Robert Bird Group
Member of the Surbana Jurong Group

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Reference: MS:EH CO/ST 210319

18th June 2021

Toga Central Developments Pty Ltd
Level 5, 45 Jones Street
ULTIMO NSW 2007

Attention: Mr David McLaren

Dear David

RE: BLOCK C WESTERN GATEWAY SUB-PRECINCT
RESPONSE TO SUBMISSIONS, INCLUDING RESPONSE TO PROJECT REVIEW PANEL
PROJECT REVIEW PANEL COMMENTS RECEIVED 28TH MAY 2021

Robert Bird Group (RBG) has been engaged by Toga to provide structural engineering advice for the proposed Block C of the Western Gateway Sub Precinct. RBG has been involved in this project since mid 2019 supporting both Toga and FJMT to develop the scheme to its current status.

RBG is a tier 1 structural engineering consultancy with extensive experience in Sydney and globally on projects that have significant heritage refurbishment components to them. Some of our experience on these types of projects locally in Sydney includes the following:

- Woolloomooloo Finger Wharf heritage refurbishment and adaptive re-use,
- The Establishment Hotel on George Street, and
- David Jones Queen Elizabeth Store

We also have extensive experience in the design of tall building structures with recent examples being Crown Barangaroo, One Central Park and Australia 108 in Australia and KL118 currently under construction in Kuala Lumpur.

As part of our initial review of the project we investigated the structural feasibility to support the proposed tower envelope without positioning new structure within the former Parcels Post building (fPPb). Refer **Annexure A** to this letter. This study investigated the possibility of cantilevering the proposed tower over the fPPb. We concluded that this option was not feasible based on the following:

- The height and plan geometry of the tower dictate that a full cantilevered solution creates a significant imbalance in gravity loads that generates an overturning moment which would result in major instability in the system. Within the proposed tower envelope there is not enough mass behind the fPPb to balance the cantilever.

- A cantilever of this magnitude would result in structural movements that would likely generate ongoing serviceability issues for the building.

- Site constraints in combination with the need to minimize disruption to the existing building would make construction of such a cantilever very difficult and costly to achieve. Safety during construction would also become a major issue.

We believe that even if a scheme could be developed that dealt with the above challenges the spatial implications and the cost of the structure required to facilitate such a solution would be overly prohibitive to the project.

Following receipt of the recent comments from the Project Review Panel, we have reviewed our proposed structural concept for the tower. In this review we investigated how we might better achieve the following:

- Minimizing the intrusion of structure within the envelope of the existing heritage building.

- Maintaining visibility as much as possible of the southern façade of the existing building. The eastern side of the existing building is considered the most appropriate location to include lateral resisting structure due to the fact that this is not of original construction.

- Utilizing the zone to the east and the south of the existing building for lateral resisting structural elements.

It should be noted that the new core structure to the east, whilst provided lateral support for the new tower will also provide the additional lateral support and stability to the existing building that will be required to ensure compliance with current codes relating to seismic loads.

To ensure the proposed intervention is respectful of the heritage fabric, the detailed structural design will be subject to ongoing heritage consultation as outlined in the Urbis Heritage Impact Statement. An example of respectful intervention is existing column encasement. RBG have developed a column encasement detail as a structural design option to be further developed and may form part of a future DA. This detail allows for a limited number of the existing structural steel columns to be integrated into the support system for the new tower. This indicative methodology involves removing the existing fire rating concrete from around the columns to expose the original structural steel sections, these structural steel columns are then encased within the envelope of the new column, maintaining the existing column but also providing the necessary strength for the support of the tower over. This design and construction technique provides the following benefits:

- There is no requirement to demolish the existing steel columns which will remain in their original position.
- The existing fPPb columns provide their own contribution to the support of the tower above.
- This strengthening technique replicates the original construction type of the fPPb with an embedded steel section within a concrete column.

Included as **Annexure A** to this letter is a Structural Options Analysis which provides a summary of our review of the various structural schemes to achieve the above outcomes. The evaluation of these schemes consider the requirement to meet minimum performance standards, minimise intrusion into the existing building, maximise the visibility of the southern heritage façade, and comply with the various geometric constraints for the new construction. As demonstrated by structural options 2A and 2B, an approach with greater flexibility to structural encroachment has the potential to a result in overall better outcomes for the precinct with respect to both the fPPb and Henry Deane Plaza.

Should you have any questions please do not hesitate to contact the undersigned.

Yours faithfully

ROBERT BIRD GROUP PTY LTD

MITCHELL STARKEY
Principal

Annexure A: Block C – Structural Options Analysis

Annexure A: Block C – Structural Options Analysis

18.06.21

TOGA

EST. 1963

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Robert Bird Group

Member of the Surbana Jurong Group

Block C – Structural Options Analysis

1. Executive Summary
2. Structure adjacent to the former Parcels Post building (fPPB)
3. Structure centred within the fPPB
4. Structure straddling the fPPB
   - Typical approach
   - Constraints & opportunities
   - Cantilever evaluation
   - Principles
   - Reference design
   - Example details
   - Alternative approaches
   - Structural Analysis
5. Conclusion

RBG Project Team

Chris Potter
Chief Operationg Officer
Joined 1988

Academic Qualifications
- B.Eng. (Hons 1)

Professional Registrations & Affiliations
- Fellow Institute of Engineers, Australia
- Chartered Professional Engineer (CPEng)
- National Professional Engineers Register
- 'Secret Clearance' for Government/ Secure projects

Career Summary
Chris joined the Robert Bird Group in 1988 as a graduate engineer and currently holds the position of Chief Operating Officer. Chris moved to Sydney in 1997 and played an instrumental role in establishing and building our NSW business.

Chris's particular expertise is in the fields of adaptive reuse and heritage refurbishments, forensic engineering and wharf projects. During his time in Sydney, Chris has led and successfully delivered numerous iconic projects including Woolloomooloo Finger Wharf, Walsh Bay Pier 6/7, and the refurbishment of the old George Patterson House into the Establishment Hotel. Chris is currently project director for the Barangaroo residential development currently under construction.

One of the highlights of Chris's career thus far has been the Walsh Bay Pier 6/7 project. A unique construction methodology was developed by the RBG team for this project. This idea delivered significant value to the project and whilst the methodology was complicated, the project was delivered on time, on budget and won numerous industry awards for the high level of innovation brought to the project.

Chris has held the following roles in RBG recently:-

2005 - 2009	NSW State Manager
2010 - 2017	Group Operations Director
2017 - present	Chief Operating Officer

Awards

Barangaroo Reserve	*2016 AILA NSW Landscape Architecture Award*
Walsh Bay Pier 6/7	*2002 Institute of Engineers Australia Excellence Award*
	2002 MBA of Australia Excellence in Construction Award
Walsh Bay Pier 8/9	*2004 Property Council of Australia (NSW) Rider Hunt Award*
	2001 UDIA (NSW) Excellence Awards, Urban Renewal Award and President's Award
Woolloomooloo Wharf Redevelopment	*2001 Engineers Australia, Highly Commended Award for Heritage & Project Development Categories*

Grant Weir
Group Managing Director
Joined 1986

Academic Qualifications

Bachelor of Engineering

Professional Registrations & Affiliations
- Fellow of the Institution of Engineers Australia
- Chartered Professional Engineers
- National Professional Engineer Register
- Registered Professional Engineer Queensland
- Registered Building Practitioner (Vic)
- Australian Institute of Company Directors

Career Summary
Grant Weir joined the Robert Bird Group (RBG) in 1986 as a graduate engineer. Since joining the company Grant has built on his engineering, project management, people management, and business management knowledge and skills. Grant is currently Group Managing Director and leads two of the Group Specialist Business Units.

With extensive engineering knowledge and experience in the design of large complex projects Grant has led design teams on major projects with particular expertise in all aspects of structural design. Both in Australia and overseas Grant has participated in many peer reviews and value engineering reviews on various types of projects, developed innovative and cost effective design solutions for challenging high-rise projects on congested and difficult sites, extensive experience in structural solutions that integrate with leading edge construction methodologies, complex staged master planned developments, experience in sites with deep basements adjacent to waterfront and waterfront developments generally, participated in the design of numerous leading edge Green Star rated projects and has extensive engineering knowledge and experience in the design of structural steelwork, reinforced and pre-stressed concrete on a wide range of structures.

Grant's skills in value and concept engineering, management of the design process, and project delivery are well recognised by RBG clients.

Mitchell Starkey
Principal
Joined 2011

Academic Qualifications
- B.Eng. (Structural)

Professional Registrations & Affiliations
- MIEAust
- CPEng

Career Summary
Mitchell has worked for Robert Bird Group since 2011. For the most part, he has been in the Sydney office, where he has led projects through all phases of the design, from concept through to construction.

Mitchell's experience has primarily focused on technically complex problems, including One Central Park, Crown, Duo at Central Park and One Sydney Harbour. Throughout his career, Mitchell has delivered design and design verification of complex steelwork projects where his focus is always on safety through all construction phases. Mitchell's experience ensures high-risk items are identified and mitigated at an early stage, allowing the development of buildable and robust designs that achieve best for project outcomes.

Mitchell is currently in the RBG Sydney Office, where he is a Principal leading the design of some of Sydney's most noteworthy projects.

1. Executive Summary

This document has been prepared in response to the Project Review Panel's (PRP) request for details outlining the alternative structural approaches and options investigated and evaluated for the Block C site. The document forms part of the Block C Response to Submissions (RTS) which responds to submissions received during public exhibition of the Block C rezoning proposal.

Various architectural massing studies were undertaken for the proposed Block C site to inform the Planning Envelope principles. The Option F1 massing concept was selected to be carried forward and was developed into the proposed Planning Envelope. RBG have carried out various structural engineering studies for the proposed Block C reference massing with specific consideration to the sensitive heritage nature of the former Parcel Post building (fPPb).

A structure fully cantilevered over the fPPb, with no supporting elements within the curtilage of the fPPb, was investigated as an initial solution. This proved to be unachievable due to the enormous overturning mass which cannot be sufficiently resisted by the built form available outside the fPPb footprint.

RBG have proposed a possible methodology for encasing select columns demonstrating how new vertical support elements can be introduced within the fPPb to provide the required lateral stability to the heritage item, support a new vertical extension and enhance the ability to appreciate the original grid.

Structural configurations with cores / bracing elements located outside of the fPPb to both the east and south are considered. These options will require additional lateral support within and above the fPPb. Alternatively, a consolidated structural core located on the eastern elevation partially located within the fPPb is shown to provide the necessary lateral support whilst providing the opportunity for enhanced visibility to the southern heritage façade from the public domain. This consolidated eastern core option is considered to achieve the least heritage impact.

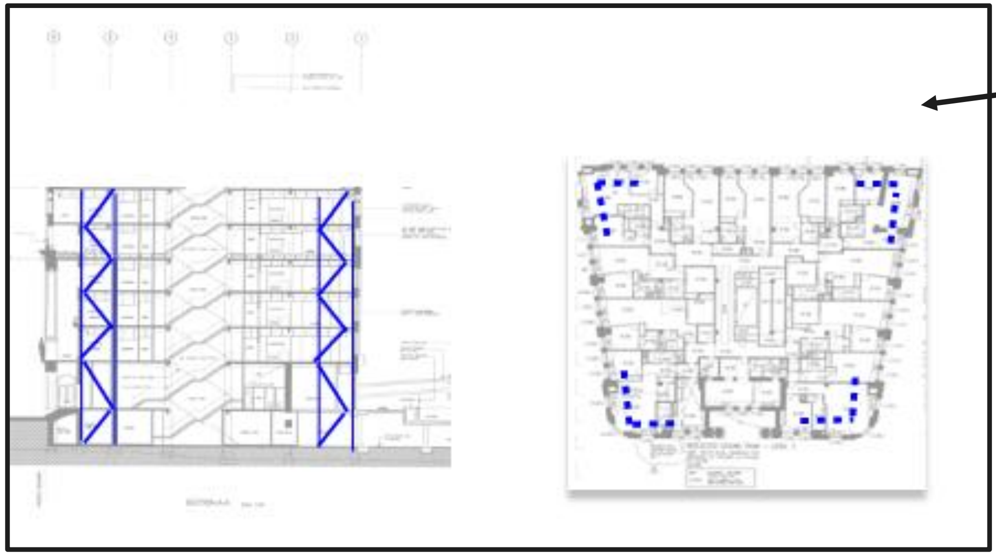
2. Structure Adjacent to the fPPb

Various iterations of tower massing, which positioned the tower mass entirely (or near entirely) over the plaza, have been investigated.

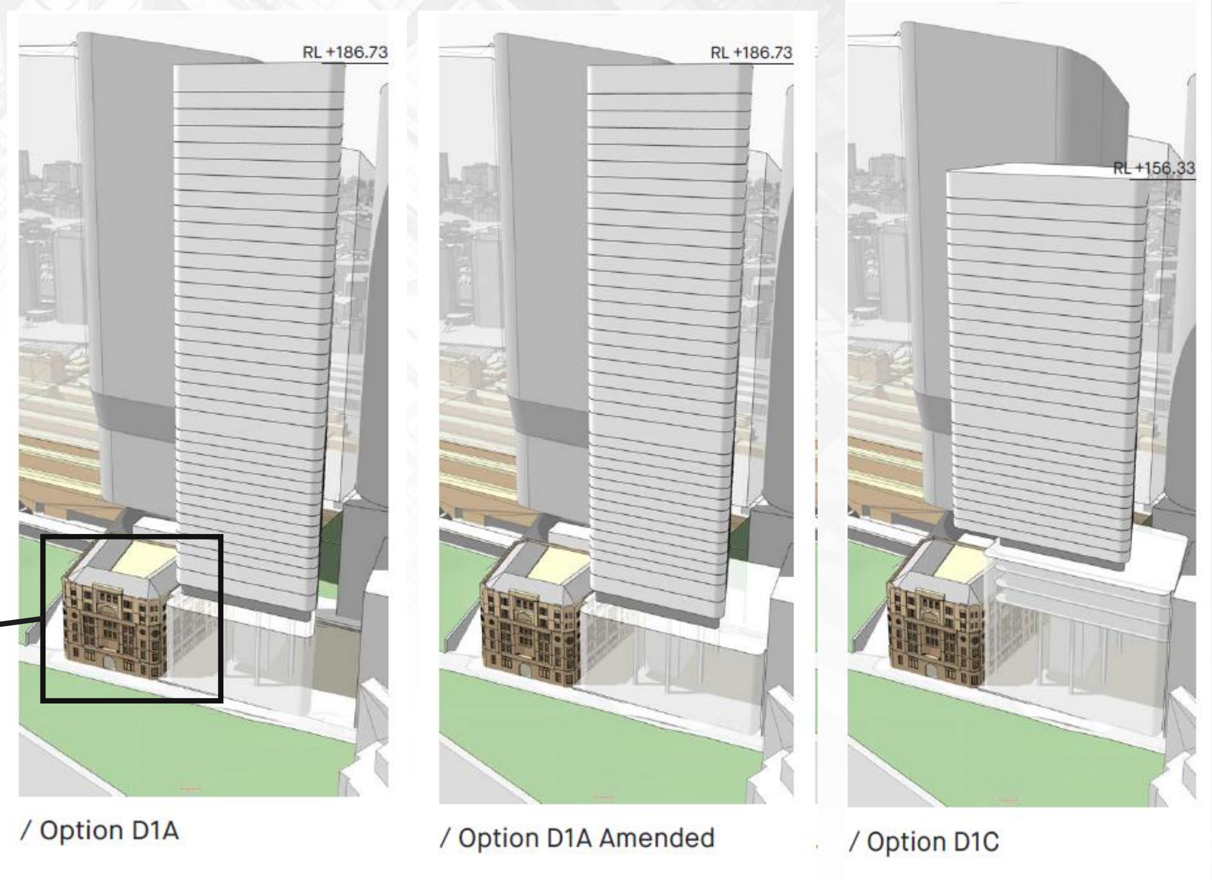
These massing concepts minimized, to the maximum extent possible, the structural impact on the fPPb, as no structural support for a new tower was required to be positioned within the fPPb.

These massing concepts were found to create an unacceptable wind environment and public realm outcome and further assessments were discontinued.

It is noted that despite these massing concepts requiring no new tower support structures within the fPPB, the fPPB will still require structural intervention to bring it up the latest seismic codes.



Indicative Bracing in Plan and Elevation of seismic upgrade.



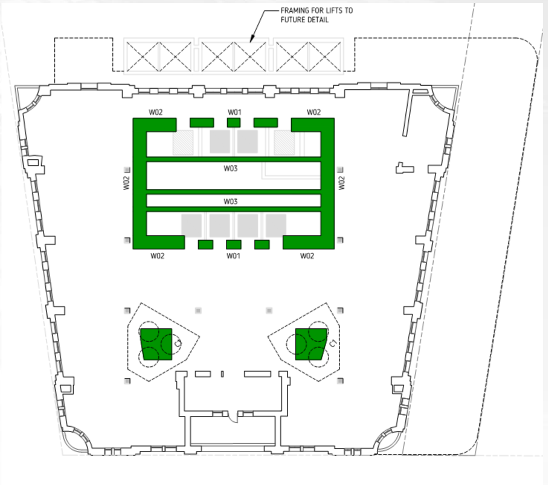
3. Structure Centered within the fPPb

/ Option A1

/ Option E1

Structural schemes were investigated to support the entirety of the tower mass positioned over the fPPb. These schemes were supported on 3 structural ‘mega’ elements through the fPPb, i.e. 2 columns and the core.

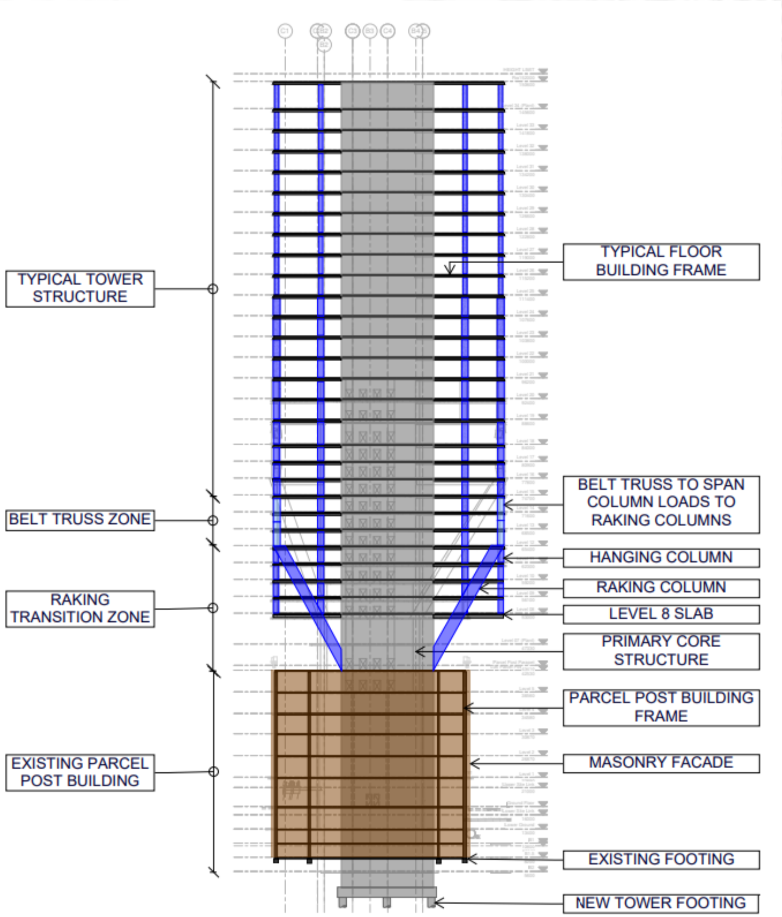
These massing concepts were not supported by the Design Review Panel as a greater setback to the northern and western façades of the fPPb was preferred, to preserve the primacy of the heritage item.

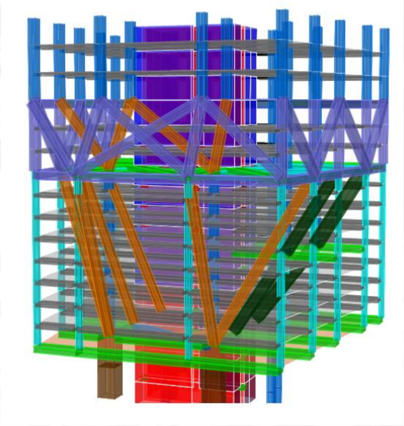


VERTICAL SUPPORT ELEMENTS PLAN - U/S LEVEL 08

3. Structure Centered within the fPPb

/ Option A1





Transition from the fPPb mega structural elements to the typical tower structural arrangement is facilitated through diagonal raking columns.

This scheme results in significant temporary works through construction and large amount of unusable space in the lower levels due to the large structural elements raking through the lower levels of the tower.

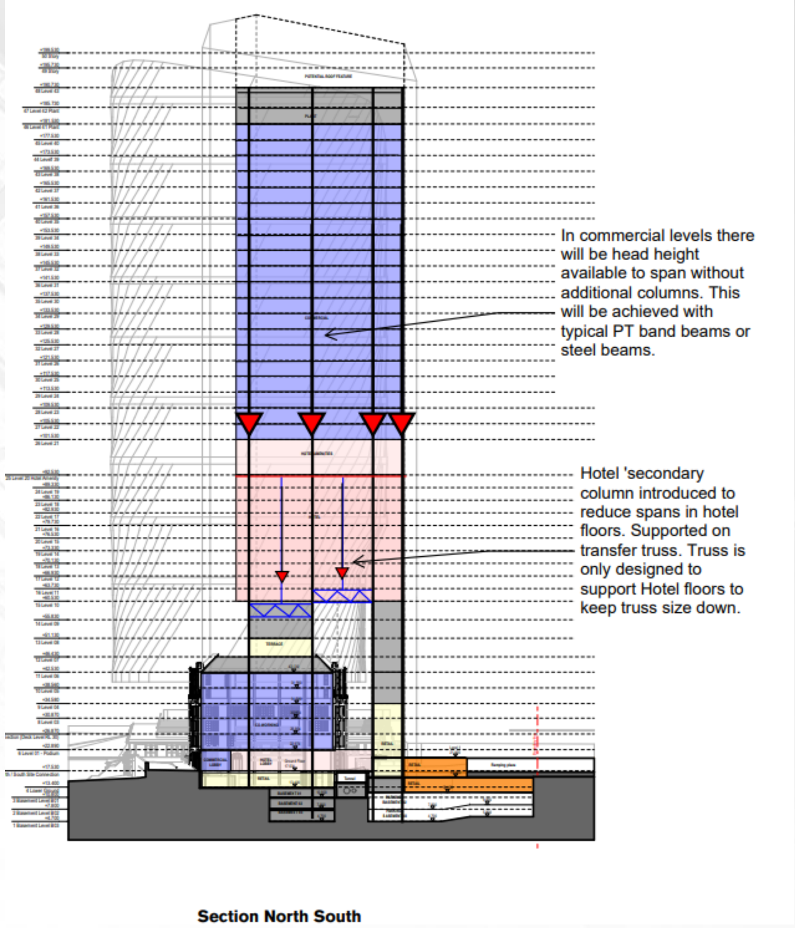
The tower structural mega elements within the existing fPPb provided the necessary lateral stability to resist seismic loads in accordance with current seismic design standards.

4. Structure Straddling the fPPb

/ Option D2A

/ Option D2B

/ Option F1



Structural Load Path Diagram

Iterations of tower massing were investigated that straddled a re-aligned through site pedestrian link which would connect the Devonshire tunnel to the Lee Street tunnel. Option F1 was preferred and was used to develop the proposed planning envelope.

A conceptual structural solution was developed to support these massing options. This solution requires the integration of large truss structures to spread the tower loads over the pedestrian link. The solution also reduced the quantum of structure within the fPPb compared to concepts positioning massing directly above the fPPb. This is achieved by shifting core areas to the eastern perimeter of the fPPb (partially outside of the fPPb) and to the south (entirely outside of the fPPb).

4. Structure Straddling the fPPb – TYPICAL APPROACH

Plan showing planning envelop and reference design floor plate.

Indicative location of centralised core

Typical structural solution:

Without considerations of the site-specific constraints the most efficient structural solution would be more consistent with typical large scale commercial projects under construction in Sydney.

The optimum structural solution would consist of a central core (indicatively shown in red) with evenly spaced columns placed at the perimeter of the building to evenly distribute the load. The column locations would be consistent from footing to roof and would not include transfers.

This solution would relieve load from the columns and result in an efficient, buildable and cost-effective structure. Columns would be spaced on a circa 8-10m grid which would make for an efficient post tensioned floor system. This would result in approximately 10-12 columns running continuously and would remove the need for complex structural transfers.

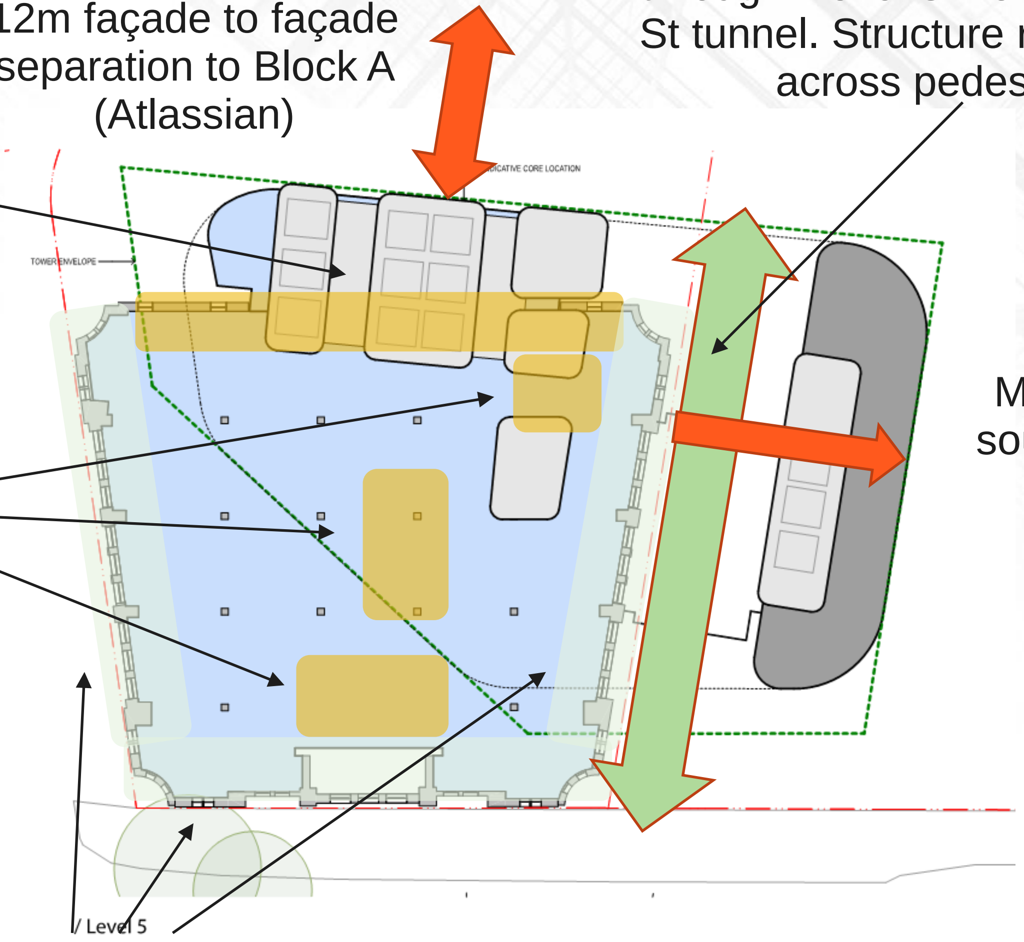
The centre core system would be extremely structurally efficient (walls would be circa 400mm thick) due to its central and symmetrical nature.

4. Structure Straddling the fPPb – CONSTRAINTS & OPPORTUNITIES

Continuous pedestrian access through Devonshire St tunnel to Lee St tunnel. Structure required to span across pedestrian link

12m façade to façade separation to Block A (Atlassian)

Eastern façade non-original fabric, demolished and rebuilt



Maximum 16m extension south of the fPPB southern facade

New building core constructed in 2000's as part of refurbishment. Previous stairs and lift locations infilled and original internal walls demolished.

Structure of fPPb unable to meet the requirements of current seismic standards and needs to be upgraded.

Original and significant heritage façade to the north, west and south of the fPPb.

4. Structure straddling the fPPb – CONSTRAINTS & OPPORTUNITIES

Existing fPPb Structure

Constructed in the early 1900’s the building is a concrete encased steel frame. The lateral stability system of the building is not obvious and unlikely to meet the provisions of current seismic standards. In Robert Bird Group’s experience with buildings of this vintage the structure that interfaces with the façade is heavily corroded which severely weakens the structure. Structural upgrades will be required to align the structure with current design standards.

Existing Lift Core

The existing lift core is not part of the original base build. It was constructed in the early 2000’s as part of the refurbishment. A portion of the existing fPPb was demolished to accommodate this core.

Devonshire Tunnel Pedestrian Access

Maintaining pedestrian access through the Devonshire tunnel creates a ‘structure free’ zone to the south of the fPPb. This results in a complex structural solution that requires the building to arch over the Devonshire tunnel.

Significant Facades

Limits the possible core locations to east and south preventing the previously discussed centralised standard core location. This is due to the north, west and southern facades which are of the highest heritage value.

4. Structure Straddling the fPPb – CANTILEVER EVALUATION

These blocks indicate the structural core zones that would theoretically be required to facilitate a cantilevered building. These fall outside the prescribed planning envelope zones and is not achievable.

Cantilever structural solution:

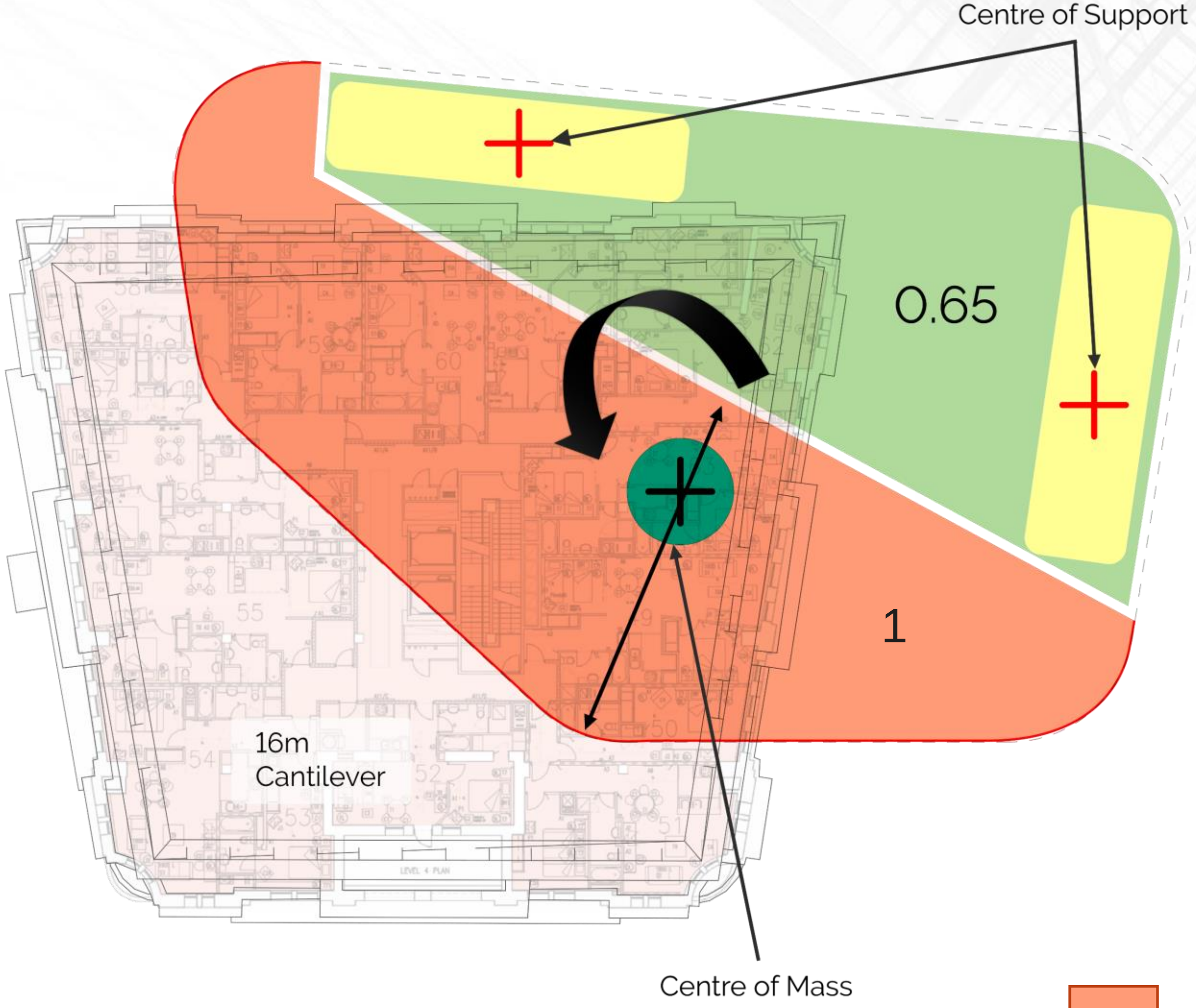
Structural schemes were studied that did not locate new structure within the existing fPPb. A structural assessment was completed on this scheme and discontinued due to inadequate spatial allowances.

This structural scheme shifted all load bearing structural elements to the periphery of the fPPb. This meant that all gravity, wind and seismic loads gathered in these areas. It was found that when the structural requirements to facilitate this load path (1800mm thick core wall zones) were combined with the lift shaft spatial requirements there was inadequate spatial allowance to stay within the proposed Planning Envelope constraints of the tower without encroaching into the fPPb.

To facilitate this structural option without intervening with the fPPb would require the envelope to the east and south to be extended to allow for appropriate structure to counteract the stresses caused by a complete cantilevered tower structure.

Therefore, this scheme is deemed infeasible as it breached boundary conditions and the proposed Planning Envelope.

4. Structure Straddling the fPPb – CANTILEVER EVALUATION



Overturning Mass Vs Restoring Mass

In order to sufficiently evaluate a cantilevered building arrangement, consideration must be given to overturning mass vs restoring mass. It is this ratio which determines the feasibility of a cantilevered solution.

Consideration must also be given to the affect the ratio has on the efficiency of the structure.

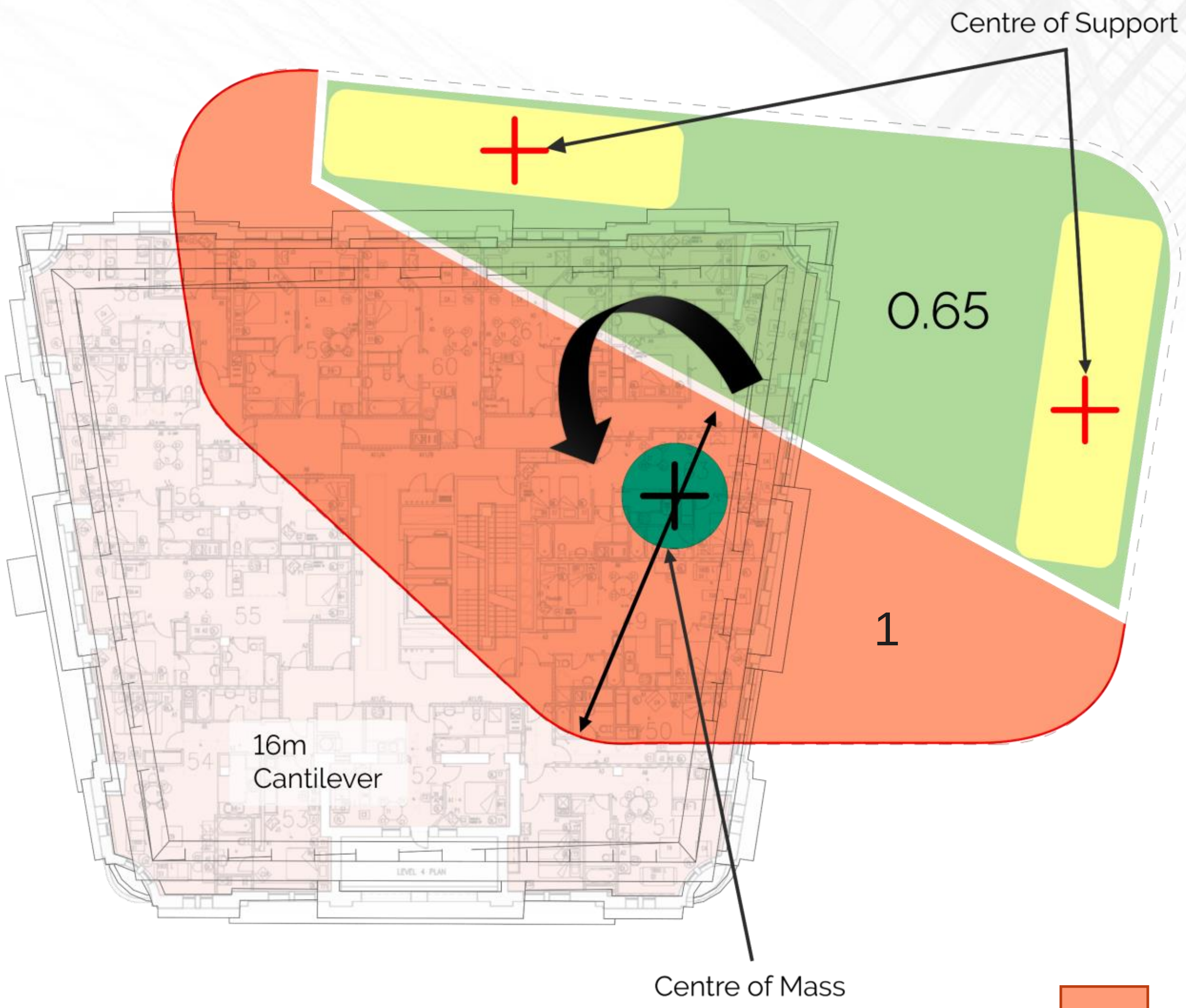
The diagram on the left illustrates overturning vs restoring mass if a cantilever structure scheme was adopted. As shown it can be seen that the restoring mass is only approximately 65% of the overturning mass.

Cantilever designs typically deliver a restoring mass which is over 200% of the overturning mass. Some relevant examples are explored in the following slides.

Overturning Mass

Restoring Mass

4. Structure Straddling the fPPb – CANTILEVER EVALUATION



Out of Balance Structural Arrangement

This type of cantilevered structural arrangement results in load path that generates a large out of balance overturning moment that induces a lean to the building.

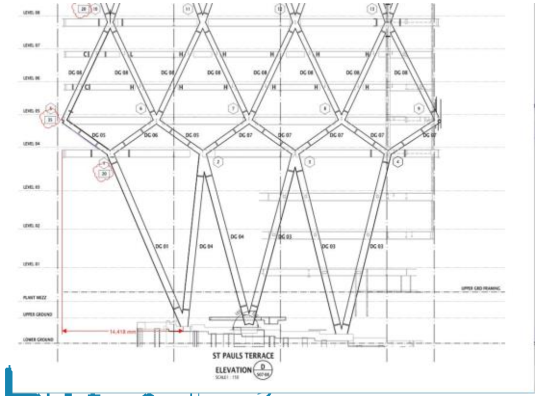
Due to the offset nature of the core, there is insufficient dead load on the back of the core to maintain stability. I.e., the cantilever has no back span. Approximately 60% of the building mass cantilevers.

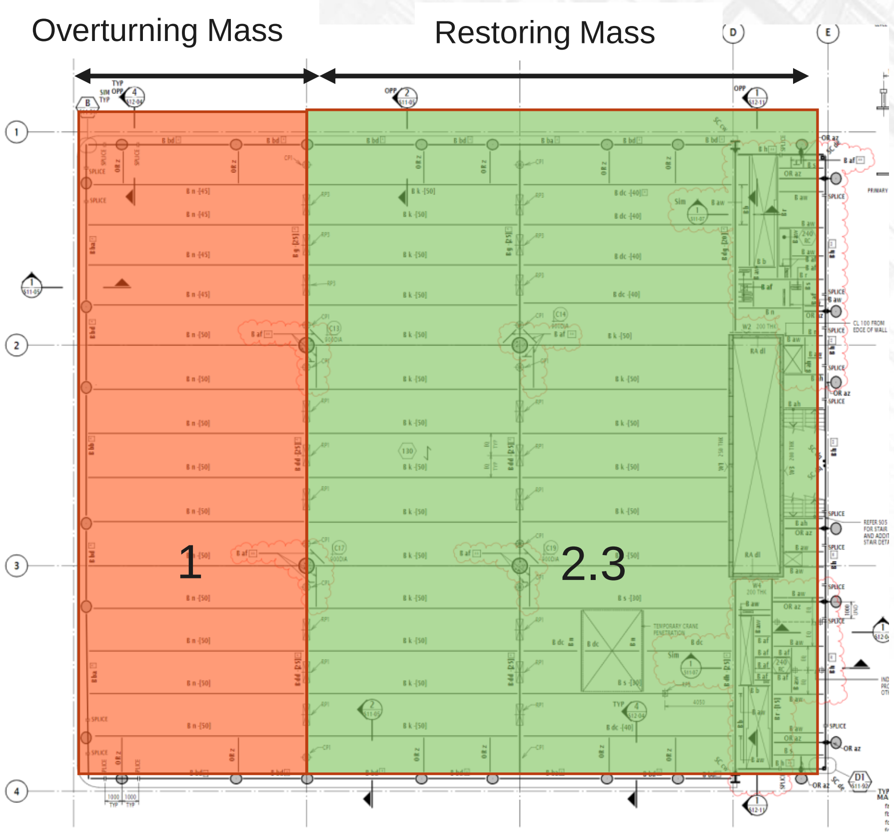
For this system to work further dead load would need to be placed on the core which would result in either intervention into the fPPb or extension of the building beyond the current envelope.

Overturning Mass

Restoring Mass

4. Structure Straddling the fPPb – CANTILEVER EVALUATION





Jubilee Place in Brisbane – 14m cantilever with diagrid structure required to facilitate the cantilever. There is a large portion of mass positioned behind the cantilever to maintain stability, only circa 30% of the building mass cantilevers. In this example the restoring mass is 230% greater than the overturning mass.

Reduced Envelope and Feasibility

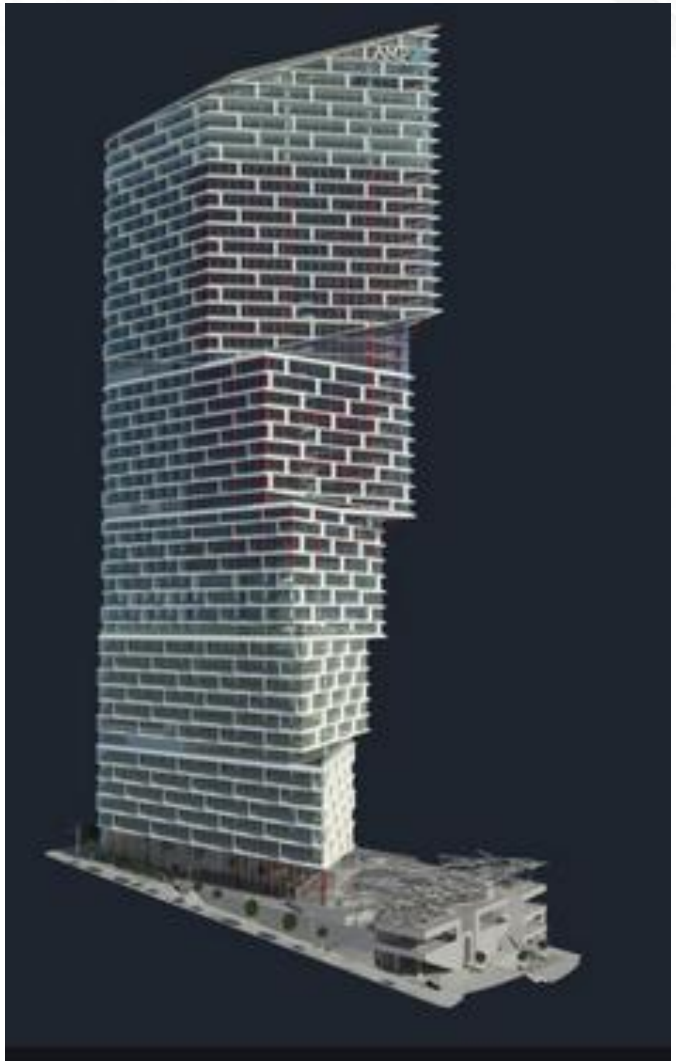
The cantilevered solution was looked at and compared to other cantilever building structures currently under construction in Sydney and Australia.

The Jubilee Place Project in Brisbane (also designed by Robert Bird Group) cantilevers over a building of heritage significance. A diagrid is used to achieve this arrangement.

A similar diagrid structure was investigated for Block C, however it was found that the ratio of cantilevering mass to restoring mass was too large to be stable.

If this structural system were applied to the Toga Central project the building height would have to be significantly reduced which would again make the project infeasible.

4. Structure Straddling the fPPb – CANTILEVER EVALUATION



Quay Quarter Tower

Quay Quarter Tower (former AMP tower) uses a large raking column system to facilitate the cantilevered addition. This building has a large core orientated in the direction of the cantilever to prevent the building from being unstable. In fact the original core was enhanced to facilitate this cantilever. The spatial allowance for the core on the TOGA Central Project means the building would need to be significantly shorter which would make the project infeasible.

The peak cantilever from the base to the roof is approximately 25m, however the average cantilever is significantly smaller than this (approximately 12m). The cantilever is generated in a progressive manner.

The restoring mass is significantly larger than the overturning mass, as shown on the following page.

4. Structure Straddling the fPPb – CANTILEVER EVALUATION

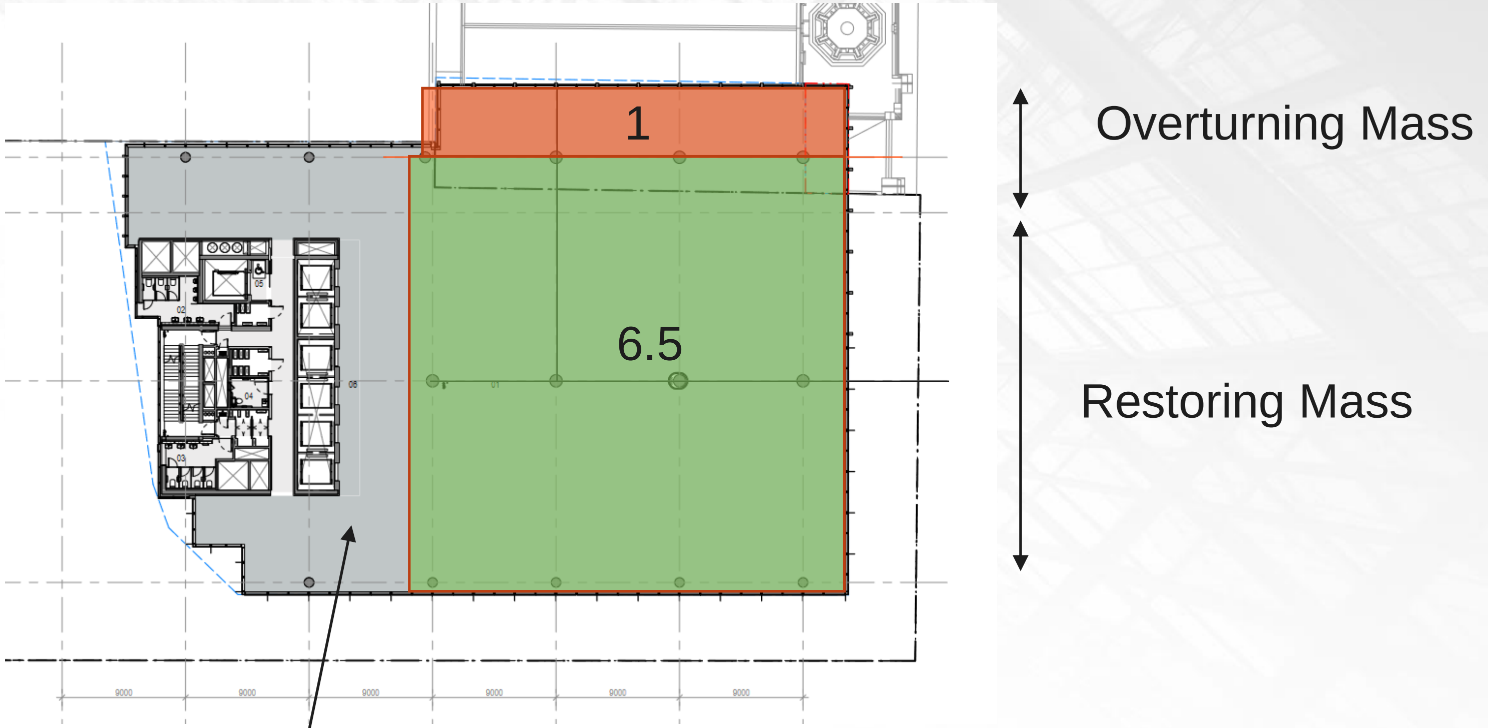
Quay Quarter Tower - 25m Cantilever

Large core positioned centrally with adequate dead load to prevent destabilisation.

The restoring mass is significantly greater than the overturning mass. Note this is the maximum cantilever. Much of the cantilever in elevations is significantly less.

4. Structure Straddling the fPPb – CANTILEVER EVALUATION

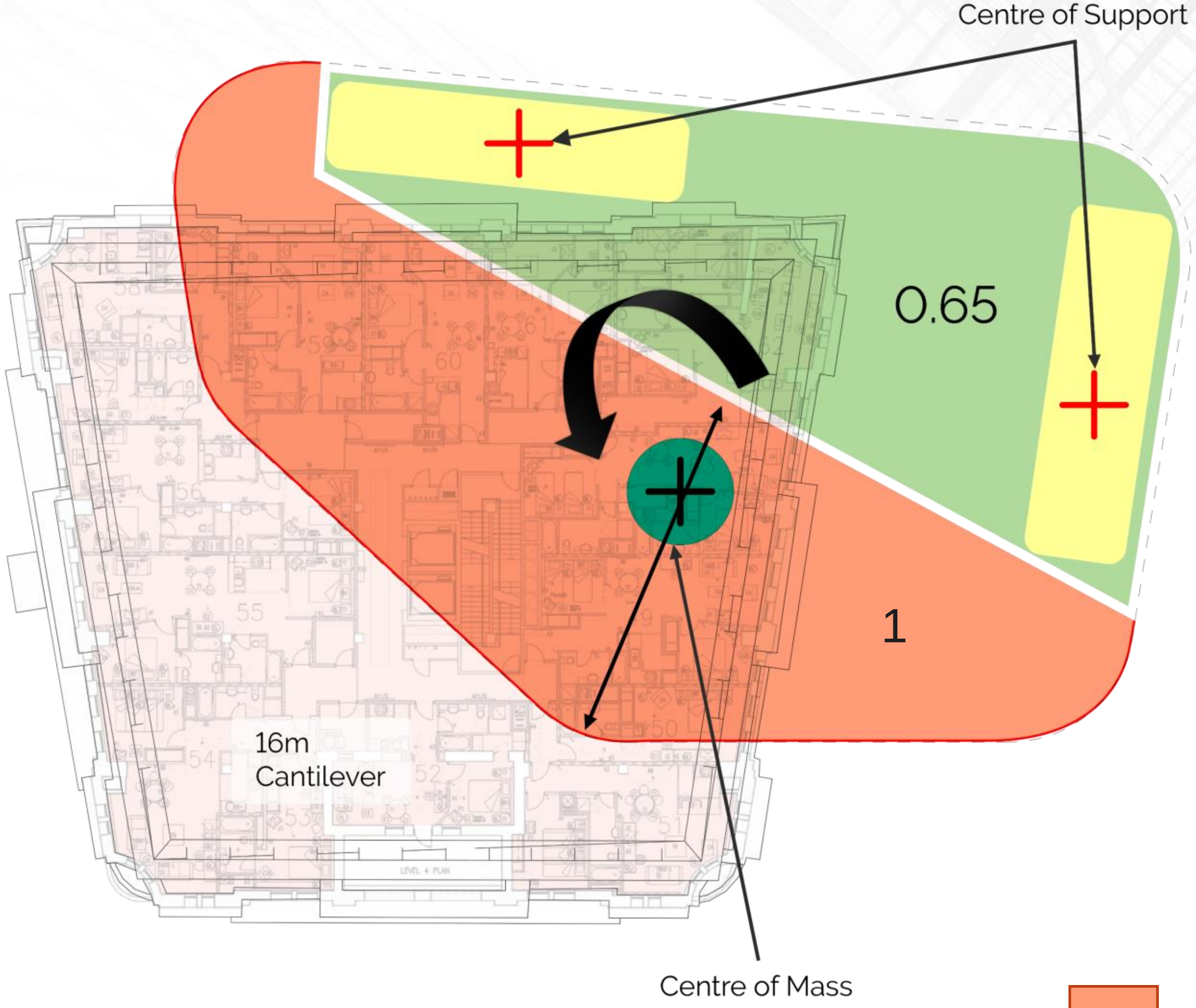
60 Martin Place - 8m Cantilever



Large core positioned centrally in direction of cantilever with appropriate dead load to prevent destabilisation.

60 Martin Place uses a cantilevered truss system, however, the overturning mass is negligible compared to the restoring mass which is 650% greater, i.e. 6.5:1.

4. Structure Straddling the fPPb – CANTILEVER EVALUATION



Unlike the previous examples, the cantilevered solution for Block C has an overturning mass greater than the restoring mass.

Refer benchmarking comparison of ratio of overturning mass relative to restoring mass.

Project	Restoring Mass	Overturning Mass
BLOCK C	**0.65**	**1**
Jubilee Place	2.3	1
Quay Quarter Tower	2.8	1
60 Martin Place	6.5	1

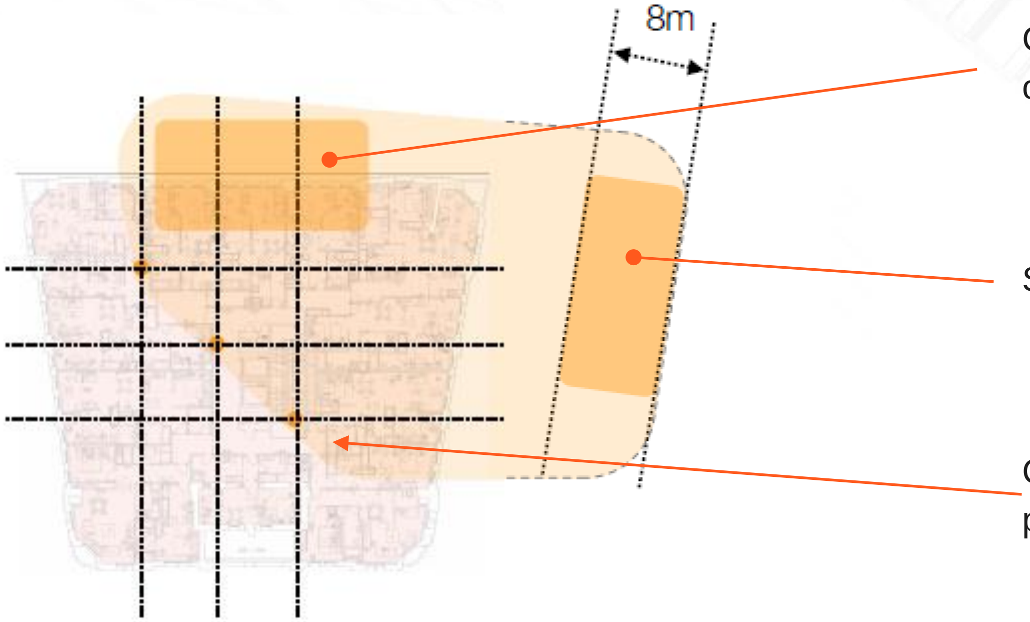
This makes the cantilevered solution infeasible

Overturning Mass

Restoring Mass

4. Structure Straddling the fPPb – PRINCIPLES

Taking into consideration the relative heritage value of the various components of the fPPB as outlined within the Urbis Heritage Impact Statement, the most appropriate opportunities for new structure have been identified as:



Utilising existing grid

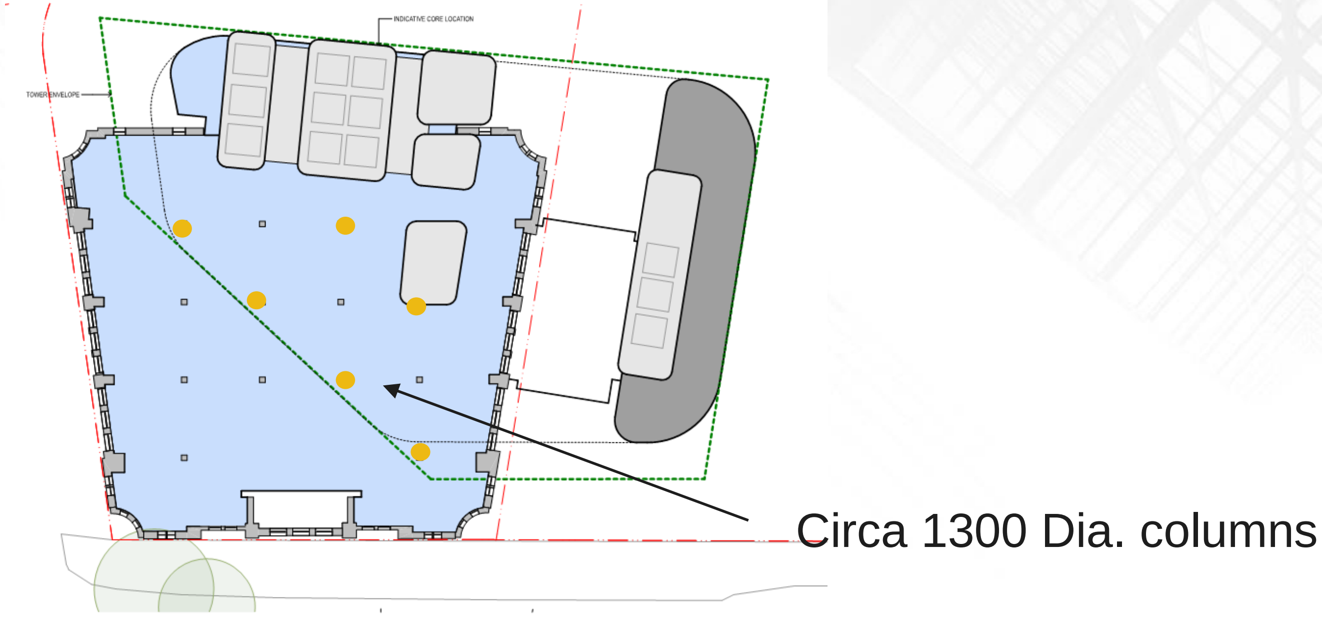
Respecting location of existing grid, and colocating columns

Core at the eastern edge of the fPPB due to historical intervention to this façade over time.

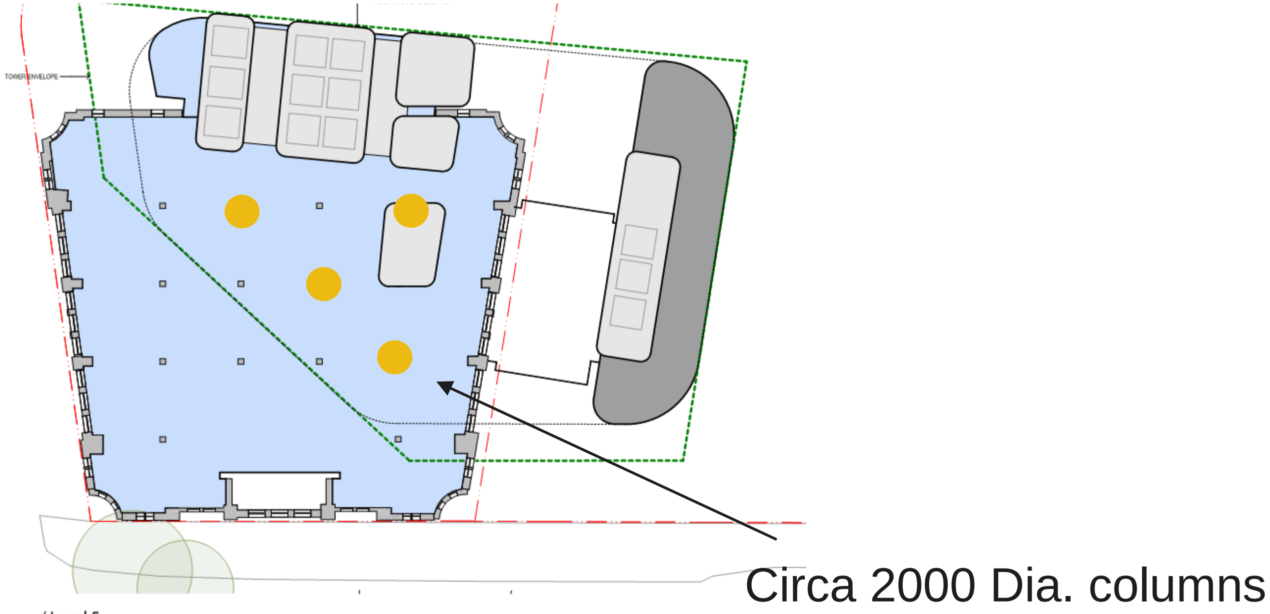
Structure and possible core south of the fPPB with sufficient separation (8m)

Columns sensitively located to reinforce the original grid and minimised where possible

4. Structure Straddling the fPPb – REFERENCE DESIGN



/ Level 5



/ Level 5

Structural schemes were devised that located the tower supporting structure on the existing structural grid.

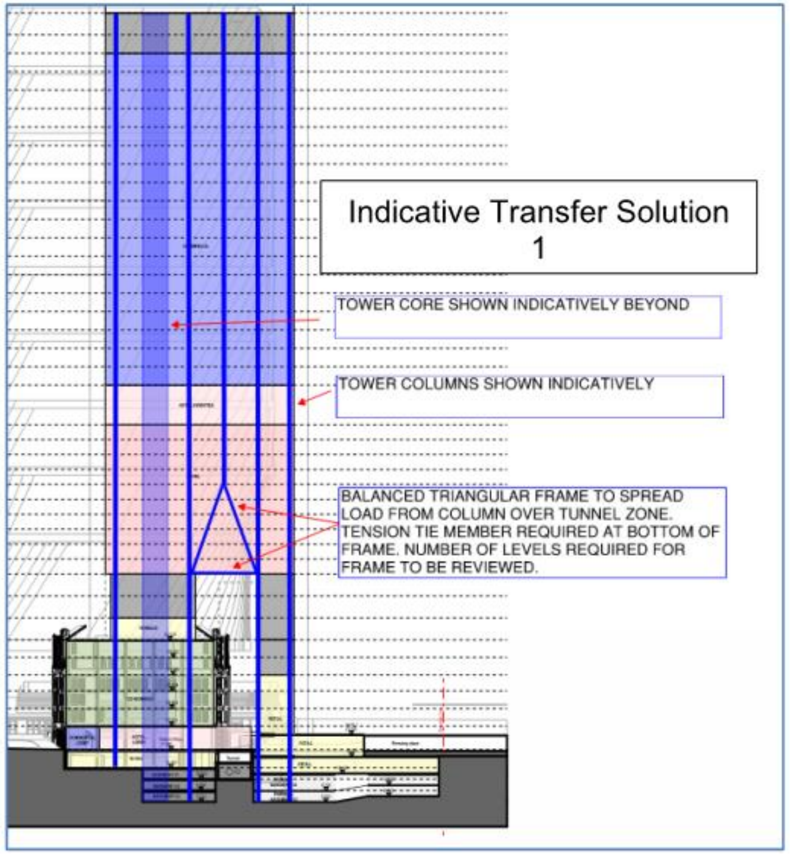
Locating tower columns provides a sensitive integration of old and new as the original grid is preserved and/or restored. Locating columns on the existing structural grid of the fPPb does however result in an inefficient hotel and commercial grid. To ensure a feasible solution is achieved in the tower complicated transfer structure is employed to realign structural grids.

Various iterations of column locations were investigated with the final arrangement to be finalised through the design competition process.

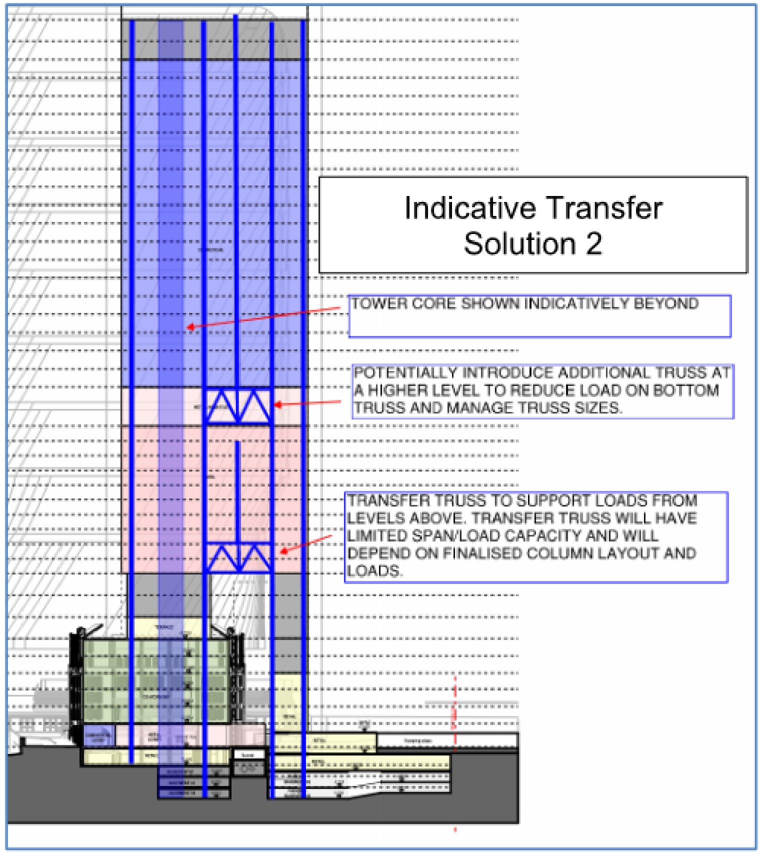
4. Structure straddling the fPPb – REFERENCE DESIGN

Transfer solutions

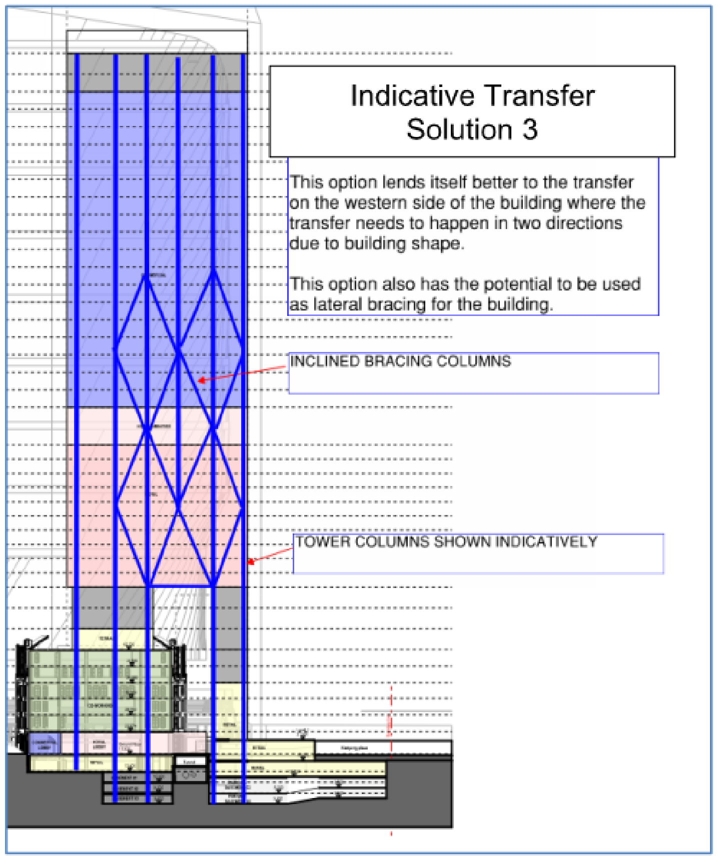
Arching the structural loads across the re-aligned through site pedestrian link is required to keep the pedestrian link free of structure. To achieve this, loads are required to be transferred and columns landed which are sensitive to the fPPB whilst maintaining the functionality of the tower floor plates above. Various indicative solutions were developed in order to demonstrate how this could be achieved.



Structural Load Path Transfer – Triangle Frame



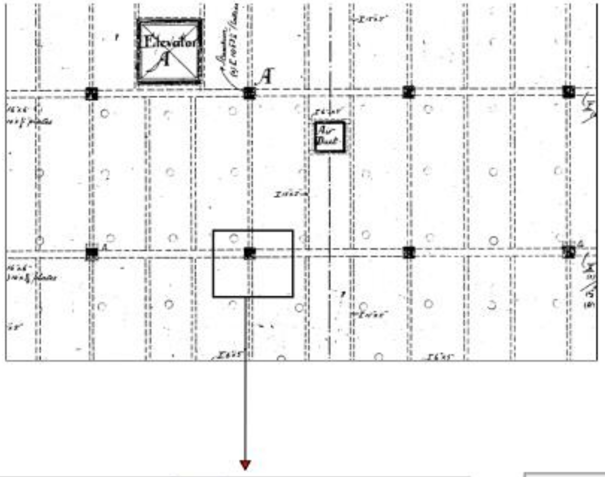
Structural Load Path Transfer – Transfer Truss

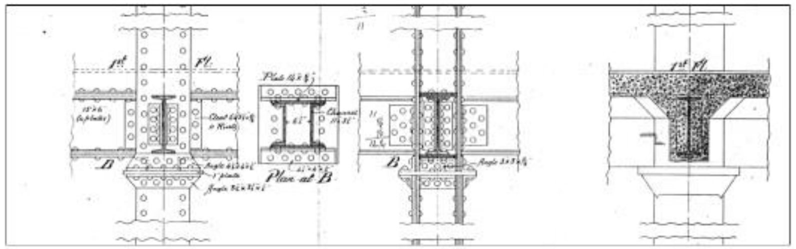


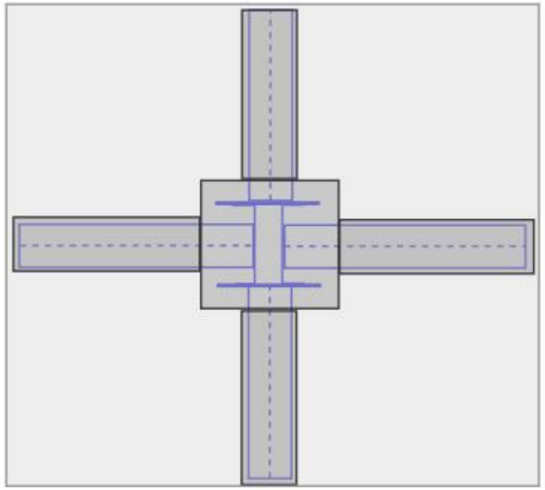
Structural Load Path Transfer – Inclined Bracing Columns

4. Structure Straddling the fPPb – EXAMPLE DETAILS

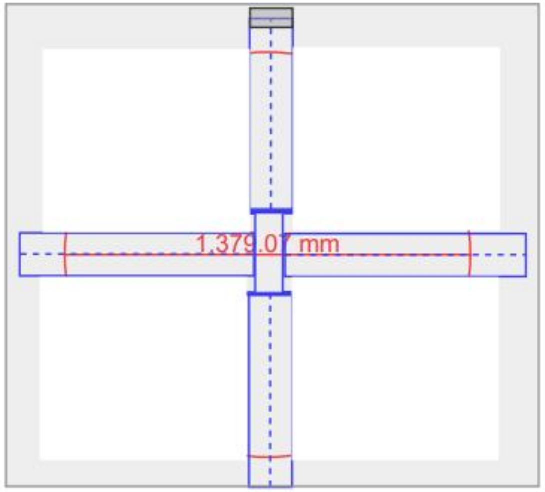
Option to Embed Existing Columns



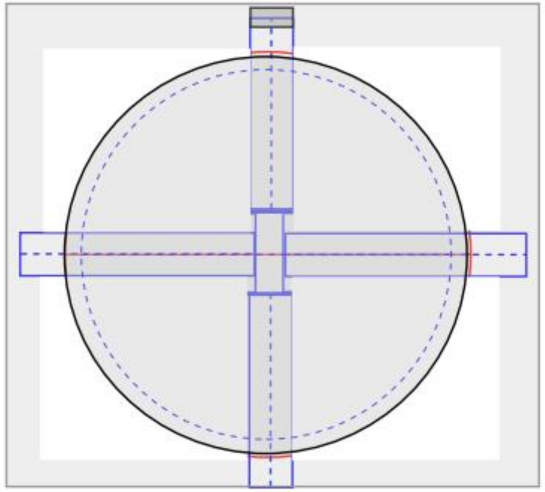




Existing Concrete Encase Steel Column
Steel Beams framing in from 4 directions.



Break Out Concrete around steel.
Demo slab in zone around steel beams for future col.



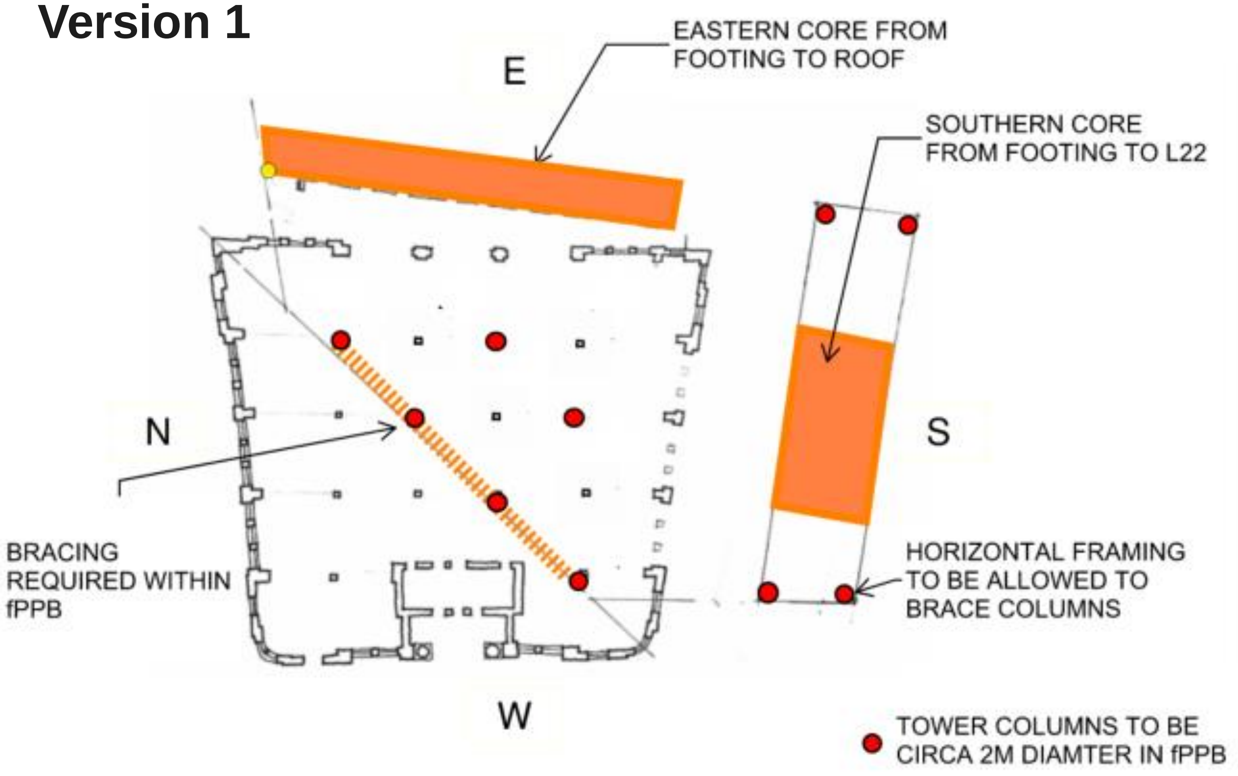
Form Reo Pour New Column Embedding existing
steel beams and column.

Indicative structural column details were investigated in order to demonstrate that integrating the existing structure with the new structure can provide a contribution to the support of the new tower.

This detail is one example of how new structure can be integrated with the old in a sensitive manner. Providing the additional required support for the new tower, strengthening the existing heritage building to meet current building code and preserve/reinstate the original structural grid.

4. Structure Straddling the fPPb – ALTERNATIVE APPROACHES

Version 1



There are two variations of this scheme that have been investigated with regard to spatial allocation of lateral elements:

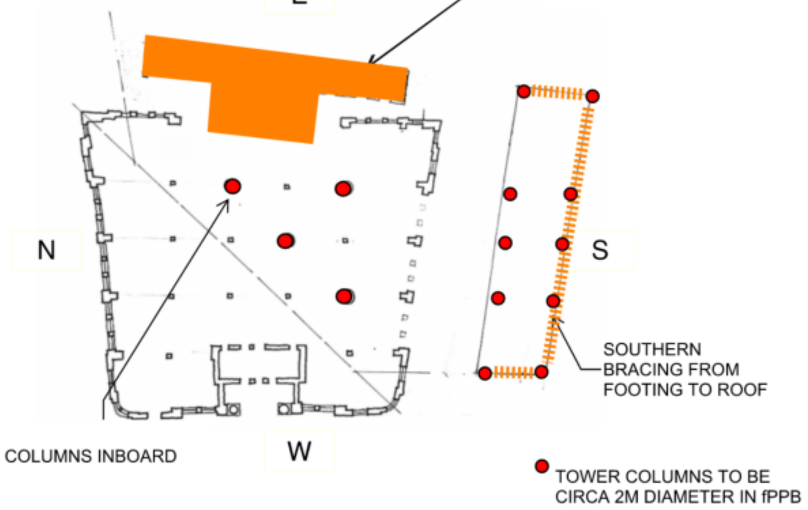
Version 1

Key core elements to service the vertical extension and provide structural support are located entirely external to the fPPb.

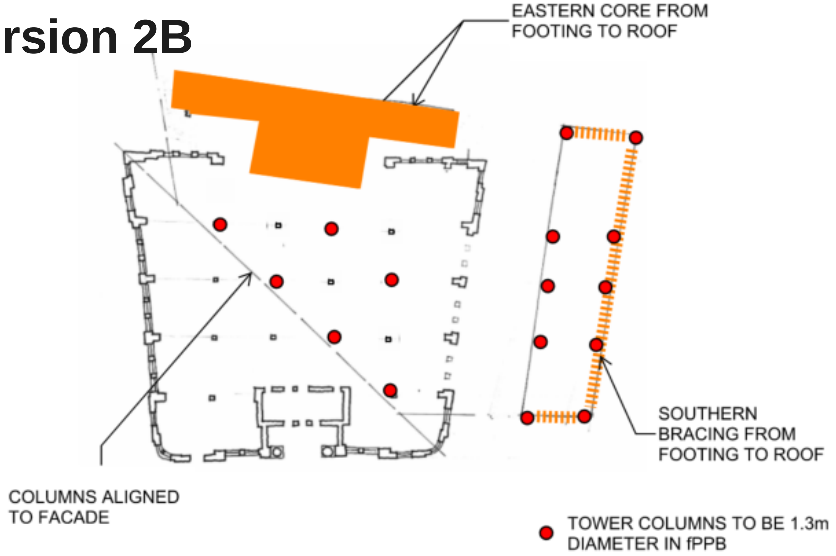
The eastern core depth is reduced in depth to fit outside the fPPb whilst remaining within the Planning Envelope boundaries. Consequently, the lateral strength of the structure is reduced and additional lateral support in the form of bracing on the opposite side of the building is required. Necessarily, this includes bracing within the fPPb. The presence of a southern core is required to accommodate the required vertical transport. This southern core element will visually obscure the southern facade of the fPPb as the core is required to be of solid concrete construction.

4. Structure Straddling the fPPb – ALTERNATIVE APPROACHES

Version 2A



Version 2B



Version 2A and 2B:

Key core elements to service the vertical extension and provide structural support are consolidated to the east of the fPPb. Extension of the core within the fPPb on the non-original eastern facade is sought to be minimised.

No southern core, but vertical columns with bracing required to the full elevation. Version 2A and 2B appear to reflect greater sensitivity to the heritage facades of the fPPb with greater opportunity for external visibility to the southern facade. Visibility to all façades with the exception of the east, which is considered to have less heritage significance.

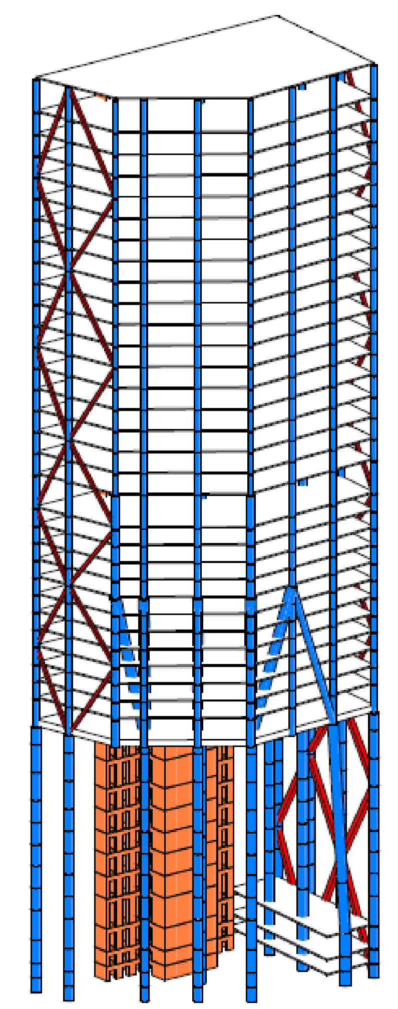
The difference between 2A and 2B is the internal column arrangement within the fPPb. Pushing the columns within the fPPb further inboard requires the size of each column to grow to 2 metres in diameter. Arrangement and design of columns is to be the subject of a Design Excellence Competition, Heritage NSW consultation and a future development approval application.

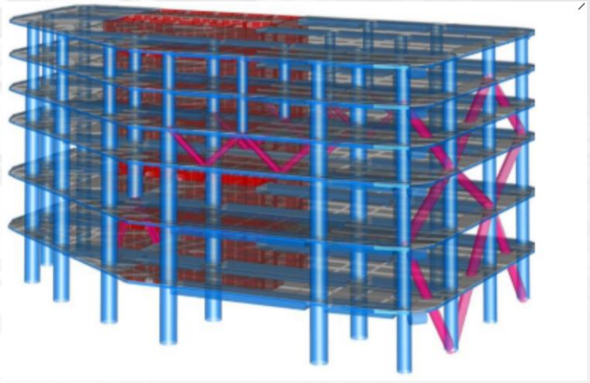
Version 2A and 2B are structurally viable and can be developed into a working concept. Compared to Version 1 (see previous page), Version 2A and 2B has potentially less impact to the fPPb and demonstrates the validity of a more flexible approach to structural encroachment, particularly where outcomes for both the fPPb and Henry Deane Plaza can be enhanced.

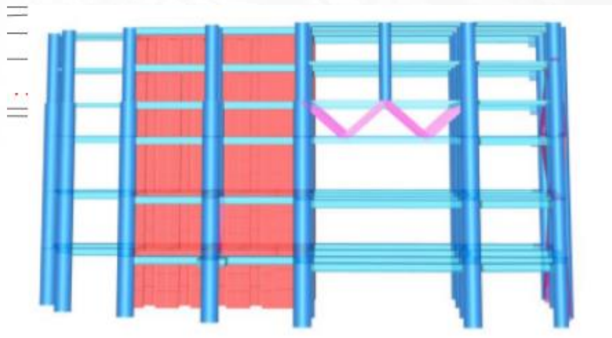
4. Structure Straddling the fPPb – Structural Analysis

Robert Bird Group have used the Finite Element Analysis (FEA) software ETABS to undertake a review of the proposed structural scheme.

The software ETABS is industry leading in the analysis and design of tall building structures and assisted RBG to develop structural sizing, including column and core wall thicknesses.







04. Conclusion

This document has been prepared as part of the Block C Response to Submissions and specifically the recent PRP advice requesting additional detail in relation to the alternative structural approaches evaluated for the Block C site.

The structural solutions which are demonstrated as viable within the proposed planning envelope can support a future development without unreasonably impacting significant heritage fabric of the fPPB. These solutions result in a minimal extent of intervention compared to other planning envelopes considered through the iterative DRP process.

The structural options proposed demonstrate that there is sufficient certainty and flexibility for the Design Excellence Competition to ensure competitors are able to propose a viable structural solution that comprises minimal structure and core within the vertical separation zone of the Planning Envelope and minimises the impact to significant heritage fabric, specifically the northern, western, and southern facades of the fPPB.