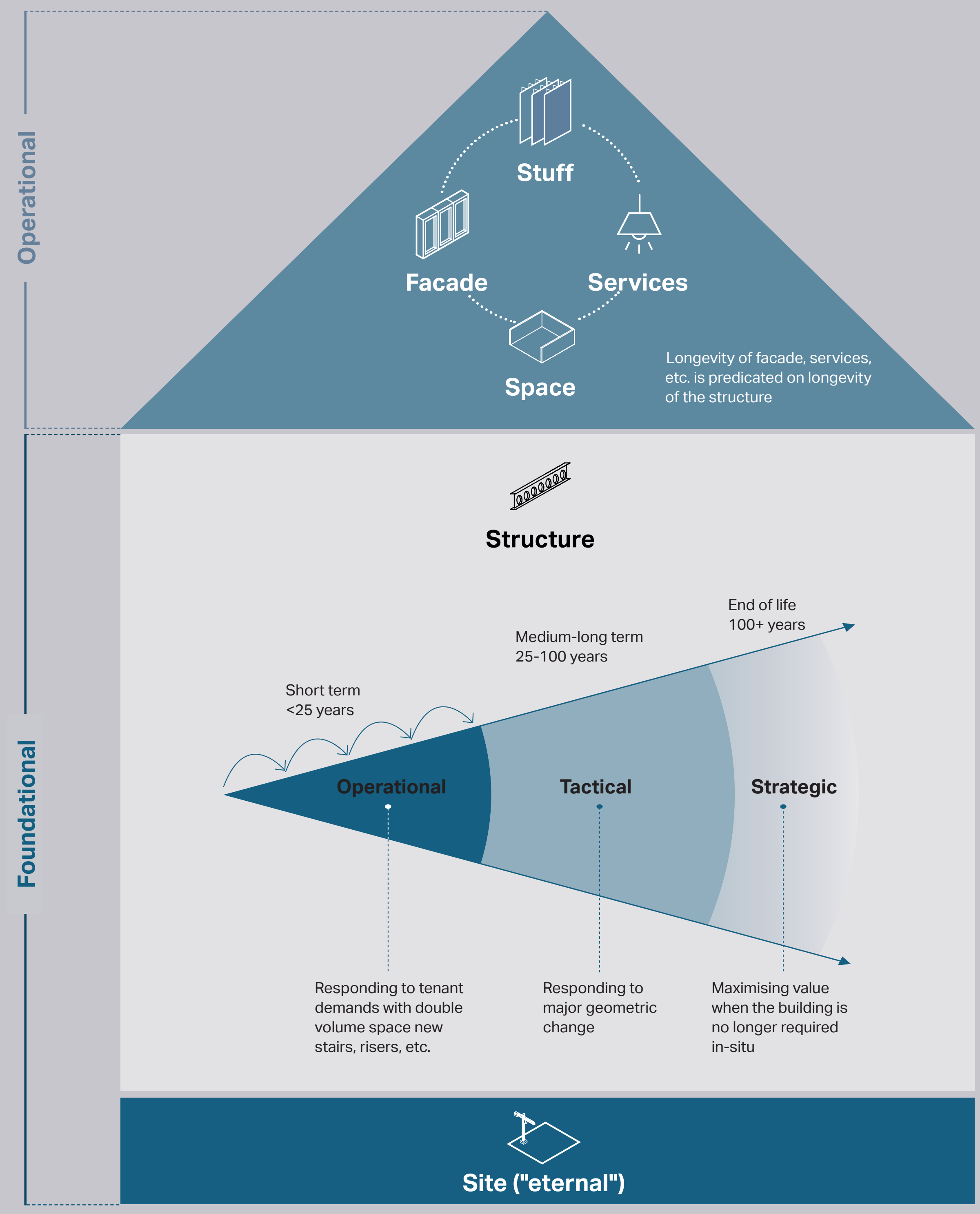


Figure 3.2 Foundational and operational adaptability and timeline for structural change

3.2 Design Principles by Building Layer

3.2.1 Building in layers

The proposed development considers the inherent properties of the building's different layers, as described by Stuart Brand in *How Buildings Learn*.

Figure 3.3 shows the defined building layers with approximate lifespans and associated whole life-cycle embodied carbon emissions percentages based on current estimates (refer to the *GLA Whole Life-cycle Carbon Assessment Template prepared by Sweco dated December 2023*).

This is used to determine the focus areas of the various design principles, both in terms of relevance for the principles regarding lifespan, as well as the degree of impact in the related embodied carbon emissions.

3.2.2 Circular economy design principles

The circular economy design principles are considered across all building layers. As shown in Figure 3.3, some principles are only addressed with solutions in some of the building layers, as appropriate.

Designing out waste is addressed with solutions across all layers.

Adaptability is considered in the design of the superstructure, facade, and services. The structural system aims to allow for future adaptability, both regarding short term changes such as vertical connectivity, as well as medium-long term changes such as changes in building geometry or functionality. This is achieved with a soft core, regular structural grid, and an adaptable floorplate system. The facade enables this adaptability through a component-based construction with mechanical fasteners that can be non-destructively decoupled from the structure.

Design strategies that enable in-use flexibility are included in the superstructure, services, and space. This is addressed through structural uniformity (generous and regular structural grids), an all-air ventilation system without ductwork, and minimal high-level servicing, enabling changeable layouts depending on tenant needs. The services also provide flexibility for future changing requirements with on-floor air handling units that enable the ability to locally turn down and/or shut-off unoccupied floors.

Design for replaceability is relevant for the services, facade, and space, where upgrades may be required for the sub-elements of a system or module with shorter technical lifespans than the whole. The services and space plan are designed with exposed and independent layers enabling easy access for maintenance or replacement. A unitised facade composed of discrete elements enables replacement of individual elements (e.g. re-glazing of insulated glazed units).

In all layers of the building expected to be partly, or fully, deconstructed at the end of the building's lifespan, design for disassembly principles should be considered. Particularly for the building layers with the potentially greatest material intensity and highest impacts (superstructure and facade), disassembly strategies are embedded in the design. A unitised facade design with mechanical connections, and one that is decoupled from the primary structure, allows for future non-destructive disassembly. The steel frame is designed with bolted connections to facilitate disassembly, and it is an ambition contingent on the structural floor system progressed, that the floor system is designed with an aim of minimal wet works to further aid disassembly and recovery at end of life. On-floor ventilation enables ease of replacement and disassembly of ventilation plant without impacting the remainder of the building.

In the building layers with the longest anticipated lifespans (substructure and superstructure), design for longevity strategies are addressed, aiming to avoid future obsolescence through enabling adaptations to changes in future functionality or use with minimal damage. In the building layers with shorter lifespans (facade, services, and space), there will be a focus on specifying durable materials and enabling ease of access for maintenance to prolong lifespans where possible.

Sections 3.2.3 - 3.2.7 outline in further detail the integration of the circular economy design principles in the proposed development.

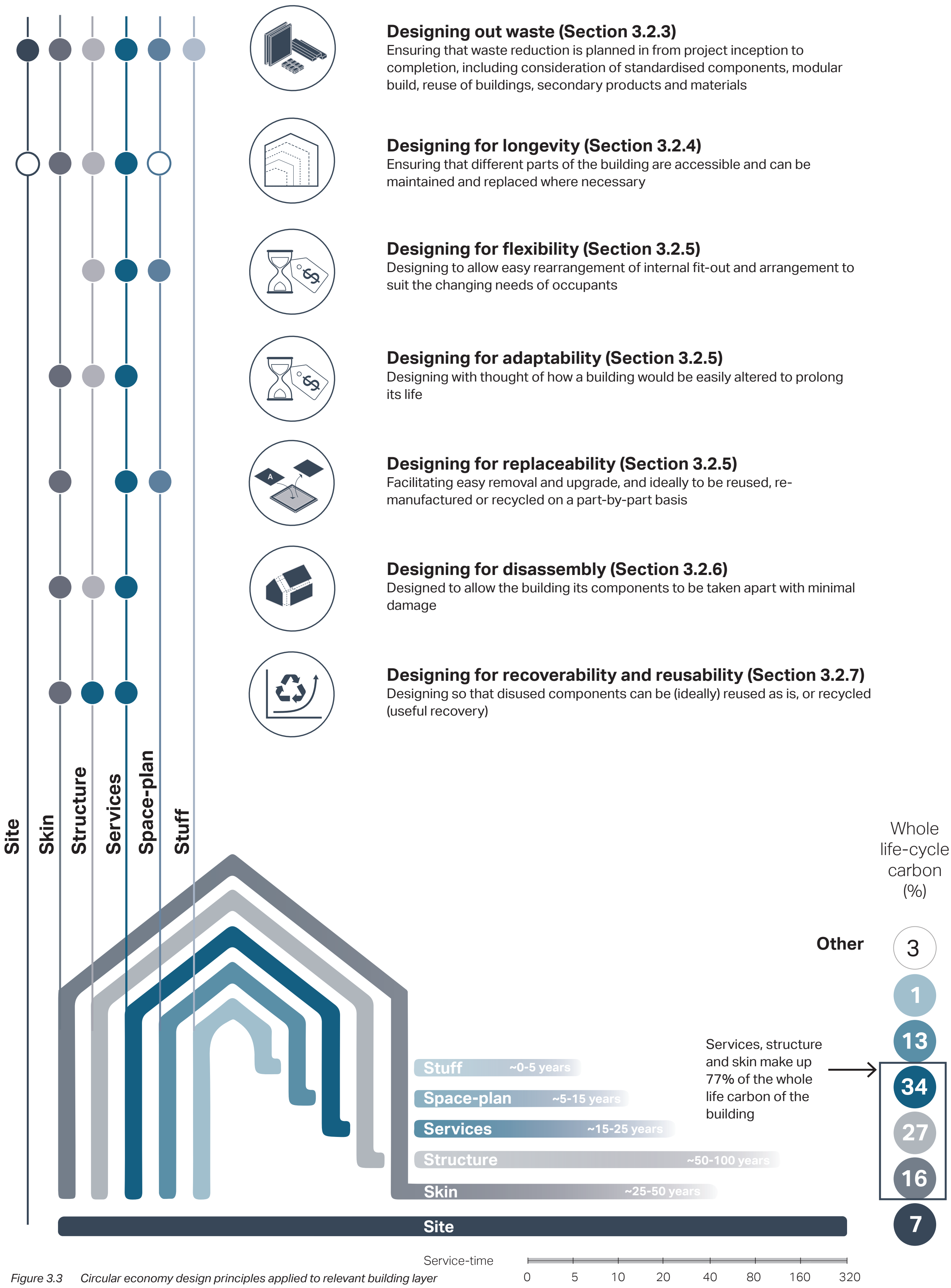


Figure 3.3 *Circular economy design principles applied to relevant building layer*

3.2.3 Designing out waste

The principle of designing out waste is applied to all building layers in the proposed development. It also covers all stages of the building's life-cycle. For the site, substructure, and superstructure, the effort lies in designing out waste at production and construction (though it is inherently considered in structural adaptability), whereas for the services, facade, and interiors, the in-use waste is equally addressed.

Site
Excavation work will be carried out for part of a new basement, however the retention of the foundations and basement will reduce the total amount of excavation work needed on site. In total approximately 15,204 m^3 of material is anticipated to be generated in the excavation. Out of this, the target is to ensure 95% will be put to beneficial use in line with the London Plan Policy SI 7.

Opportunities for reducing waste in the design of the public realm and landscape are being considered through reuse of the deconstruction waste in landscaping items (e.g. mounds, street furniture, etc.).

Substructure
The existing foundation and basement will be retained in the proposed development so far as possible, and the extent of new basement minimised. This will significantly reduce the amount of new material required for the substructure, as well as the amount of deconstruction waste.

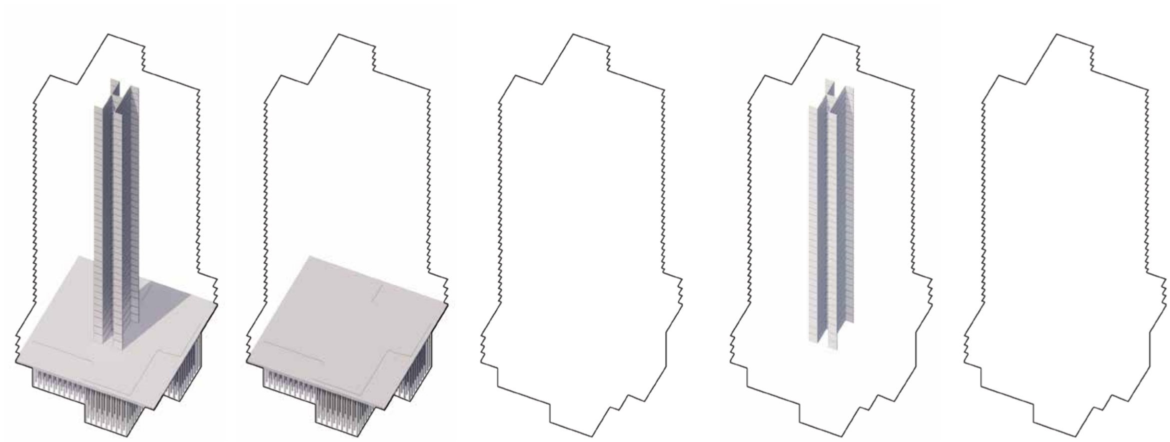
In the same way that the existing foundation and basement are being reused, the foundation and basement in the redevelopment are expected to last beyond the lifespan of the proposed development. This unlocks the potential for repeated direct reuse, providing benefits beyond the system boundary.

Superstructure
The retention of the existing central core reduces some of the waste related to the deconstruction of the existing superstructure. The proposed superstructure is designed as a lightweight steel structure, with a focus on rationalisation and material use reduction. The relatively lightweight steel construction minimises loads on the existing (and new) foundations, and is so designed to ensure compatibility with the existing foundation design.

All reinforcement bar contained in the superstructure concrete elements will contain high proportions of recycled content (ca. 98% recycled content). It is also the ambition that all structural steel elements, except connections, plate, and any fabricated elements, are to be procured as Electric Arc Furnace (EAF) steel with high recycled content (above 90%). In areas where the structural spans allow for it, the aim is to procure reused steel elements. This is however subject to availability of supply and will have to be procured on a just-in-time basis. Actions to implement these measures will include early engagement with the supply chains to mitigate procurement risks so far as possible.

The steel frame is designed to use elements of standard dimensions, and with bolted connections to enable future disassembly. In the design of the structural floor system, and contingent on the structural floor system progressed, there is an ambition to minimise wet works for ease of disassembly, and to allow for future recovery and reuse, reducing waste at deconstruction (see Section 3.2.6).

Structural Retention of Existing Building Elements (By Volume)



	OVERALL	FOUNDATION	SLAB	CORES	COLUMNS
Material Volume	**7,583** m^3	**6,000** m^3	**0** m^3	**1,583** m^3	**0** m^3
Ratio by Volume	**31** %	**24** %	**-** %	**6** %	**-** %

Figure 3.4 Retention of structure broken down by structural element (by volume)

Temporary Propping of Retained Core

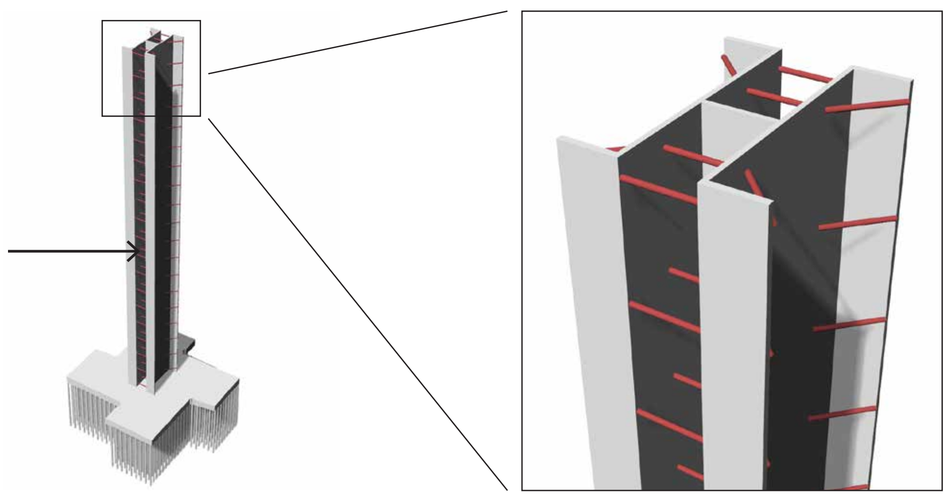


Figure 3.5 Early sketch of temporary propping to enable retention of the existing core

Shell/skin
The facade is designed with standard dimensions and modularity, to enable off-site pre-fabrication of repetitive elements. This minimises construction waste, as well as improves health and safety on site. These standardised facade components will aid in-use upgrades and reuse.

The facade system is designed with mechanical fasteners (between elements), and bolted connections to the structure to minimise waste during deconstruction. This optimises the potential for future reuse and recycling (see Section 3.2.6).

Material selection is carried out with a focus on high reusability/recyclability.

Services
The ventilation system consists of an all-air system and on-floor air handling units (AHUs). The number of AHUs is chosen to obviate the need for underfloor ventilation ductwork (the raised floor acts as a pressurised plenum), thereby minimising ductwork throughout the building.

No terminal units are needed in the servicing design since the all-air system provides both ventilation, and heating and cooling. This reduces waste as terminal units are often replaced during fit-outs.

The absence of on-floor ductwork and minimal high-level servicing, enables changeable layouts without generating MEP waste (where services are reconfigured), and reduces the number of in-use replacements and maintenance required.

The soffit is designed to be visible, enabling exposed services to ease access for removal and replacements of the minimal high-level services (limited to lighting, detection, etc.).

Space
The floor system is designed with a good quality flat soffit to avoid the need for ceilings. Subject to availability, the proposed development will aim to procure reused raised access flooring where there is no need for a pressurised floor plenum. The risk on availability of supply of the quantum of reused raised access flooring will be mitigated through early engagement with supply chain.

In highly trafficked areas, such as lobbies, publicly available space, and amenity spaces there will be an enhanced focus on robust and durable materials.

Stuff
Opportunities for omitting/minimising Cat A will be explored in future stages to minimise potential future waste.

Construction stuff
The strategy for construction waste management will involve methods of waste elimination and reduction. These construction waste materials may have alternative uses elsewhere on the site and will mostly be inert or environmentally benign. Any opportunities to maximise the recycling potential of construction materials will be investigated.

A Construction Management Plan (CMP) has been prepared to help minimise construction impacts (refer to *Construction Management Plan prepared by Velocity Transport Planning dated December 2023*). A Resource Management Plan (RMP) will be prepared to set resource efficiency targets in line with BREEAM Wst 01.

Plans to prove and quantify
A thorough feasibility assessment, including Pre-demolition Audit, has been produced to quantify options for existing building retention and the materials arising from the deconstruction.

Waste targets will be included as a contractual requirement in the Contractor Preliminaries. This includes requirement to record and report construction waste arisings in the Resource Management Plan (RMP).

New materials to be tracked as part of BREEAM sustainable procurement process. A BREEAM-compliant Sustainable Procurement Plan will be produced before the end of RIBA Stage 2.

Material strategies will be tracked as part of the BREEAM Mat 06 process.

Early identification of potential end of life routes for key reusable materials will be captured in Material Passports. The data for key reusable products will be collected and stored in a Material Passport.

Process for Fabrication and Assembly of Facade Modules

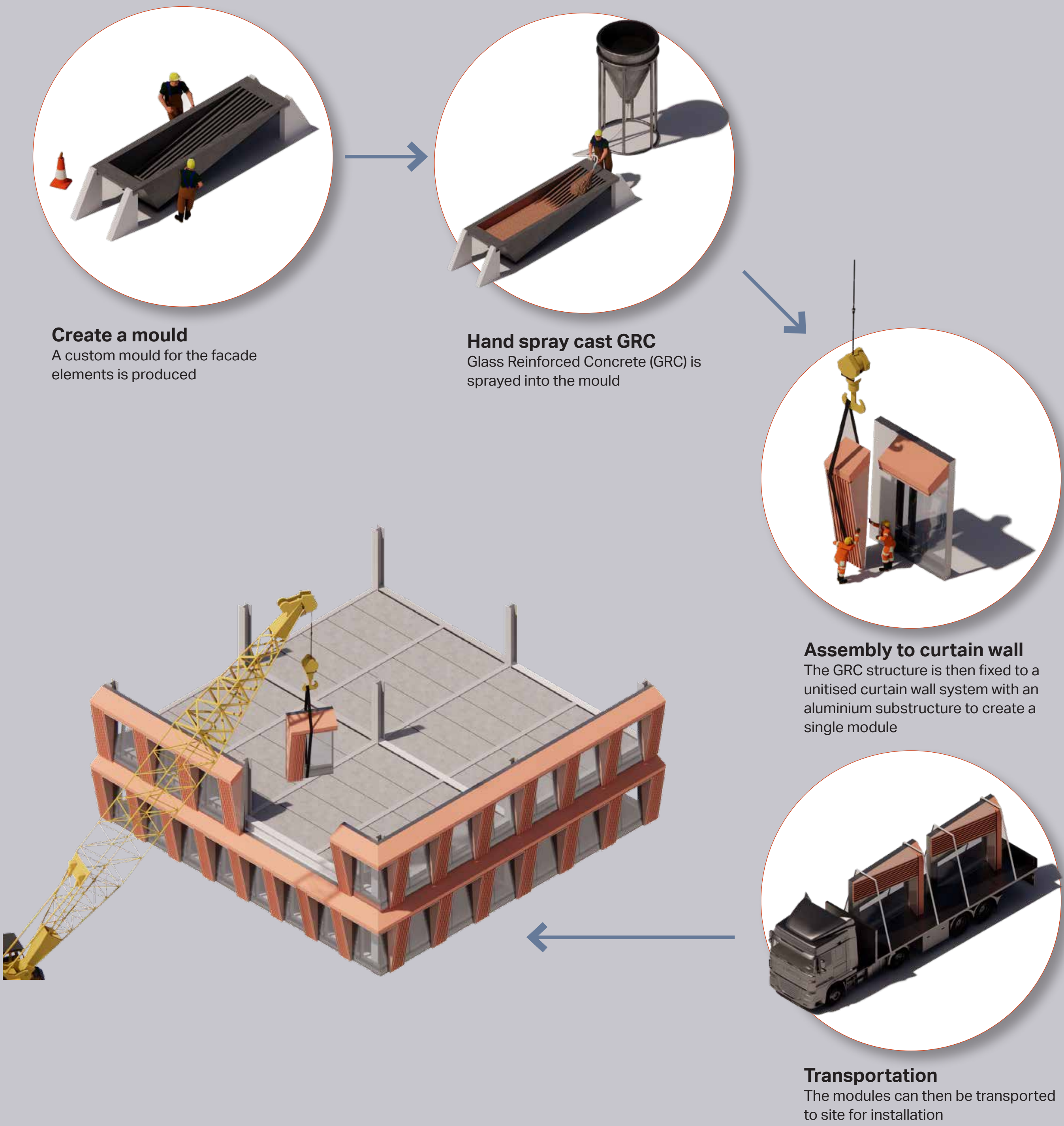


Figure 3.6 Process for fabrication and assembly of facade modules

3.2.4 Designing for Longevity

The principle of designing for longevity is a key principle for the proposed development, and is informed by the learnings from the challenges found in preventing the premature obsolescence of the existing tower.

Design considerations have been focused on the building layers that have an impact on the long-term functionality of the building (the structure, skin/shell, and building services), and which contribute to most to the whole life-cycle embodied carbon.

Structure
The structure has been designed to provide high flexibility in-use and potential for adaptations through a soft core, regular structural grid, an adaptable floorplate system, and a generous floor to floor height.

In order to minimise the load on the existing foundation, and thereby prolong its lifespan, a load-balancing approach has been adopted. The superstructure is designed to be relatively lightweight with most of the additional structural loads landing outside the footprint of the existing foundation. The new substructure is furthermore designed to ensure compatibility with the existing foundation design.

The global stability system is based a soft core approach (see Figure 3.8) that enables future adaptations (e.g. introduction of new risers at the central core) without compromising the global structural integrity.

The structure is designed to adapt to short term and medium-long term changes (see Section 3.2.6) in a non-destructive way and without compromising the structural integrity in order to prevent premature obsolescence.

Shell/skin
The modularity of the facade design (as discrete elements) allows for replacement of individual units, avoiding extensive demolition of the facade where replacement is required. The facade materials will furthermore be specified with a focus on high durability and robustness e.g. glass reinforced concrete (GRC) is currently considered as a durable solution for the facade cladding. Different facade elements have different lifespans and it should be possible to replace shorter lifespan elements (e.g. re-glazing of insulated glazing units) in-situ to extend the overall lifespan of the facade.

Services
Building services generally have a shorter lifespan than the structure and the facade, both due to durability of materials and systems, but also due to technical and regulatory development which may require upgrades to systems.

To optimise the longevity of the building services in the proposed development, accessibility to aid maintenance and replacement of certain components is promoted. This is achieved through a soffit design that allows for exposed services, and adequate maintenance space in plant rooms.

The longevity of the overall systems is also being considered. The ventilation system is designed with fresh air rates exceeding statutory requirements, thereby including capacity for future change of use or need. The heating and cooling systems, as well as stormwater drainage, are designed with an allowance for future climate change.

Space/Site
In highly trafficked areas, such as lobbies, publicly accessible space, and amenity spaces, there will be an enhanced focus on robust and durable materials. Likewise, in the design of the public realm there is a focus on selecting materials with high durability.

Plans to prove and quantify
New materials to be tracked as part of BREEAM sustainable procurement process. A BREEAM-compliant Sustainable Procurement Plan will be produced before the end of RIBA Stage 2.

Material strategies will be tracked as part of the BREEAM Mat 06 process.

Designing a Tower for Future Uncertainties

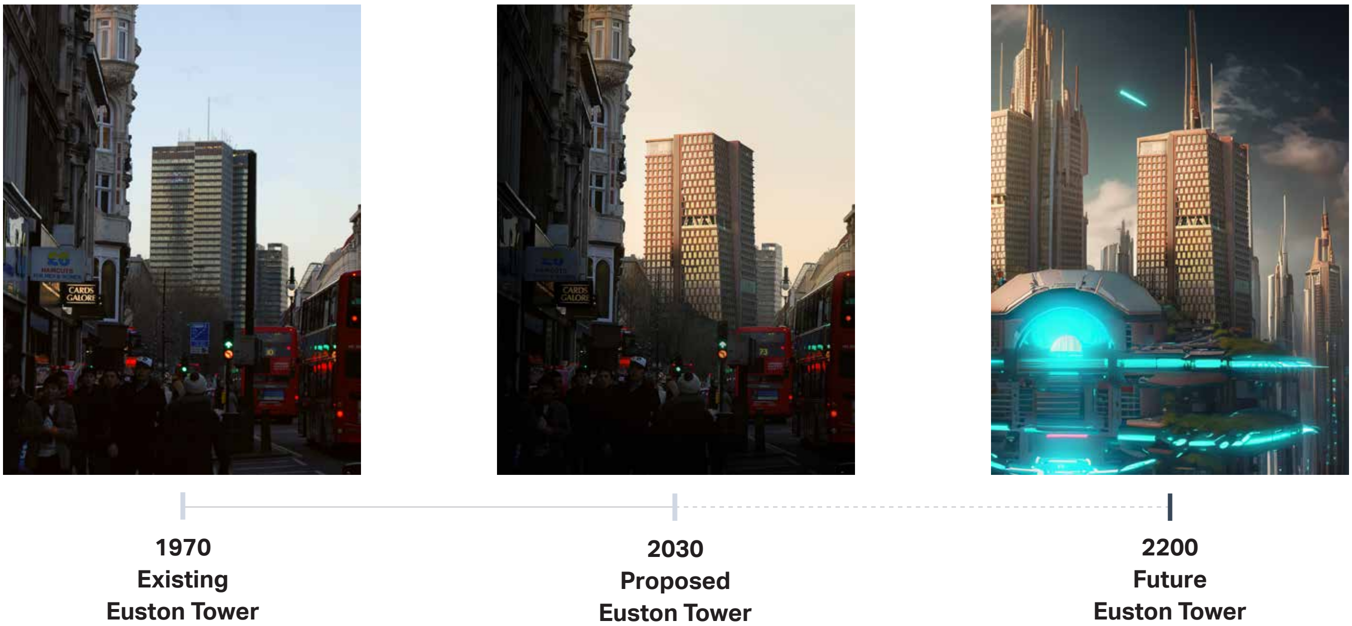
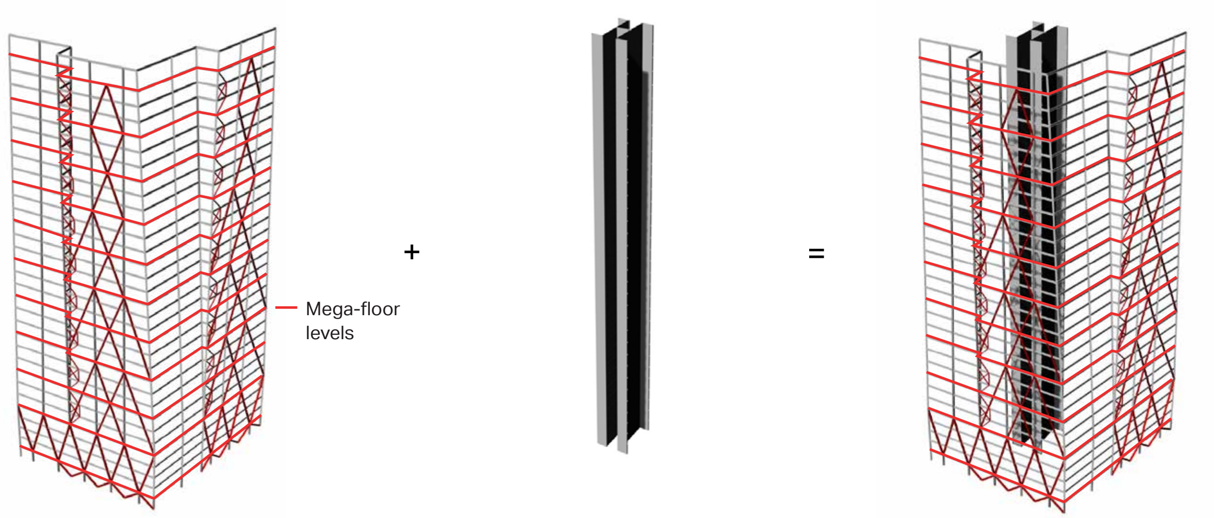


Figure 3.7 The aim with the proposed development is to consider future uncertainties to prevent premature obsolescence

Global Stability System and Soft Core Approach



Perimeter braced frame

The perimeter braced frame is designed to limit deflection due to wind and to resist the global overturning moment in the ultimate limit state.

Existing central core

The existing central core works to transfer lateral loads from interstitial floors to the perimeter bracing through the mega-floors

Global stability system

The existing core elements contribute to local stability by transferring loads to mega-floor levels

Figure 3.8 Perimeter braced frame enables the soft core approach

3.2.5 Designing for Flexibility and/or Adaptability

The principles of designing for adaptability and/or flexibility have been applied to multiple layers of the proposed development, and are key drivers to ensure that the building is fit for purpose and can be easily adapted to prevent premature obsolescence.

Superstructure
The structure is designed with a regular structural grid and open floorplates to accommodate short term flexibility in the layout such as changing tenant workplace fit-outs.

The central core is designed as a soft core that is not part of the global stability system. It therefore enables future changes such as additional lifts, risers, etc. without impacting on the global structural stability system.

Levels 03 - 11 are designed as lab-enabled spaces, which is achieved through a structural design that allows for the heightened vibration criteria, and an increased floor to floor height to accommodate required servicing provisions. These floors are flexible and can equally function as standard commercial office.

The proposed development aims to adopt adaptable floorplates in the structural design, that enable local changes in connectivity such as double height spaces, as well as more significant geometric or spatial changes such as new terraces or changes in future building use, while minimising waste. Refer to Section 3.2.6 for details.

Shell/skin
The facade is designed with operable vents to enable natural ventilation, making it adaptable to changing patterns of use. The modular design of the facade, and its ability for being decoupled from the structure (see design for disassembly description), enables future spatial adaptations to the perimeter of the tower, such as adding terraces.

Services
The ventilation system provides flexibility for future changing requirements with fresh air rates exceeding statutory requirements. The heating and cooling systems, as well as stormwater drainage, are designed with an allowance for future climate change.

The on-floor air handling units (AHUs) add to flexibility in use, as they enable occupiers to locally turn down and shut-off unoccupied floors. The system is designed as an all-air system without ductwork and, in addition to the minimal high-level servicing, enables changeable layouts without significant reconfiguration and waste.

Space
Levels 03 - 11 are designed as lab-enabled spaces. The core and floor layouts, as well as the all-air ventilation system, minimises coordination and allows for various tenant scenarios with potential for a wide range of current and future workplace fit outs.

Raised access flooring is proposed throughout, which allows a flexible "plug and play" approach to workplace deigns.

The design for exposed soffits with minimal high-level servicing allows for flexibility in lighting layouts, and easy reconfiguration with minimal impact on services.

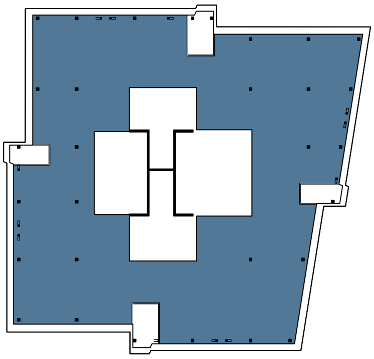
Plans to prove and quantify
Studies have been conducted to understand how flexibility and adaptability are delivered as part of the pre-application process, in addition to the Functional Adaptation study conducted as part of BREEAM Wst 06. Refer to the Functional Adaptation study BREEAM Wst 06 in Appendix D.

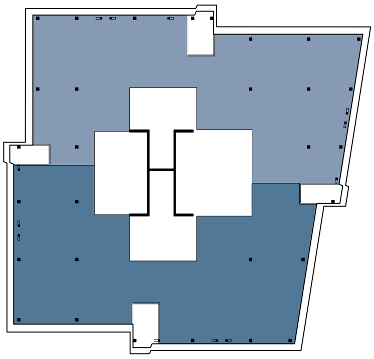
O&M manuals will capture the adaptation principles so that they are recorded.

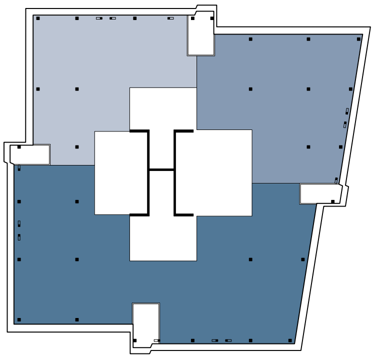
End of life routes (reuse, adaptability, disassembly, etc.) will be captured as part of Material Passporting process.

Requirements for LCAs and Material Passporting will be included in Contractor Preliminaries.

Floor Layout Flexibility for Various Tenant Scenarios







Single Tenant

Allows a single tenant use of the entire floor plate.

Two Tenants

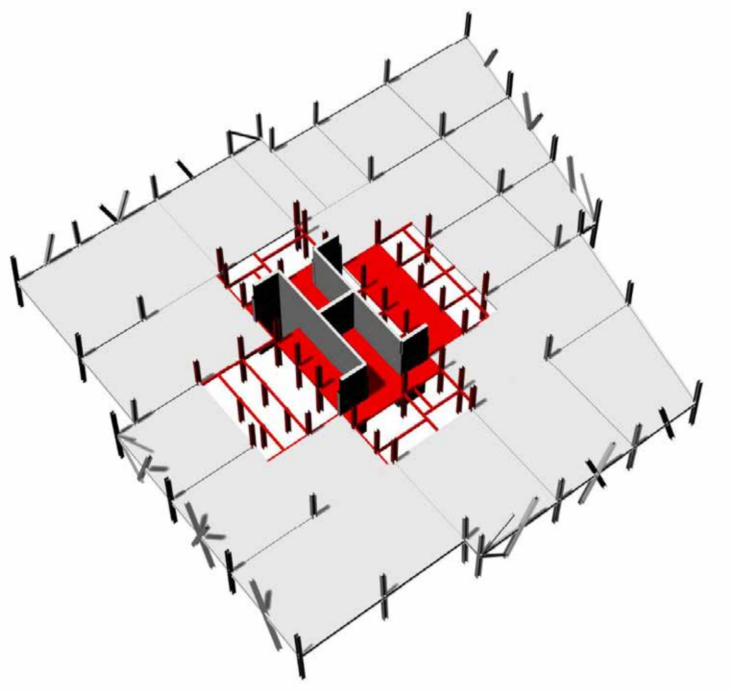
It is possible to split office levels into two tenant spaces taking advantage of the central elevator lobby and escapes that provides direct access for both tenants

Multiple Tenants

It is proposed to limit the office floor stack to three tenant spaces per storey, given the smaller footprint of the upper portion of the tower

Figure 3.9 Internal layout allowing for several flexible tenant scenarios

Soft Core Approach



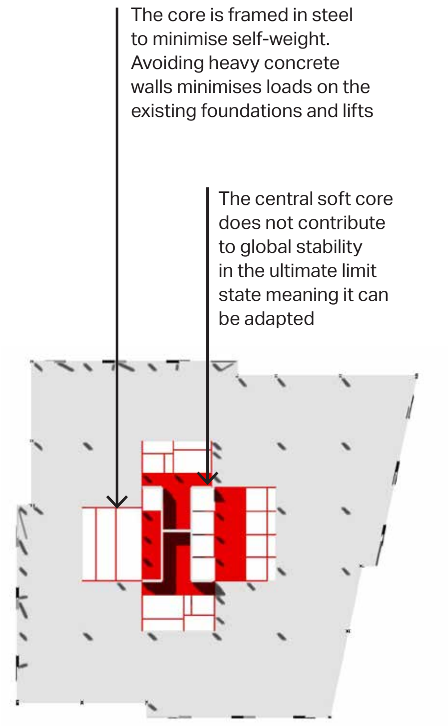


Figure 3.10 The core is designed as a soft core that accommodates riser expansion or contraction

3.2.6 Designing for Disassembly

The principle of design for disassembly has been considered for the superstructure, facade, and building services. These will be further investigated through detailing of the building elements in the following project stages.

Similarly the use of mechanical connections in the interior finishes and fitout will also be investigated at a later project stage.

Superstructure
In order to better enable future adaptations and design for disassembly for the high impact elements in the building, it has been prioritised to use a steel frame in the proposed development. The steel frame will be designed with bolted connections to allow for separation of the elements for future high value reuse.

Beyond the frame, the structural floor system design has been an area of focus, with the aim of best enabling its disassembly, and crucially reusability, where adaptations are made to the structure or at end of life.

Three different floor systems are currently being considered as potential options, as shown in Figure 3.11. Key in these studies is to balance the impacts of upfront embodied carbon, technical feasibility, disassembly and reusability, cost, risk, and programme. Other options may be explored as appropriate.

Option1: Precast Solid Planks
The precast solid plank system comprises 150mm thick, solid precast planks, dropped directly onto steel beams with shelf angles. Diaphragm demand and robustness is provided through the shelf plates and threaded bar. The aim in this option is to minimise the extent of wet works as far as technically and economically possible, to aid non-destructive disassembly.

This option provides the best result in terms of disassembly and reusability. The detail would allow the planks to be pried apart, such that the steel beams and precast planks could be recovered whole for reuse elsewhere. A proposed process for recovering the elements at end-of-life with this system can be seen in Figure 3.12.

Option 2: Precast Hollowcore Planks
The precast hollowcore plank system comprises 250mm thick, solid precast planks, dropped directly onto steel beams with shelf angles. In this case a rebar tie is required to provide the necessary robustness and diaphragm demand. The aim in this option is to minimise the extent of wet works as far as technically and economically possible, to aid non-destructive disassembly.

This option provides a good result in terms of disassembly and reusability. The detail would allow the planks to be pried apart, but unlike the precast solid plank option, the hollowcore planks would need to be cut during disassembly. This would still allow the steel beams and planks to be recovered for reuse elsewhere, noting a shortening of the hollowcore planks.

Option 3: Composite In-situ with Demountable Connection
The composite metal deck option comprises a typical metal deck with in-situ concrete topping. It is similar to a conventional system of this type, with the addition of a sacrificial steel plate bolted to the top flange of the beam, which aids separation of the decks from the steel beams.

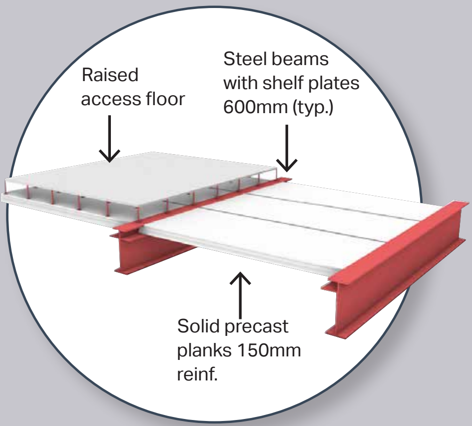
This option would allow recovery of the steel beams for use elsewhere, but the decks would need to be cut, and even if done so strategically, they are unlikely to be useful elsewhere. This may be possible in future with advancing technologies and techniques. The process for recovering the steel beams is shown in Figure 3.12. Composite action between the steel an concrete would be leveraged in this option, to reduce the amount of steel required.

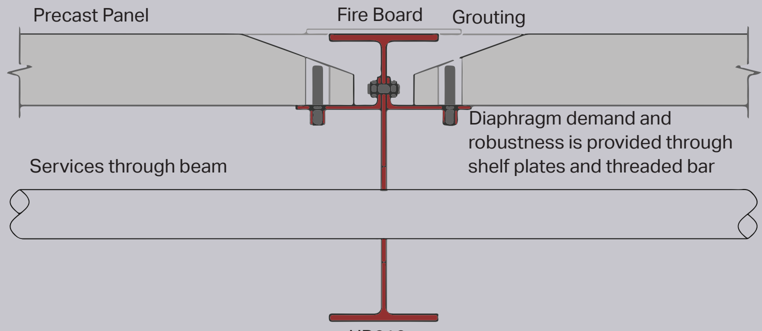
Across all options, one of the main challenges of enabling disassembly and reusability in the structural design is balancing demountability with upfront embodied carbon, since generally the reversible connections require additional material (in this case steel elements). Each option also has a different impact on cost and programme, especially the pre-cast options which demand significant hook time during construction.

To address these challenges, the connection details will have to be further developed along with embodied carbon emissions studies and reduction scenarios. Cost and programme implications will be tracked along with the options studies.

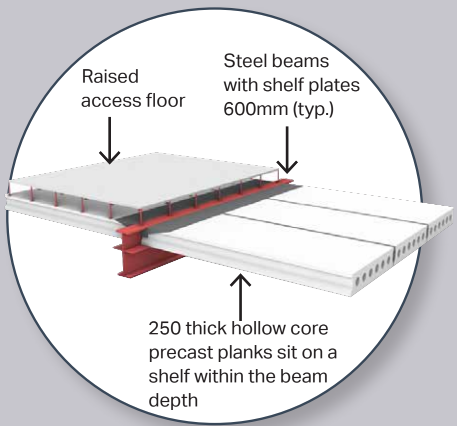
Structural Floor System Options

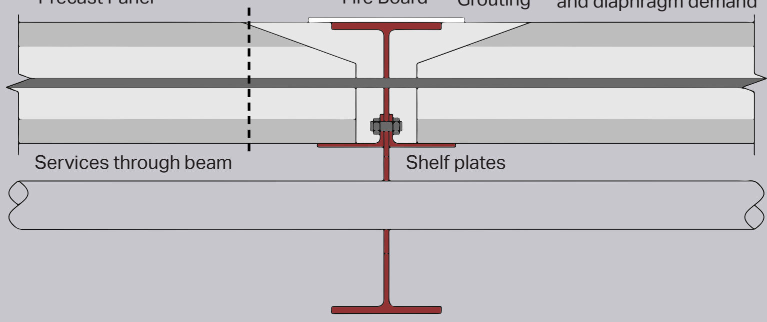
Option 1: Precast Solid Planks



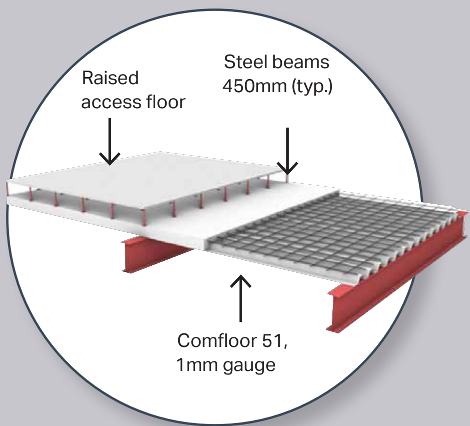


Option 2: Precast Hollowcore Planks





Option 3: Composite In-situ with Demountable Connection



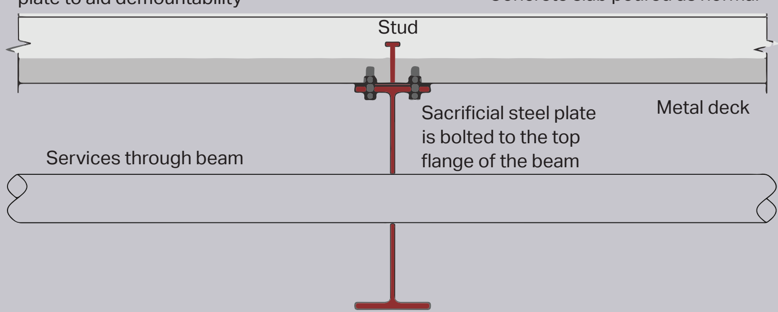


Figure 3.11 Potential structural floor systems evaluated in terms of disassembly and reusability

Shell/skin
The unitised facade is designed to be manufactured using component-based construction and combined using mechanical fasteners. The facade system is connected to the primary structure by a bolted connection to a cast-in channel, meaning the facade can be decoupled without impacting the primary structure.

Services
The clear soffit is designed to enable exposed services, easing access for maintenance and replacement. On-floor ventilation enables ease of replacement and disassembly without impacting the remainder of the proposed development.

Plans to prove and quantify
Studies have been conducted to understand how flexibility and adaptability are delivered as part of the pre-application process, in addition to the Functional Adaptation study conducted as part of BREEAM Wst 06. Refer to the Functional Adaptation study in BREEAM Wst 06 in Appendix D.

O&M manuals will capture the adaptation principles so that they are recorded.

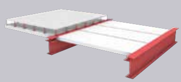
End of life routes (reuse, adaptability, disassembly, etc.) will be captured as part of Material Passporting process.

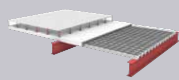
Requirements for LCAs and Material Passporting will be included in Contractor Preliminaries.

Sketch Process for Disassembling Structural Floor Systems

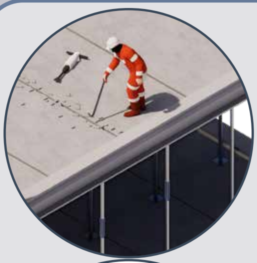
1 **Remove facade**

Dismantle facade and remove in modules



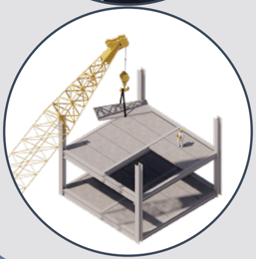


Pre-cast floor systems (options 1& 2)



2a **Dismantle precast planks**

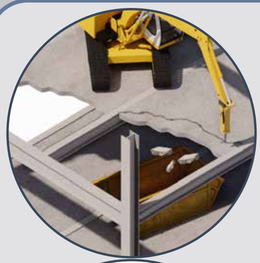
Secure area, prop from below, pry precast planks apart and remove loose grout between planks



3a **Remove planks**

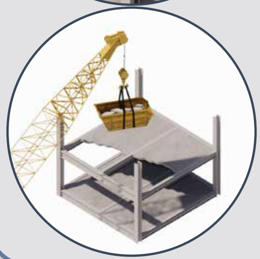
Lift planks from existing position using crane and store for reuse

Composite in-situ floor system (option 3)



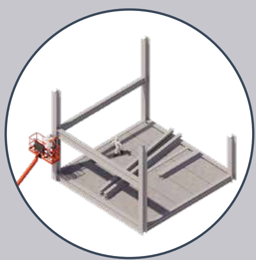
2b **Deconstruct in-situ composite decks**

Secure area, break away concrete slab into skips, remove debris



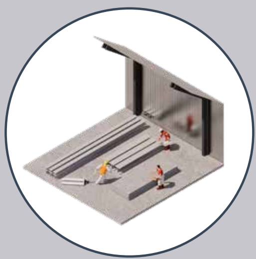
3b **Remove concrete rubble**

Skip lifted from existing position using crane, crushed concrete to be recycled



4 **Dismantle steel frame**

Unbolt and remove steel framing elements and store for reuse



5 **Prepare elements for future reuse**

Make good steel elements (remove old grout, adjust geometry where required, reapply protective coatings, etc.)

Figure 3.12 Sketch process for disassembly for pre-cast floor systems (Options 1 & 2) and composite in-situ floor system (Option 3)

3.2.7 Designing for recoverability and reusability

Superstructure
As detailed in Section 3.2.6, the principle of disassembly, specifically to allow for recoverability and reusability during deconstruction, has been embedded within the design of superstructure. This was outlined in Section 3.2.6 as it is clear that effective recovery is predicated on non-destructive disassembly, so the principles are inextricably linked.

The steel frame will be designed with bolted connections to allow for separation of the elements for future high value reuse, and is furthermore designed with sections in standardised dimensions to enhance the reusability of the elements for future buildings.

Enabling the future reuse of the structural floor system has been a special focus. Optioneering studies were conducted for three floor system solutions, as described in Section 3.2.6. As evidenced in the existing building, in-situ concrete is typically difficult to reuse in structural applications (its highest value application) and has not been achieved at scale. There exists precedent for recovering and reusing pre-cast concrete elements, and accordingly, two of the floor system option studied in Section 3.2.6, use pre-cast concrete planks, noting the caveats of cost, programme, risk, etc.

Figure 3.13 shows a hierarchy of the structural floor system options in terms of disassembly and reusability. Lowest in the hierarchy is the composite in-situ floor system with conventional connections (typical practice). This system would not allow for the decks to be recovered in a state fit for reuse (they would be broken down and torn from the shear studs). It is possible that the steel beams would be recoverable for reuse, though they may be damaged when the decks are removed.

The same system, with the addition of a demountable connection as in Section 3.2.6, would facilitate improved recovery of the steel beams (the beams and decks would be easier to separate due to the sacrificial plate). Again, the composite in-situ decks are unlikely recoverable for reuse, though this may be possible in future with advancing technologies and techniques.

For the pre-cast hollowcore plank system, the connection between planks would allow the planks to be pried apart, but the planks would need to be cut during disassembly. This would allow the steel beams and planks to be recovered for reuse elsewhere, though the planks would be shortened somewhat.

The pre-cast solid plank system would provide the best result in terms of disassembly and reusability. Like the pre-cast hollowcore planks, the connection between the planks would allow the planks to be pried apart, but without the need to cut the planks, the steel beams and precast planks could be recovered whole for reuse elsewhere

These options will be further explored as the design develops, along with embodied carbon, cost, risk, and programme implications.

Shell/skin
The component-based construction and mechanical fasteners allow for future separation of materials for potential reuse or recycling. The process of testing the existing facade glass for recycling back into the flat glass manufacturing, can inform the recyclability of the new glass applied in the project. The discrete layers in the modules allow for separation of constituent material parts to avoid contamination that could prevent future recyclability.

Services
The clear soffit is designed to enable exposed services, easing access for maintenance and replacement. Services can be removed for recovery and reuse generally without impacting the primary structure.

Plans to prove and quantify
O&M manuals will capture the adaptation principles so that they are recorded.

End of life routes (reuse, adaptability, disassembly, etc.) will be captured as part of Material Passporting process.

Potential end of life routes for key reusable materials will be identified early on. The data for these key reusable products will be collected and stored in a Material Passport. For more information on the strategy for applying material passports in the proposed development, see Section 3.5.1.

Structural floor system hierarchy of disassembly and reusability

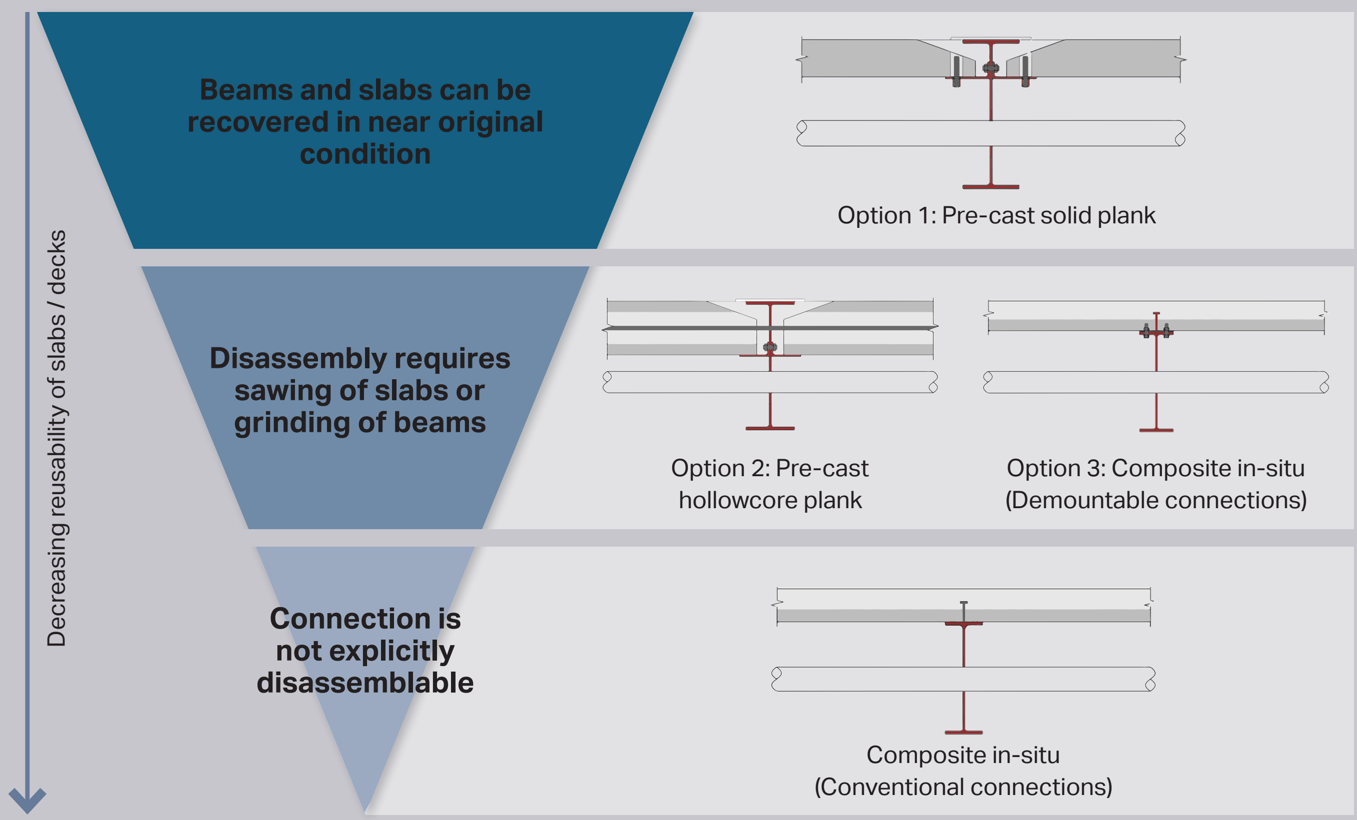


Figure 3.13 Hierarchy for disassembly and reusability of different structural floor systems

3.3 Bill of Materials & Recycled Content

3.3.1 Material intensity

The Bill of Materials has been completed based on information provided by the design team. The proposed development's overall mass of raw materials during the construction stage (A1-A3) is 72,452 tonnes (new material only, not including material retained in-situ from the existing building (foundations and central core)). A summary of the quantities across the building element categories is shown in Figure 3.14.

The Bill of Materials is aligned with the current cost plan and the submitted Whole Life-cycle Carbon Assessment (WLCA).

The quantities captured in this Bill of Materials reflect the items that are currently quantifiable in the WLCA. Material element categories that are currently (either fully or partly) included as benchmark values or cost coverage factors in the WLCA are not captured in the Bill of Materials. This concerns the external works and parts of the building services.

The Bill of Materials performance indicators can be seen in Figure 3.15. For all the building element groups, the material intensity performs within the second quartile, in line with the GLA's expectation that applications "will tend towards the median and lower quartile figures in the future".

3.3.2 Recycled content by value

Of the 72,452 tonnes of materials, 13,517 tonnes are of recycled content. This makes up 26% recycled content by value. This does not include material retained in-situ from the existing building (foundations and central core).

The primary items with recycled content in the design are the following:

- The steel frame with an overall assumed 87% recycled content
- The reinforcement bar with 98% recycled content
- Concrete mixes with 4% recycled content (assuming a nominal 25% GGBS cement replacement and currently 0% recycled aggregate).

Further opportunities will be sought as the design is progressed.

The proposed development is committed to a minimum of 25% of the building material elements comprising recycled or reused content (by value), exceeding the policy target of 20%, see Figure 3.16. The proposed development will endeavour to meet this target, wherever technically, practically, and feasibly possible.

The detailed Bill of Materials and calculations are included in the GLA Circular Economy Statement Template as part of this planning application. Refer to Appendix C.

Bill of Materials and Recycled Content by Building Element Categories

	Material quantity (tonnes)	Construction Waste (tonnes)	Recycled content (tonnes)	Recycled content by value (%)
Substructure	20,341t	819t	2,544t	65%
Superstructure	40,928t	425t	10,436t	70%
Facade	4,232t	323t	293t	8%
Internal Walls & Doors	3,650t	62t	213t	7%
Finishes and fittings	2,080t	111t	32t	TBC
Building Services	1,220t	11t	0t	0%
Total	**72,452t**	**1,752t**	**13,517t**	**26%**

Figure 3.14 Bill of Materials and recycled content summarised across building element categories

Bill of Materials Performance Indicator

	Material Intensity (Module A) (kg/m² GIA)	Performance Indicator
Substructure	262	2nd Quartile*
Frame	117	2nd Quartile*
Upper Floors	383	2nd Quartile*
Roof	23	2nd Quartile*
Fabric	55	2nd Quartile*
Internal Walls and Partitions	47	2nd Quartile*

** Evaluated based on GLA CE Statement Appendix 4. The values do not align with the CE Statement template which appears to be calculating incorrectly*

Figure 3.15 Material intensity results compared with GLA benchmark quartiles (Appendix 4 of the GLA CE Statement Guidance)

3.4 Recycling and Waste Reporting

The Recycling and Waste Reporting Table has been completed based on information provided by the design team. The quantities of construction and demolition waste, excavation waste, and municipal waste that arise throughout various life stages of the building have been estimated. A summary of the targets is shown in Figure 3.16. The proposed development will endeavour to meet these targets, wherever technically, practically, and feasibly possible.

3.4.1 Demolition waste

The demolition waste arising from the existing tower has been estimated in the Pre-demolition Audit to be 37,420 tonnes. A summary of the main materials can be found in Section 2.3.

Of the total waste, a minimum of 98% diversion from landfill for reuse, recycling or recovery is targeted.

For more details on the quantities of the demolition waste streams refer to the Pre-demolition Audit in Appendix A.

For details on the innovative approach to recovering the materials at higher value, refer to Strategy for Material Recovery in Appendix B.

3.4.2 Excavation waste

It is estimated that approximately 12,670 m^3 of excavated material will be produced. Applying an industry standard bulking factor of 1.2 to this volume equates to approximately 15,204 m^3 of excavated material, equivalent to 30,408 tonnes, assuming a conversion rate of 2 tonnes/m^3 material. The estimated material excavated from the foundations are anticipated to include the substructure concrete walls and slabs, piles arising, and pile caps.

Of this, a minimum of 95% will be diverted from landfill for beneficial use in line with policy requirements.

3.4.3 Construction waste

The proposed development is anticipated to generate approximately 5,185 tonnes of construction waste, assuming best practice performance is realised.

Construction waste will be separated into recyclable waste streams before removal from site for processing.

Of this, a minimum of 96% will be diverted from landfill for reuse, recycling and/or recovery, exceeding policy requirements.

3.4.4 Operational waste

The existing waste management operations are currently segregating material effectively, and the proposed waste strategy will therefore maintain the same principles of consolidation and collection for each waste stream.

The operational waste generation quantity has been estimated as 2,927 tonnes/annum. The proposed development is committed to targeting at least 65% recycling rate for municipal waste, contributing to achieving this 2030 target for Greater London.

More information on the excavation and construction waste is included the *Outline Site Waste Management Plan prepared by Velocity Transport Planning dated December 2023*, that forms part of this planning application. For more information on the operational waste refer to *Operational Waste Management Strategy prepared by Velocity Transport Planning dated December 2023*.

The detailed Recycling and Waste Reporting Table and calculations are included in the GLA Circular Economy Statement Template as part of this planning application. Refer to Appendix C.

Circular Economy Targets

		Policy Requirement	Target Aiming For (%)	Policy Met?
	Demolition waste materials (non-hazardous)	Minimum of 95% diverted from landfill for reuse, recycling or recovery.	98%	Exceeds Policy
	Excavation waste materials	Minimum of 95% diverted from landfill for beneficial reuse.	95%	Yes
	Construction waste materials	Minimum of 95% diverted from landfill for reuse, recycling or recovery.	96%	Exceeds Policy
	Municipal waste	Minimum 65% recycling rate by 2030.	65%	Yes
	Recycled content	Minimum 20% of the building material elements to be comprised of recycled or reused content.	25%	Exceeds Policy

Figure 3.16 Circular economy targets for the proposed development

Waste Reporting and Performance Indicator

	Source of Information	Overall Waste (tonnes)	Overall Waste (kg/m² GIA)	Performance Indicator
Demolition Waste	Pre-demolition Audit	37,420	0.48	Median
Excavation Waste	Site Waste Management Plan	30,408	0.39	2nd Quartile
Construction Waste	Site Waste Management Plan	5,185	0.067	2nd Quartile
Municipal Waste	Operational Waste Management Strategy	2,927	0.038	3rd Quartile

Figure 3.17 Waste arisings in the proposed development compared with GLA benchmark quartiles (Appendix 4 of the GLA CE Statement Guidance)

3.5 End of Life Strategy

The end of life strategies included in the Bill of Materials are aligned with the Whole Life-cycle Carbon Assessment (WLCA) for the proposed development.

For the majority of the building components, the reuse and recycling targets are the default end of life scenarios, as per the RICS Professional Statement *Whole life carbon assessment for the built environment 2nd edition*.

3.5.1 Material passports

In line with British Land's ambitions, the proposed development is committed to preparing material passports for key reusable materials. The relevant key reusable materials will be identified as the design is developed.

Working with the Principal Contractor, material passports will be produced during construction and finalised at practical completion, to capture the materials used in the proposed development, and detailed data for the key reusable materials to better facilitate future reuse.

Figure 3.18 shows a sketch process to develop the material passports. The relevant key reusable products will be identified as the first step in this process. Some of the potential items have been identified in line with the circular economy design principles. There is a high potential for reusability and future impact in the steel elements for the proposed superstructure. Some of the facade elements, such as the glass and aluminium framing would be considered for key reusable products.

To secure implementation, data for the material passports will be gathered from the Principal Contractor through a material passport reporting template and specification clauses that will be included in the Contractor Preliminaries.

Indicative Process for the Application of Material Passports

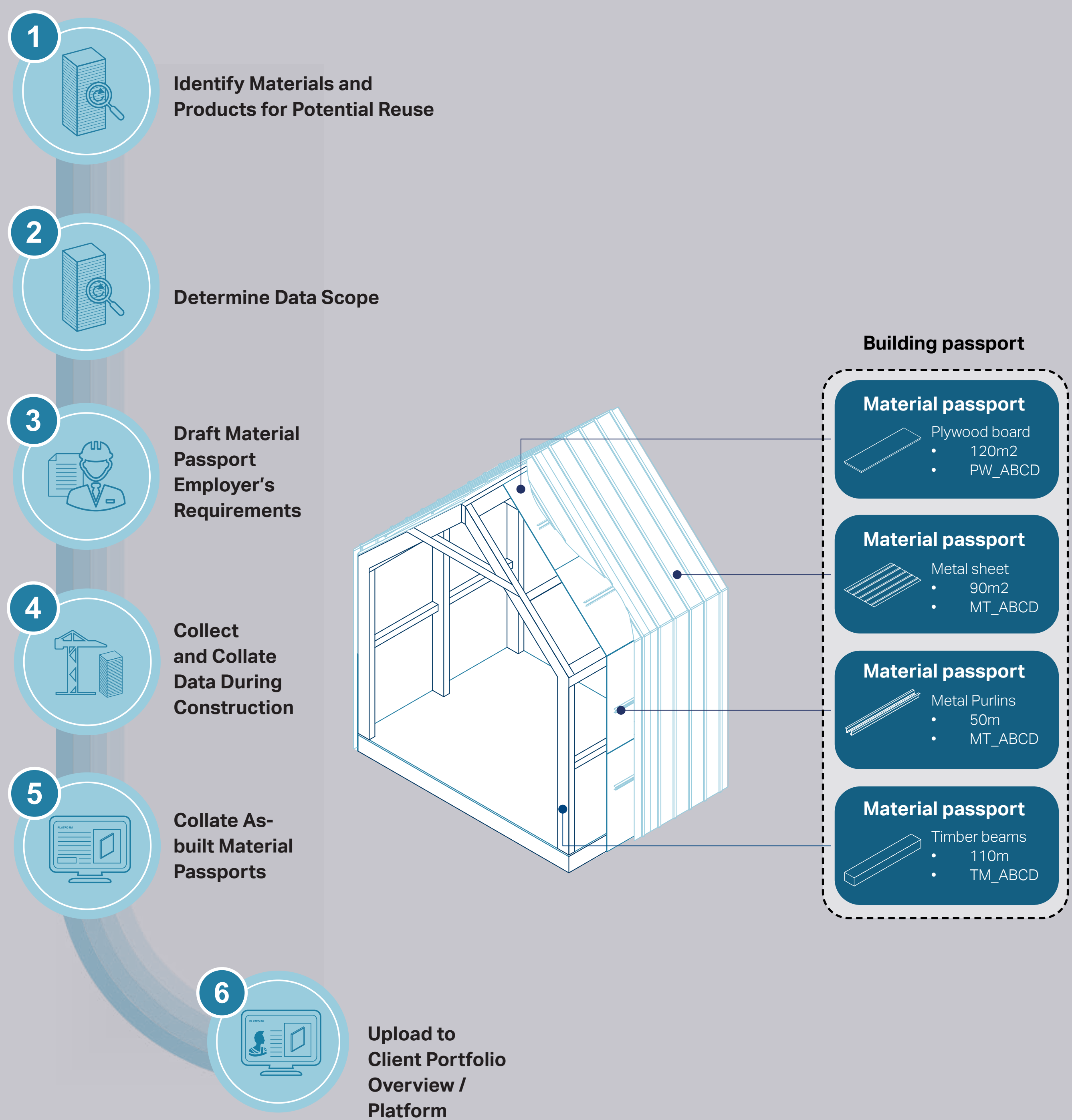


Figure 3.18 Waste arising in the proposed development compared with the GLA's benchmark figures

3.6 Implementation & Post-construction Reporting

The circular economy aspirations outlined in this statement will be managed by British Land and the project team throughout design development. The project team will assess the design based on the circular economy strategy, as well as the other sustainability criteria outlined in the *Sustainability Statement prepared by GXN dated December 2023*.

The design team is committed to ensuring ongoing monitoring of the stated circular economy strategies. Design commitments will be secured and advanced through materials and circular economy workshops to be held throughout the project stages. These workshops will be used to assess designs in line with the circular economy commitments and principles set out in this statement.

The following documents are actively being used to support the implementation of the aspirations outlined in this statement:

- Pre-demolition Audit (refer to Appendix A)
- Material Recovery Strategy (refer to Appendix B)
- Material efficiency report BREEAM Mat 06 - to be tracked and updated at each of the RIBA stages with implementation recorded from RIBA Stage 4
- Functional Adaptation study BREEAM Wst 06 - to be updated during RIBA Stage 4 (refer to Appendix D).

Where appropriate, targets and performance clauses will be included part of Contractor Preliminaries, to secure their implementation, with regular reporting required for tracking.

It is agreed that a Post-construction Report will be prepared on completion of the works, and submitted to the planning authority.

This report will be produced in line with the GLA Circular Economy Statement Guidance to include:

- Updated Bill of Materials based on actual materials used
- Updated Recycling and Waste reporting table based on actual materials handled, quantities, destinations, etc.
- As-built performance against all the key commitments and metrics that are included in this statement
- Lessons learned
- Supporting evidence as appendices.

Where significant change is noticed, between the as-built performance and the commitments in this statement, explanation will be provided to describe the reasons that have caused the difference.

Figure 3.19 Close up render of the proposed development

4

Euston Tower

Summary and Conclusions

4.1 Conclusion

This Circular Economy Statement demonstrates British Land's commitment to delivering a world leading science, technology and innovation building and public realm for Camden and the Knowledge Quarter that inspires, connects, and creates opportunities for local people and businesses.

As outlined in this statement, the proposed development adopts the principles of the circular economy across all areas of design, construction, and operation. This will ensure that it delivers world leading sustainably performance that is fit for now and the future.

Wherever technically, practically, and economically feasible, the proposed development meets and exceeds the sustainability requirements of planning policy.

The proposed development includes a range of circular economy strategies and approaches, as detailed in this statement and its supporting appendices, including:

- **Maximising utility of existing buildings**
  - Achieved by strategically retaining as much as possible of the existing building, reducing waste and the need for new materials
  - A thorough and transparent Feasibility Study studying the condition of the existing building, and assessing options for redevelopment has been undertaken and independently assessed
  - Retention of 31% of the existing structure, following a detailed feasibility study (satisfying the GLA requirements for a pre-redevelopment audit), which has been independently reviewed by a third-party assessor, and their report has been issued to Camden.
- **Minimising waste in deconstruction and construction**
  - A pre-demolition audit has been undertaken and is included in Appendix A
  - A transparent approach to handling deconstructed materials and identifying opportunities to put them to best use
  - A detailed assessment of opportunities for on site and off site deconstruction waste reuse/ upcycling/recycling are considered and captured in the material strategy as part of this statement
  - The proposed development is targeting 98% of the demolition waste to be diverted from landfill, 96% of the construction waste to be diverted from landfill and 95% of excavation waste to be put to beneficial use
  - Prototyping innovative approaches for structural reuse of concrete and recycling of building glass at scale, with ambition to publish the findings
  - Designing a modular facade utilising off-site manufacturing to reduce waste.
- **Minimising waste in operation and end of life**
  - The overall strategic design approach is to design a building for adaptability and longevity, reducing waste and preventing premature obsolescence
  - Particular focus is applied to the structure as it is the most carbon-intensive element, and is seen as foundational to meaningful long-term adaptability
  - Considering the different building elements in layers to enable maintenance and replacement that minimises destructive impacts on other building elements (especially structure)
  - Dedicated storage areas for waste recycling
  - The proposed development will contribute to achieving the GLA's municipal waste target of 65% recycling by 2030
  - Improving end of life reusability by committing to capture useful data for key building elements in material passports
  - Committing to submitting a post-construction report to report as-built circular economy performance.
- **Seeking to use reused/recycled materials**
  - Using reused and/or high recycled content materials where possible, targeting 25% recycled content by value
  - Driving innovation by upcycling/transforming materials from the deconstruction to reduce waste and the reliance on virgin materials, captured in the material strategy as part of this statement.

The Bill of Materials and Recycling and Waste Reporting Table has been summarised in this statement, with the full details and calculations included in the Circular Economy Statement Template which is located at Appendix C.

To ensure successful implementation, the key initiatives and commitments detailed in this statement, and its supporting documents, will be implemented, monitored, and/or reviewed as the design develops, and subsequently during the operational phase of the proposed development.

Figure 4.1 Render of the proposed development as seen from Tottenham Court Road