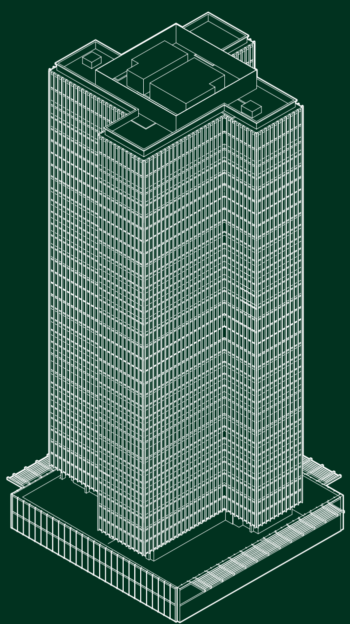

EUSTON TOWER

Feasibility Study Volume Three
Options for Retention and Extension

December 2024

British Land

Revision B | December 2024

This document supersedes Revision A submitted in December 2023. It was updated in December 2024 to reflect revisions to the proposed development, noting that the principles of the Feasibility Study are unchanged. Principally, these updates include:

- Massing updates to reflect the revised massing
- Rationalisation of the podium assumptions between options in the Feasibility Study
- Updates to the floor areas and facade areas for all options in the Feasibility Study
- Assumption of composite metal deck as the baseline floor system in the Feasibility Study
- The inclusion of detailed breakdowns and curves for WLCAs for the lab-enabled options
- Updates to all WLCAs in the Feasibility Study to reflect the changes above.

Revision	Issued for	Date	Prepared by	Checked by
A	Planning Submission	06.12.2023	GXN	AOZ
B	Planning Revisions	11.12.2024	GXN	AOZ

Issue: 11 December 2024
Rev: B

Contents

Executive Summary - Volume Three

This study forms part of the design evolution and pre-application process to explore options for re-imagining Euston Tower. This document is Volume Three of a detailed, three-part feasibility study assessing, in detail and transparently, the opportunities for reuse, degrees of retention and refurbishment of the existing tower.

In Volume One the focus was on the condition of the existing tower. The study showed that significant intervention to key building elements is required to bring it up to the standard that is required by current Building Regulations and guidance, let alone the standards expected for a contemporary, high quality, flexible, and sustainable building. The resulting floorplates would be compromised and unsuitable for the Central London office market.

Notwithstanding the strong policy position against loss of commercial space, Volume Two expanded on Volume One to explore alternative uses for the tower: Office-only (continued use), Office and Laboratory, Residential and Office, Residential and Laboratory, Hotel-only, Hotel and Student Accommodation.

Regardless of use, the same primary issues identified in Volume One would need to be addressed before the building can be brought back to life. The extent of structural alterations necessary to deliver these upgrades is exacerbated in the residential (including student accommodation) mixed-use options, where each use requires two, independent escape cores. This also precludes the possibility of mixing more than two distinct use cases.

This Volume builds further on Volumes One and Two to explore solutions to make the tower work with an expanded floorplate. The extent of this floorplate is intended to be indicative, and it does not presuppose the outcome of any developments around massing.

A consolidated core layout is desirable to improve flexibility and connectivity of the floorplate. When coupled with the desire to maximise retention, this leads to a preference for a consolidated, central core. Substantial structural works would be necessary to deliver this core, including new lift shafts and new risers. Large portions of the existing floor slab would be impacted by these interventions leading to a reduction in the slab ultimately retained.

The existing floor to floor heights are challenging for delivering a high quality, flexible, and sustainable commercial building, especially one that offers the floor to ceiling heights sought by the market. By analysing 725 leasing deals conducted in Central London in the ten year period between 2012 and 2022, it was clear that occupiers lease spaces with clear ceiling heights of 2.6m or higher. Of these only five (<1%) had ceiling heights that could reasonably be achieved with the existing floor levels at Euston Tower. Resetting the floor to floor heights by strategically removing slabs is technically possible, but would bring with it significant construction complexity, temporary works, and health & safety risks, and result in disproportionately limited retention. It would result in an efficient use of the land.

Regardless of floor to floor heights, retaining significant portions of the floor slabs would constrain grid options to tie in with the existing building grid, and bake in many of the limitations of the existing structure. These limitations would inhibit floorplate flexibility and adaptability in-use, restricting options for future use and increasing the likelihood of significant further interventions (and associated carbon emissions) being required in the future.

Taking all these factors into account, this study concludes that an option that retains the substructure and core with new floor slabs is the most feasible to achieve the project vision and missions. Balancing structural retention with the constraints and construction complexity that comes with greater levels of retention, it would deliver flexible floorplates with clear spans, enabling the building to be more easily adapted to different users and uses over time, while mitigating where possible the short-term carbon impacts through deconstruction, reuse and recycling.


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Anti-freeze
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13

Euston Tower

Introduction

13.1 Background

Standing as a forgotten landmark on the northern edge of central London, Euston Tower is the tallest and oldest building in the Regent's Place campus. Comprising 645,000ft^2, it was completed in 1970 as an office building to provide cellular office accommodation typical of the period, and formed part of a wider master plan known as Euston Centre.

The site falls within the London Borough of Camden, and is bounded by Euston Road to the south, Hampstead Road to the east, and the pedestrianised Regent's Place Plaza to the west. It now sits within the Knowledge Quarter Innovation District.

Since its completion in 1970, it has undergone a small refurbishment to add a secondary glazing system and perimeter fan coil system (ca. 1990), but beyond this its external form and façade remain largely as originally constructed. These elements of the building are in a generally poor condition, due to a combination of wear in use and the quality of the original detailing.

Gradually it has been vacated, and since 2021, with the exception of the retail at ground level, the building is entirely disused.

Accordingly, British Land is seeking to transform Euston Tower into a beautifully designed, sustainable, new building, delivering pioneering workspace, accessible and inclusive spaces for neighbouring communities, and support the development of the local economy. Their vision is to create 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 a first step in the re-imagining of Euston Tower, British Land is assessing the opportunities for retention and refurbishment of the existing tower and its basement. At a high level this assessment considers the condition of the existing building and its fitness for purpose, the technical feasibility of upgrades where appropriate, alternative use cases, the economic viability of these scenarios, and options for retention and extension of the existing tower.

13.2 Revisions to the Application

There have been revisions made to the pending strategic application for full planning permission (ref. 23/5240/P), submitted in December 2023 for the proposed development.

The principal components of the 2024 revisions are detailed in the Planning Statement addendum. With respect to the Feasibility Study, the primary revision is an adjustment to the tower massing to create a simpler, rectangular form.

The Feasibility Study has been updated to reflect this revision to the proposed development, noting that the principles of the Feasibility Study are unchanged. Principally, these updates include:

- Massing updates to reflect the revised massing
- Rationalisation of the podium assumptions between options in the Feasibility Study
- Updates to the floor areas and facade areas for all options in the Feasibility Study
- Assumption of composite metal deck as the baseline floor system in the Feasibility Study
- The inclusion of detailed breakdowns and curves for WLCAs for the lab-enabled options
- Updates to all WLCAs in the Feasibility Study to reflect the changes above.

Where volumes are not impacted by the 2024 revisions, these have been left unchanged. Accordingly, the feasibility study comprises:

- Volume One - Assessing the Existing Building (unchanged from submission dated December 2023)
- Volume Two - Pathways for Alternative Uses (unchanged from submission dated December 2023)
- **Volume Three - Options for Retention and Extension (this document) (superseded by submission dated December 2024).**

13.3 Structure of this Study

This feasibility study is split into three volumes, which together form a detailed and transparent assessment of the opportunities for retention and refurbishment of the existing tower.

This document forms Volume Three of the study.

Volume One
(unchanged from submission dated December 2023)
Volume One explores, in detail, the condition of the existing tower. It considers the planning policy relating to the future use of Euston Tower, as well as market requirements for continued commercial use of the tower.

It presents 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.

Volume One concludes that the cost of upgrades for continued office use and the quality required would make viability challenging, and the resulting product would be compromised in the leasing market. Therefore alternative use cases should be explored.

Volume Two
(unchanged from submission dated December 2023)
Volume Two explores pathways for alternative uses within the existing tower. It studies a broad spectrum of realistic use cases, with both single- and mixed-use options, specifically:

- Office-only
- Office and lab
- Residential and office
- Residential and lab
- Residential and hotel
- Hotel-only
- Hotel and student accommodation.

It considers the policy position for each use case in turn, and how the specifics of the site and proposals are suited or unsuited thereto.

It presents stacking diagrams and test layouts, which are developed working through the implications on structures, MEP, fire, and vertical transportation.

As in Volume One, it sets out the upgrades required to comply with current legislation for each respective alternative use case.

Finally it considers the economic viability of the alternative use cases.

Volume Two concludes that only continued commercial use is appropriate, and that additional value is required to improve the viability. Therefore options that generate additional lettable area should be explored.

Volume Three (this document)
(superseded by submission dated 2024)
In response to the preceding two volumes, Volume Three explores options for retention and extension of the existing tower.

It considers commercial use only, and details several options for retaining portions of the existing tower while at the same time extending the floorplates. The options range from maximum retention and extension, through partial retention and extension retaining some floor slabs and/or the core, to new build.

The study shows how, due to the interventions required to comply with Building Regulations, there is no scenario that retains 100% of the existing structure within the existing envelope, and that accordingly the schemes should be measured against an upgraded tower.

Each option entails a different level of complexity. For each option the amount of structural salvage, the buildability and impact of temporary works is assessed. The resulting quality of space is considered looking at grid constraints and floor to ceiling heights. Finally, the impact on flexibility, adaptability, and potential to design for disassembly is studied. This is followed by a feasibility stage whole life-cycle carbon assessment of the options.

Volume One
Unchanged from submission dated December 2023

Volume Two
Unchanged from submission dated December 2023

Volume Three
Superseded by submission dated December 2024

Figure 13.1 Three volumes of this feasibility study

13.4 Purpose of this Report

This study forms part of the design evolution and pre-application process to explore options for re-imagining Euston Tower. This document is Volume Three of a detailed, three-part feasibility study to assess, in detail and transparently, the opportunities for reuse, and degrees of retention and refurbishment of the existing tower.

This document is prepared in response to the requirements of the London Plan 2021, specifically policy SI 7 and its associated guidance on the circular economy, but also takes cognisance of policy D3 with regards to optimisation of site capacity. It is also aligned with the policies of the Camden Local Plan 2017 and its supplementary document: Camden Panning Guidance - Energy efficiency and adaptation which in clause 9.4 requires a condition and feasibility study, and an options appraisal for all major developments proposing substantial demolition.

This Volume builds on Volumes One and Two to explore solutions to make the tower work with an expanded floorplate. The options presented vary in degrees of structural retention (but also complexity). For each option in turn, the degree of retention is considered, as well as the level of future-proofing delivered by each option. The impact on buildability, driven by factors such as complexity of construction methodology, temporary works, and health & safety is assessed. Finally the efficiency of each option is also considered.

Section 14 explores and builds on the market commentary presented in Volume One. It shows how demand in the high-end office space is sensitive to clear floor to ceiling heights, especially for larger floorplates, and the impact of floorplate size on daylighting.

Section 15 presents a study that sets the baseline for maximum possible retention. Due to the upgrades required to comply with Building Regulations, it is not possible to retain 100% of the existing structure, and this new baseline should be used as the measure for comparisons with the options presented in later sections.

Sections 16 and 17 present the options study complete with feasibility level whole life-cycle carbon assessments. They set out the overarching considerations and parameters, and then step through each of the options in turn, Finally, they present a brief conclusion to this part of the study, showing that a solution that retains the core and foundation is the most suitable option. While subjective, this option offers the best balance of structural retention and buildability, and delivers floorplates that would be flexible and adaptable to future needs. It is acknowledged that more retention would result in lower upfront carbon emissions today, but to do so would bake in many of the adaptability limitations of the current structure, increasing the risk of further interventions (and their associated carbon emissions) being required in the medium-term future.

Section 18 outlines how resource efficiency will be addressed through the building's life-cycle, as well as the steps taken to future proof the building and reduce future waste.

The aim of this study is to outline and explore the various factors — technical, economic, policy-driven, market demand, etc. — that inform a re-imagining of Euston Tower. Together with London Borough of Camden and its stakeholders, this will allow for an informed, fact-based decision to be made for Euston Tower's future. A future which realises British Land's vision to create 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.

13.5 Project Team

Client	British Land
Project Manager	Gardiner & Theobald
Cost Manager	Gardiner & Theobald
Architect	3XN Architects
Executive Architect	Adamson Associates
Planning Consultant	Gerald Eve
Structural Engineer	Arup
Services Engineer	Arup
Fire Engineer	Arup
Wind	Arup
Transport & Servicing	Velocity
Lifting Consultant	SWECO (with input from Arup)
Facade Consultant	Thornton Tomasetti (with input from Arup)
Sustainability Strategy	GXN
Sustainability Consultant	SWECO
Daylight	Point2
Market Analysis	CBRE
Financial Viability	DS2

14

Euston Tower

Lettability & Daylighting

14.1 Impact of Floor to Ceiling Heights

14.1.1 Feasibility Volume One Market Summary

In Feasibility Volume One, a thorough analysis of the market conditions was undertaken.

It showed that a "flight to quality" was evident in the market. Driven by more stringent corporate ESG requirements from tenants, there is an increased desire by large office occupiers to acquire high quality buildings, those that satisfy the latest guidance and achieve top certifications like BREEAM, WELL, and NABERS.

Floor to ceiling height plays an integral part in lettability, with occupiers displaying clear preference for BCO-compliant spaces.

14.1.2 Lettability

The floor to ceiling heights (and by implication floor to floor heights) are a critical factor in determining the feasibility of retaining elements of the existing structure. Indeed regardless of the intervention, it is crucial that the space delivered is attractive to the market, and eminently lettable.

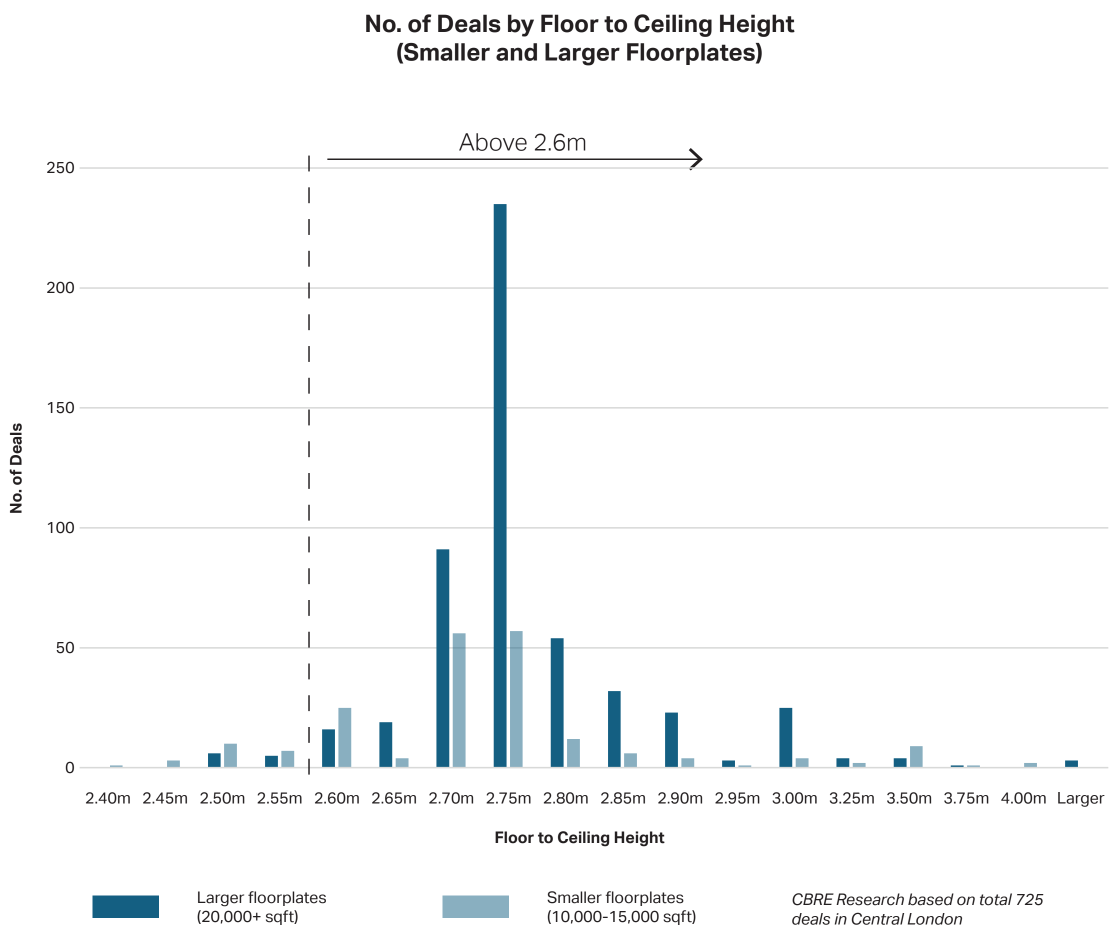
In its Guide to Specification, The British Council for Offices (BCO) recommends floor to ceiling clear heights. For new-build it recommends 2.6 - 2.8m, while for refurbishment the recommendation is 2.45 - 2.8m.

The existing floor to ceiling heights at Euston Tower sit outside of this range for new build (existing floor to ceiling is 2.5m).

For refurbishment, the existing clear height is already at the lower end, and would be reduced with the introduction of modern services which are required. Without a ceiling, it would be possible to achieve the lower range of the floor to ceiling heights in limited areas, noting that significant areas would be compromised and/or non-compliant. With a ceiling included, the floor to ceiling heights would fail to meet the recommendations of the BCO across extensive portions of the floorplate (the room sections are shown in Feasibility Volume One Section 6.4).

The evidence suggests that the market demands significantly taller floor to ceiling heights than currently exist at Euston Tower, especially for larger floorplates at the higher end of the market.

In the analysis in Volume One, 725 central London leasing deals were analysed for the ten year period between 2012 and 2022. The analysis considered both smaller floorplates (10,000-15,000 sqft) and larger floorplates (20,000+ sqft). Across all deals there are only five deals in this analysis for the floor to ceiling height that could reasonably be achieved with or without a ceiling zone within the existing structure at Euston Tower (0.5% of all deals analysed). Refer to the summary in Figure 14.1. The implication is that occupiers in Central London lease spaces with floor to ceiling heights of at least 2.6m, or preferably higher. The existing slab levels at Euston Tower do not allow this, and the risk is exacerbated due to the quantum of floor area at Euston Tower.



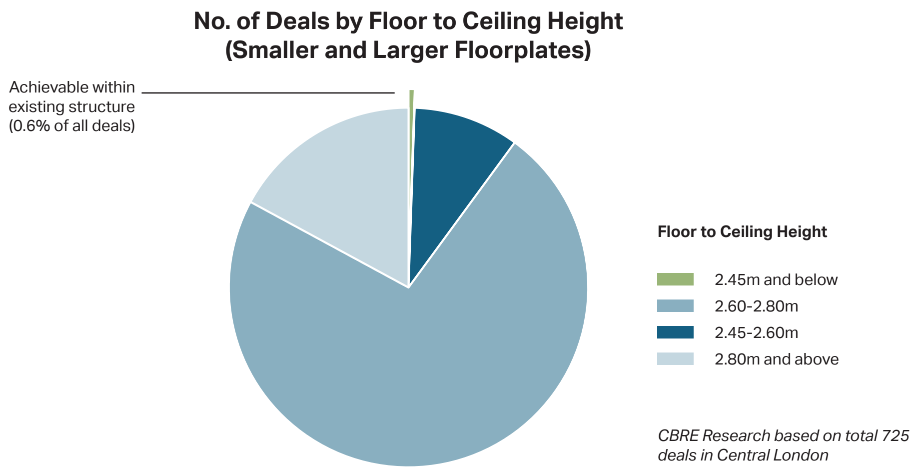


Figure 14.1 Summary of leasing data from Volume One

14.1.3 Daylighting

One of the drivers for the clear floor to ceiling heights recommended in the BCO guidance, is to help ensure good daylighting, which is important for the health and well-being of occupiers. Noting that floor to ceiling height is one of many parameters that affects daylight performance (others include: context, floorplate depth, facade design, etc.).

It is clear from the conclusions of Feasibility Volumes One and Two, that only continued commercial use is appropriate for the building, and that options that generate additional lettable area should be explored to improve viability.

A daylighting study was conducted to establish the impact of extending the floorplates on daylighting performance. The following options were assessed where in all cases the building is upgraded to meet current building regulations (i.e. additional ventilation, risers, firefighting lifts, etc.):

- Existing floorplate
- Existing floorplate with 1m extension
- Existing floorplate with 3m extension.

The methodology used was as per *BRE Site Layout Planning for Daylight and Sunlight: a guide to good practice (BRE209 2022).* Assumptions used in the assessments are as per Figure 14.2. The recommendation for daylight performance is F_{plane} 50% above E_T 300lux for 50% of daylight hours (BS EN 17037).

It was concluded in Feasibility Volume One that, regardless of the development option pursed, the existing facade requires replacing. Accordingly, all daylighting assessments assume the same, new facade with assumptions as per Figure 14.2, and internal ceiling heights as per the upgraded options in Volume One Section 7.4 (see Figure 14.3).

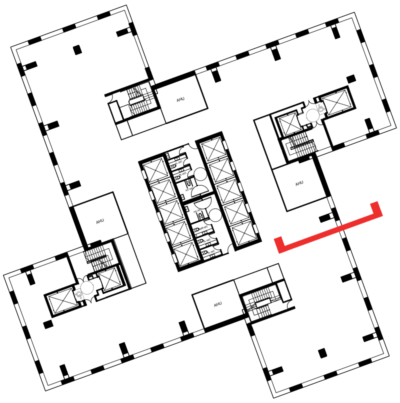
The results are shown in Figure 14.5. It is clear that the daylight performance drops off significantly, even with a 1m extension. Noting that this is unlikely to generate enough lettable area to significantly improve viability. This is because the "good" daylight zone* is typically limited to a relatively narrow band at the perimeter (see indicative section in Figure 14.4). One way to improve the daylight penetration of this "good" zone, is to increase the floor to ceiling height.

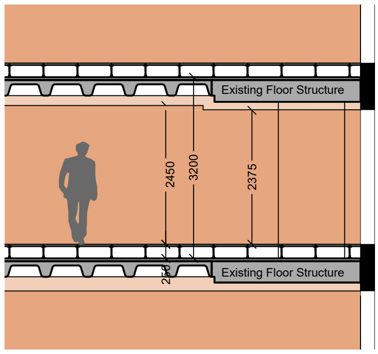
Software		SOL
Methodology		BRE Site Layout Planning for Daylight and Sunlight: a guide to good practice (BRE209 2022)
Assessment plane		850mm working plane
Grid size		500mm square grid
Weather data		CIBSE WCT16SET
Sky model		Perez
Method		2 phase at 60min intervals
Reflectances		
	Partitions	0.7
	Floors	0.4
	Ceilings	0.8
	Reveals (int)	0.7
	Reveals (ext)	0.2
Windows		
	VLT	60%
	Maintenance	8%
	Frame	8%
	Geometry	Floor to ceiling at 50% WWR

Figure 14.2 Assumptions used for daylighting studies

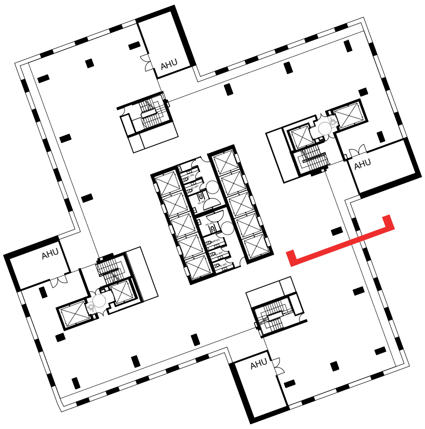
** "Good" daylight be considered approximately 300 lux illuminance at the working plane*

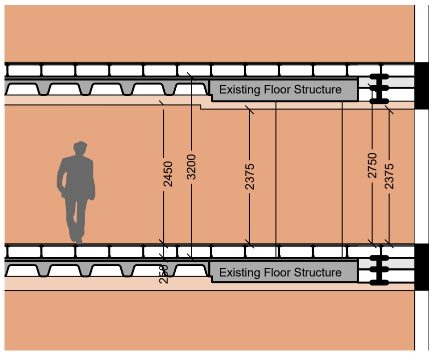
Existing floorplan



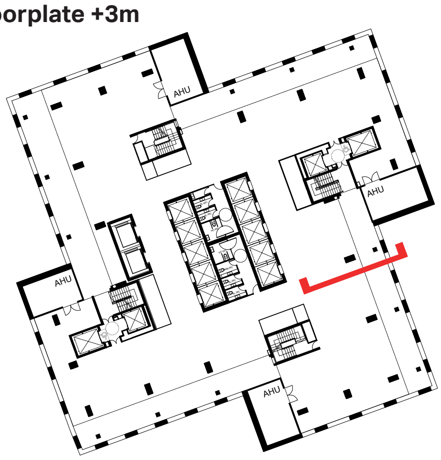


Existing floorplan +1m





Existing floorplan +3m



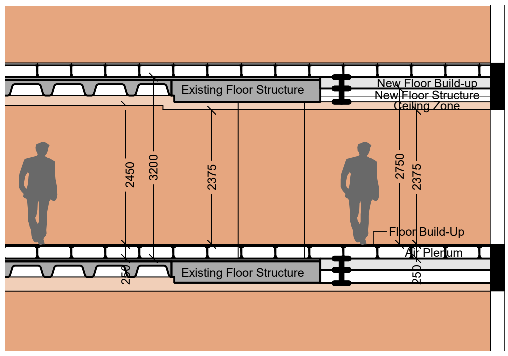


Figure 14.3   Floorplate layouts and sections assessed for daylighting studies

In the layouts in Figure 14.3, it is important that the AHU rooms are on the facade to eradicate the need for supply / extract ductwork across the floorplate.

The results are shown in Figure 14.5. It is clear that the daylight performance drops off significantly, even with a 1m extension. Noting that this is unlikely to generate enough lettable area to significantly improve viability. As stated above, this is because there are limits to the "good" daylight zone, and in this case it is exacerbated because of the bulkhead in the extensions that impinges on the daylight zone in the facade.

Increasing the glazing ratio would help to improve daylight performance, but this must be balanced with solar gains to avoid unnecessary cooling energy demand. The current WWR of 50% is on the upper end for a pragmatic low energy facade. Similarly, an increased visual light transmittance (VLT) would improve daylighting but comes with an increased g-value resulting in increased solar heat gains. Strategies like higher reflectances, light shelves, etc. are not considered feasible as they are thought to be too restrictive to potential occupiers.

One feasible way to improve the daylight penetration of the "good" daylighting zone, is to increase the floor to ceiling height.

As a means of testing this, two additional studies were conducted, where in all cases the building is upgraded to meet current building regulations (i.e. additional ventilation, risers, firefighting lifts, etc.):

- Expanded floorplate at 3.2m floor to floor height
- Expanded floorplate at 3.8m floor to floor height.

Apart from the increased floor to floor heights, everything else is identical between the two studies. All assumptions are as per those detailed in Figure 14.2.

The results, shown in Revision A of this document, showed clearly that the increase in floor to floor height from 3.2m to 3.8m increased the daylight penetration. With the extension there was also more useful floor area in the "good" daylight zone, as much of the core could be consolidated within the central area, and only the AHU rooms were needed at the facade.

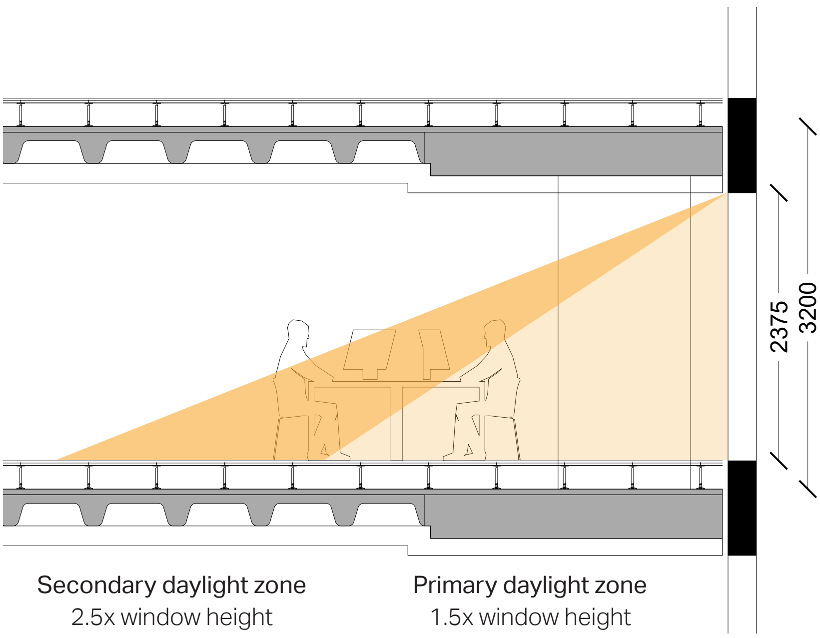
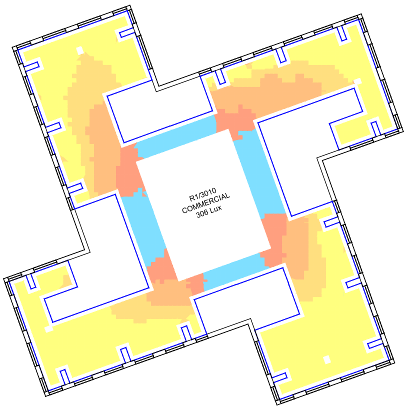


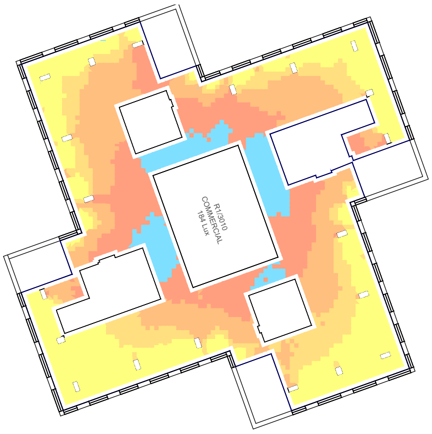
Figure 14.4 Indicative sketch showing good daylight zone (Schumann et al., 2013). For side lit spaces, this zone is limited to the perimeter as indicated

Existing floorplate



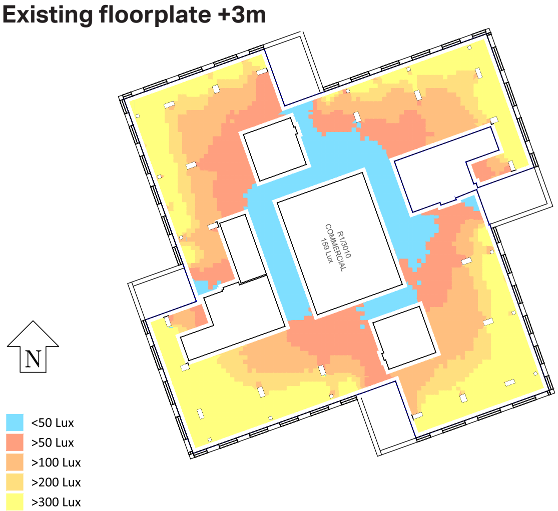
Floor to floor	3.2m
Floor to ceiling	2.375-2.450m
Facade	New with 50% WWR
E_T	300lux
F_{plane}	51%
Well daylit area	~341m²

Existing floorplate +1m



Floor to floor	3.2m
Floor to ceiling	2.375-2.450m
Facade	New with 50% WWR
E_T	300lux
F_{plane}	32%
Well daylit area	~290m²

Existing floorplate +3m



Floor to floor	3.2m
Floor to ceiling	2.375-2.450m
Facade	New with 50% WWR
E_T	300lux
F_{plane}	30%
Well daylit area	~313m²

Figure 14.5 Results of daylighting studies

14.1.4 Benefits of Expanded Floorplates and Larger Floor to Ceiling Heights

Expanded floorplates and larger floor to ceiling heights are key to delivering a sustainable development that can adapt to changing demands, and one that will be attractive in the market and therefore well-used now and into the future.

They impact the following, all of which are important considerations overall:

- **Optimise site capacity**
  Expanded floorplates deliver more useful area on the same footprint, helping to optimise the site capacity in a well-connected and strategically important location. Refer to Volume One Section 5.4.
- **Lettability**
  It is imperative that the development attracts the right occupiers to ensure the building is well-utilised. The market demands floor to ceiling heights of 2.6m or larger. Refer to Section 14.1.2. This is a rather unique refurbishment project, and leasing it as a refurbishment project would be seen to be not viable for a building of this size. A refurbishment that results in a poorly-let / under-utilised building would be environmentally wasteful.
- **Daylighting**
  Allows for larger windows and more natural light to penetrate deeper into the office space. Natural light is known to improve mood, productivity, and overall well-being among employees. Refer to Section 14.1.3.
- **Adaptability and flexibility**
  Expanded floorplates with regular column grids and clear spans is required to deliver "flexible open space". This is the most in-demand feature for occupiers, refer to Volume One Section 4.1. Larger floor to ceiling heights allow room to grow services depth to flex to the changing demands of the future, mitigating premature obsolescence. It also allows for the installation of various internal layouts and furniture to meet future needs.
- **Views out**
  Added internal clear height enables improved views out from deeper on the floorplate, maximising the project's unique views and location. Views out are important for the health and well-being of occupiers.
- **Openness**
  Larger ceiling heights help to create a sense of spaciousness and openness, which can contribute to a more pleasant and inspiring work environment. This can also make offices feel less cramped and more visually appealing, which is important for the well-being of occupiers.
- **Impression and branding**
  For some occupiers, having an impressive office space is essential for creating a positive impression on clients, partners, and employees. A spacious, high-ceilinged office can reflect a company's success and values.

Figure 14.6 Daylight in existing Euston Tower 2022

15

Euston Tower

Establishing a New Baseline

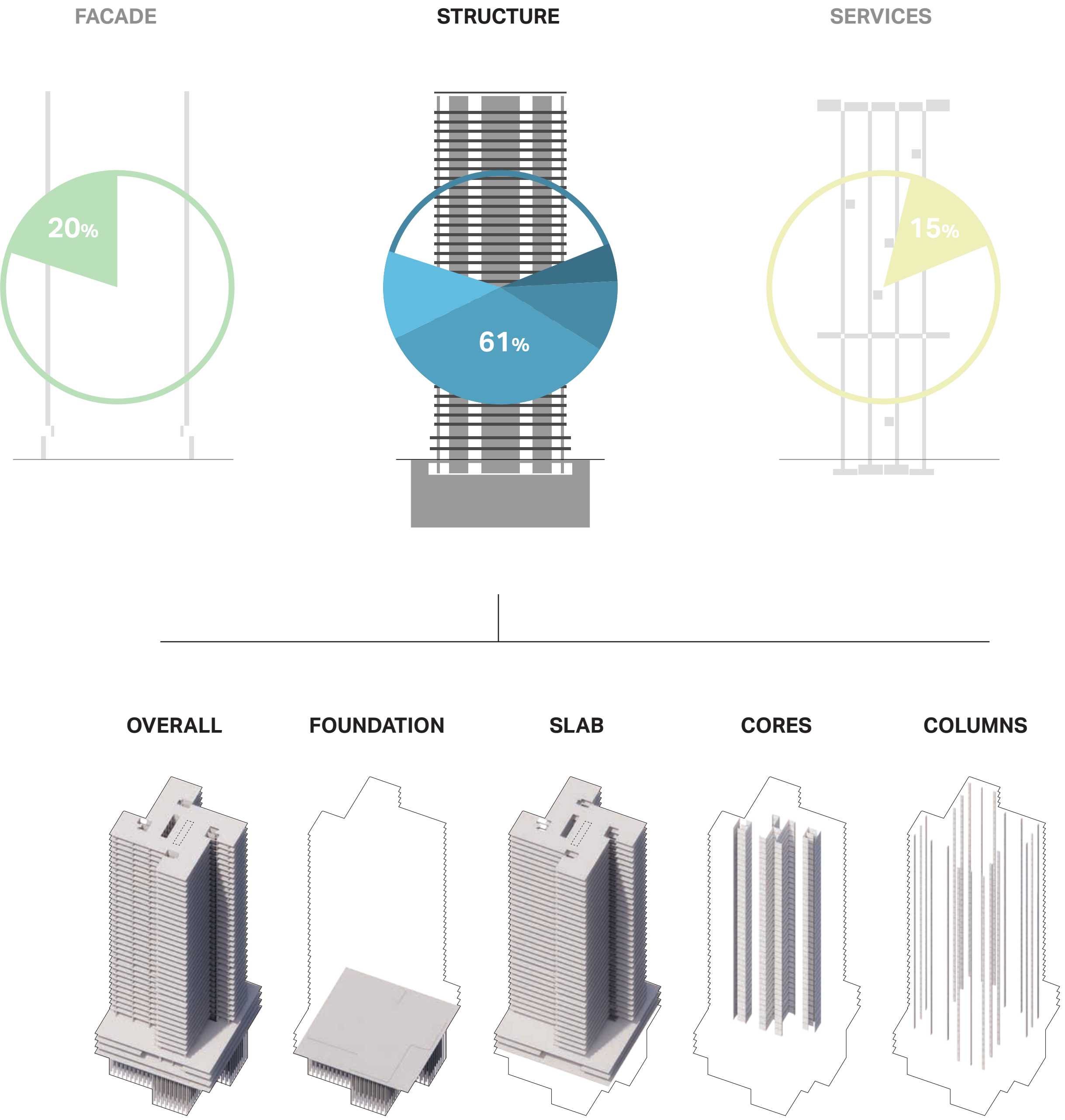
15.1 Carbon Distribution

In Volume One it was shown that the distribution of embodied carbon within the existing tower is primarily in the structure. With the façade needing replacement and the existing services already mostly stripped out, this makes the structure the key focus for retention.

However, it was shown that widespread upgrades are required to the existing building to bring it up to compliance with the current Building Regulations. Among other things, these upgrades result in new penetrations to the existing structure, eroding the total structure that can be retained.

The impact of said interventions means that 100% structural retention is not feasible within the current envelope. This section aims to re-establish the baseline for what is meant by maximum retention within the current envelope, based on the requirements for compliance with current Building Regulations. This is then used as a baseline against which the options for structural retention that follow in this study are compared.

As shown in Volume One, approximately 61% of the embodied carbon in the existing building is in the structures. This then breaks down into the constituent structural building elements, the distribution of which is shown in Figure 15.1. It is clear that the majority of the structural embodied carbon is in the foundation (19%), slabs (60%), and cores (14%), and these therefore present the biggest opportunities for retention.



	OVERALL	FOUNDATION	SLAB	CORES	COLUMNS
Embodied Carbon	**8,950** tCO2e	**1,683** tCO2e	**5,348** tCO2e	**1,266** tCO2e	**651** tCO2e
Ratio of Carbon	**100** %	**19** %	**60** %	**14** %	**7** %

Figure 15.1 Embodied carbon of existing tower broken down by structural element

15.2 Minimum Upgrades Required

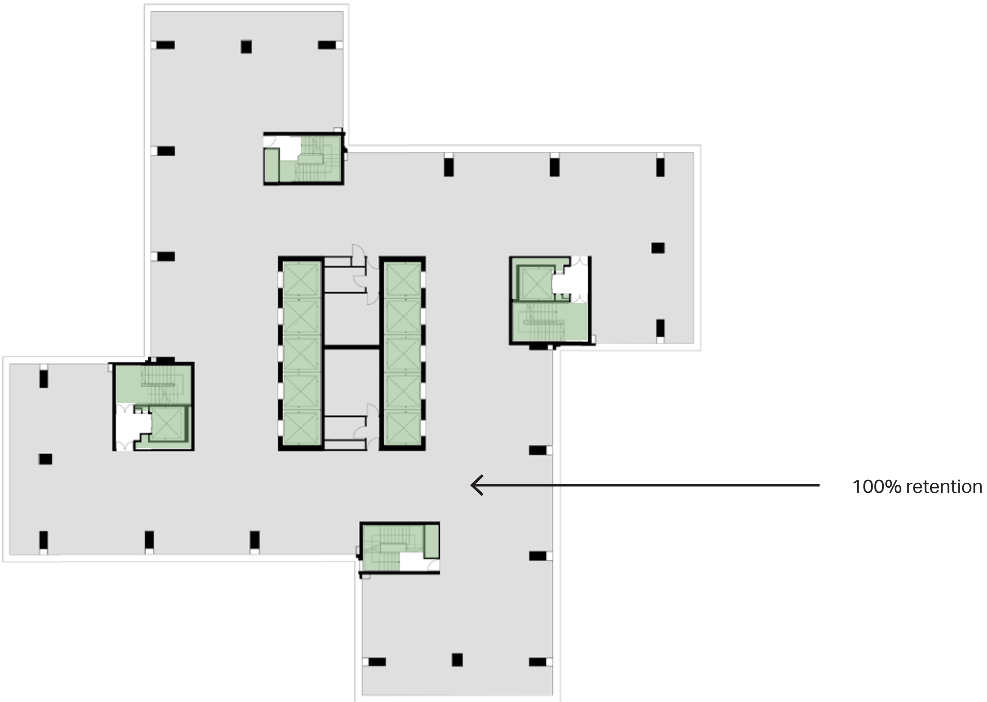
As shown in Volumes One and Two, the following minimum upgrades are required for compliance with current Building Regulations:

- Structural fire performance upgraded to 120 minutes
- Sprinkler provision added throughout
- Mechanical smoke ventilation added
- Dedicated fire fighting lifts required (not shared with goods lifts)
- Fire fighting lifts upgraded to current standards
- Fire compartmentation added to facade
- New air handling plant with higher fresh air rates to meet ADF, and heat recovery to meet ADL
- New central plant provisions with energy efficiency to meet ADL
- Facade thermal performance upgraded to meet energy efficiency requirements in ADL.

Working within the existing envelope (i.e. no floorplate extensions), the impact of these upgrades on the existing floorplate are shown in Figure 15.2. The penetrations required for new lifts and risers are shown in orange. However, wherever a portion of the ribbed slab is interrupted the entire ribbed structure must be removed in this location. This results in additional demolition shown in red.

If the existing floorplate is considered to be 100% retention, the resulting best-case maximum retention on the upgraded floorplate is 82% (by volume). This is considered the best-case estimate as the retention is likely to be lower in reality, as the slivers of retained floor slabs are unlikely to be maintained.

EXISTING FLOORPLATE



UPGRADED FLOORPLATE

Figure 15.2 Diagram showing erosion of floor slab due to upgrades to meet current Building Regulations

When this is scaled up to the full building, the 60% of embodied carbon in the slabs reduces to 49%.

Combining this with all the other structural elements, results in the maximum possible structural retention of the existing, when considering the upgrades required. Figure 15.3 shows that this maximum structural carbon retention is 89%.

The same can be done considering structural retention by volume. When considered by volume, maximum structural retention is 90%.

This is considered the baseline for maximum structural retention. The only way a larger degree of retention could therefore be achieved would be to expand the floorplate and introduce new core elements in areas of the expanded floorplate (as to minimise penetrations in the existing floorplate). It is acknowledged that greater structural salvage could be achieved by doing so. This is the starting point for the exploration in the next section.

** Assumes no floorplate extension (i.e. working within the existing envelope), meaning new risers need to be cut out of the existing floorplate. With extended floorplates, possibility exists to position risers outside of this existing footprint, resulting in potential higher degrees of retention.*

EXISTING FLOORPLATE

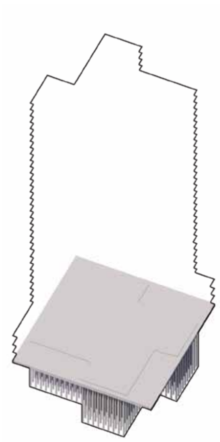
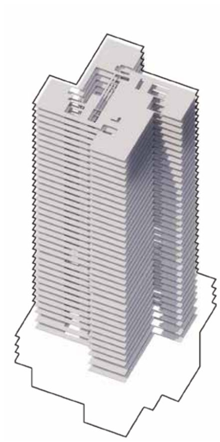
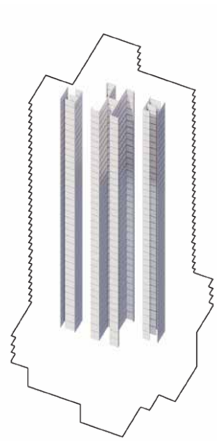
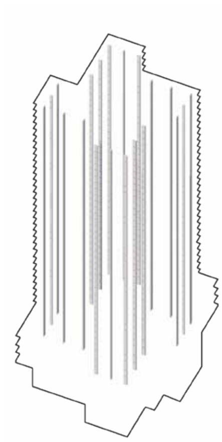
5,348 tCO2e

60 %

UPGRADED FLOORPLATE

4,385 tCO2e

49 %

	OVERALL	FOUNDATION	SLAB	CORES	COLUMNS
					
Embodied Carbon	**7,986** tCO2e	**1,683** tCO2e	**4,385** tCO2e	**1,266** tCO2e	**651** tCO2e
Ratio of Carbon	**89** %	**19** %	**49** %	**14** %	**7** %

MAXIMUM RETENTION*

Figure 15.3 Embodied carbon of existing tower after upgrades, broken down by structural element