Robert Bird Group

Structural Viability Report
Adina Central Proposed Redevelopment
2 Lee Street, Haymarket

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Report Amendment Register

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1.0 General

1.1 Introduction

Robert Bird Group (RBG) has been engaged by Toga to provide structural engineering advice for the proposed redevelopment of the existing heritage building at the site of 2 Lee Street, Haymarket.

The proposed redevelopment consists of a new tower positioned over and adjacent the existing Parcels Post Building (existing heritage building), refurbishment of the existing Parcels Post building and a new three level basement. The tower consists primarily of a hotel and commercial usage with other retail spaces.

The intent of this document is to provide confirmation that the proposed building envelope is structurally viable and identify areas that will need to be revised and validated in future design stages. Key information for this document will include:

- Description of the current structural scheme and analysis completed to date.
- Key constraints identified for consideration in the structural design.
- Key structural parameters and performance indicators that will provide the basis of design for the structure.
- Areas of further work identified for future design stages.

Figure 1 below shows an image of the proposed reference building envelope.

Figure 1 – Proposed Reference Building Envelope

2.0 Referenced Documents

2.1 Standards and Codes

All relevant Australian codes and standards will form the basis for the structural design, including:

NCC 2019	Building Code of Australia
AS/NZS 1170.0	Structural Design Actions – General Principles
AS/NZS 1170.1	Structural Design Actions – Permanent, Imposed, and other Actions
AS/NZS 1170.2	Structural Design Actions – Wind Actions
AS 1170.4	Structural Design Actions – Earthquake Actions in Australia
AS 1720	Timber Structures
AS 2159	Piling – Design and Installation
AS 2312	Guide to the Protection of Structural Steel Against Atmospheric Corrosion
AS/NZS 2327	Composite Structures - Composite Steel-concrete Construction in Buildings
AS 3600	Concrete Structures
AS 3700	Masonry Structures
AS 3735	Concrete Structures Retaining Liquids
AS 4100	Steel Structures
AS/NZS 4600	Cold-formed Steel Structures
AS 4678	Earth-retaining Structures
ISO 2631-2:2003	Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)

2.2 Consultant Reports

The following reports are to be used to obtain critical design information and provide guidance during structural design:

Report on Geotechnical Desktop Study by Douglas Partners dated 2020

2.3 Existing Building Drawings

The following drawings are currently available for the existing building on the site:

- Structural drawings by D.W. Knox and Partners dated 1999.
- Architectural drawings by Synman Justin Bialek Architects dated 1998-1999.
- Mechanical, electrical and hydraulic drawings by Adamus Consulting Practice dated 1998-1999.

Please note the documentation listed above is not ‘As-Built’ documentation and does not necessarily reflect the conditions on site. These drawings should be used as a reference guide only.

3.0 Description of Site

The site is located at 2 Lee Street in the suburb of Haymarket in Sydney.

The site is bordered by Lee Street to the North, Henry Deane Plaza to the West and Railway Square YHA site to the South. To the East the site is bordered by the entrance areas of Central Station.

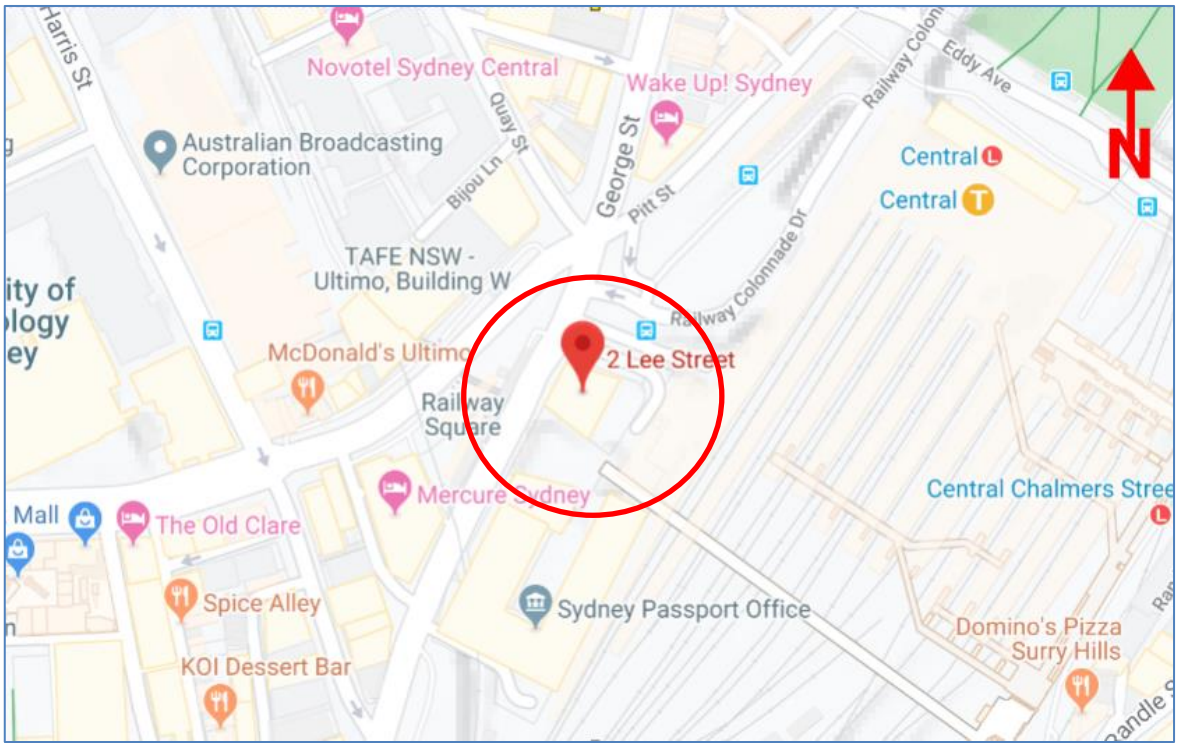


Figure 2 - Site location

4.0 Existing Structure

The Parcels Post building was constructed between 1912 and 1913. A refurbishment of the building took place in the early 2000's which included demolition of portions of the existing structure and installation of new structure.

The building is nominated as an item of local significance under Schedule 5 of the Sydney Local Environment Plan 2012, 'Former Parcels Post Office including retaining wall, early lamp post and building interior', Item 855. The building is also included within the Central Railway Station State heritage listing, Sydney Terminal and Central Railway

RBG's understanding of the existing structure is based on scans of the D.W. Knox and Partners drawings 97246-S1 to S27, with S2 and S23 missing, dating from 1999. These are refurbishment drawings, marked 'Working Drawing Subject to Council Approval', which provide incomplete details of the existing structure. Notably, the sizes and details of the structure supporting the perimeter of the existing building are not legibly shown.

RBG understand the following:

- The existing building is 8 storeys and includes a roof plant room and single-level basement.
- The structural frame consists of concrete encased steel columns and steel beams. As was the construction method of the period it is anticipated that concrete has been provided for fire rating purposes only.
- On typical floors secondary beams span in the East- West direction dividing the slab span into 3 spans per primary bay.
- The slab is a reinforced concrete slab of varying thickness.

- Columns and walls are founded on high level pad footings, allowable rock bearing capacities have been nominated on the drawings.
- Working design loads have been provided on the drawings.
- Alterations to the structure were made in the early 2000's which generally consisted of the addition of a new steel portal structure on the roof, relocation of stairs and lifts and other minor works.
- The lateral load resisting system of the building is not immediately obvious.

3 below is an architectural section outlining the refurbished features of the building.

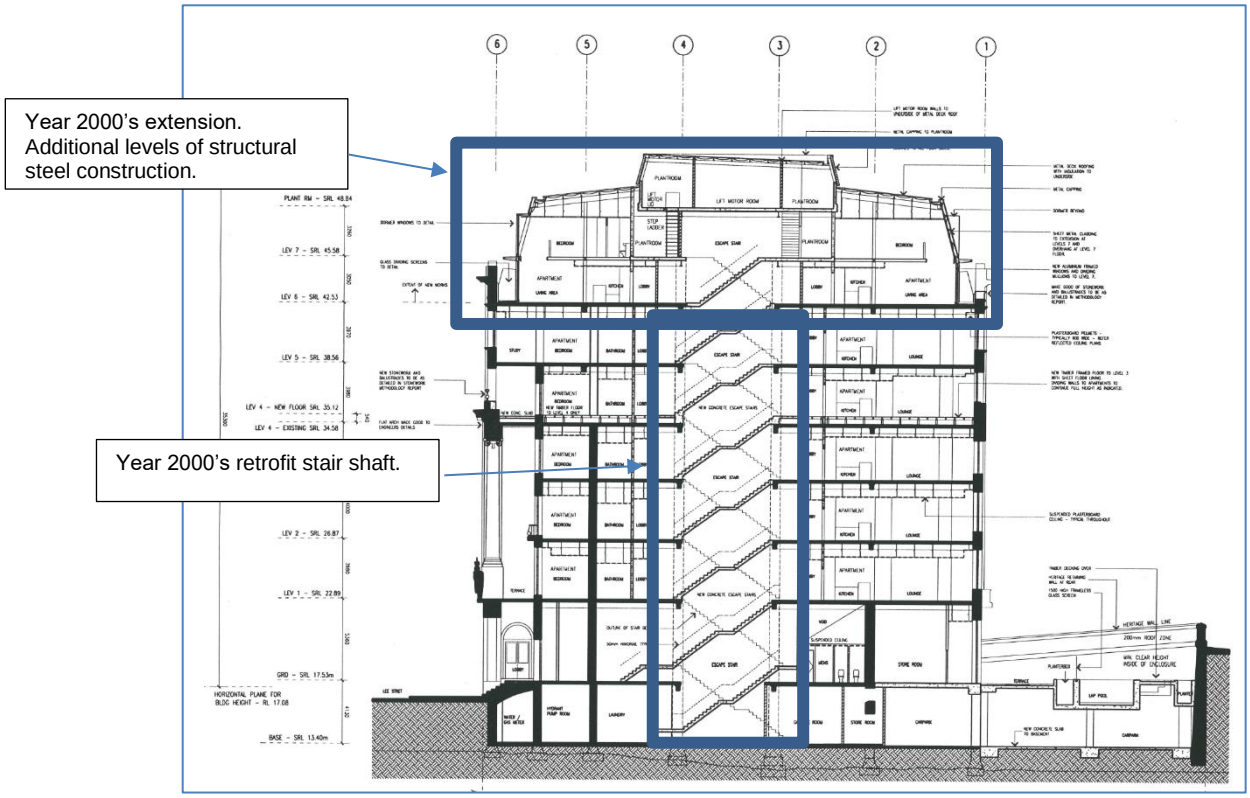


Figure 3 - Architectural Section through building.

The structural design and construction methodology will rely heavily on the performance characteristics of the existing building. RBG identify the following as key considerations the structural design shall respond to:

In RBG's experience, structures constructed in this period have no provision to resist seismic loading. It is likely the Parcels Post building also has no allowance for seismic loading. The structural design should consider the capacity of the existing structure to resist seismic loads in both the temporary and permanent condition.

It is unknown whether the existing building will meet current structural fire requirements. Additional testing will be required to confirm slab thicknesses and reinforcement covered.

Allowable floor loads have been nominated on the existing structural drawings. These will need to be checked against proposed architectural usage and construction methodologies to confirm if these are adequate in the permanent and temporary case. Where existing structural capacities are insufficient strengthening may be required.

Materials investigation of the existing structure should be carried out to identify areas of durability concern.

At this stage, no survey or material testing of the existing structure has been completed, RBG recommend this is completed to understand risk items within the existing structure that may have implications on the design.

5.0 Structural Scheme Description

The proposed structural scheme is based on the FJMT drawings issued to RBG on the 8th October, 2020.

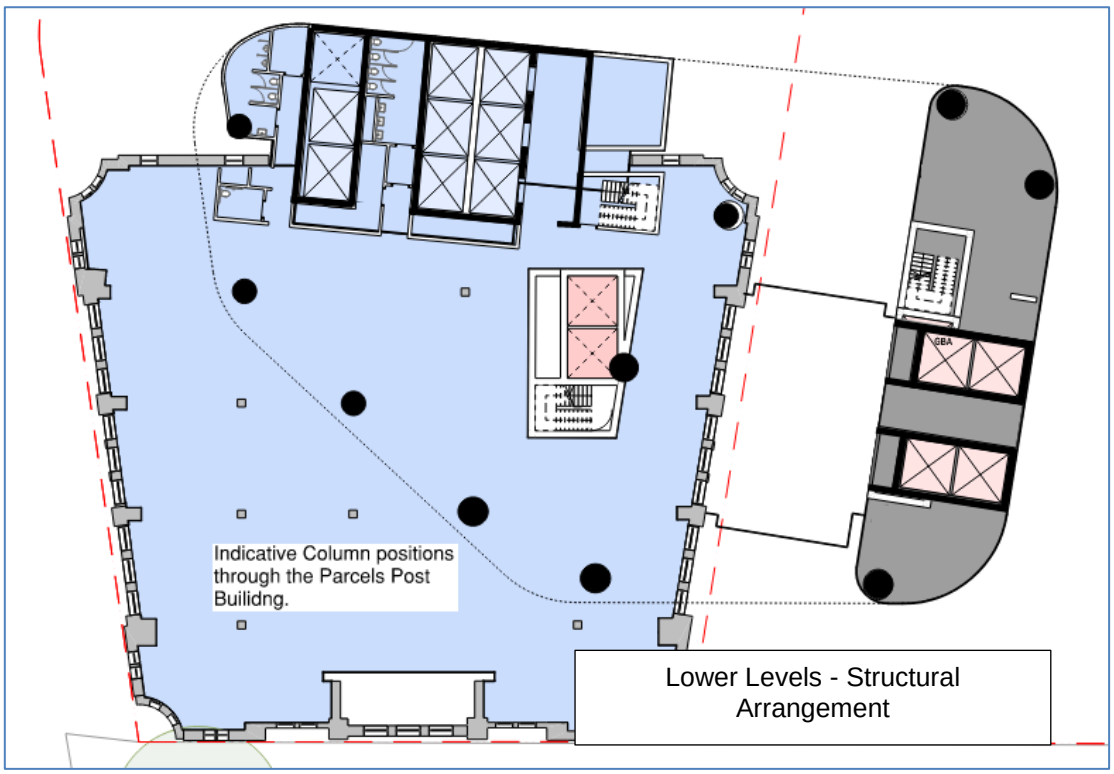
The proposed development consists of approximately 34 stories of hotel and office usage positioned over and adjacent the existing Parcels Post building.

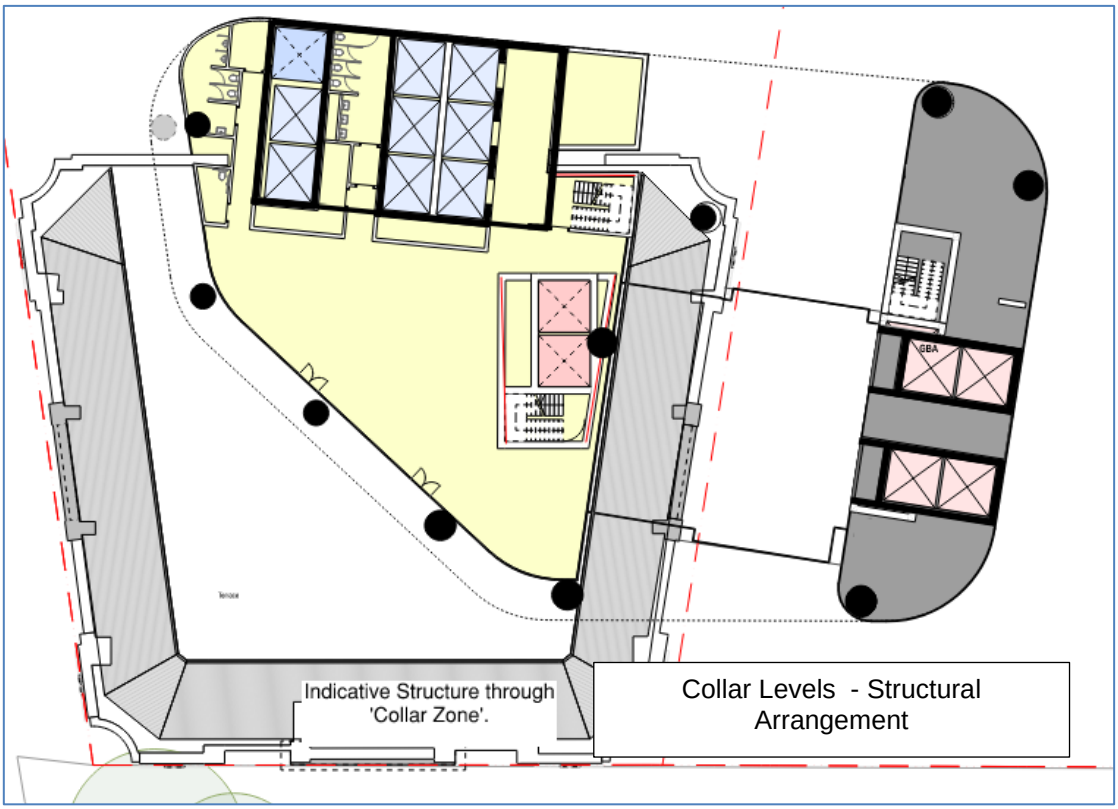
The proposed tower is supported on reinforced concrete columns and stabilised laterally by two reinforced concrete cores; future assessments will determine whether the cores need to be complimented by a bracing system. Due to the positioning of the envelope of the building over the existing Parcels Post building tower columns will be required to pass through the existing Parcels Post building, footings for these columns will need to be founded on suitable material within the basement of the existing Parcels Post building.

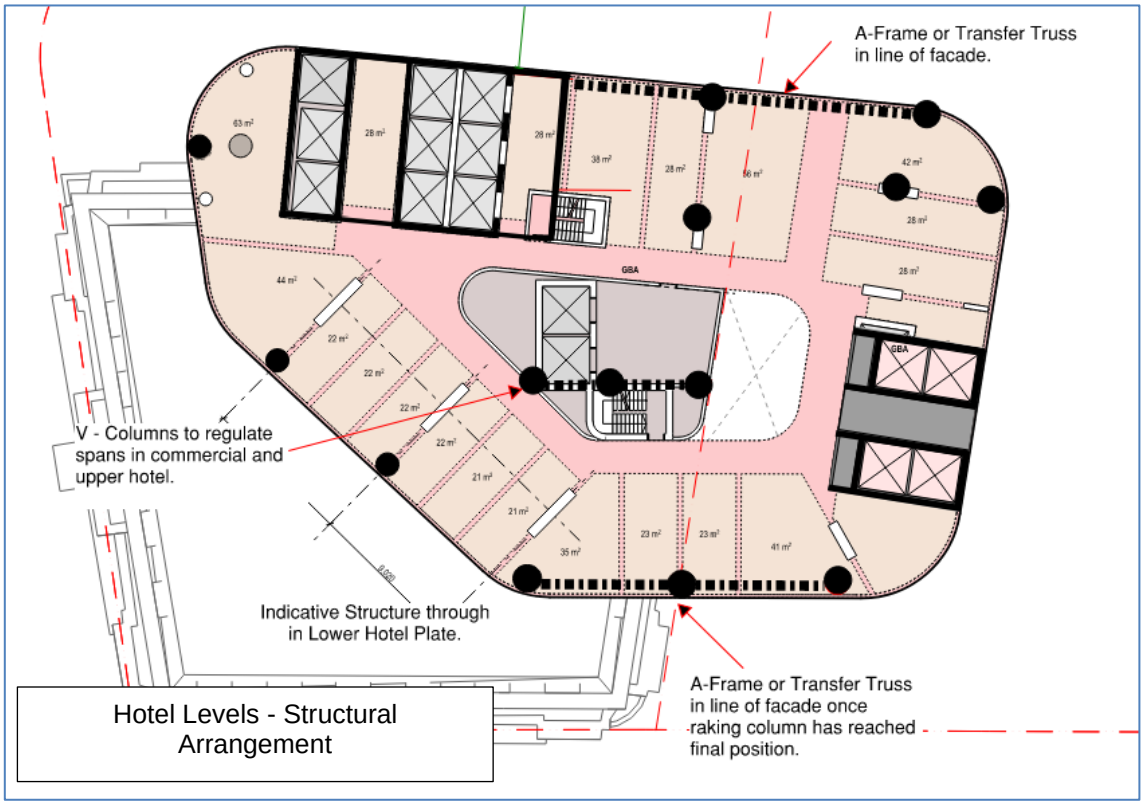
RBG has investigated existing potential structural strategies for this building envelope with the key differences being driven by the location of primary support structure through the Parcels Post Building. The proposed structural strategies are described briefly below, locating the columns further back from the façade (Structural Option 2) will create significant additional structural complexity which may not be viable. Both options will be evaluated during future design phases of the project.

Structural Option 1 – Outboard Column Positions through Parcels Post

Structural Option 1 is the optimum scheme providing the best distribution of new structure in the existing Heritage building that works with the Architectural envelope over it. This option involves positioning columns on the more outboard existing structural grid through the Parcels Post building. This strategy simplifies the structural design and buildability when compared to Structural Option 2 as there is a reduced building cantilever. Figure 5 below shows the column arrangements associated with this Structural Strategy.




Indicative Structure through 'Collar Zone'.
Collar Levels - Structural Arrangement


A-Frame or Transfer Truss in line of facade.
V - Columns to regulate spans in commercial and upper hotel.
Indicative Structure through in Lower Hotel Plate.
A-Frame or Transfer Truss in line of facade once raking column has reached final position.
Hotel Levels - Structural Arrangement

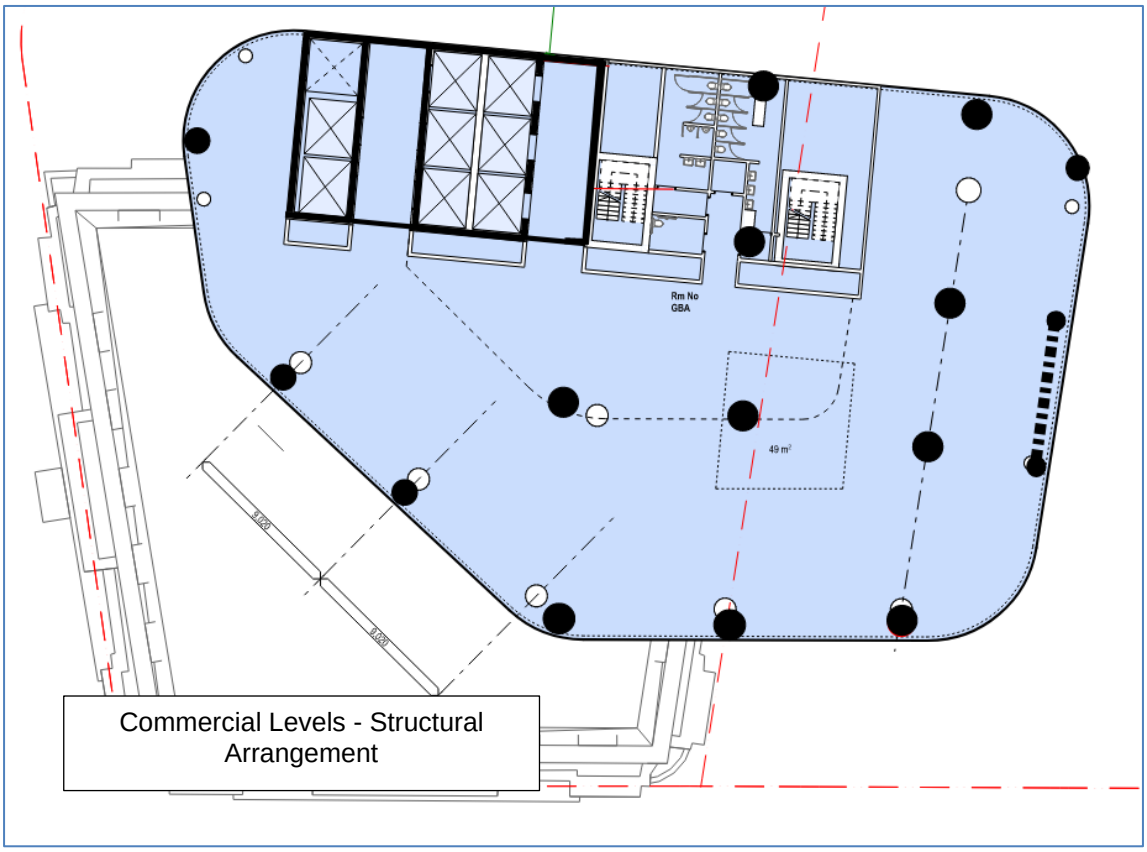


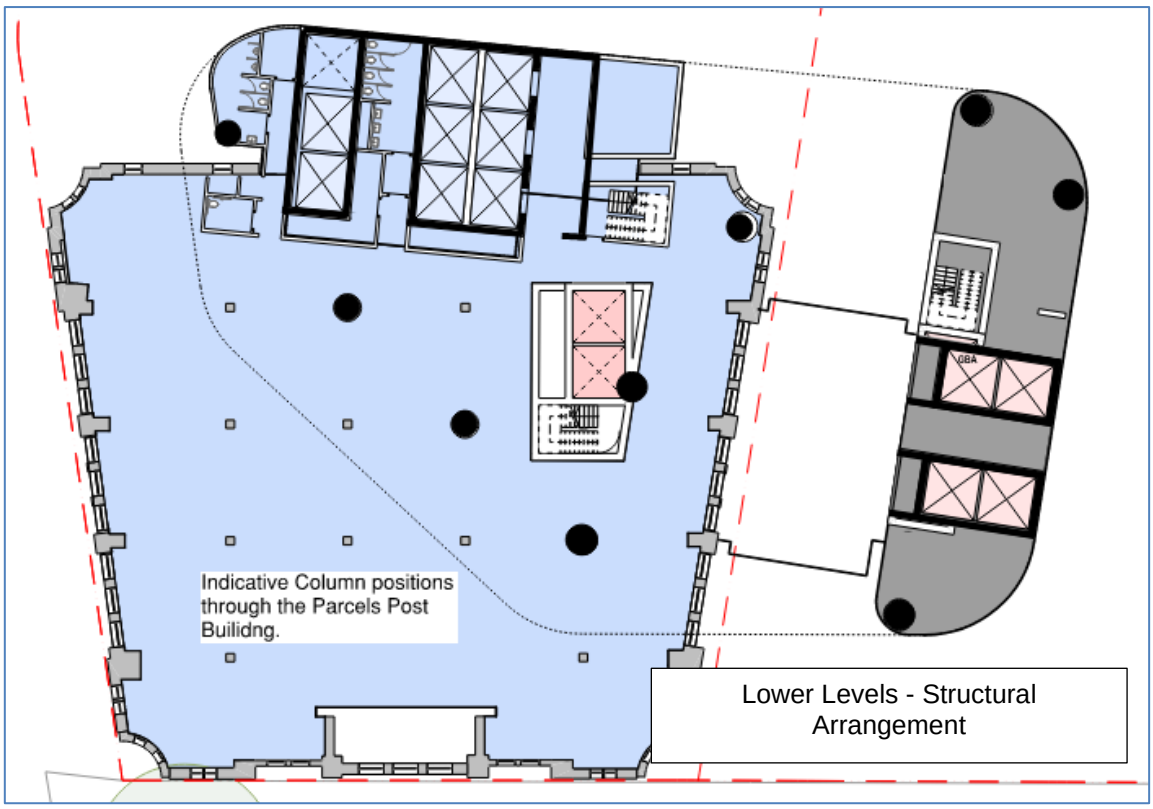
Figure 5 - Structural Option 1 – Scheme Description

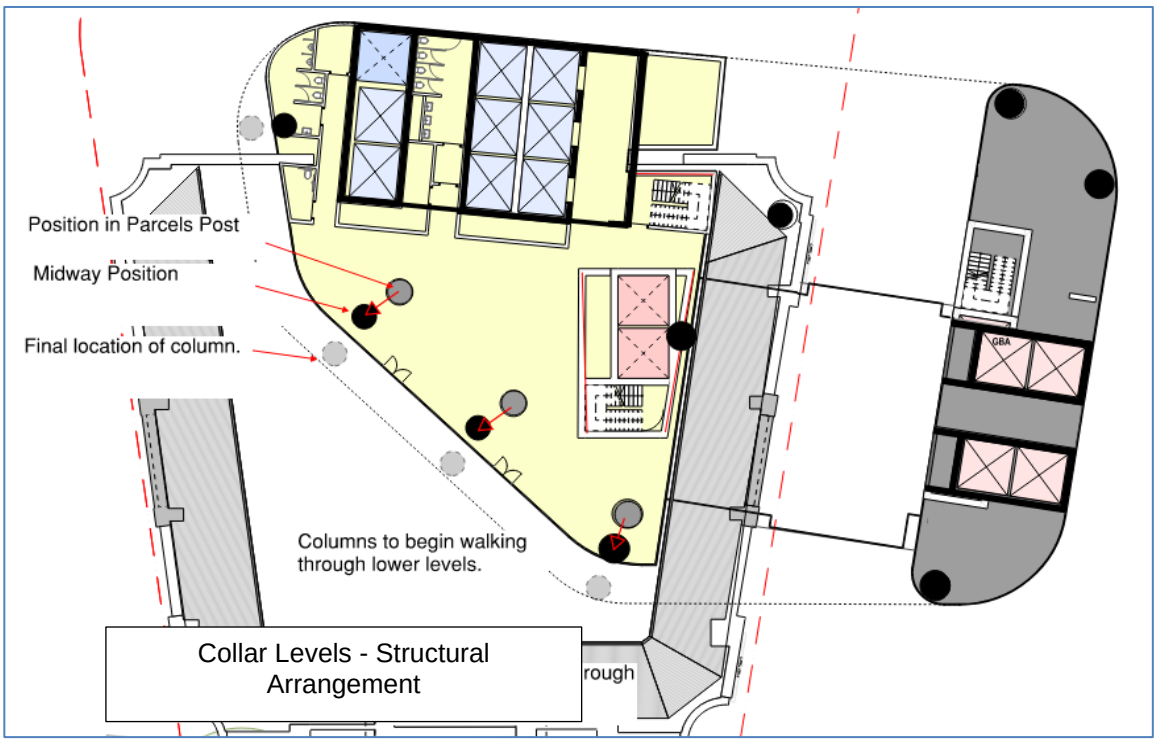
Structural Option 2 – Inboard Column Positions through Parcels Post

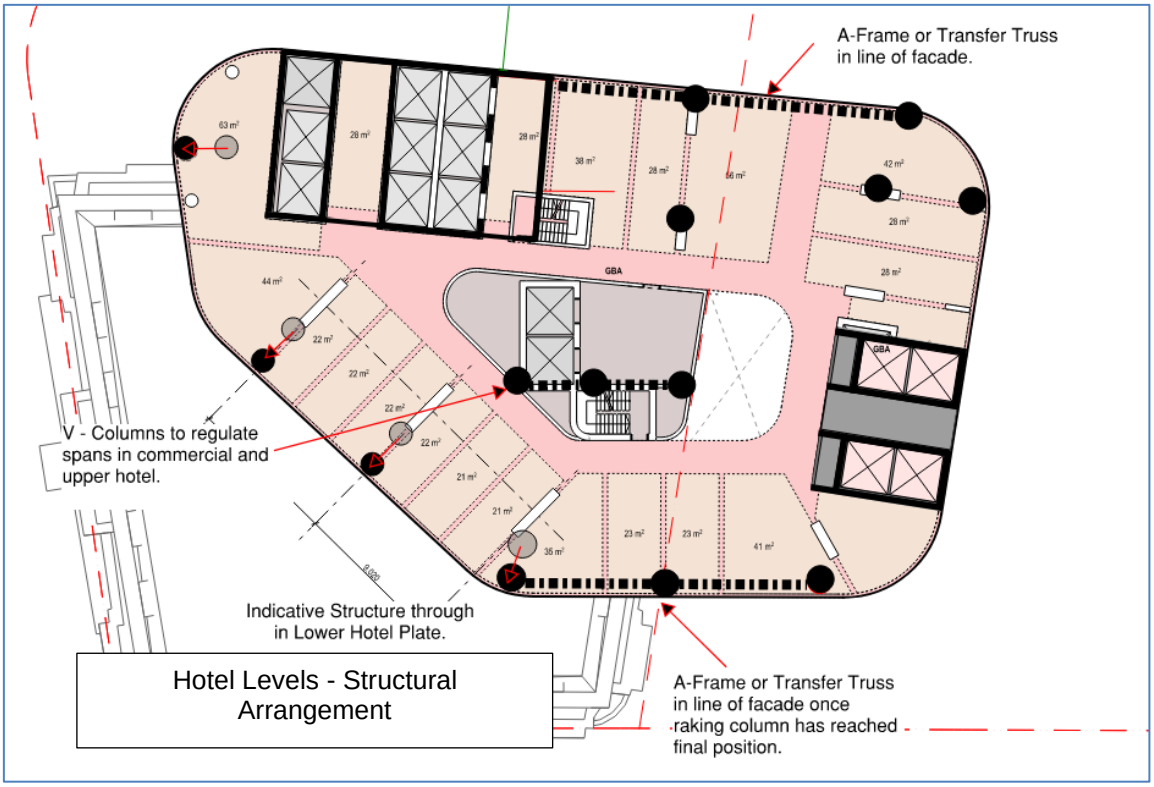
This structural option indicatively utilises the more in-board column grid (however replacing with larger columns) as per figure 4 below.

Utilising these column positions introduces complexity in the levels above the Parcels Post both from a constructability and a structural design perspective.

Figure 6 below indicatively describes the structural arrangement of the levels above that would be required to support this scheme.







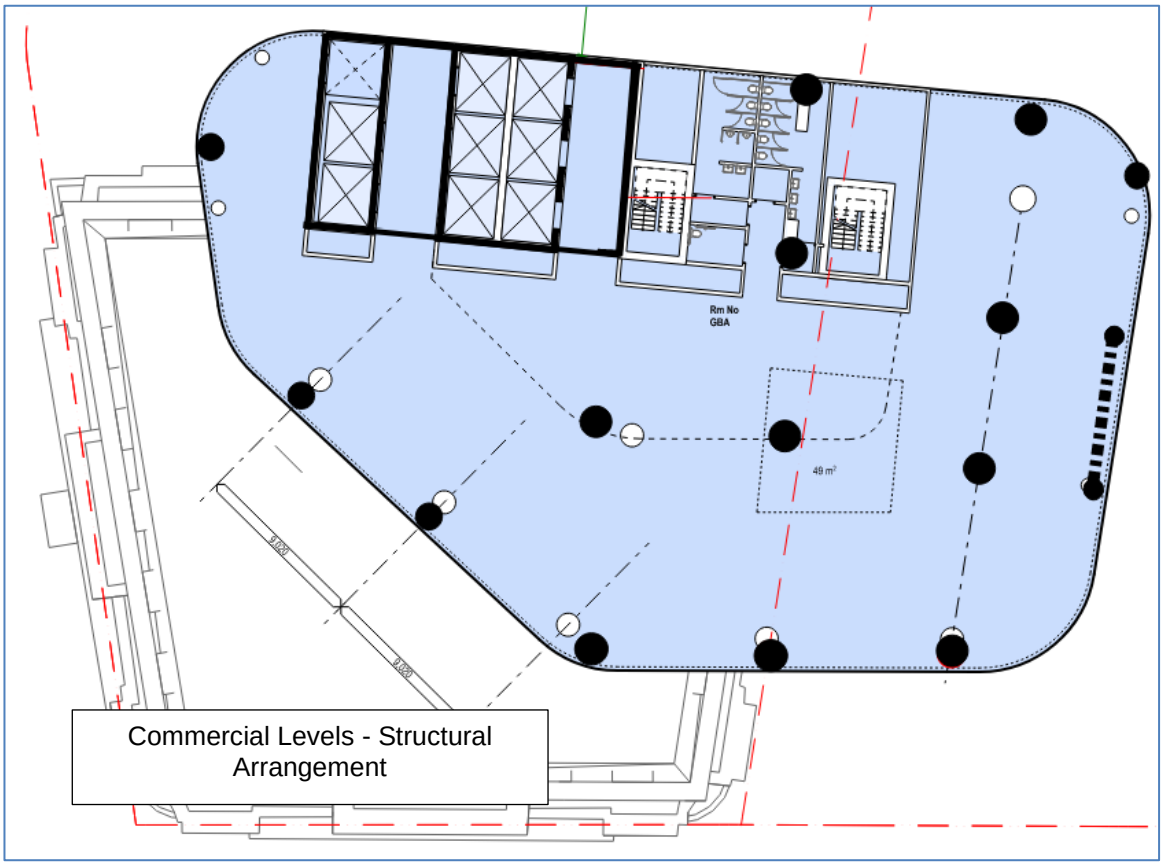


Figure 6 – Structural Option 2 - Scheme Description

Transfer Structure

There are two areas where the tower structure will be required to span over the existing services easements. These tunnels may be required to remain in-situ throughout the construction works. Three indicative structural solutions have been provided below in figure 5 to resolve the two areas presented in figure 7. The options below have been provided as a reference only and it is expected these will be developed in further detail in design stages.

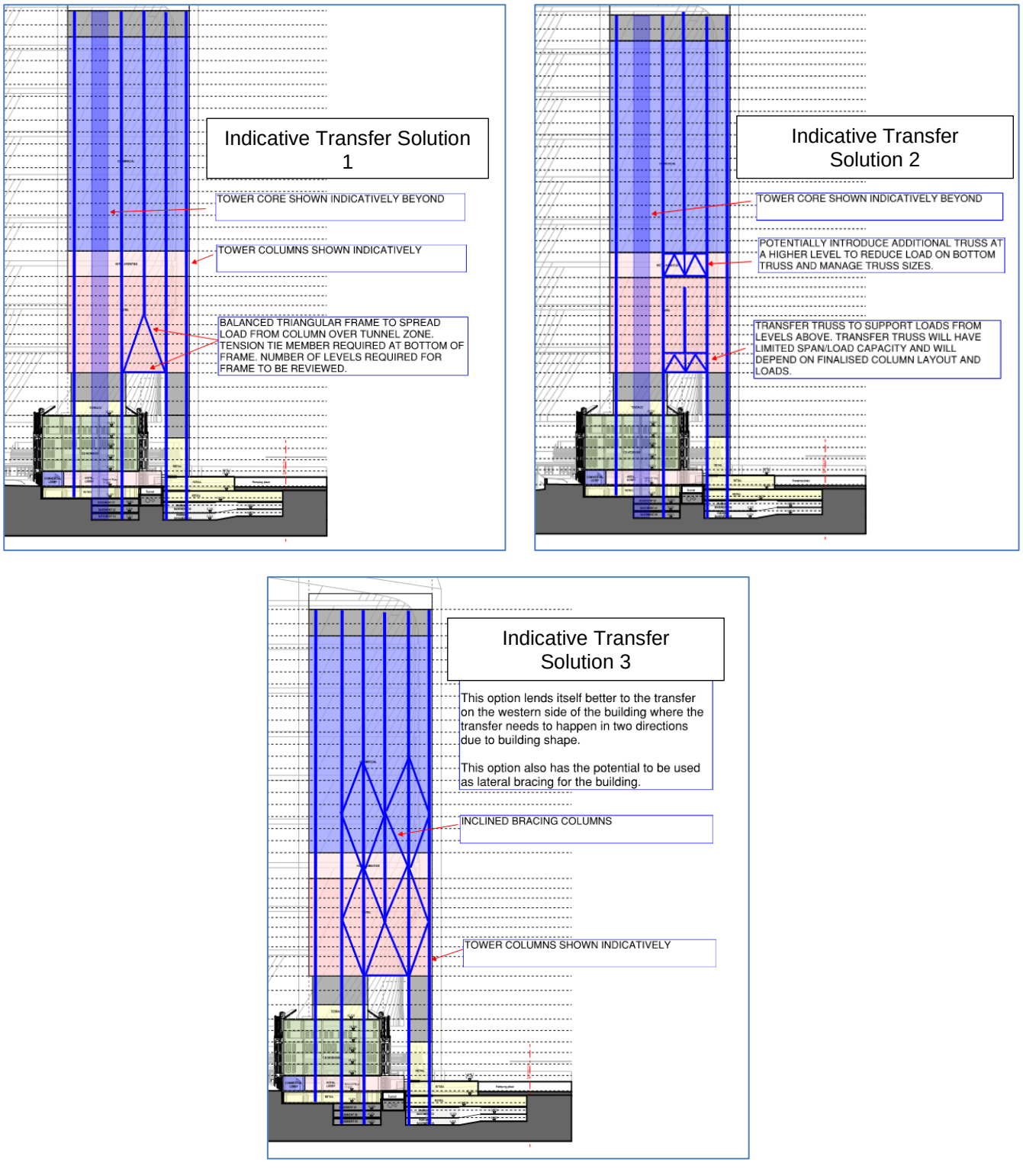


Figure 7 - Indicative Solutions to span building over tunnel

Douglas Partners Geotechnical advice suggests new structural elements will be able to be founded on Sandstone of medium to high strength. The selection of footing type will likely be high level pad footings or bored piers (or potentially a combination of the two), the final footing type will be influenced by the magnitude of the loads, rock strength and access constraints of the drilling equipment within the existing building.

RBG has identified the following items as critical to be considered in the structural design:

- New footings will be required for the proposed new structure. These footings will be positioned directly adjacent the existing footings, consideration should be given to safe installation of new footings.
- Positioning of new tower footings directly adjacent services easements will need special consideration not to cause damage to existing assets.
- The proposed design of any new tower structure founded within the existing Parcels Post building, should facilitate construction techniques that reduce risk of damage to the existing structural fabric.
- Construction of the cantilevered sections of tower will require consideration of the structural capacity of the existing Parcels Post building to support construction activities.
- Transfer and/or raking structure through the lower levels of the tower will require a structural solution that allows for maximum efficiency and regularity of hotel room layouts.
- The transition between the hotel and commercial structural grids will require a structural solution that is compatible with the architecture.
- Basement construction will require consideration of the adjacent structures including Central Station and the pedestrian tunnel which extends through the site.

6.0 Geotechnical

The structural design will be required to consider the preliminary information provided in the ‘Report on Geotechnical Desktop Study’ by Douglas and Partners. Possible geotechnical conditions for the site are given in the report based on the results of nearby investigations. Further geotechnical investigations will be required to determine geotechnical parameters for design.

Key items noted in the report include:

- The proximity of the site to Central Station to the East.
- The impact of excavation induced ground movement on adjacent Lee Street and Central Station.
- There is an existing pedestrian tunnel which extends through the site.
- Groundwater is likely to be present and dewatering will be required for construction of basements particularly where they intercept deeper sand profiles.
- Shoring walls will need to be designed to reduce groundwater inflow and to control drawdown of water levels on adjacent sites as this has the potential to cause settlement.
- The shoring will need to be socketed into competent rock which can be problematic for some shoring systems and can result in decompression and loosening of the surrounding sandy soils where present.
- If cut-off walls into rock are successfully constructed to reduce inflow and drawdown of water levels, then it is technically feasible to construct a drained basement. This however will be subject to review and approval by both the Council and by Water NSW. Alternatively, a tanked basement could be constructed to reduce the need for long term collection, possible treatment and removal of groundwater inflows. A tanked basement will need to be designed for hydrostatic uplift.
- The confined footprint of the tower structure means that loads applied to the founding substrate will be very high.
- The existing structural drawings from D.W. Knox and Partners show that the footings for the refurbishment works were designed to be cast on rock having an allowable bearing capacity of 800 kPa.

7.0 Construction Methodology

7.1 Introduction

The presence of the Parcels Post Building drives the need for a structural design that facilitates a safe and economical construction methodology.

RBG identify the following as the key construction challenges the design shall respond to include:

- Temporary stability of Parcels Post building (including wind and seismic loads) during demolition and new build construction phases.
- The installation of the commercial core will require removal of the Eastern Parcels Post façade.
- The structural design shall consider the spatial allowance within the Parcels Post building for construction activities (e.g. set up of jump form, excavation equipment, construction of new footings).
- The method for constructing the cantilevering tower sections above the existing Parcels Post Building is a key project challenge. It is unlikely the Parcels Post building will have sufficient capacity to support large portions of the new tower.
- Above the structural transition zone typical floors should be designed with consideration of achieving quick cycle times.

7.2 Base Case Construction Methodology

A base case structural methodology has been developed for the purpose of preliminary planning. It is acknowledged that there are alternate methods for construction, and these will be explored in future design phases.

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