A

Euston Tower

Appendices

Appendices

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A Floorplate Layout

In developing the floorplate and core layouts, the starting point was to retain as much as possible of the existing slab.

The amount of the existing slab which could be retained is linked to the location of additional core elements which, as shown in Feasibility Volume One and Section 15, require voids to be punched through the existing slab. The existing slab consists of the structural ring beam, ribbed slab zones, and flat slab zones. Because the ribbed slabs span in a single direction, when additional voids are introduced there can be larger amounts of existing slab removed than just the void itself. Therefore multiple options for core layout were considered.

The following options are studied:

- Retain Everything Existing (Dispersed Core)
- Retain Everything Existing and Remove Central Core
- Retain Central Core with New North Core
- Retain Central Core with Centralised North Core
- Retain Central Core and Two Satellite Cores
- Retain And Expand Central Core.

All options are assessed using the same, typical extended floorplate, and uses a decentralised ventilation system as the basis for proposals. The extent of this floorplate is intended to be indicative of one plausible extension only, and it does not presuppose the outcome of any developments around massing.

Ultimately the conclusions are not sensitive to the shape or absolute dimensions of the extended floorplate. This to say that the outcome of this assessment would be the same regardless of the shape of the extension.

A.1 Retain Everything Existing (Dispersed Core)

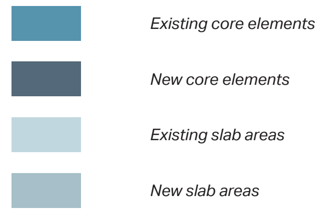
This is the option that aims to retain as much as possible of the existing slab, while delivering the upgrades required by Building Regulations, and an extended floorplate. The resulting floorplate is shown in Figure A.1, where retained structural elements are indicated in red.

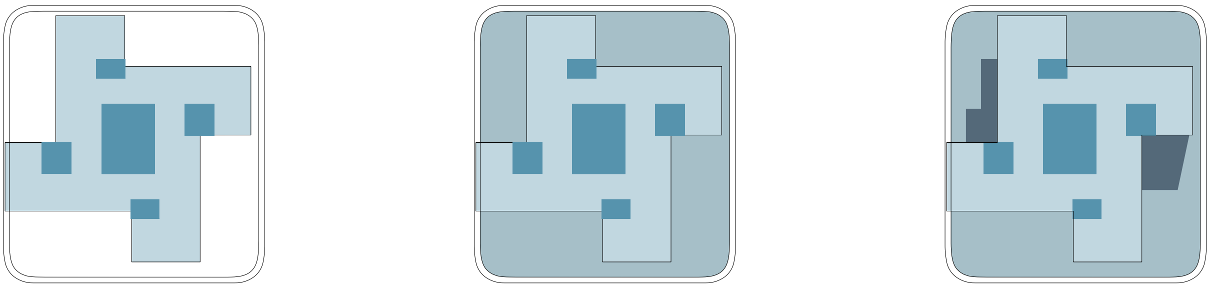
To achieve this, the central core and satellite core structures would be retained, along with all relevant columns. All new core elements would be designed to be outside the footprint of the existing floorplate, meaning no new penetrations would be required in the existing slabs. The east and west satellite cores would remain as escape cores complete with fire-fighting lifts. Evacuation lifts and additional passenger lifts to these cores would be appended outside of the existing footprint. For the north and south satellite cores, the existing stairs would be removed and the cores would become riser shafts (the other two existing stairs are sufficient for escape).

While this would result in potentially maximised slab retention, the core would essentially be elongated to the width of the floorplate and dispersed. The resulting floorplate would be disconnected, especially the area that is sandwiched between the central core and the new western core elements. Flexibility would be inhibited by retaining the north and south satellite cores, and the pinch points at the double column arrangements which are needed because the columns supporting the existing slab must be maintained in their original locations.

Floorplate retention would be very near to 100%, retaining on average 149 tCO_2e per storey.

This core layout would be inhibiting to connectivity and flexibility for a contemporary office.





Existing central core, all satellite cores and existing slab are retained

Floor plate is extended with pinwheel fully maintained

All new core area is added in areas of extended floorplate, no core penetrations required in existing

Figure A.2 Diagram showing elements that are retained in this option and the position of new core elements

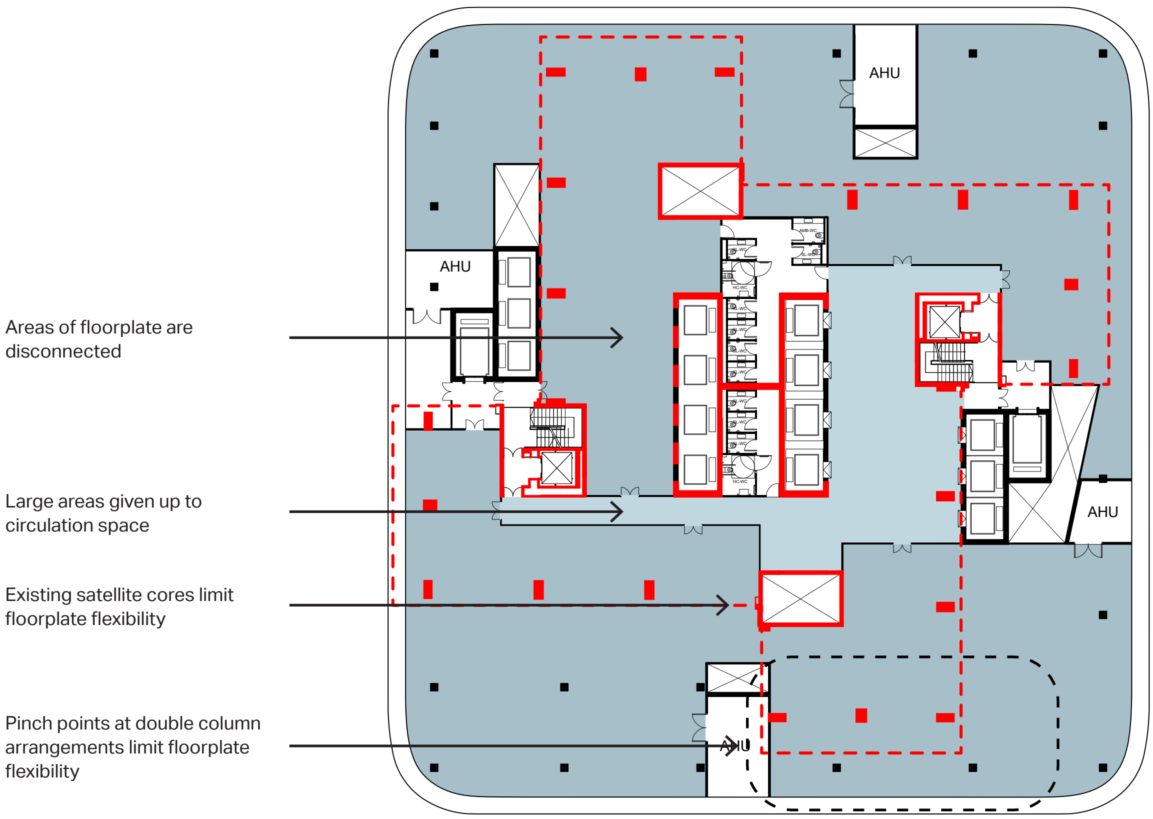


Figure A.1 Indicative floorplate and core layout with all new core elements outside of the existing slab footprint

A.2 Retain Everything Existing and Remove Central Core

One way to improve the connectivity of this floorplate would be to relieve the pressure on the central core area. In this case total removal of the existing central core was considered, with all new core elements incorporated outside the footprint of the existing floorplate. The void left over from removal of the central core would be filled in and become a part of the usable floorplate.

This move appears to be a natural progression from the limitations of the layout in Section A.1.

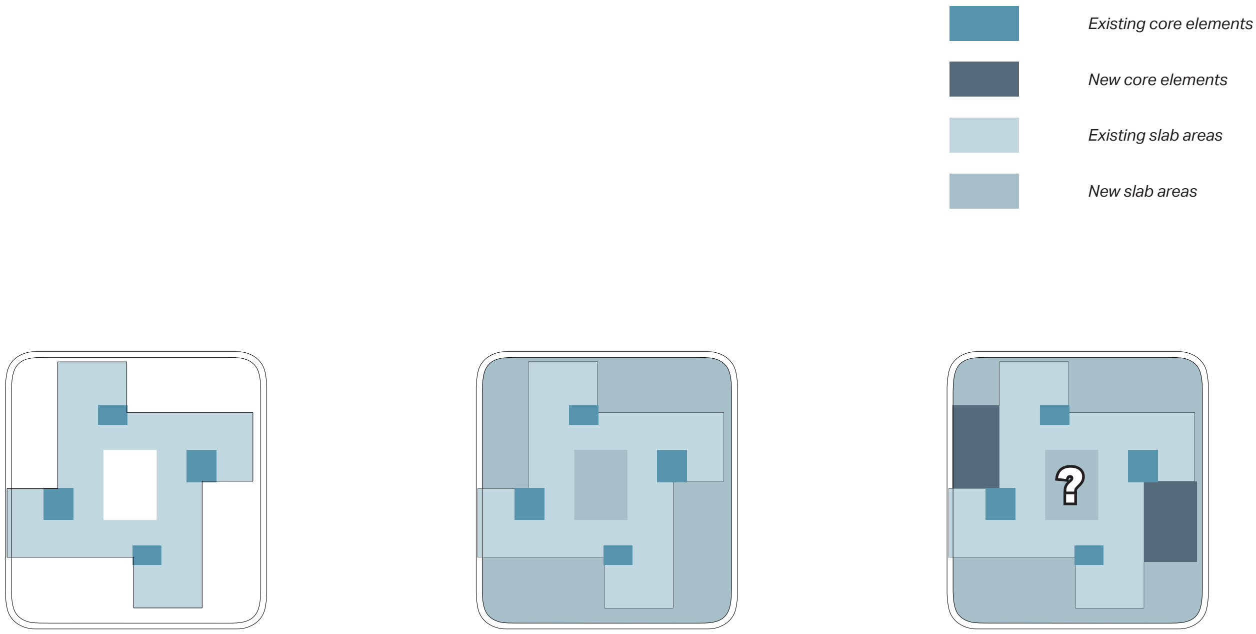
While this may be attractive diagrammatically (see Figure A.4), there are a number of practical and programmatic hurdles that preclude this option being considered further.

From a structural perspective, the key is to maintain stability of the primary structure before the existing central core (which currently provides said stability) could be removed. Practically this means building a full new stability structure (either temporary or permanent) ahead of removing the existing core.

From a construction sequencing perspective, there are two ways that this could be achieved. One way would be to construct a full temporary works bracing around the outside of the existing building. Another way would be to construct and install the permanent perimeter bracing system that is proposed for the extended floorplates. In this case new floor slabs would need to be installed at the perimeter bracing system's nodes to enable the diaphragm action that is required for lateral stability. This is all before the central core could be removed.

With a new stability in place, columns would be added around the core, and the slabs would be temporarily propped on every level to support slab edges. The core walls would be cut out and removed, noting that the practical aspects of removal would be contingent on the temporary stability strategy chosen. Finally the resulting void would be in-filled with new floor slab.

This core layout would ultimately not be viable when considering the practical and programmatic implications.



All satellite cores and existing slab are retained, existing central core removed

Floor plate is extended with pinwheel fully maintained, central core area is filled in

All new core area is added in areas of extended floorplate, no core penetrations required in existing

Figure A.3 Diagram showing elements that are retained in this option and the position of new core elements

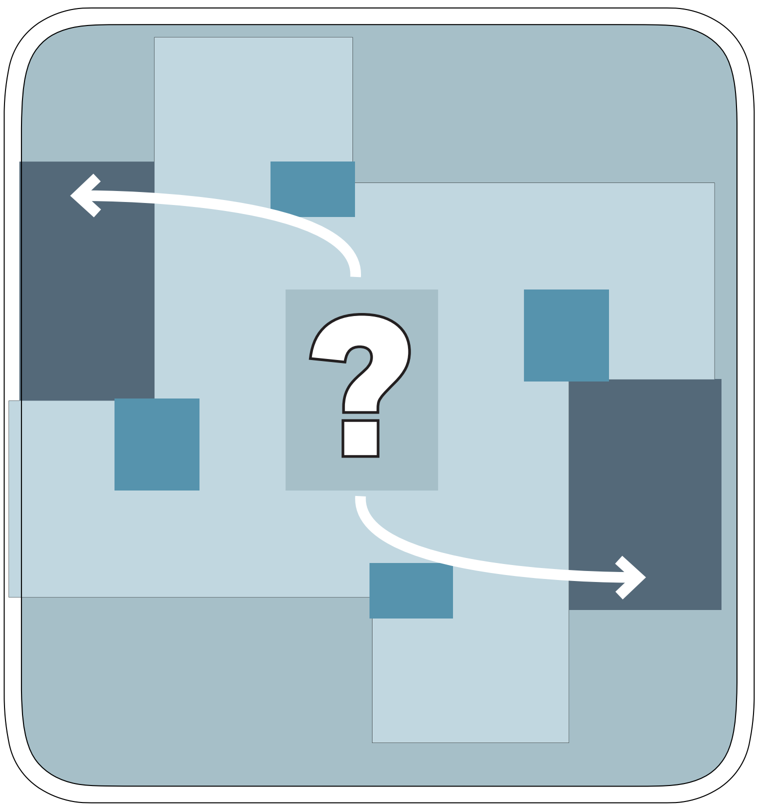


Figure A.4 Diagram showing concept intent for removing central core

A.3 Retain Central Core with New North Core

Another way to improve the connectivity of the floorplate from Section A.1 would be to consolidate all the new core elements in a single area. Doing so effectively relies on removing the existing satellite cores, but all other structure (vertical and horizontal) would remain.

To achieve this, the central core structure would be retained, along with all relevant columns. All new core elements would be designed to land outside the footprint of the existing floorplate, meaning no new penetrations would be required in the existing slabs. The voids left by the removed satellite cores would be in-filled and form part of the open floorplate.

Fire fighting lifts, escape stairs, and evacuation lifts would be consolidated within the footprint of the existing central core. The new passenger lifts, both low-rise and high-rise, along with new risers, would be provided in the north-east corner of the floorplate. These penetrations would be designed to fall only in areas of the new extended floorplate.

This corner of the floorplate is chosen because it minimises the impact on natural daylight and sunlight, and faces directly onto neighbouring buildings. All other elevations have uninterrupted views, and the western elevations interact with Regent's Place Plaza.

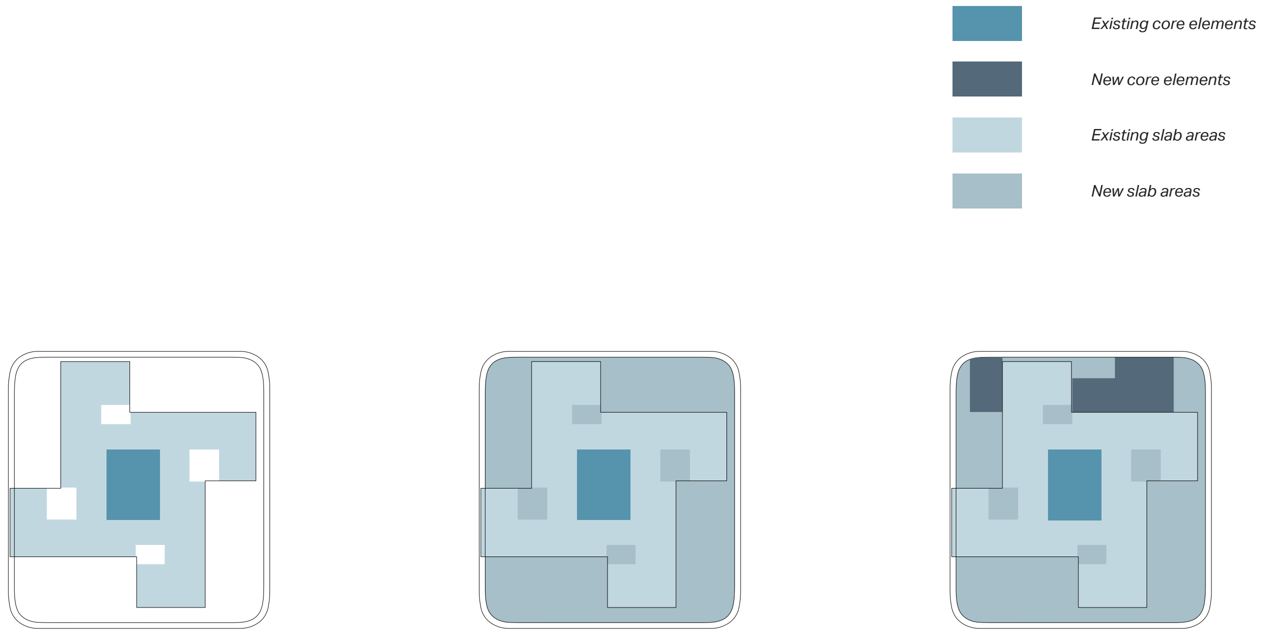
The resulting floorplate would have slightly reduced structural retention compared with the maximum retention option in Section A.1, but improved connectivity enabled by removing the satellite cores and consolidating the new core elements. However, having both an offset core and central core results in a disconnected floorplate, and the inability to split the floorplate for more than two tenancies. With the passenger lifts all at one end of the floorplate, the lease span in some areas would be as much as 40m, significantly larger than a typical 12-15m. Flexibility would still be somewhat inhibited by the pinch points at the double column arrangements which are needed because the columns supporting the existing slab must be maintained in their original locations.

The north core lift location would limit the floorplate to a maximum of two tenancies, and the MEP distribution strategy would be compromised by having to cross through tenant areas.

Floorplate retention would be 97%, retaining on average 144 tCO_2e per storey (of 149 tCO_2e per storey).

While this core arrangement looks plausible on a single plan, it would be challenging (but not impossible to resolve) with inclined or stepped elevations, used to reduce the massing of the tower in longer views.

This core layout would be inhibiting to connectivity and flexibility for a contemporary office.



Existing central core and existing slab are retained. Satellite cores removed

Floorplate is extended with pinwheel fully maintained. Satellite core areas are filled in

All new core area is added in areas of extended floorplate, no core penetrations required in existing

Figure A.6   Diagram showing elements that are retained in this option and the position of new core elements

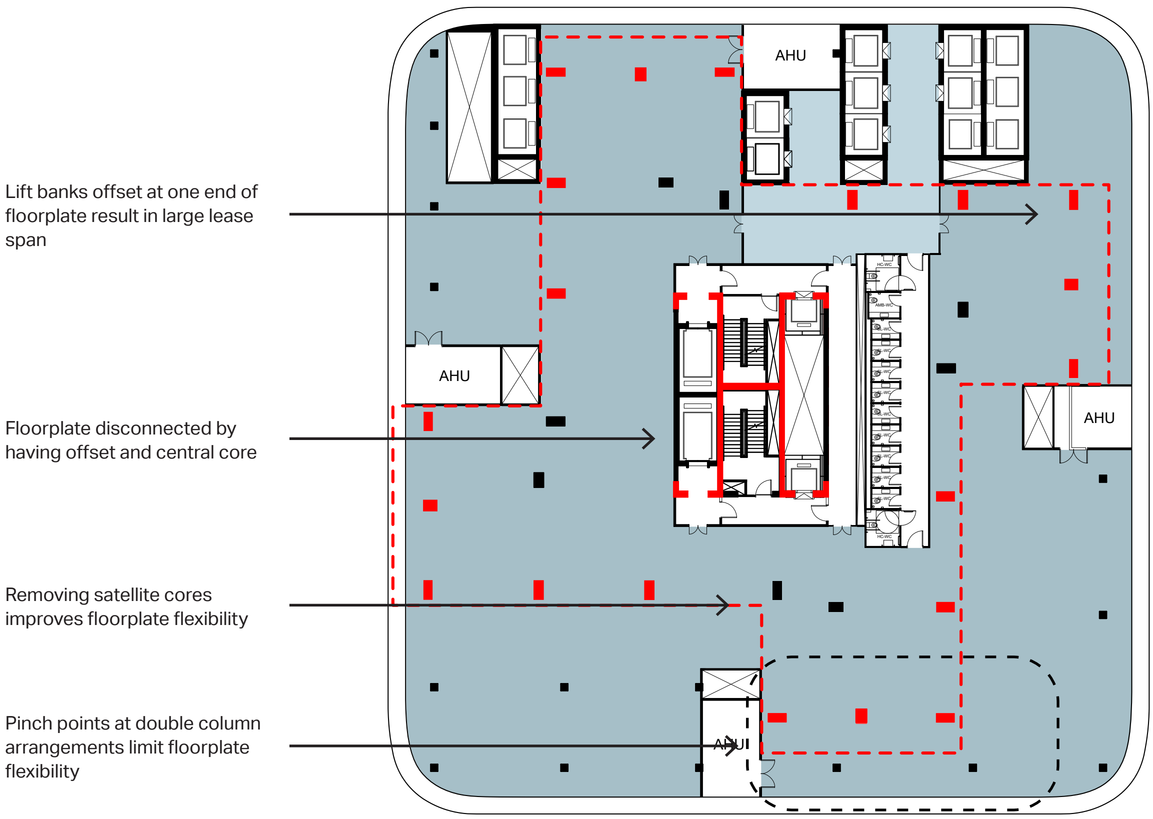


Figure A.5   Indicative floorplate and core layout with all new core elements outside of the existing slab footprint

A.4 Retain Central Core with Centralised North Core

The floorplate layout could be improved by centralising the new north core. See Figure A.7.

To achieve this, the central core structure would be retained, along with all relevant columns. Instead of all new core elements landing outside of the existing floorplate as in the preceding options, here the north arm of the pinwheel would be removed, along with the relevant sections of the perimeter ring beam, to accommodate the new core elements.

Fire fighting lifts, escape stairs, and evacuation lifts would be consolidated within the footprint of the existing central core. The new passenger lifts, both low-rise and high-rise, along with new risers, would be provided along the north edge of the floorplate.

The existing satellite cores would be removed and the resulting voids in-filled to form part of the open floorplate.

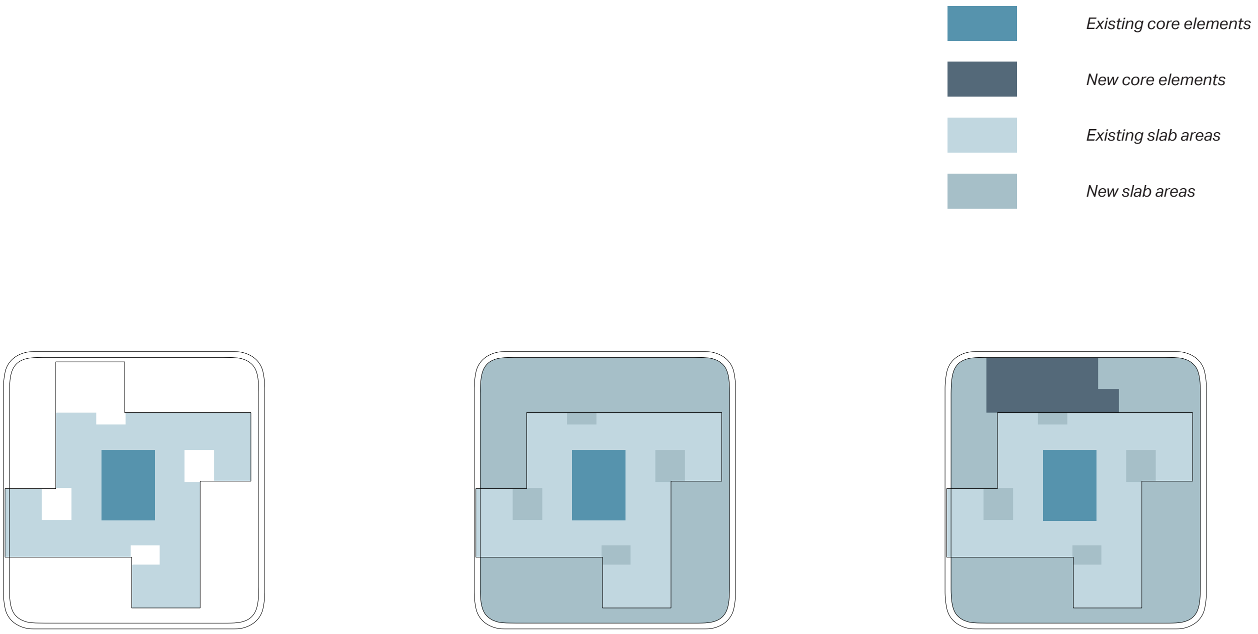
The resulting floorplate would be fundamentally similar to the one shown in Section A.3, but with further reduced structural retention owing to removal of the north pinwheel arm. Connectivity would be slightly improved by centralising the north core, by having more circulation central to the floorplate. But the large lease span, and disconnect by having both offset and central cores, would not be improved. Flexibility would still be inhibited by the pinch points at the double column arrangements which are needed because the columns supporting the existing slab must be maintained in their original locations.

The north core lift location would limit the floorplate to a maximum of two tenancies, and the MEP distribution strategy would be compromised by having to cross through tenant areas.

Floorplate retention would be 86%, retaining on average 128 tCO_2e per storey (of 149 tCO_2e per storey).

As in Section A.3, this core arrangement looks plausible on a single plan, but it would be challenging with inclined or stepped elevations, used to reduce the massing of the tower in longer views.

This core layout would be inhibiting to connectivity and flexibility for a contemporary office.



Existing central core and most existing slab are retained. Satellite cores and north arm removed

Floorplate is extended with remaining pinwheel fully maintained. Satellite core areas are filled in

New core area is added in area where north arm was removed. No core penetrations required in existing

Figure A.8 Diagram showing elements that are retained in this option and the position of new core elements

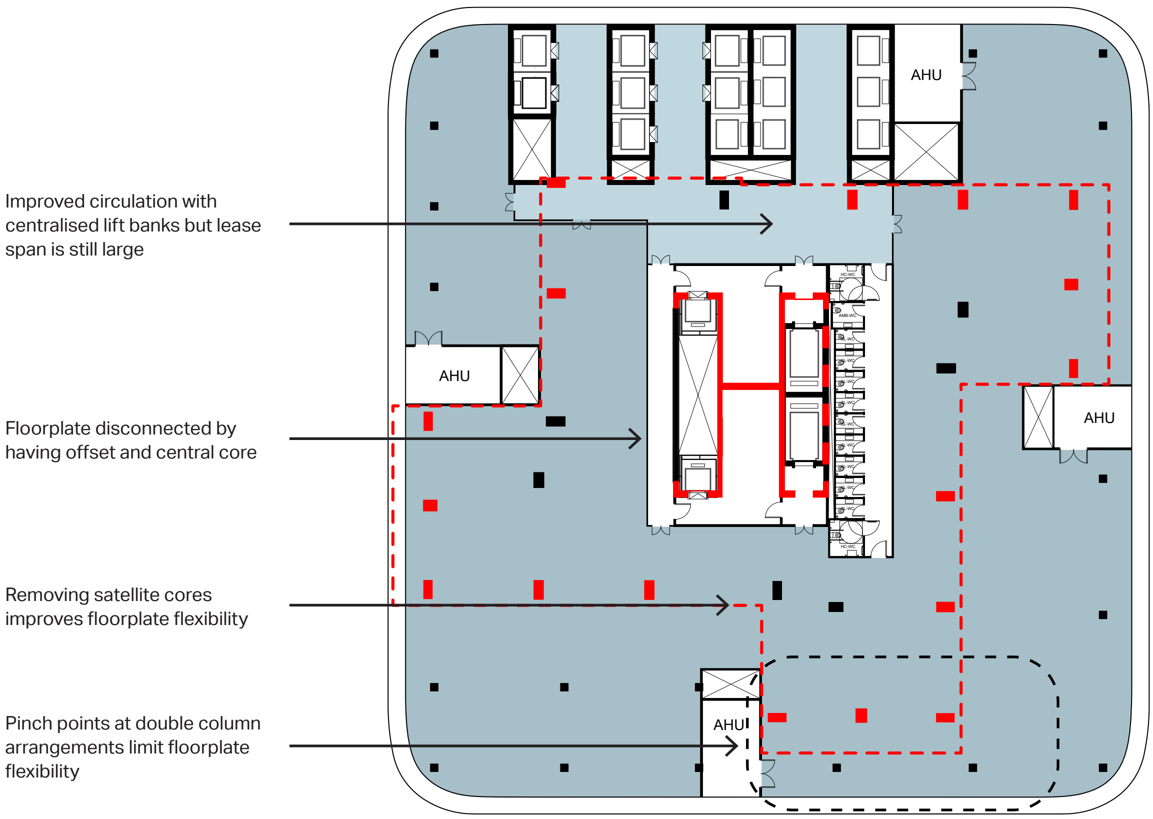


Figure A.7 Indicative floorplate and core layout with all new core elements consolidated where the north pinwheel arm has been removed

A.5 Retain Central Core and Two Satellite Cores

In each of the preceding options, by aiming to retain as much of the structure as possible, the floor layout would result in a split core arrangement. The analysis shows that, to varying degrees, such an arrangement would be detrimental to floorplate connectivity.

It is therefore clear that a single, central core arrangement would be preferable.

The layout in Figure A.9 shows one such arrangement, the key difference from the previous options being that in this case new core elements would be added within the footprint of the existing floor slab.

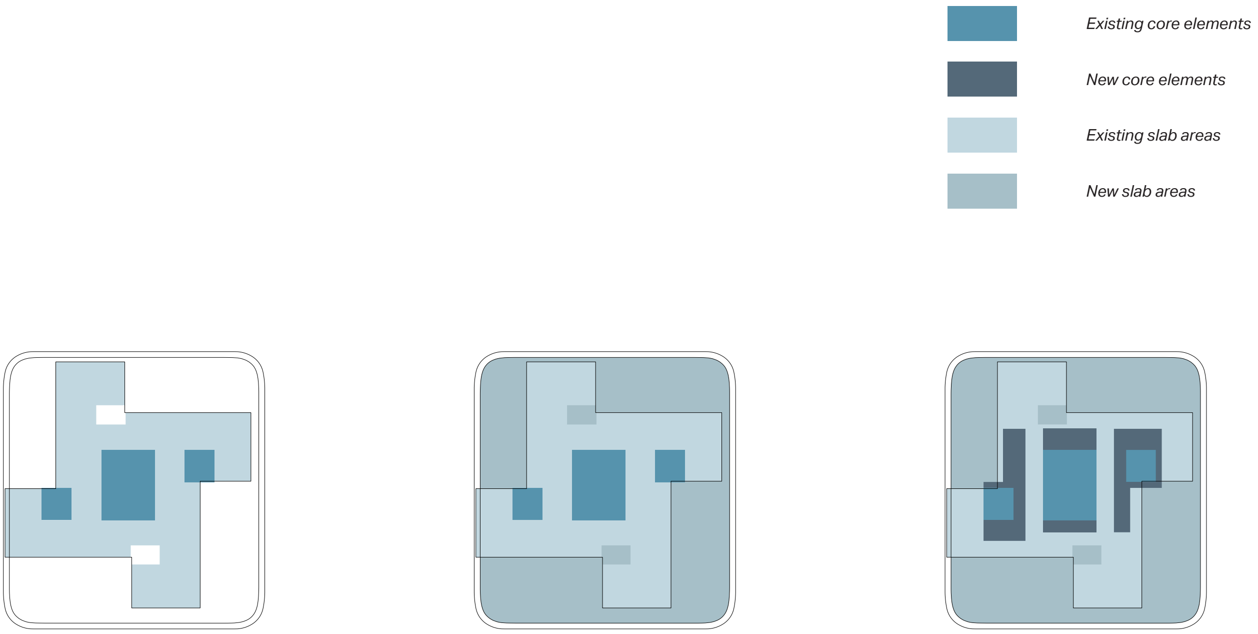
To achieve this, the central core and the east and west satellite core structures would be retained, along with all relevant columns. The east and west satellite cores would remain as escape cores complete with fire-fighting lifts. Evacuation lifts, additional passenger lifts, and new risers would be appended to these cores. The north and south satellite cores would be removed entirely to improve connectivity, and the resulting voids in-filled to form part of the floorplate.

As shown in Feasibility Volume One, introducing new penetrations in the existing floor slabs results in larger holes than required, and the positions of these penetrations are limited by coordination with the existing structure (avoiding perimeter ring beam and pile caps). It was subsequently shown that this layout is incompatible with retaining the full foundation, as certain lift pits would clash with the existing pile cap.

Notwithstanding these limitations, the resulting floorplate with its central core would offer good connectivity and reasonable lease spans. Flexibility would be inhibited by the pinch points at the double column arrangements which are needed because the columns supporting the existing slab must be maintained in their original locations. This could be mitigated by looking at options for the extent of floor slab retained.

Floorplate retention would be 75%, retaining on average 111 tCO_2e per storey (of 149 tCO_2e per storey).

While this core would result in relatively low structural retention, it would still retain the central core, two of the four satellite cores, and a large portion of the existing floorplate. At the same time it would present improved connectivity and efficiency.



Existing central core, east and west satellite cores, and existing slab are retained

Floorplate is extended with pinwheel fully maintained. North and south satellite core areas and filled in

Cores expanded with new core area. Significant penetrations required in existing slabs

Figure A.10 Diagram showing elements that are retained in this option and the position of new core elements

Subsequently know that these lift pits clash with existing pile cap

Existing slab eroded due to penetrations for new core

Removing satellite cores improves floorplate flexibility

Pinch points at double column arrangements limit floorplate flexibility

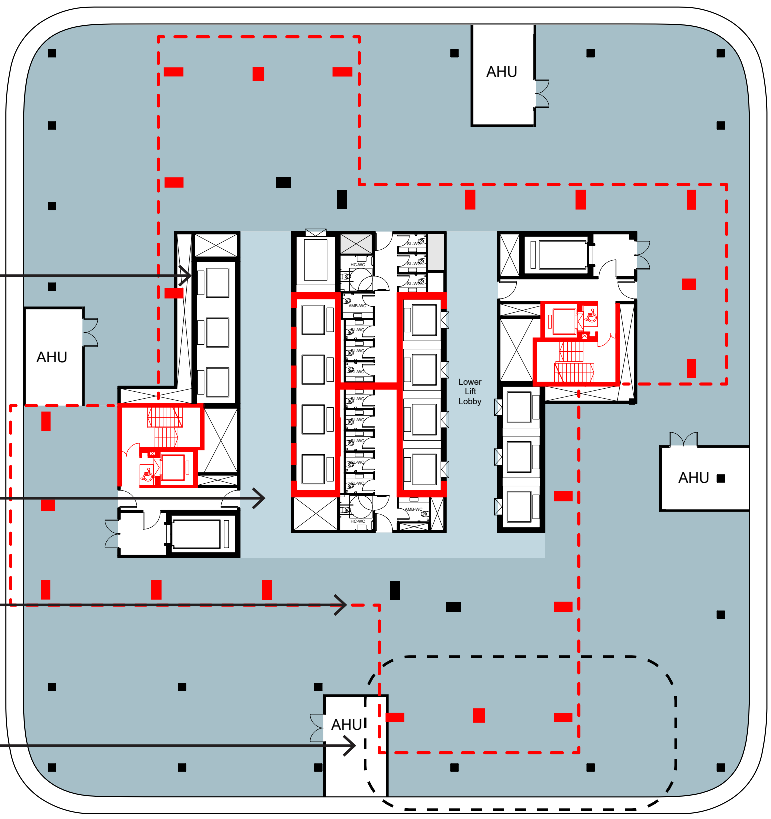


Figure A.9 Indicative floorplate and core layout with all new core elements located around the existing central core and satellite cores in the existing floor slab

A.6 Retain and Expand Central Core

Another option for a single, central core arrangement is the core layout shown in Figure A.11. Like the option in Section A.5, in this case new core elements would be added within the footprint of the existing floor slab.

To achieve this, the central core would be retained along with all relevant columns. Escape stairs would be located within the central area of the retained core, while fire-fighting lifts, evacuation lifts, additional passenger lifts and the like would be added in the areas around the retained central core.

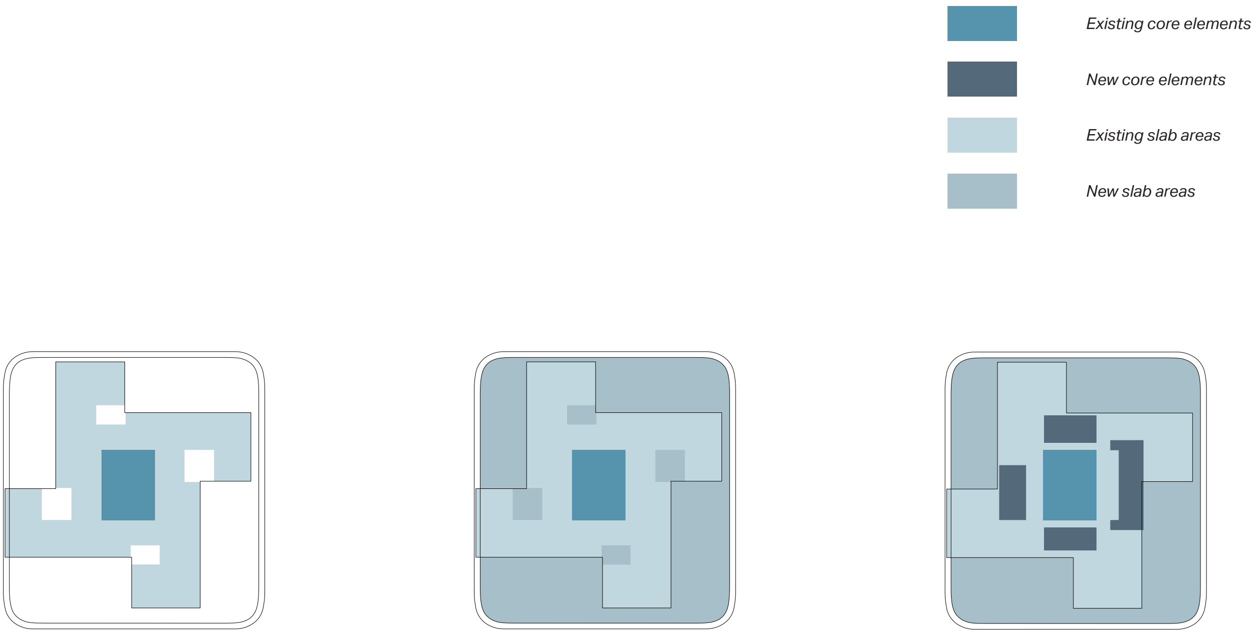
All four satellite cores would be removed entirely to improve connectivity, and the resulting voids in-filled to form part of the floorplate.

As shown in Feasibility Volume One, introducing new penetrations in the existing floor slabs results in larger holes than required (due to over-removal of the ribbed slabs), and the positions of these penetrations are limited by coordination with the existing structure (avoiding perimeter ring beam and pile caps).

Notwithstanding these limitations, the resulting floorplate with its central core would offer good connectivity and reasonable lease spans. Flexibility would be somewhat inhibited by the pinch points at the double column arrangements which are needed because the columns supporting the existing slab must be maintained in their original locations. This could be mitigated by looking at options for the extent of floor slab retained.

Floorplate retention would be 79%, retaining on average 117 tCO_2e per storey (of 149 tCO_2e per storey).

While this core would result in one of the lowest overall structural retention of the options in this section, it would still retain the central core, and a large portion of the existing floorplate. At the same time it would allow improved connectivity and efficiency.



Existing central core and existing slab are retained. Satellite cores are removed

Floorplate is extended with pinwheel fully maintained. Satellite core areas and filled in

New core area is added around central core. Significant penetrations required in existing slab

Figure A.12   Diagram showing elements that are retained in this option and the position of new core elements

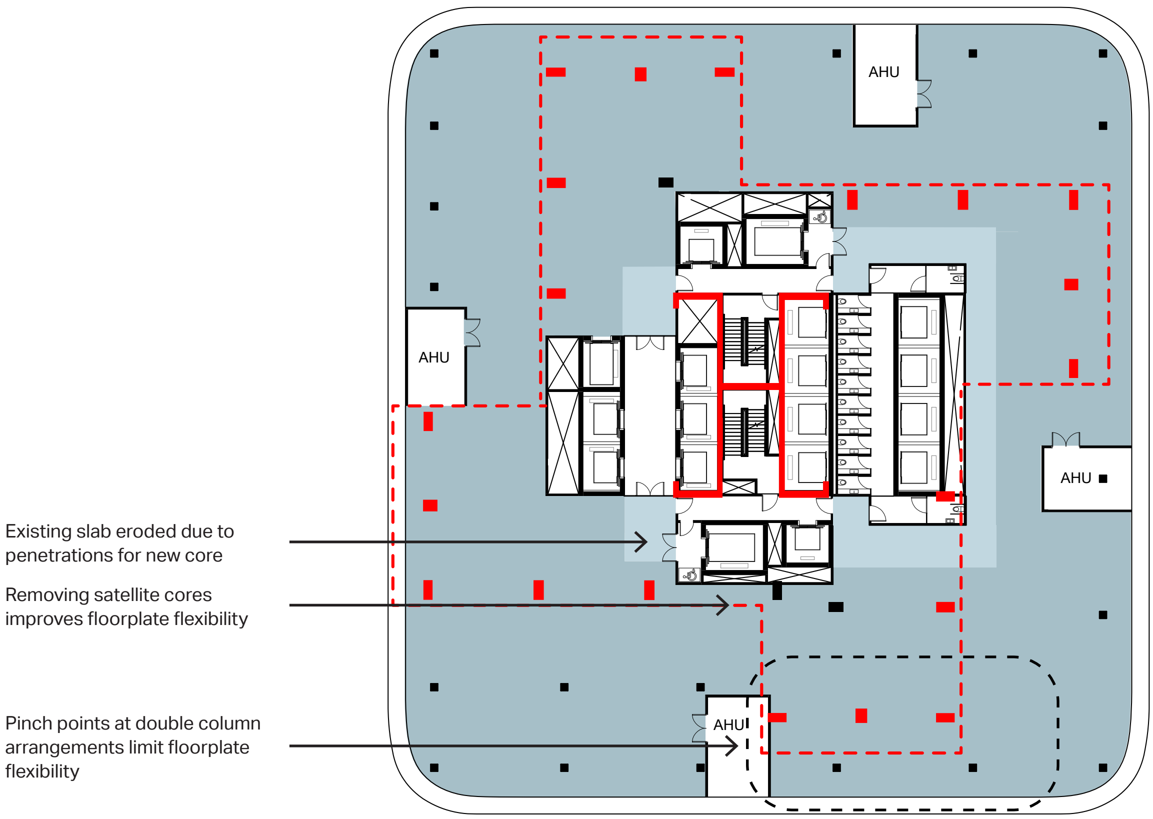
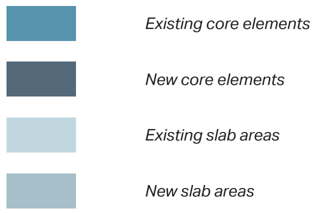


Figure A.11   Indicative floorplate and core layout with all new core elements located around the existing central core in the existing floor slab

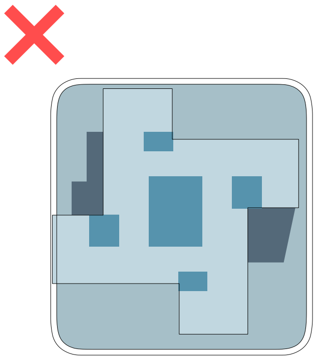
A.7 Summary

This Section has studied different floorplate and core layouts with the primary aim of retaining as much of the existing structure as possible.

Structural retention is a key consideration, but so is connectivity, and efficiency. Figure A.13 summarises the options presented in this section.

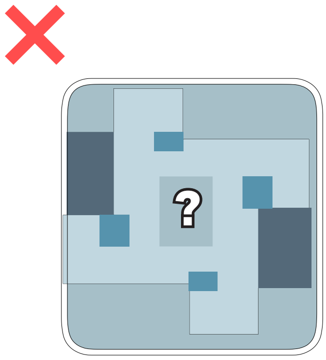


RETAIN EVERYTHING EXISTING (DISPERSED CORE)



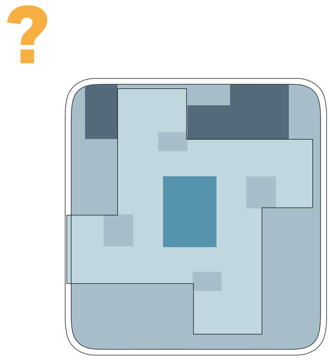
This core layout would be inhibiting to connectivity and flexibility for a contemporary office, though structural retention would be maximised.

RETAIN EVERYTHING AND REMOVE CENTRAL CORE



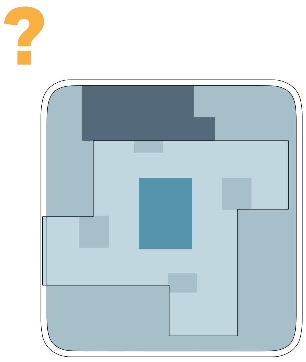
Practically and programmatically this core would not be viable.

RETAIN CENTRAL CORE WITH NEW NORTH CORE



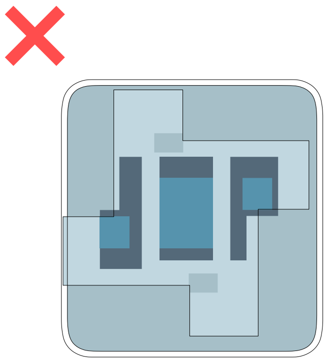
This core layout would be inhibiting to connectivity and flexibility for a contemporary office.

RETAIN CENTRAL CORE WITH CENTRALISED NORTH CORE



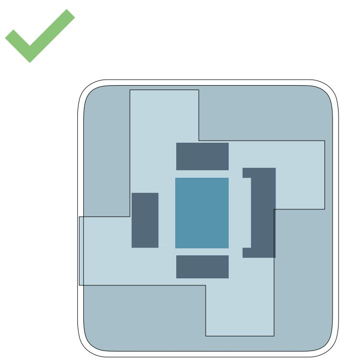
This core layout would be inhibiting to connectivity and flexibility for a contemporary office.

RETAIN CENTRAL CORE AND TWO SATELLITE CORES



This core layout would present improved connectivity and efficiency, but would be incompatible with existing pile cap. Structural retention would be relatively low, though still retain the central core, two satellite cores, and a portion of the existing floorplate

RETAIN AND EXPAND CENTRAL CORE



This core layout would present improved connectivity and efficiency. Structural retention would one of the lowest, though still retain the central core, and a portion of the existing floorplate.

Figure A.13 Summary of floorplate layout options

B Extent of Slab

In developing the floorplate and core layouts, the starting point was to retain as much as possible of the existing slab. This leads to the natural inclination to provide new core elements outside of the footprint of the existing slab.

However, as shown in Appendix A, when doing so the floorplates would generally result in split core arrangements, with poor connectivity and flexibility. This could be alleviated with a central, consolidated core, but this would require significant new penetrations in the existing floor slabs.

In Feasibility Volume One and Section 15, it was shown how the existing floorplate is quickly eroded when new penetrations are punched through, due to a combination of the ribbed slab structure and buildability constraints.

This Section examines options for retaining different portions of the existing floor slabs. The following options are studied:

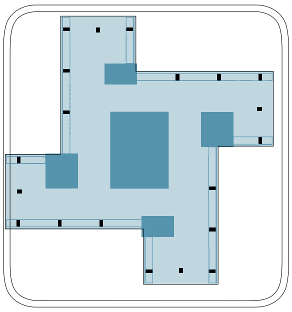
- Retain Everything Existing
- Retain Everything Except the South Pinwheel Arm
- Retain the Central Square and the East and West Pinwheel Arms
- Retain the Central Square and the East Pinwheel Arm
- Retain the Pinwheel Arms
- Retain No Existing Slab.

These options are shown diagrammatically in Figure B.1. Of course it is possible to combine options to produce other permutations, but these options are chosen as the logical touch-points from which conclusions about the other permutations can be derived.

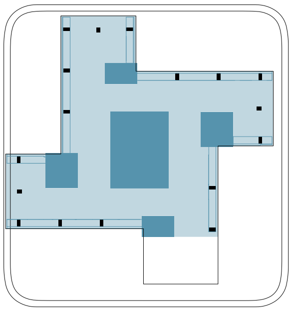
All options are assessed using the same, typical extended floorplate, and use a decentralised ventilation system as the basis for proposals. The extent of this floorplate is intended to be indicative of one plausible extension only, and it does not presuppose the outcome of any developments around massing.

Ultimately the conclusions are not sensitive to the shape or absolute dimensions of the extended floorplate. This to say that the outcome of this assessment would be the same regardless of the shape of the extension.

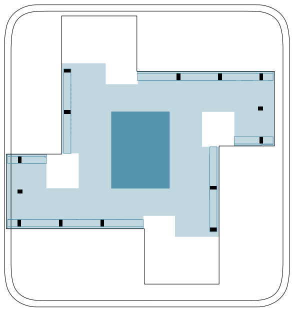
RETAIN EVERYTHING



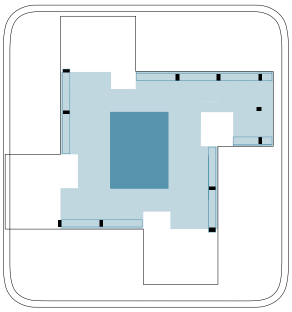
RETAIN EVERYTHING EXCEPT SOUTH PINWHEEL ARM



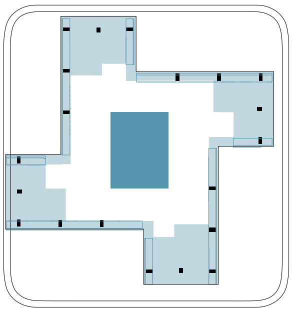
RETAIN THE CENTRAL SQUARE AND EAST AND WEST PINWHEEL ARMS



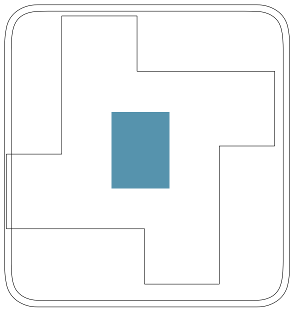
RETAIN THE CENTRAL SQUARE AND THE EAST PINWHEEL ARM



RETAIN THE PINWHEEL ARMS



RETAIN NO EXISTING SLAB



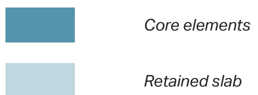


Figure B.1 Overview of slab extent options studied in this Section

B.1 Retain Everything Existing

In this option the aim is to retain the full extent of the existing pinwheel. As shown in Feasibility Volume One and Section 15, it is not possible to do so unless all new core areas are located outside of the existing floorplate, due to the upgrades required to meet current Building Regulations and the increased servicing necessitated by the extended floorplates.

However it was shown in Appendix A, that the core in such a layout would be too dispersed, resulting in a disconnected floorplate.

Figure B.3 overlays the proposed core with the existing floorplate and structural system. The columns supporting the existing slab must be maintained in their original locations which would create pinch points on the floorplates, and significantly reduce flexibility.

In this scenario, there would be reduced opportunities to design the structural systems for adaptability, or the ability to include soft spots. These opportunities would be limited to areas of new-build slab only.

This option presents maximum retention, but its floorplate would be disconnected and have limitations on flexibility and adaptability.

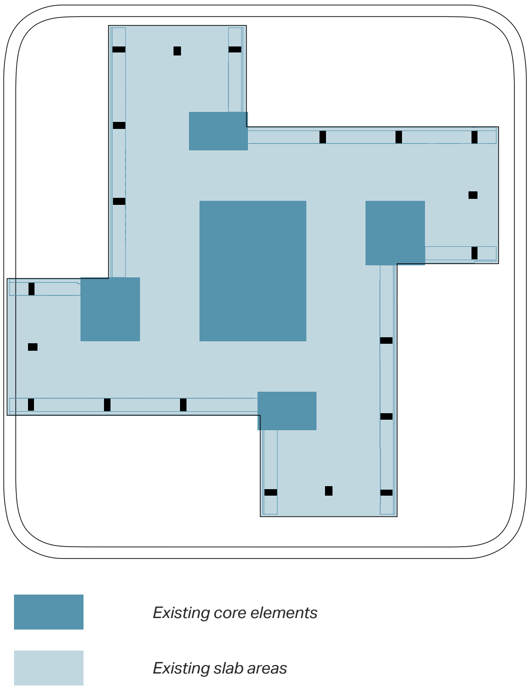


Figure B.2 Diagram showing elements that are retained in this option

Figure B.3 Structural overlay showing the extent of existing slab and structure retained with dispersed core layout

B.2 Retain Everything Except the South Pinwheel Arm

A natural follow on from the option shown in Section B.1, would be to remove the pinwheel arms that inhibit flexibility, while retaining the remainder of the existing floorplate. This is shown schematically in Figure B.4.

This approach would alleviate the pinch points due to the double column arrangements, and in turn improve flexibility of the floorplate layout. Noting however that all other columns would be retained, they must remain in their original positions, constraining possible options for the grid layout.

Temporary works requirements would be similar to that in the Retain Everything Existing option, with the addition of full-height temporary propping required to the unconstrained edge of the south pinwheel arm.

Figure B.6 shows the structural implications of these moves overlaid on the existing structural system. Key here is removing the south pinwheel arm in a way that makes sense structurally, therefore the whole pinwheel arm would be removed back to the next column line. Continuity of the perimeter ring beam would generally be maintained through retention of all four satellite cores.

In this scenario, there would be reduced opportunities to design the structural systems for adaptability, or the ability to include soft spots. These opportunities would be limited to areas of new-build slab only.

This option presents high levels of retention and slightly improved flexibility. It would still require extensive intervention and temporary works.

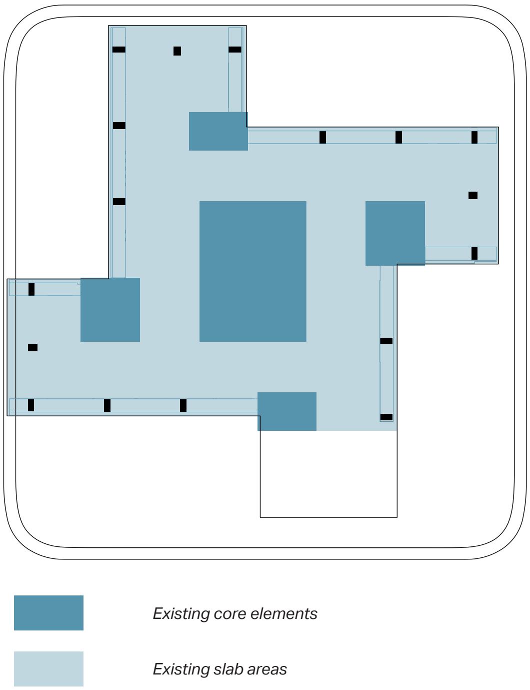
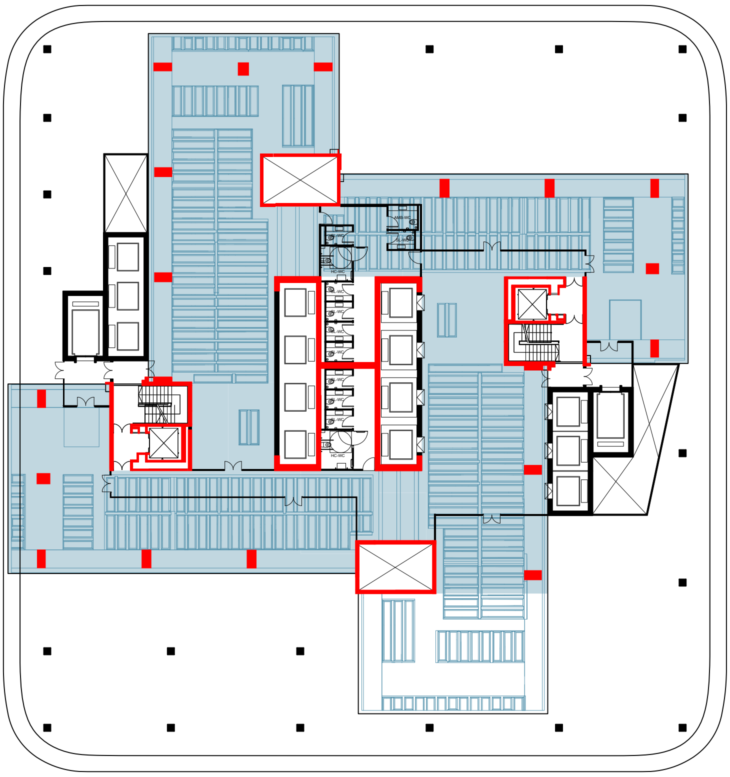


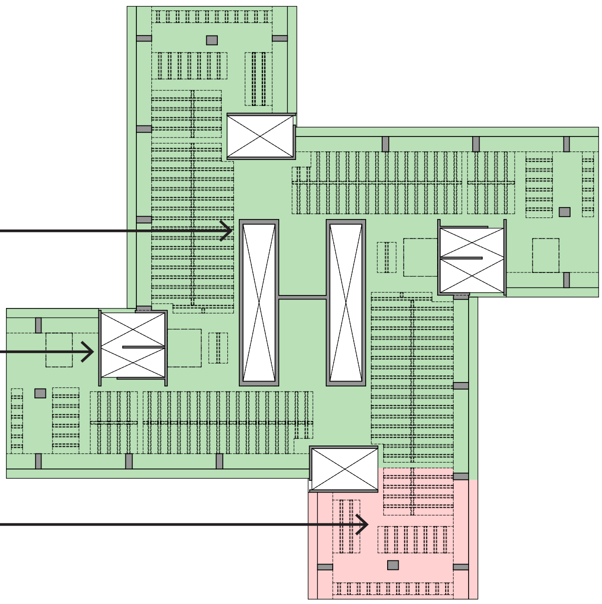
Figure B.4 Diagram showing elements that are retained in this option



Retained cores and columns

Existing slab areas

Figure B.5 *Structural overlay showing the extent of existing slab and structure retained with dispersed core layout*



No new penetrations required around core

All cores retained therefore no additional supporting construction required

Slab cut back to column line on south arm to reduce impact of existing grid. Full-height temporary propping required to unconstrained slab edges

New supporting construction

Existing slab removed

Existing slab retained

Figure B.6 *Structural diagram showing interventions required to existing structure*

B.3 Retain the Central Square and the East and West Pinwheel Arms

Another option for existing slab retention and in trying to improve flexibility and adaptability, would be to remove one or more of the pinwheel arms entirely (in this case the north and south arms are removed). In this option, the perimeter ring beam would be maintained and, where possible along with all central slab within the line of the ring beam. All slab and columns falling outside of this footprint would be removed and replaced with new construction. This is shown schematically in Figure B.7.

Like the option in Appendix B.2 this approach would alleviate the pinch points due to the double column arrangements, and in turn improve flexibility of the floorplate layout. The central columns that would be retained must remain in their original positions, constraining possible options for the grid layout. Adaptability would be unchanged, as though there is greater extent of new floor slab, this is mostly taken up by the central north core.

Temporary works requirements would be similar to that in the Retain Everything Except the South Pinwheel Arm option, with the addition of another unconstrained slab edge on the north pinwheel arm.

Figure B.8 shows the structural implications of these moves overlaid on the existing structural system. Unlike the previous option, key here is maintaining continuity of the perimeter ring beam to support the retained slab, meaning that new construction would be required prior to demolition of the satellite cores. This would introduce an additional health & safety risk by having demolition and construction activities happening simultaneously and in close proximity.

In this scenario, there would be reduced opportunities to design the structural systems for adaptability, or the ability to include soft spots. These opportunities would be limited to areas of new-build slab only.

This option presents high levels of retention and improved flexibility. It would still require extensive intervention and temporary works.

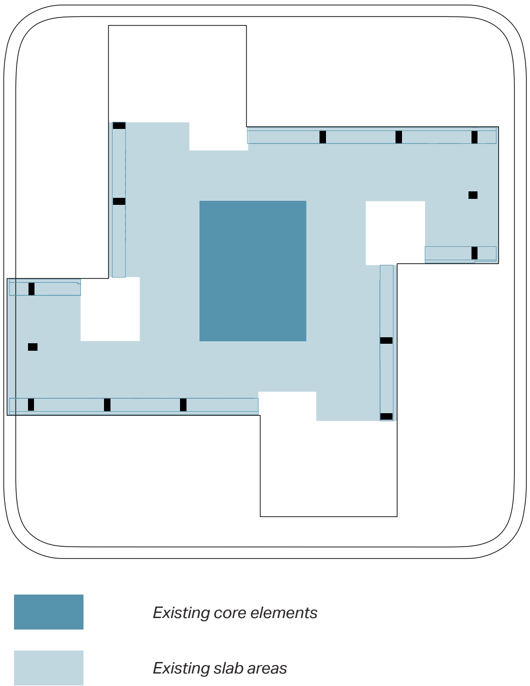


Figure B.7 Diagram showing elements that are retained in this option

Retained cores and columns

Existing slab areas

Figure B.9 *Structural overlay showing the extent of existing slab and structure retained with centralised north core layout*

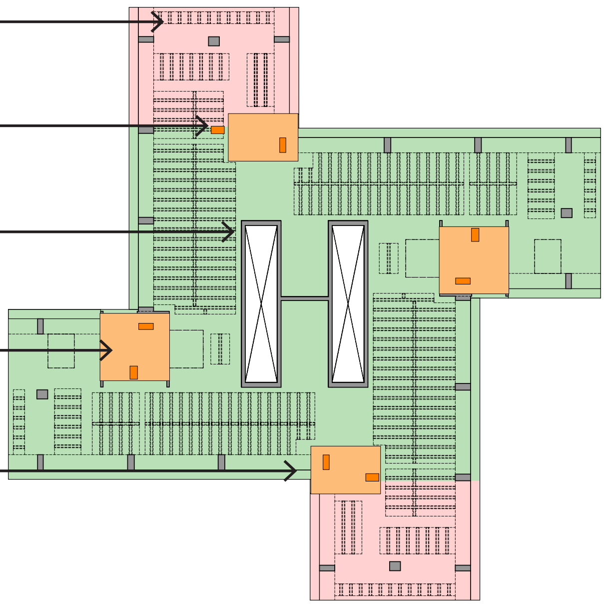
Slab cut back on north and south arms to reduce impact of existing grid. Full-height temporary propping required to unconstrained slab edges

Column integrated with north core wall

Minimal new penetrations required around core

Indicative new slab thickening to pick up existing slab edges

New construction necessary to hold up remaining structure. To be completed prior to demolition.



New supporting construction

Existing slab removed

Existing slab retained

Figure B.8 *Structural diagram showing interventions required to existing structure*

B.4 Retain the Central Square and the East Pinwheel Arm

A logical progression from the previous option for existing slab retention, and in trying to improve flexibility and adaptability, would be to remove further pinwheel arms. In this case, the north, west, and south arms would be removed entirely, with the east arm retained. The perimeter ring beam would be maintained and all central slab within the line of the ring beam. All slab and columns falling outside of this footprint would be removed and replaced with new construction. This is shown schematically in Figure B.10.

Like the previous option, this approach would alleviate the pinch points due to the double column arrangements, as well as more of the central columns, and in turn improve flexibility of the floorplate layout. The central columns that would be retained must remain in their original positions, constraining possible options for the grid layout. Adaptability would generally be improved across the floorplate as there is greater extent of new floor slab which could be designed to accommodate soft spots and for disassembly.

Temporary works requirements would be similar to that in the Retain the Central Square and the East and West Pinwheel Arms option, with the addition of another unconstrained slab edge on the west pinwheel arm in this case.

Figure B.11 shows the structural implications of these moves overlaid on the existing structural system. Key here is maintaining continuity of the perimeter ring beam to support the retained slab, meaning that new construction would be required prior to demolition of the satellite cores. This would introduce an additional health & safety risk by having demolition and construction activities happening simultaneously and in close proximity.

In this scenario, the opportunities to design the structural systems for adaptability, the ability to include double height spaces or soft spots would be improved, but limited to being outside the central area (i.e. in areas of new construction only).

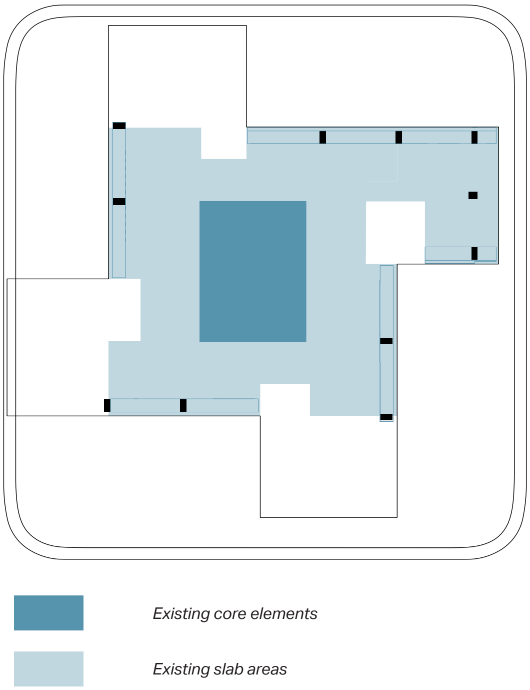


Figure B.10 Diagram showing elements that are retained in this option

This option presents moderate levels of retention and improved flexibility. It would still require extensive intervention and temporary works.

Retained cores and columns

Existing slab areas

Figure B.12 Structural overlay showing the extent of existing slab and structure retained with centralised north core layout

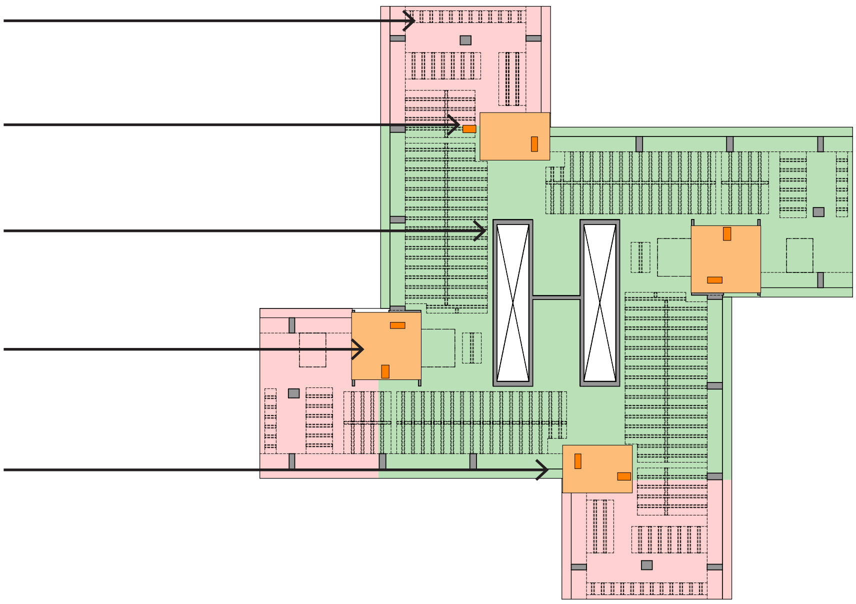
Slab cut back on three arms to reduce impact of existing grid. Full-height temporary propping required to unconstrained slab edges

Column integrated with north core wall

Minimal new penetrations required around core

Indicative new slab thickening to pick up existing slab edges

New construction necessary to hold up remaining structure. To be completed prior to demolition.



New supporting construction

Existing slab removed

Existing slab retained

Figure B.11 Structural diagram showing interventions required to existing structure

B.5 Retain the Pinwheel Arms

The preceding options have focussed on maximising retained floor slab by positioning the new core elements outside the central zone of the existing floor plate. However, as shown in Appendix A, when doing so the floorplates would generally result in split core arrangements, with poor connectivity and flexibility.

This could be alleviated with a central, consolidated core, but this would require significant new penetrations to central core area, ultimately eroding the extent of floor slab retained. A natural option might be to try retaining all slab *outside* of this area. This leads to the option shown schematically in Figure B.13, where the pinwheel arms would be retained while the central core area would be removed to make way for the new core arrangement.

This option would provide good flexibility for the new central core, and alleviate some of the temporary works required for making the new penetrations. However, by retaining the pinwheel arms entirely, the double column arrangement from the Retain Everything Existing option would be reintroduced, hindering floorplate flexibility

Crucially the remaining pinwheel would effectively be remote. This structure must be linked to the central core at all times, which would require a complex construction methodology. The perimeter ring beam and corresponding columns must be retained so far as possible, new construction would be required prior to demolition of the satellite cores to maintain this link, and significant, complicated temporary works would be needed during demolition and construction. Temporary steels would be required at least every third level. This added complexity would be likely to result in a construction cost premium, and additional embodied carbon.

The structural implications are shown in Figure B.14. Like the other options that have simultaneous demolition and construction, there would be an additional health & safety risk by having these activities happening simultaneously and in close proximity.

This option would reduce the intervention required to the central slab area for a central core. But its construction would be complex, and it would require excessive temporary works.

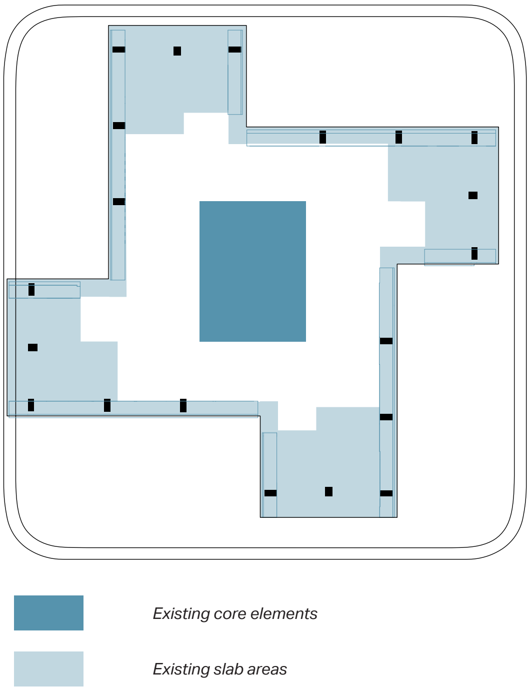


Figure B.13 Diagram showing elements that are retained in this option

Retained cores and columns

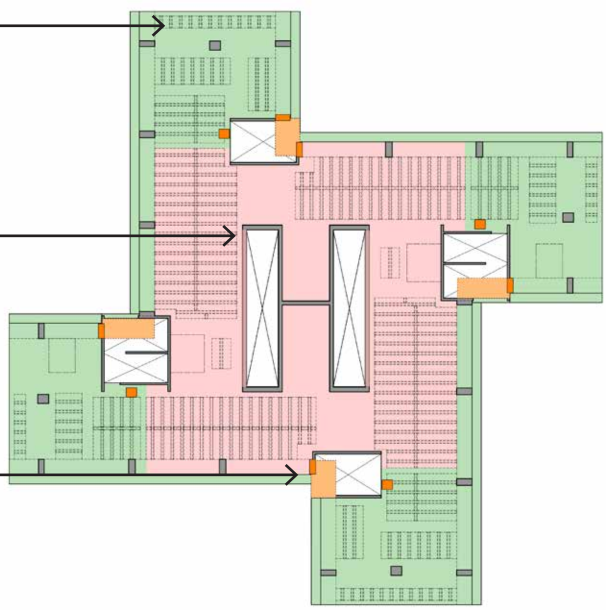
Existing slab areas

Figure B.15 Structural overlay showing the extent of existing slab and structure retained with central expanded core layout

Leaving only arms remote from core requires complex methodology

Good flexibility for new core

New construction necessary to hold up remaining structure. To be completed prior to demolition.



New supporting construction

Existing slab removed

Existing slab retained

Significant temporary works during demolition and construction to link the remaining structure with the central core. Steels required at least every third level.

Figure B.14 Structural diagram showing interventions required to existing structure

B.6 Retain No Existing Slab

The other bookend of the slab retention options is the option shown schematically in Figure B.16 where no slab is retained, but the core would be retained.

For the floorplate design, this would result in the most flexibility for grids and cores. Crucially it would also enable the new floorplates to be designed fully for adaptability, meaning new holes, double height spaces, and the like could be introduced in a relatively unintrusive manner. This goes together with being designed for disassembly, ensuring that components and materials could be more easily separated at end of life to reduce waste.

Compared to all the other options, this would be the least complex to deliver, reduce the risk of unknowns, and minimise the extent of temporary works required, with no need for slab support or slab edge propping (limited to retaining the core). The structural implications are shown in Figure B.17.

Health & safety risk would be improved compared to the other options, by minimising simultaneous demolition and construction in close proximity.

While this option would retain only the core, it presents reduced risks around buildability and an opportunity to design a new floor system that would be flexible, adaptable, and disassemblable.

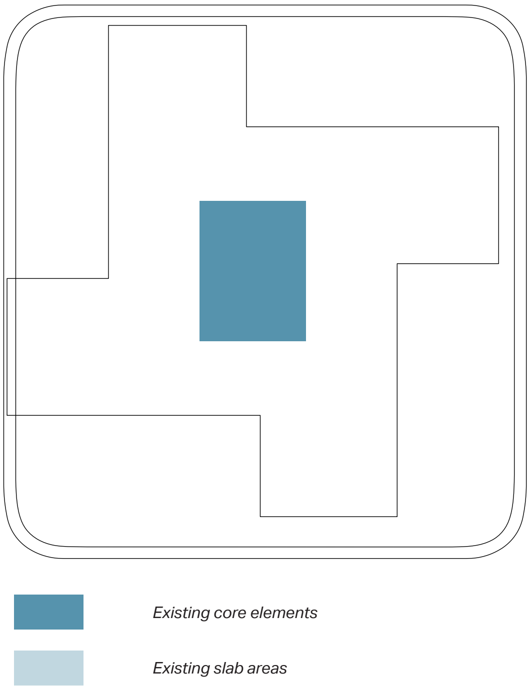
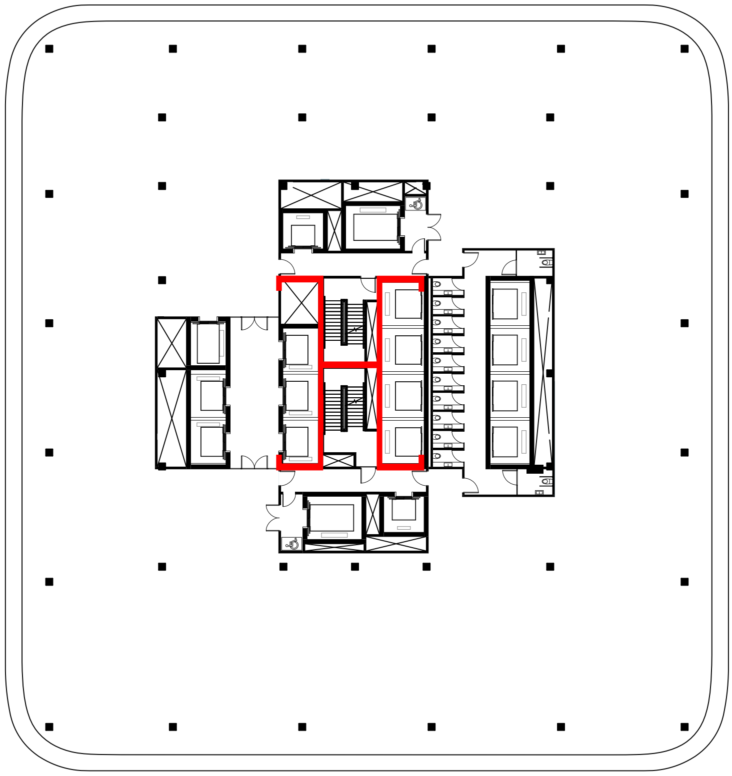


Figure B.16 Diagram showing elements that are retained in this option



Retained cores and columns

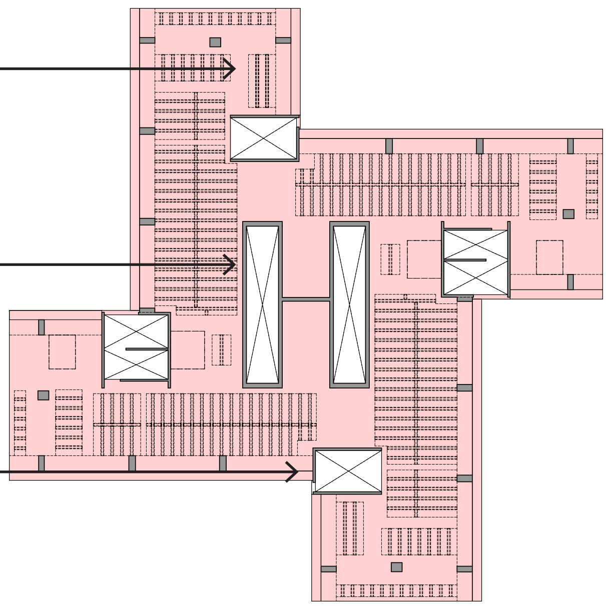
Existing slab areas

Figure B.18 Structural overlay showing the extent of the structure retained with centralised expanded core layout

All slab elements removed, leaving only core

Most flexibility for grids and cores

Doesn't achieve objective of maximising retention



New supporting construction

Existing slab removed

Existing slab retained

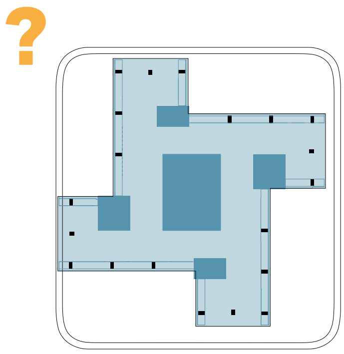
Figure B.17 Structural diagram showing interventions required to existing structure

B.7 Summary

This Section has studied different options for extent of slab retention each associated with a particular core layout. The options presented are some discrete possibilities, but not exhaustive, chosen because they illuminate the general issues and considerations associated with floor slab retention. It is possible to combine these options to arrive at other possibilities for retention, but the issues faced would be similar.

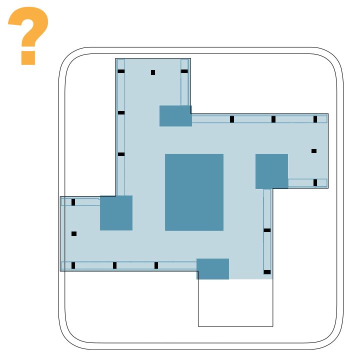
The primary aim is to retain as much of the existing structure as possible. Of course structural retention is a key consideration, but so is flexibility, adaptability, and buildability (construction complexity, temporary works required, and the like). The diagrams alongside summarise the options presented in this section.

RETAIN EVERYTHING EXISTING



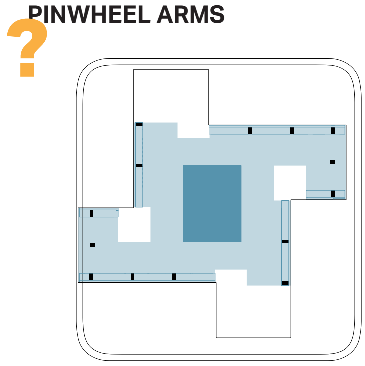
This option presents maximum retention, but its floorplate would be disconnected and has limitations on flexibility and adaptability.

RETAIN EVERYTHING EXCEPT THE SOUTH PINWHEEL ARM



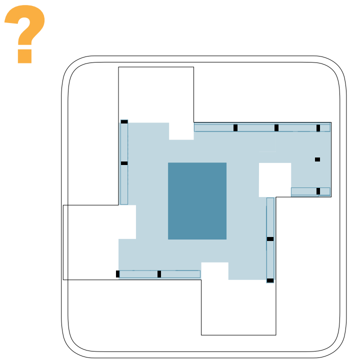
This option presents high levels of retention and only slightly improved flexibility. It would still require extensive intervention and temporary works.

RETAIN THE CENTRAL SQUARE AND THE EAST AND WEST PINWHEEL ARMS



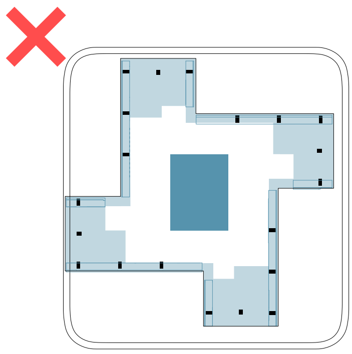
This option presents high levels of retention and somewhat improved flexibility. It would still require extensive intervention and temporary works.

RETAIN THE CENTRAL SQUARE AND THE EAST PINWHEEL ARM



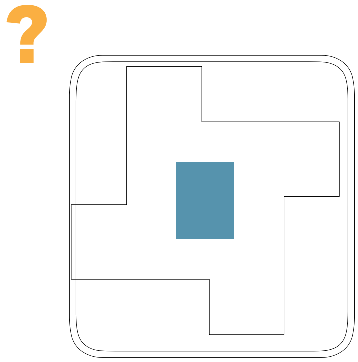
This option presents moderate levels of retention and improved flexibility and adaptability. It would still require extensive intervention and temporary works.

RETAIN THE PINWHEEL ARMS



This option would reduce the intervention required to the central slab area. But its construction would be complex, and it would require significant temporary works.

RETAIN NO EXISTING SLAB



While this option would retain only the core, it presents reduced risks around buildability and an opportunity to design a new floor system that would be flexible, adaptable, and disassemblable.

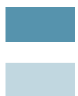


Figure B.19 Summary of slab retention options

C Extent of Section

This Section evaluates how much of the existing building could be retained vertically, while achieving as many of the brief requirements as possible.

There are a multiple elements to consider within this parameter, specifically:

- Central core
- Satellite cores
- Number of slabs retained.

It was shown in Appendix A that retaining the satellite cores, along with the upgrades required for Building Regulations compliance and the extended floorplates, would generally be too inhibiting to floorplate flexibility. Therefore, all studies in this Section assume the central core, substructure, and foundation would be retained.

For the number of slabs retained, there are various ways this could be delivered, ranging from retaining all slabs, through retaining some interstitial slabs, to retaining no slabs at all. This Section highlights some of the options for consideration in this regard.

Ultimately it is possible to combine parameters to produce a myriad of permutations. The studies presented here are not exhaustive, instead they are chosen to be indicative of the issues and conclusions stemming from such combinations.

The following are evaluated in this section:

- Retain Every Slab (All Cores, or Central Core Only)
- Retain Interstitial Slabs and Central Core
- The Retain the Core and New Build studies are not detailed in this Section as they retain no floor slabs, but they are studied in detail in as part of the options appraisal in Section 16.

C.1 Retain Every Slab

In this option, all existing floor slabs would be retained. Two sub-options for core retention are: retain all cores, or retain only the central core.

Crucially, although technically possible from an engineering perspective, this option is not feasible from a commercial viewpoint, regardless of core arrangement. **Ultimately the existing 3,200mm floor to floor height is challenging for delivering a modern office offering. Retaining every slab would only create a larger quantum of highly compromised floor space. At the same time, retaining every slab would carry the existing column grid, and retain many of the limitations of the existing structure, hindering flexibility and adaptability in-use, and potential for non-destructive disassembly at end of life.**

Regarding the cores, as shown in Appendix A, retaining the satellite cores would result in a floorplate that inhibits the connectivity and flexibility required for a modern office.

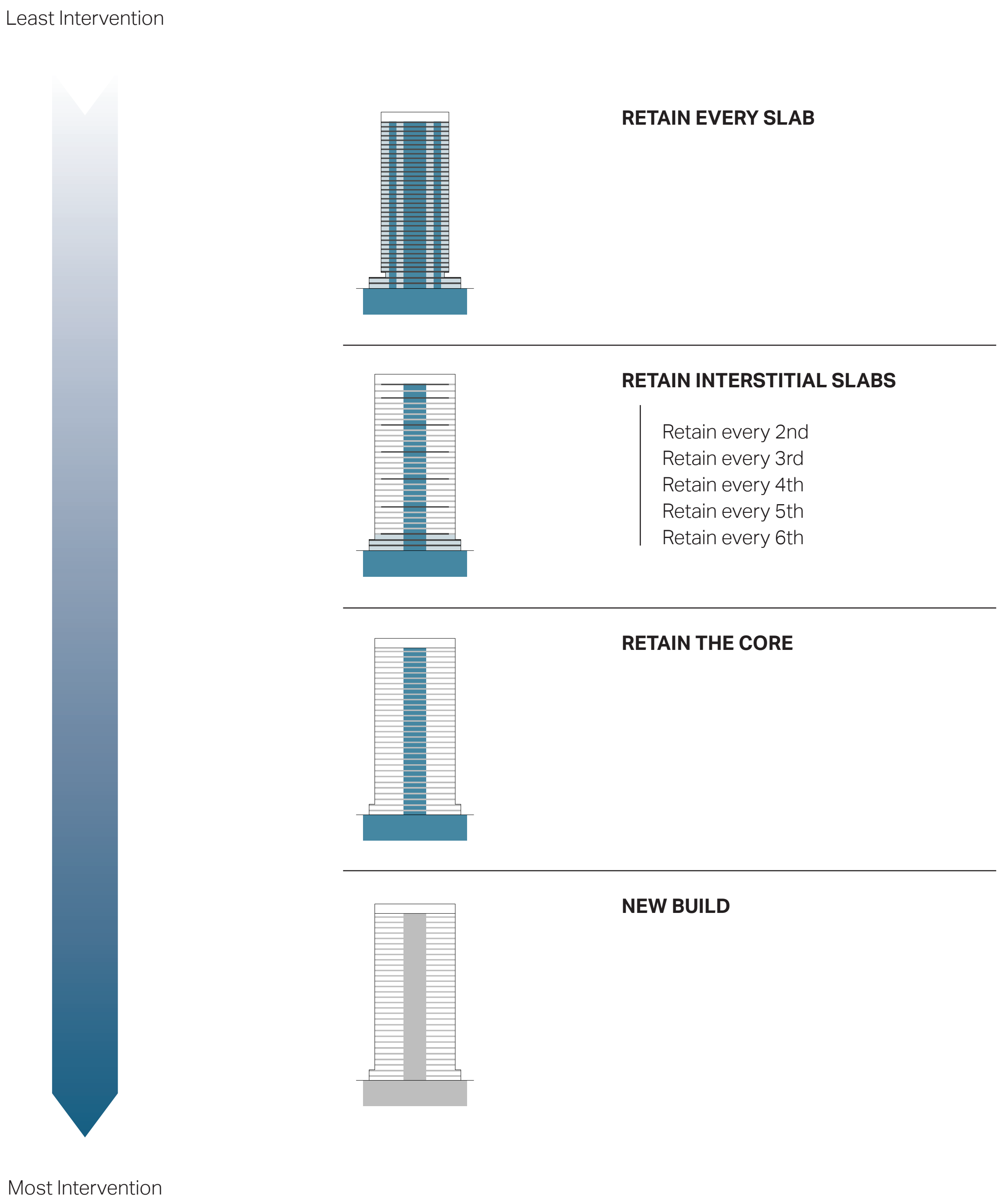


Figure C.1 Spectrum of retention for vertical structure (Retain the Core and New Build studies shown for completeness only (detailed in Section 4.6)

C.2 Retain Interstitial Slabs and Central Core

In trying to alleviate the pressure on the constrained floor to floor height, a natural progression is to retain interstitial floors rather than all of them.

This leads to the various sub-options which are explained in this Section, where removing interstitial slabs (and inserting some new slabs) would allow the floor to floor heights to be strategically reset. The sub-options range from: retaining every second slab to retaining every sixth.

Retain Every 2nd Slab
This option is shown diagrammatically in Figure C.3. Every second slab would be retained and every other slab would be removed fully.

16 slabs would be retained above the podium.

This would result in a significant loss of floor area within the existing height, essentially a poor volumetric efficiency. The maximum GIA would be reduced by 50%, relative to a baseline area assuming full floorplate retention within the existing envelope.

The resulting floor to floor height of 6.4m would be over-dimensioned and inefficient, regardless of whether the space is programmed for office or lab.

This option would result in poor volumetric efficiency and over-dimensioned floor to floor heights. Flexibility, adaptability, and disassembly would be limited by the retained slabs and columns.

Retain Every 3rd Slab
This option is shown diagrammatically in Figure C.2. Every third slab would be retained and the two others removed fully. A single new slab would be added to replace those removed.

11 slabs would be retained above the podium.

This would result in a significant loss of floor area within the existing height, essentially a poor volumetric efficiency. The maximum GIA is reduced by 34%, relative to a baseline area assuming full floorplate retention within the existing envelope.

The resulting floor to floor height of 4.8m would be over-dimensioned and inefficient, regardless of whether the space is programmed for office or lab.

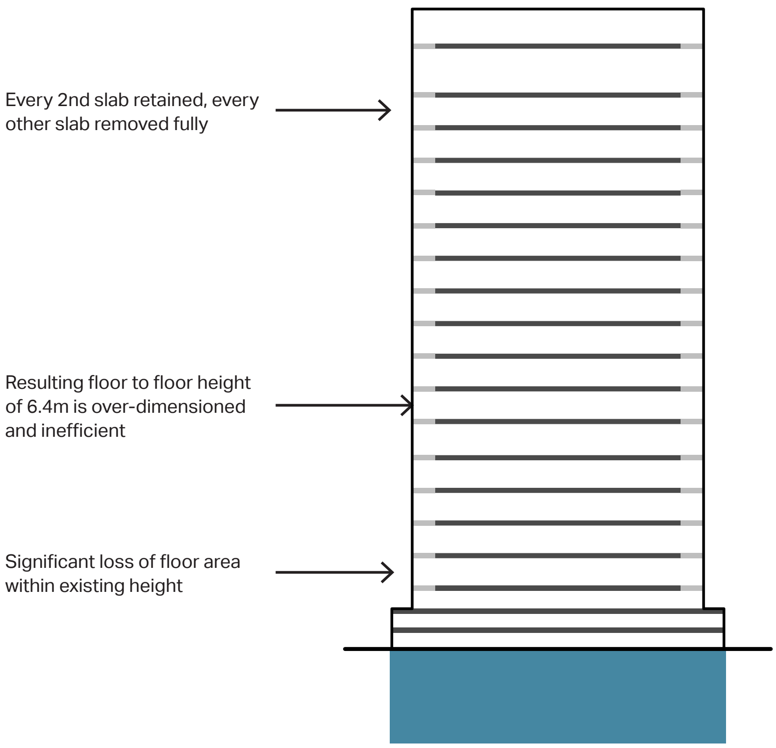
This option would result in poor volumetric efficiency and over-dimensioned floor to floor heights. Flexibility, adaptability, and disassembly would be limited by the retained slabs and columns.

RETAIN EVERY 2ND SLAB

Existing structural elements

Existing floor slabs

New floor slabs

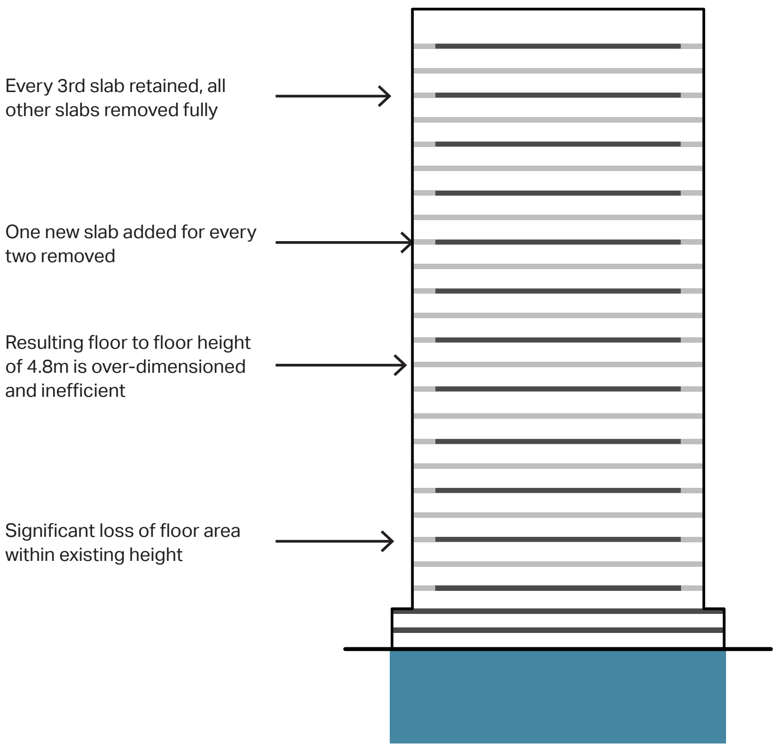


Nº	Slabs retained above podium	**16**
m²	GIA reduction*	**~50** %
	Typical floor to floor	**6.4** m

* Relative to baseline area assuming 100% of floorplates retained with existing envelope

Figure C.3 Diagram showing retention of every 2nd slab above the podium

RETAIN EVERY 3RD SLAB



Nº	Slabs retained above podium	**11**
m²	GIA reduction*	**~34** %
	Typical floor to floor	**4.8** m

* Relative to baseline area assuming 100% of floorplates retained with existing envelope

Figure C.2 Diagram showing retention of every 3rd slab above the podium

Retain Every 4th Slab
This option is shown diagrammatically in Figure C.5. Every fourth slab would be retained and the three others removed fully. Two new slabs would be added to replace those removed.

8 slabs would be retained above the podium.

This would result in a significant loss of floor area within the existing height, essentially a poor volumetric efficiency. The maximum GIA is reduced by 25%, relative to a baseline area assuming full floorplate retention within the existing envelope.

The resulting floor to floor height of 4.3m would be over-dimensioned and inefficient, regardless of whether the space is programmed for office or lab.

This option would result in poor volumetric efficiency and over-dimensioned floor to floor heights. Flexibility, adaptability, and disassembly would be limited by the retained slabs and columns.

Retain Every 5th Slab
This option is shown diagrammatically in Figure C.4. Every fifth slab would be retained and the four others removed fully. Three new slabs would be added to replace those removed.

7 slabs would be retained above the podium.

This would result in a loss of floor area within the existing height, but here the reduction of the maximum GIA would be reduced by 22%, relative to a baseline area assuming full floorplate retention within the existing envelope. The volumetric efficiency would be reduced compared to the existing envelope, but would be somewhat mitigated by the new floors.

The resulting floor to floor height of 4.0m would be over-dimensioned and inefficient for offices, but workable for a lab space. The floor to floor height of the uppermost level would be 6.4m because it is effectively the remaining height after maximising retention with even floor to floor height distribution below (it would not be possible to retain the other slabs and reset the heights evenly within the existing height).

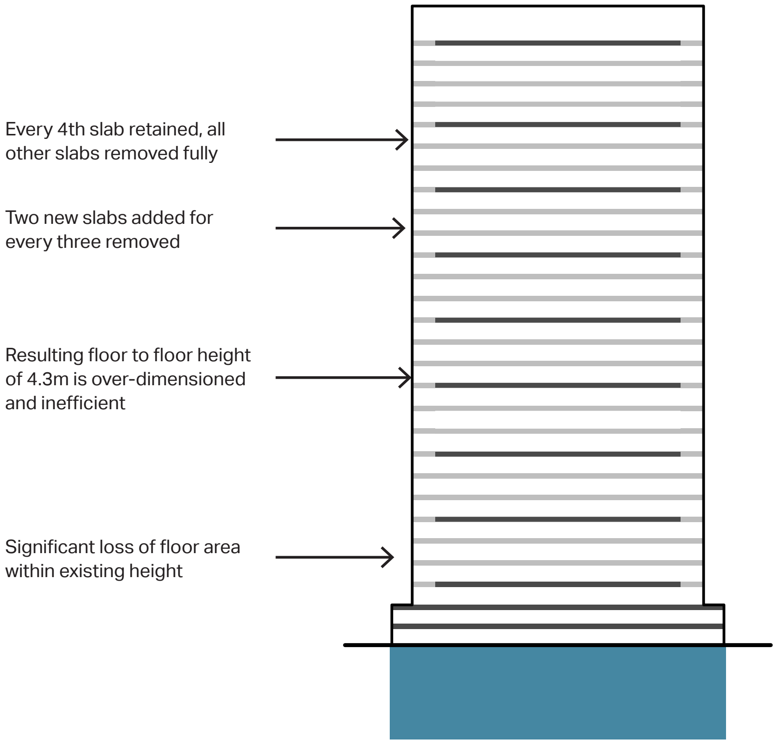
Notwithstanding that the floor to floor height would be over-dimensioned for offices, this option has potential to maximise the opportunity for lab-enabled space. Flexibility, adaptability, and disassembly would be limited by the retained slabs and columns.

RETAIN EVERY 4TH SLAB

Existing structural elements

Existing floor slabs

New floor slabs

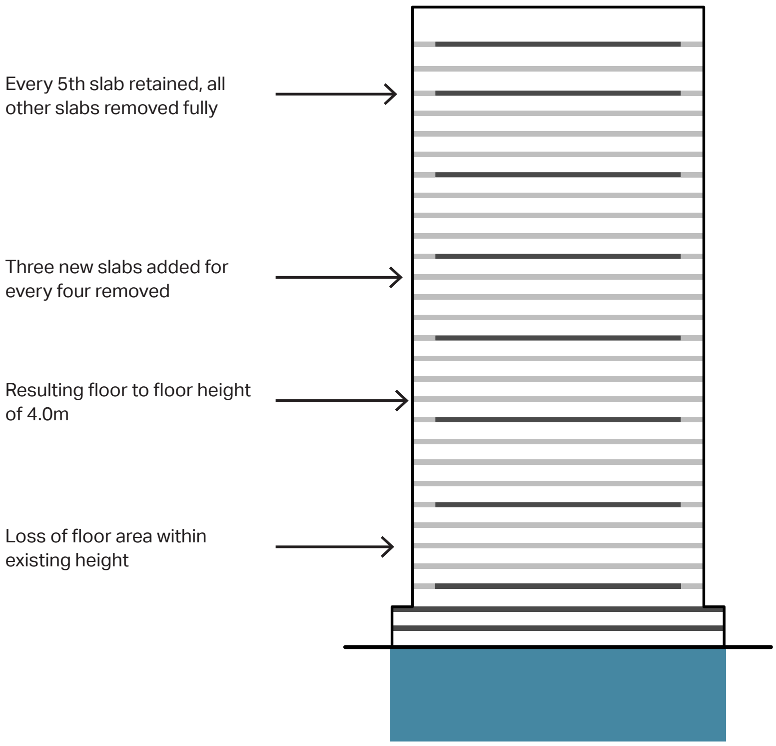


Nº	Slabs retained above podium	**8**
m²	GIA reduction*	**~25%**
	Typical floor to floor	**4.3** m

* Relative to baseline area assuming 100% of floorplates retained with existing envelope

Figure C.5 Diagram showing retention of every 4th slab above the podium

RETAIN EVERY 5TH SLAB



Nº	Slabs retained above podium	**7**
m²	GIA reduction*	**~22 %**
	Typical floor to floor	**4.0** m

* Relative to baseline area assuming 100% of floorplates retained with existing envelope

Figure C.4 Diagram showing retention of every 5th slab above the podium

Retain Every 6th Slab
This option is shown diagrammatically in Figure C.6. Every sixth slab would be retained and the five others removed fully. Four new slabs would be added to replace those removed.

6 slabs would be retained above the podium.

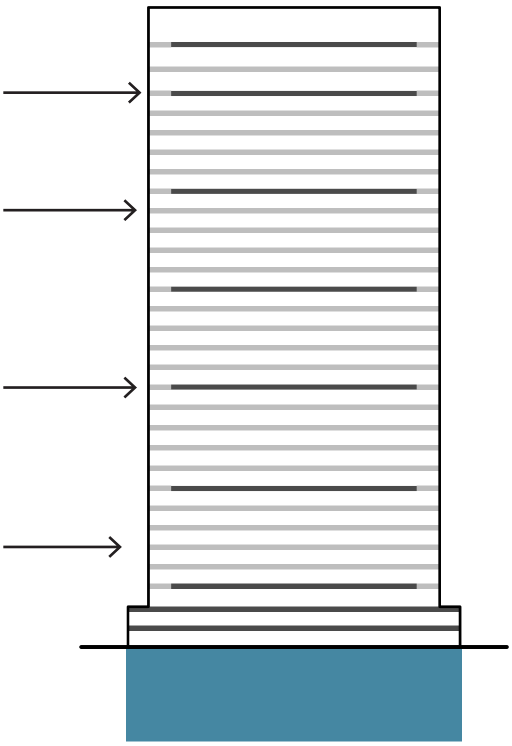
This would result in a loss of floor area within the existing height, but here the maximum GIA would be reduced by 19%, relative to a baseline area assuming full floorplate retention within the existing envelope. The volumetric efficiency would be reduced compared to the existing envelope, but would be somewhat mitigated by the new floors.

The resulting floor to floor height would be inconsistent, most floors would be 3.84m but some floors would be 3.98m. This is due to the existing Level 12 (MEP level) having a 0.7m larger floor to floor height than the typical existing office levels.

The floor to floor height of the uppermost level would be 6.4m because it is effectively the remaining height after maximising retention with even floor to floor height distribution below (it would not be possible to retain the other slabs and reset the heights evenly within the existing height).

Notwithstanding the varied floor to floor heights, which are also contingent on whether lab-enabled floors are included, as a principle this option has potential for further consideration. Flexibility, adaptability, and disassembly would be limited by the retained slabs and columns.

RETAIN EVERY 6TH SLAB



Existing structural elements

Existing floor slabs

New floor slabs

?

Nº	Slabs retained above podium	**6**
m²	GIA reduction*	**~19%**
	Typical floor to floor	**3.84 &** **3.98** m

* Relative to baseline area assuming 100% of floorplates retained with existing envelope

Figure C.6 Diagram showing retention of every 6th slab above the podium