3.2.3 Stability

The building includes two primary lift and stair cores and two stair cores to west of the site. These are distributed across the floor plate of the building providing vertical circulation.

Upon review of the existing structural arrangement it is reasonable to assume that the stability of the building is provided by the reinforced concrete walls of these cores that are continuous to the foundation. The cores elements act as stiff vertical cantilevers, attracting and transferring the horizontal forces to the piled foundations.

The floors plates act as diaphragms transferring the horizontal forces from the facade back to the main stability elements. The core walls are generally 200mm thick.

The separating walls in between lift shafts appear to be infill walls supported off RC beams at floor levels.

3.2.4 Existing Facade

The existing façade consists primarily of the following brick faced precast concrete elements:

- Mullions and spandrel beams fixed to the slab edge
- Columns fixed back to primary structural columns.

The precast concrete mullions are typically spaced at 3.9m centres. There appears to be movement joints between floor levels and a further vertical joint between mullions and the spandrels. Punched windows are mounted into the facade and fixed back to the precast elements. It is understood the existing windows were installed during the recent refurbishment and are in sound condition. There are hence opportunities to reuse/recycle the windows to reduce potential environmental impacts via the circular economy principles.

Typically, there are 450x700mm RC downstand beams positioned around the full perimeter of the building to fix the cladding elements potentially to help control edge deflections. In some locations these RC downstand beams contain vertical joints suggesting the edge band beam (slab) is the only primary structure.

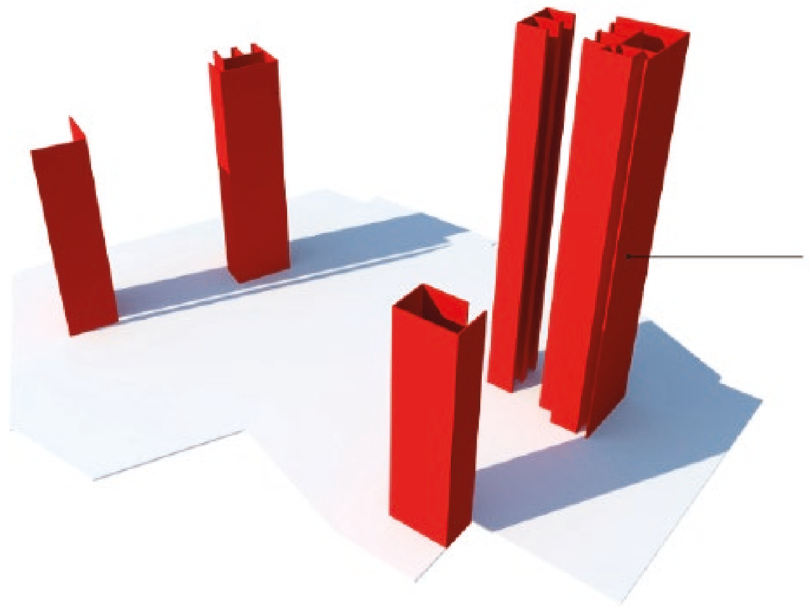


Figure 3.5 Existing cores - isolated 3D view

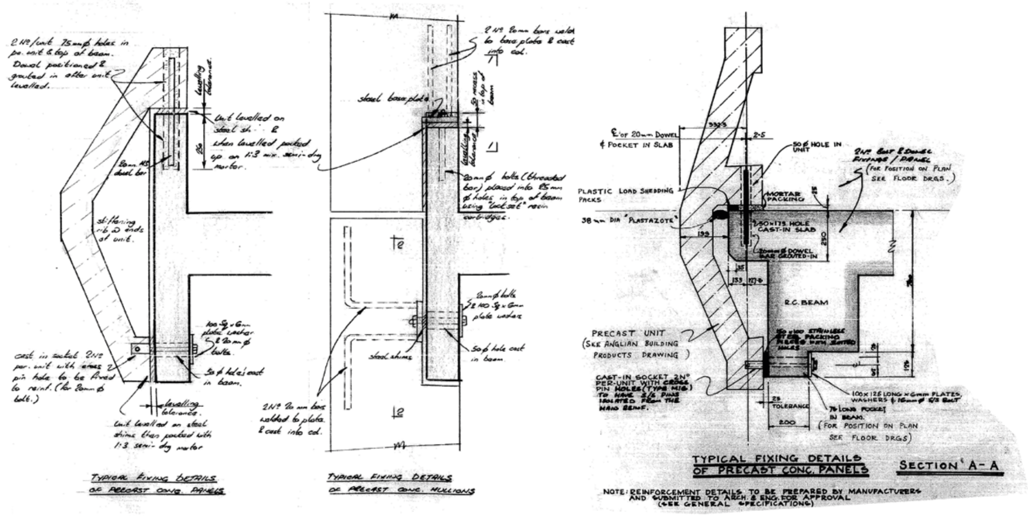


Figure 3.6 Existing facade fixing details

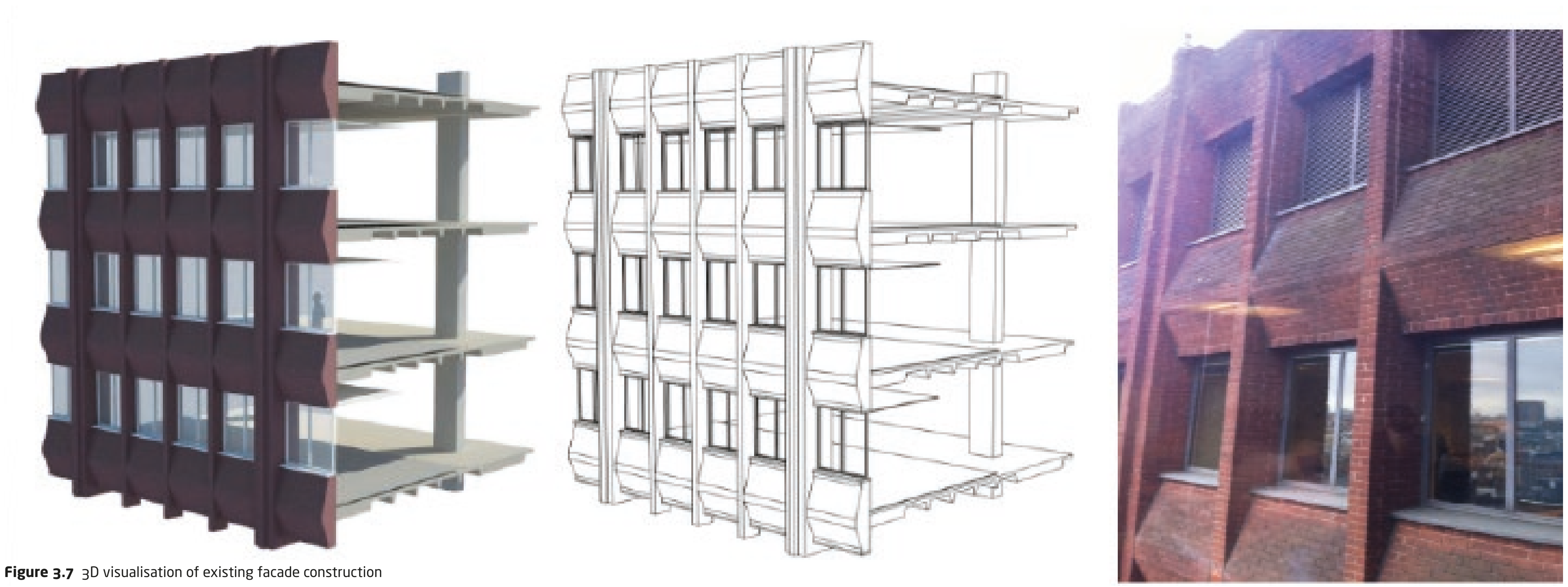


Figure 3.7 3D visualisation of existing facade construction

4 Proposed super-structure

4.1 Overview

The structural design philosophy will focus on the creative reuse of the existing structural fabric, prioritising material efficiency. A key component of enhancing the structure's efficiency is the addition of two new floors above the 10th level, which will require the implementation of a column strengthening strategy and foundation improvement. To optimise the building's performance, the core layout will be reconfigured to improve vertical circulation, and a new building envelope will be introduced, offering both aesthetic and energy efficiency benefits. Additionally, the existing transfer elements in the step-back areas will be demolished to improve structural efficiency. In another instance of reuse, the existing core piled bases will be repurposed by removing the fill material between the lift pits, enabling the use of the existing bases for the proposed lift pits.

4.2 Demolition

As part of the proposed scheme, local demolition will be required. This primarily involves modifications to facilitate the installation of new cores, as well as the removal of existing setbacks to accommodate the additional floors. The scope of demolition has been carefully considered to balance the retention of the existing structure as much as possible with the practical and technical challenges of integrating the new and existing elements.

4.3 Floor plates

The proposed floor construction typically consists of profile metal decking floor slabs supported on new steel framing. The profile metal decking typically spans up to 3.9m (half of the existing structural grid) and requires intermediate steel beams for support.

Slimflor beams have been proposed for the secondary beams. Slimflor beams are universal steel sections with welded bottom plates. The additional bottom plate firstly increases stiffness and thereby minimises structural depth and secondly allows the metal decking to be easily installed as the bottom plate acts as a supporting 'shelf'.

Supporting the metal deck on the bottom plate also creates a flat slab soffit which allows for flexible service distribution. As the slab thickness is shallower than the beam depth, the arrangement will introduce an upstand. This will need to be fire protected and incorporated within the architectural build-up.

The proposed slab construction around the new stability cores is proposed to be solid reinforced concrete (RC) slabs and is typically 325mm thick to match the existing floor plates. Hydro-demolition of the existing floor plates allow new reinforcement to be lapped on to existing reinforcement to create an effective transfer of forces between the two elements. Solid RC slabs are also proposed where infills of small to medium sized floor openings are required.

4.4 Stability system

The global stability of the building is provided by the two new cores that will replace the original north and south cores. The new cores are larger than the existing cores and will be located approximately in the same areas.

The existing north core will be demolished entirely and reconstructed. It will incorporate 6no. passenger lifts (including 1no. evacuation lift), 1no. shuttle lift, 1no. cycle lift and 1no. firefighting lift. The existing pile cap will also be demolished to allow for deeper lift pits and the incorporation of additional piles to strengthen the core foundations.

The existing south core will be partially demolished and rebuilt, and will consist of 2no goods lift, and 1no. firefighting lift. The existing staircase will also be retained. The south core foundations will also be partially retained and rebuilt.

A third existing stair core adjacent to the neighbours at 119 Shaftesbury Avenue, which currently serves basement to level 06, will be retained. Additionally, a new evacuation lift will be installed alongside this core.

Below is a summary of the typical structural works required:

- Demolition of the existing floor slab, beams and columns that fall into the extent of the proposed core structure. Typically affected ribbed slab bays will need to be demolished entirely and rebuilt due to loss of integrity.
- Where the existing core is no longer required, the core walls will need to be demolished and the existing core shafts will need to be infilled with new floor slabs.
- Where the proposed core does not fall into the extent of existing core foundations, a new piled foundation will be required. Local breakout of the existing basement slab will be required. New pile caps will then be formed and connected to the existing piles where possible.
- It is anticipated that temporary works will be required during the core related structural works, as the stability of the building will be significantly impaired during the deconstruction of the existing cores.

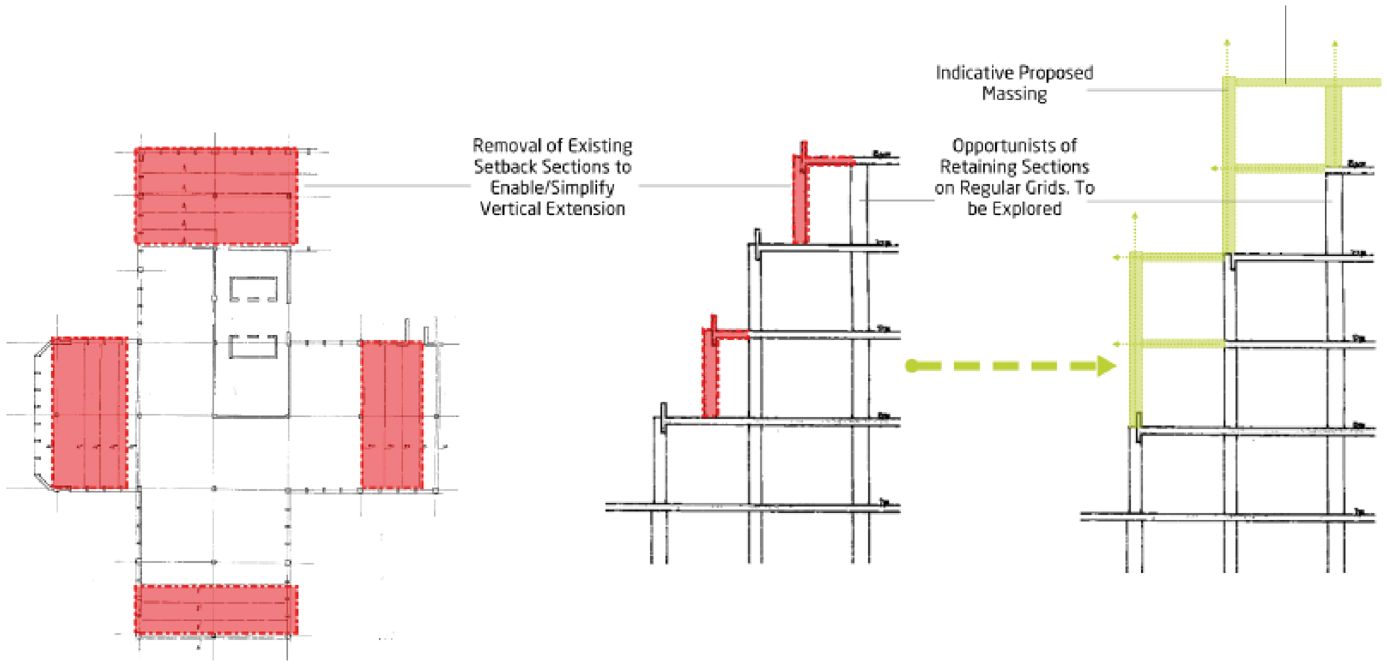


Figure 4.1 Plan and section views demonstrating demolition and extension principles

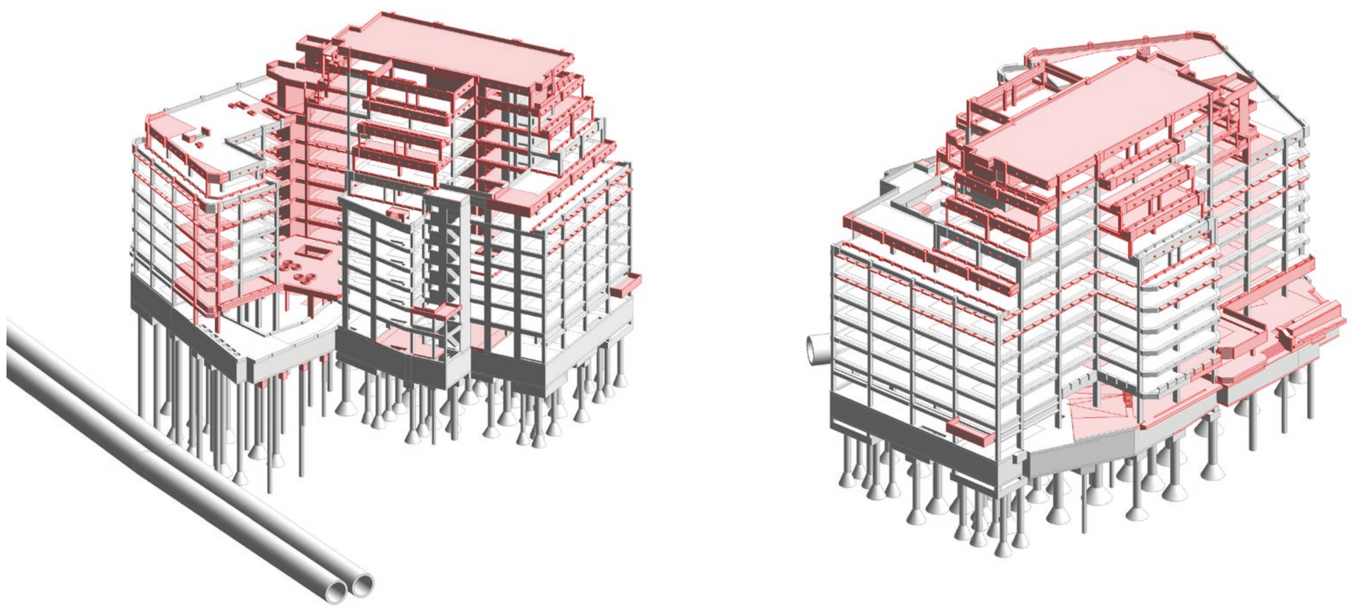


Figure 4.2 3D visualisation of structural demolition (red)

4.5 Terraces

As the building steps back, several terraces are proposed to provide landscaping and amenity space. These areas are likely to experience some of the heaviest loading in the proposed structure, and due to the need for additional insulation and waterproofing, the available structural zones are very limited. Therefore, careful consideration of the landscaping—its type, extent, and position—along with whether the terraces will be accessible, is crucial.

The exact landscaping build-up is not fully known at this stage. However, AKT has utilised its experience to assess suitable allowances, which will need to be confirmed and, if possible, adopted by both the architect and landscape architect. The timing of the landscaping installation is also expected to interact with the façade, given the increased loading. As such, a detailed assessment will be required when developing the construction sequencing and any pre-setting of the façade elements.

4.6 Facades

Two new façade systems are proposed: a precast concrete façade for the main body of the building, consisting of precast concrete spandrels and mullions spanning from column to column. This design reduces the impact of slab edge deflection on the façade, but results in increased localised loading on the existing beams.

The second façade type is a unitised system, applied where the building steps back. This system is slightly lighter and is continuously supported at the head of the panel.

The façades have stringent deflection criteria; however, to achieve an economical and low-carbon solution, careful coordination between the façade design, structural concept, and installation will be necessary to assess the deflection that the façade elements will experience. This is particularly relevant for façade elements supported on transfer structures, where pre-setting may be required to ensure the façade is level after the structure deflects.

4.7 Transfer beams

In general, the most efficient way to transfer load from a structure to the foundations is by the shortest and most direct load path possible. As such complex heavy transfer structures should be avoided as they increase material use, embodied carbon and tend to have cost and programme implications.

Where the proposed massing requires step back of the façade that does not align with the structural grid, transfer structures will be necessary. This will require careful coordination between façade design, structural concept and construction sequencing.

KEY:

- 1 - Intensive and Tree Planter Loading
- 2 - Terrace General Paving
- 3 - Top Roof with PV Panels
- 4 - Loggia Loading*

*for loggia loading refer to sketches 125SA-AKT-XX-XX-SK-S-00402 to 00404

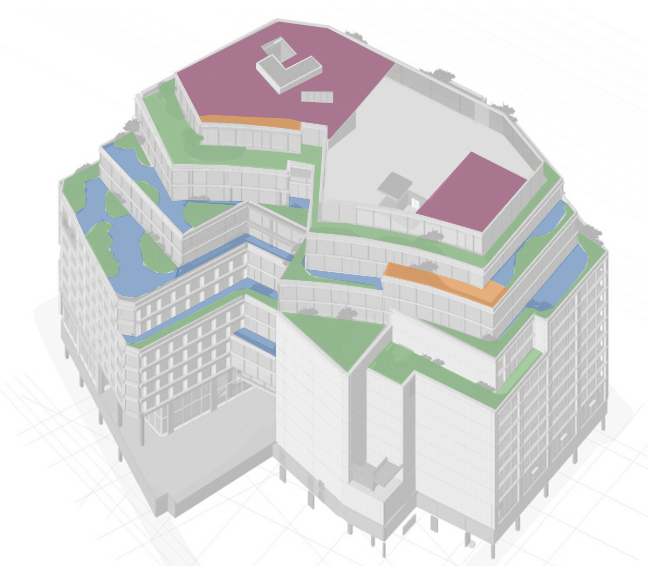
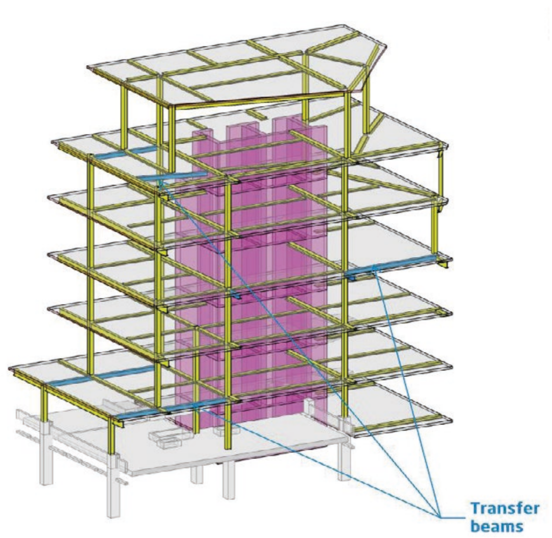
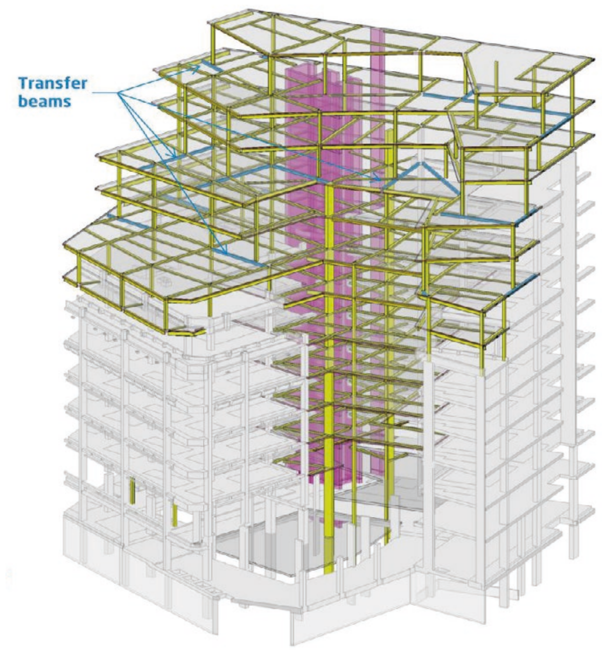


Figure 4.3 Roof terrace loading - coordination with landscaping



1. Phoenix Street Elevation



2. Charing Cross Road Elevation

Figure 4.4 Transfer structures - Charing Cross Road and Phoenix Street elevations

4.8 Columns strengthening

It is important to recognise that the existing structure was originally designed to accommodate high imposed loads. As a result, there is a degree of residual capacity within the original floor slab and columns.

From an analysis of the existing column capacities and proposed loading, the column types that may require strengthening were identified. This will be validated following the receipt of the findings from the fabric survey and confirmation of proposed build ups.

AKT has considered concrete jacketing as a form of column strengthening. This method essentially encases an existing column with additional concrete to increase its section size. This will effectively share a proportion of the increased loading and provide further confinement on the existing column increasing its capacity.

The new concrete jacket will utilise self-compacting concrete and can use either regular or high-strength concrete. Dowel bars will need to be post-fixed into the existing column, with the existing concrete surface treated with an appropriate epoxy or scabbled to ensure an effective bond between the new and existing concrete sections.

The concrete jacket will also require a follow-up visit to inject high-strength grout at the top of the new jacket.

Figure 4.6 Concrete jacketing 3D

4.9 Edge beam alterations

Various alterations to the existing edge beams are being proposed to integrate new structure with the existing building. An overview of the existing edge beam typologies for a typical floor is provided in sketch 125SA-AKT-XX-XX-SK-S-00601. Based on the archive records, the edge beams are generally 450 by 700 deep reinforced concrete beams. Various other RC beam sizes are present, but all beams are downstands and monolithic with the slab and columns.

Where the existing floor structure is to be extended, a near flush soffit is to be maintained between the existing and new slab to avoid encroaching on the MEP services zone and floor to ceiling heights. Alterations to the existing edge downstand beams are therefore required.

The edge beam alterations consists of reducing the existing downstand beam to be flush with the slab soffit and a new rolled open steel section is installed to re-support the existing and new slab edges. Support of the slabs is taken off the bottom flanges to maintain, as close as possible, the existing structural zones. Post fixed dowels will be installed through the beam web to provide a tie connection between the existing and new slabs.

Where existing downstand beams remain as perimeter elements, minor modifications may be permitted to facilitate the replacement and connection of new façade panels. Based on AKT's interpretation of the archive records, the smaller concrete projections on the face and soffit of the beam would appear to be non-structural and therefore, if required, can be removed without affecting the integrity of the section.

4.10 Band beam alterations

A key principle in the demolition strategy is to avoid compromising the primary frame where possible. This generally means planning demolition cut lines away from band beams and edge beams. In most conditions it is beneficial to plan cut lines up to the edges of the beams so that the entirety of the ribbed slab portions can be removed, negating the need for temporary support.

Disruption to the band beams is unavoidable where the new stability cores are being reconstructed. To accommodate the larger footprint of the new stability cores, certain spans of the band beam are proposed to be removed. The result would be a loss of beam continuity across the building and possibly increased stress in the beam.

An assessment of the affected band beams was carried out to ensure that the partial demolition does not compromise structural integrity. The beam capacities were recalculated based on record reinforcement drawings and compared against the new load requirements and span configurations. The analysis showed that the band beams remain within their capacity despite changes to the span configuration. Therefore, strengthening of the band beams is not required. The primary factor contributing to this outcome is the lower design loads for the new uses, combined with the existing structural elements' spare capacity.

Where existing reinforcement bars are exposed due to partial demolition, corrosion protection of these elements is to be reinstated. An epoxy resin coating is to be applied to the surface of the reinforcement. Prior to application, the rebar is to be mechanically cleaned to allow bonding with the repair products.

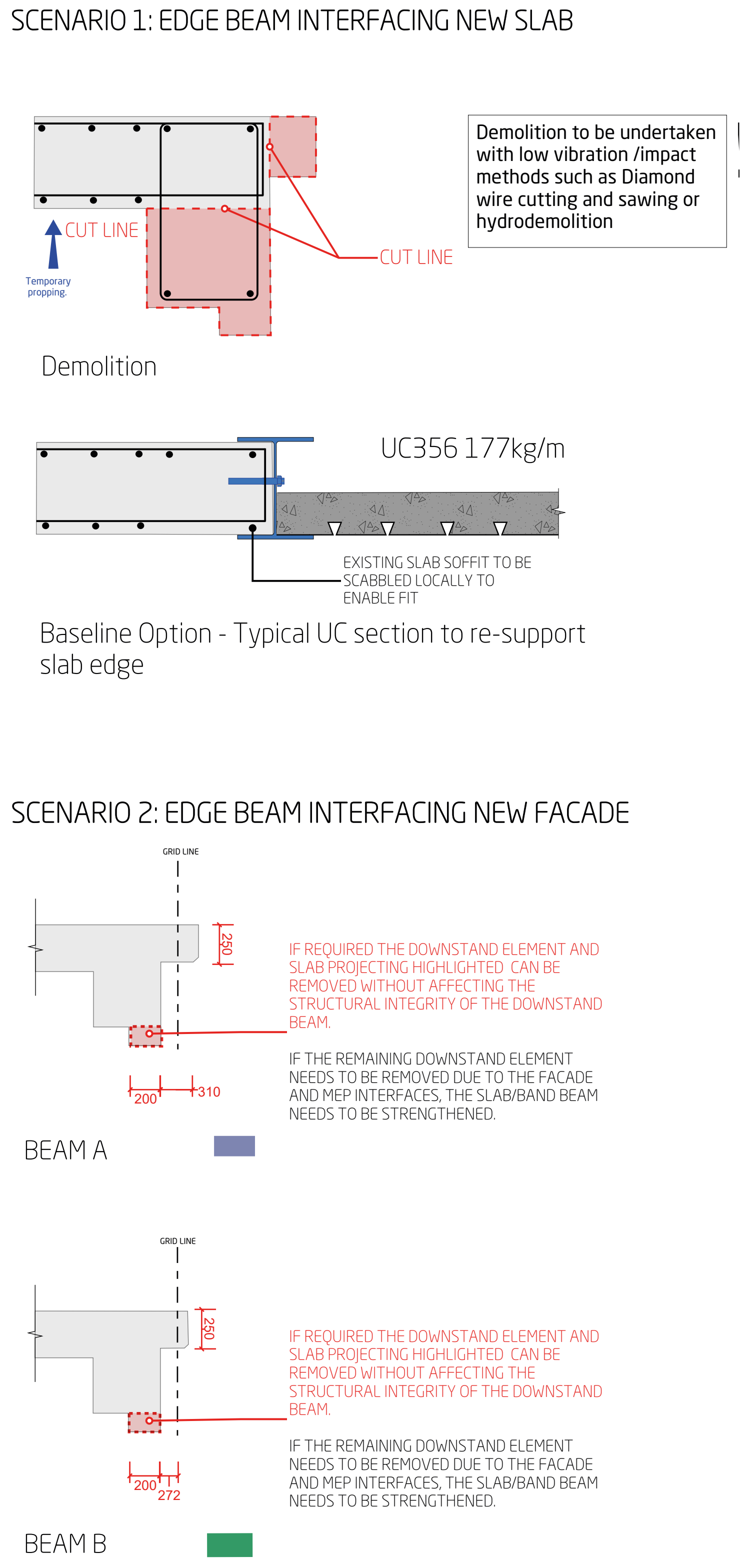


Figure 4.5 Edge beam alteration details

5 Proposed substructure

5.1 Ground Floor

The ground floor of the site is stepped, making it unsuitable for the proposed retail use. To facilitate level access directly from the street, the ground floor slab will be locally demolished and rebuilt. Furthermore, the removal of the ramp to the basement requires the installation of additional structural elements to span the former opening.

The relocation of the UKPN in the northern corner will involve breaking out the slab and recasting it at the new level. These alterations will be supported by the existing columns, potentially with the use of steel angles or concrete or steel jackets to accommodate the new slab.

Temporary propping of these columns is likely to be necessary during the demolition of the slab. Additionally, the top of the retaining wall will require temporary propping during this phase.

5.2 Basement

5.2.1 Basement slab

The basement slab, located above the main pile caps, is typically 350mm thick and spans across approximately three levels, with some localised variations. The levels are approximately 20.220m in the north, 18.7m in the south, and 19.15m in the north-western corner. In the northern corner, the existing slab will be removed to facilitate the relocation of the UKPN into the basement. This process will require temporary works to prop both the top and bottom of the wall, which must be carried out sequentially, along with the underpinning of the wall, to allow for an increase in the basement depth. The new slabs will be tied to the edges of the existing pile caps.

Where new cores are required, the existing pile caps will be broken out, and new pile caps will be installed. These new pile caps will be connected to both the existing and new piles for the core, with settlement controlled to align with the adjacent structures.

5.2.2 Pile reuse

A key objective of the scheme was to maximise the reuse of the existing structure, including the optimal reuse of the existing piles. An in-depth assessment was carried out to evaluate the capacities of the existing piles and how they could be utilised in conjunction with additional piles. This assessment included the following:

The capacity of the existing piles was calculated and verified for reuse through back-analysis, based on their geometry and properties as detailed in the available record information. This back-analysis was cross-referenced with the pile capacities listed in the historic Piling Schedule.

Given the differing nature and timing of the new loading, it is essential to ensure sufficient compatibility between the new and existing piles, both in terms of load-bearing capacity and settlement behaviour. To achieve this, the proposed pile diameters have been selected to optimise settlement compatibility.

It should be noted that, although a larger diameter of 1200mm would be more suitable for pile compatibility, the restricted headroom on site limits the availability of suitable equipment. This may constrain the selection of potential contractors.

5.2.3 Waterproofing strategy

The proposed basement waterproofing strategy will consist of a combination of Grade 2 and Grade 3 areas. Given the significant retention of existing structures and the interfaces between new and existing elements, a robust and consistent solution is required. The protection will be provided through a combination of Type A (tanked/membrane) and Type C (cavity drained) systems. This approach offers a new waterproofing solution that is independent of the structural elements, ensuring continuity across both the retained and new components.

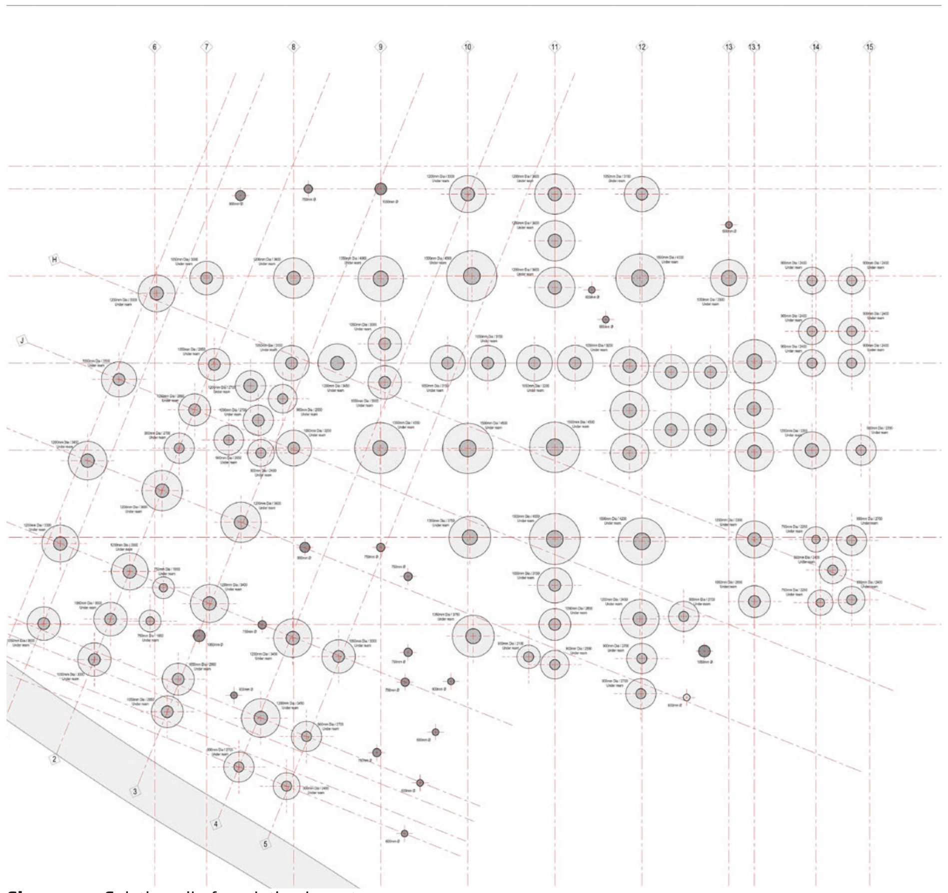


Figure 5.1 Existing pile foundation layout

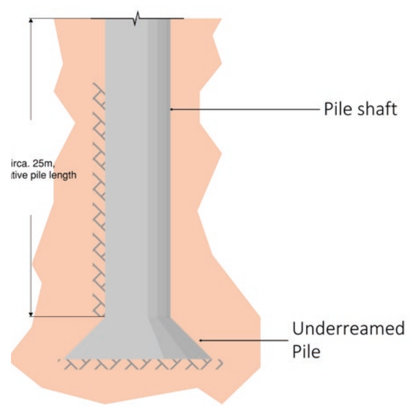


Figure 5.2 Typical section of under-reamed pile

6 Construction sequencing

Due to the extensive alterations for new cores and internal atriums a careful phasing of the works is required. This is key to the stability of the existing structure and the buildability of the proposed scheme. This section outlines the proposed construction sequencing for both the superstructure and substructure. The final phasing and sequencing will require extensive input from the main contractor when appointed.

6.1 Superstructure elements

1. Soft strip: Remove all finishes, including any screeds, and dismantle the façade. At this stage, a further topographical survey should be conducted to confirm the position of the existing structure and identify any additional investigations that may be necessary.
2. Demolition of upper floors and setbacks: Carefully demolish Level 10 and the setbacks of the existing structure to prepare the upper floors for the additional stories.
3. Installation of temporary works: Temporary works are required to facilitate the demolition of the existing cores and the installation of the new cores. These works will support the temporary slab edges and provide additional stability to the retained frame during the demolition and installation process. This may involve propping along the demolition cut lines and bracing for added stability. The extent of temporary works may be reduced if the core alterations are executed sequentially.
4. Installation of new cores: Once the necessary temporary works have been implemented, demolition of the slabs around the proposed cores can proceed. An approximate saw cut line of 1 metre around the core perimeter will be required to create sufficient space for the formwork needed to cast the new cores. This 1-metre strip will be integrated into the core, and an additional strip of hydro demolition will be necessary around this area to facilitate lapping of the new and existing reinforcement.
5. Removal of existing core: The existing core can be removed once the temporary works are in place.
6. Alterations to the floors: After the new cores are installed, the alterations to the floors, including demolition and infilling, can occur on a storey-by-storey basis. This is also when any column strengthening will take place. Care must be taken to ensure that the stability of the floor plates is maintained, and additional bracing may be necessary depending on the final sequencing.
7. Erection of new storeys: The new steel frame structure will be installed on the existing frame for the additional stories, with the understanding that additional bracing may be required before the installation of concrete within the metal deck.
8. Installation of the façade: The installation of the façade is expected to occur after the frame has been erected.

6.2 Substructure works

1. Excavation and breaking out of existing basement: The proposed drainage and new lift pits will necessitate breaking out the existing basement slab to install the new drainage and excavate for the new lift pits, as well as to accommodate additional requirements.
2. Installation of new piles: Once the existing slabs have been broken out, the installation of the new piles can commence using a low head height piling rig. These piles must be carefully positioned to avoid interference with the existing piles.
3. Demolition of ground floor: The ground floor will be replaced to provide level access. To facilitate the demolition of the existing ground floor, the retaining wall will need to be propped in a temporary condition. An assessment will also be required to determine whether the retained columns will need propping; at this stage, it should be assumed that all columns will require support.
4. Casting and fixing of new piles and pile caps: The new piles and pile caps need to be tied in with the new lift shafts and lifts.
5. Casting of ground floor: Following the completion of the basement works and the construction of the new core up to ground floor, the new slab can be cast. This will need to be sequenced in such a manner to ensure sufficient propping to the existing retaining wall is maintained.

6.3 Further construction considerations

In addition to the complicated sequencing required for the project, the site has a number of spatial issues which will further complicate the construction process. These include the following:

- Adjacent property requiring fire escape through site

This portion of the works may require further temporary work phasing to ensure a escape route is maintained.

- Narrow access routes

This will limit deliveries logistic and careful planning is required

- Limited laydown area

Due to the size of the site, there is no / limited places to store materials on site.

- 24/7 access to UKPN during construction

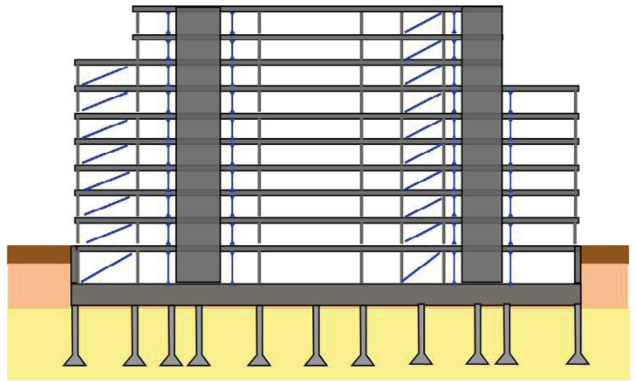


Figure 6.1 Installation of temporary works

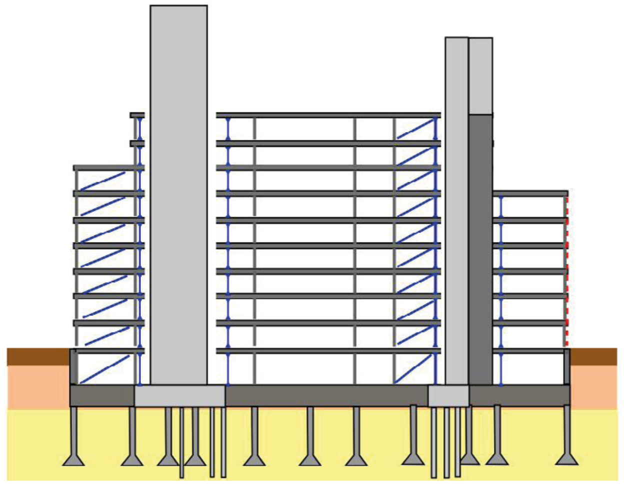


Figure 6.2 Casting of new cores