

Residential Staging & Construction Methodology Review

TOP RYDE SHOPPING CENTRE

July 2008

Top Ryde Shopping Centre Redevelopment RESIDENTIAL

1.0 INTRODUCTION & BACKGROUND

This report has been prepared by Bovis Lend Lease following a request from The Beville Group to provide advice on construction staging and methodology for the residential buildings at Top Ryde Shopping Centre and provide commentary on potential impacts and issues that may have an impact on the retail development and adjoining properties.

This report has been prepared following Development Consent No.1025/2007 acknowledging Consent Condition No.3 calling for amendment of LDA672/2006 Construction Management Plan before commencement of works for construction of Levels 3 & 4 slabs and completion of perimeter façade to 1200mm above Level 4 within Stage 1 retail works at Top Ryde Shopping Centre. The inclusion of these works in the retail stage will provide significant separation between operating retail areas and residential construction. This report sets out the construction methodology for the residential works based on this staging and completion of Stage 1 retail works.

This report focuses on the following key elements:

- Construction Staging Options
- Construction Methodology
- Impacts of the construction of the Residential buildings on the Retail development components and adjoining properties

This report assumes that all necessary authority approvals will be reasonably attainable.

1.1 Construction Staging Options

BLL examined the options for the residential staging for the purposes of this report, and has prepared the commentary based on construction of Buildings B and F directly following the retail works completing 1200mm above Level 4.

BLL has also examined the construction methodology and potential impacts on the overall development during construction of the remaining residential buildings. Therefore construction of residential buildings B & F will be referred to as Phase 1 residential, and buildings C,D & E will be referred to as Phase 2 residential.

1.2 Construction Methodology

BLL have addressed the methodology that should be applied for each of the Phases nominated above, as well as the impacts on the overall development to enable a commentary on the most appropriate buildings to be incorporated in Phase 1 residential.

1.3 Construction Impacts

The mitigation options in this report included consideration of the construction logistics and the impacts on the retail development and adjoining properties during the construction of both the integrated residential stage and the remaining residential buildings.

2.0 RESIDENTIAL CONSTRUCTION PHASE 1

2.1 Buildings B & F

2.1.1 Construction Methodology

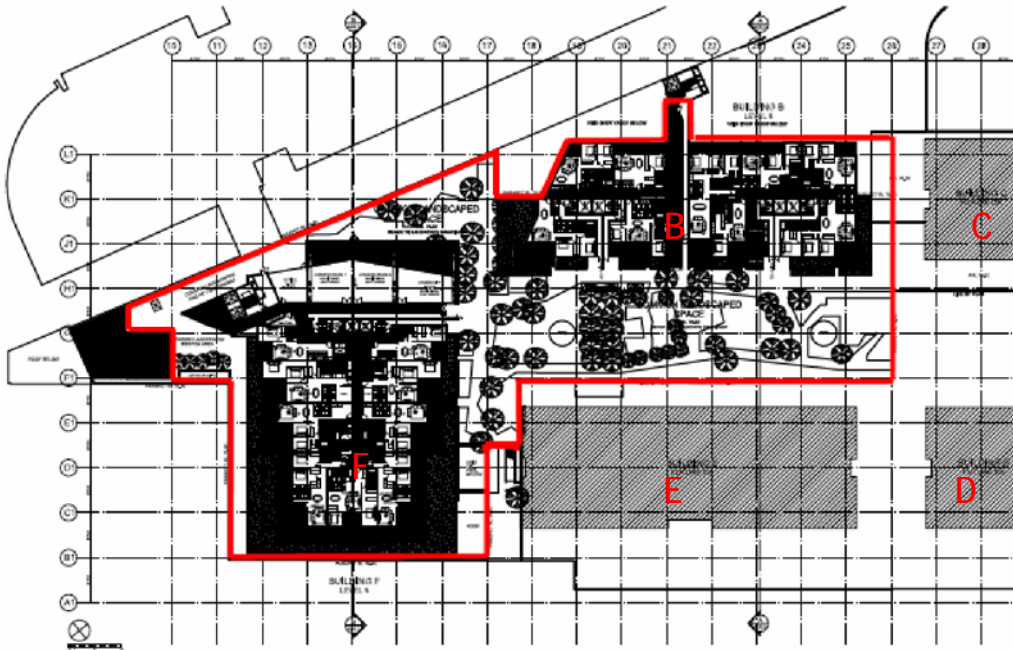
The predecessor for commencement of the residential component of the development is the completion all of Level 3 slab on RL 69.70 and Level 4 slab on RL 72.50 in Stage 1 retail works. The completion of these slabs provides a separation to retail whereby Level 2 retail car parking is a significant distance away from residential construction on Level 4.

The first activity for the residential component is the construction of Level 5 (SSL 75.62) This area of structure required to be constructed is governed by the footprint of the residential buildings B & F as well as the requirement to build over Level 3 Service Bay and Tucker Street ramps.

The Tucker Street ramps provide the only access to the Service Bay on Level 3 from Pope Street; Tucker Street will be utilised as the main materials handling zone for the residential buildings upon removal of the residential tower cranes.

Level 5 will be constructed utilising the retail tower cranes prior to them being dismantled and removed. Once this level is constructed, it will form the base for the individual residential structures.

Figure 1: Extent of Level 5 RL75.700



Commencing from a common podium on Level 5 the residential buildings will be constructed as independent projects. The first activity for each of the buildings will be the establishment of the core systems.

BLL examined two options for the core:

- Systems based formwork (ie: Jumpform)
- Conventional formwork (ie: poured down with the slabs)

The first option was selected; 'Jumpform' system. This options has a setup time which delays the commencement of the slabs to allow the Jumpform to be established and proceed ahead of the typical floor decks. However, once commenced this process allows a faster cycle time for the structure and the net result is a much faster overall structure period.

Level 3 and Level 4 can be utilised for site accommodation and material storage; application of pre-fabrication and pre-finished materials and systems should implemented where possible to reduce frequency of materials and construction workers movement.

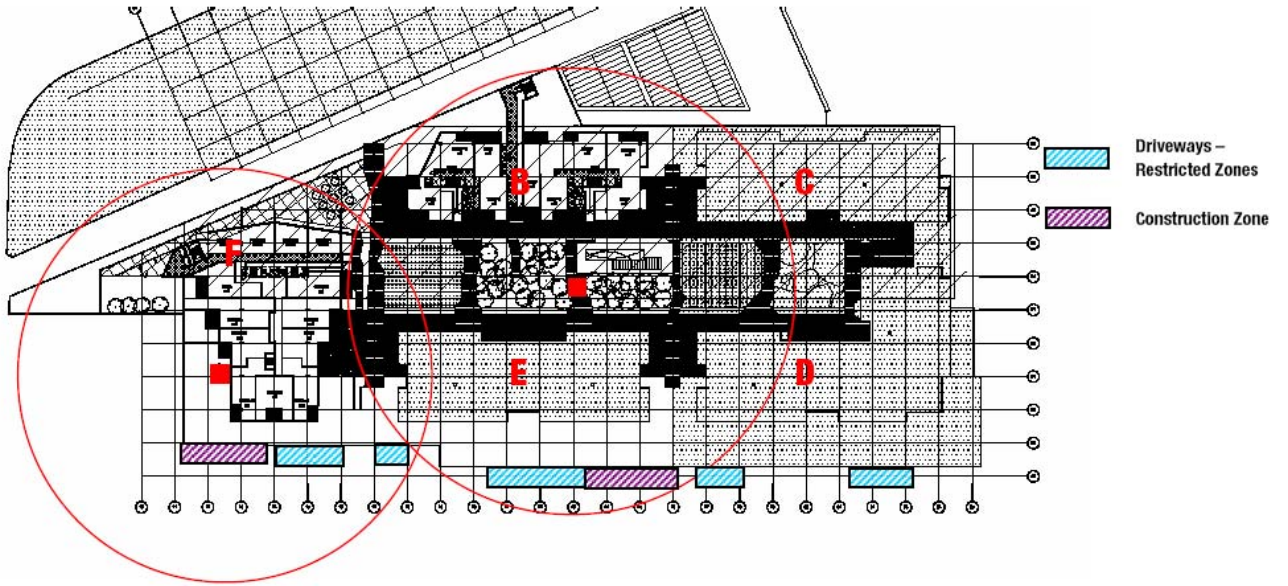
Each of the buildings will have a dedicated tower crane, supervision, labour and subcontractors. This allows each building to be independent of one another, negating any potential delays in one tower affecting the other. It also ensures cycle times can be maintained at minimal durations by not relying on any shared or coordinated crane time throughout the structure program.

While the tower cranes are being utilised dedicated construction zones are required on Tucker Street. Whilst the construction zones are in operation, the pedestrian movement will be directed to the lights at Blaxland Road before being able to cross over to the western side of Tucker Street.

Upon removal of the residential tower cranes (following completion of the facades) all materials handling will be via the Tucker Street ramps and the Level 3 Service Bay. Materials will then be handled to the towers via the use of twin man / materials hoists and subsequently via the builders lift once available.

A high level of coordination is required during the period of the first retail opening and the removal of the Tucker Street construction zones to ensure both the smooth operation of the newly opened centre and the maintenance of the residential construction materials deliveries program. The diagram below denotes the Tucker Street construction zones established in Stage 1 retail works and adjacent retail driveways; these driveways are to be controlled with construction site traffic management.

Figure 2: Materials Handling – Tower Crane Locations and Construction Zone



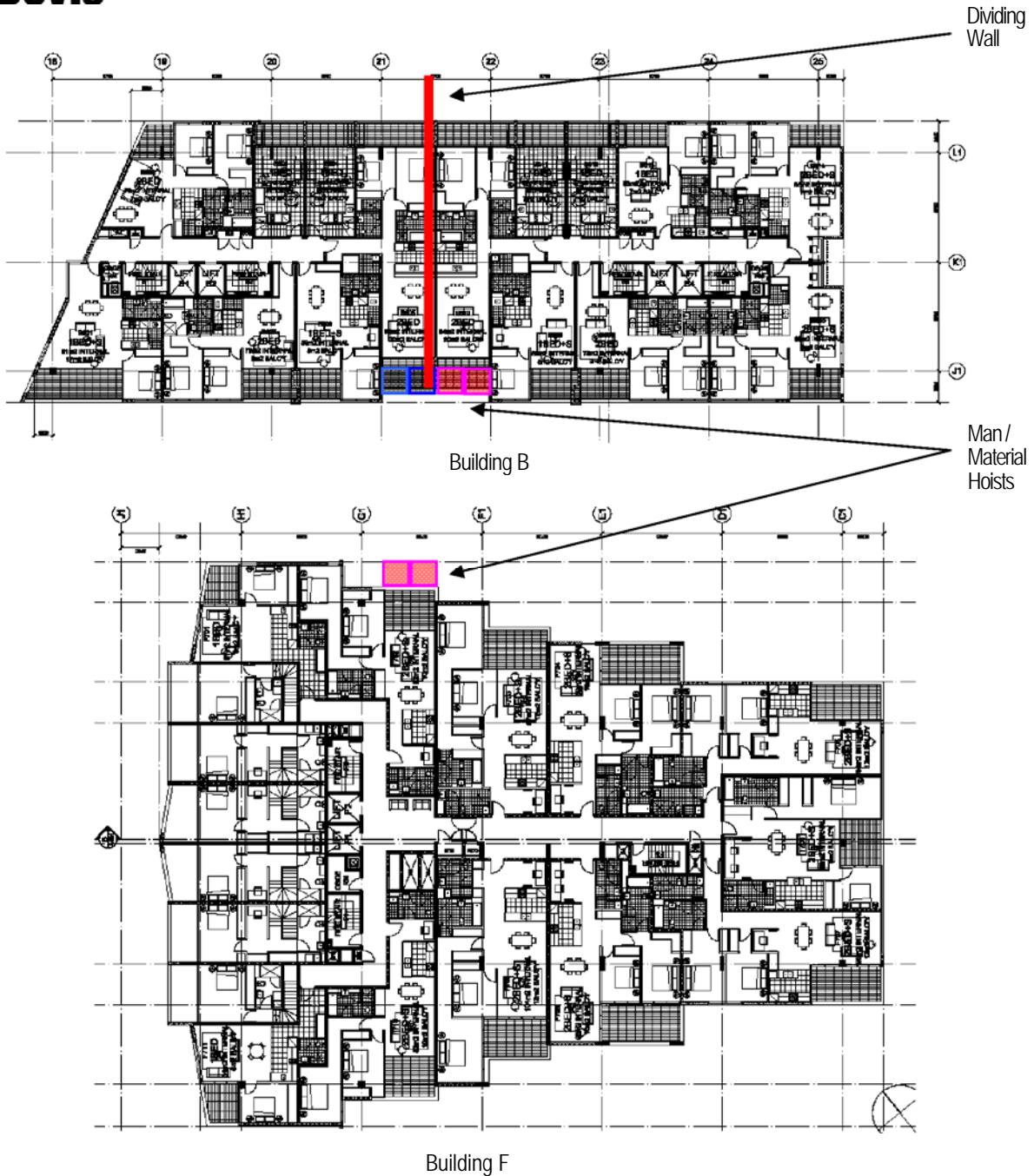


Figure 3: Man & Materials Hoists (Buildings B & F)

The typical floor structures above have a cycle time of 6 days per floor, with each floor split into two pours. The edge protection for the floors will be in the form of full height perimeter scaffold with shade cloth and a catch deck at the lower level. The scaffold will be erected with the structure basing off Level 4 and 5 (depending on the elevation).

The scaffold will also be utilised for the erection of the façade, hence the predecessor activity to crane removal is completion of façade at the uppermost level.

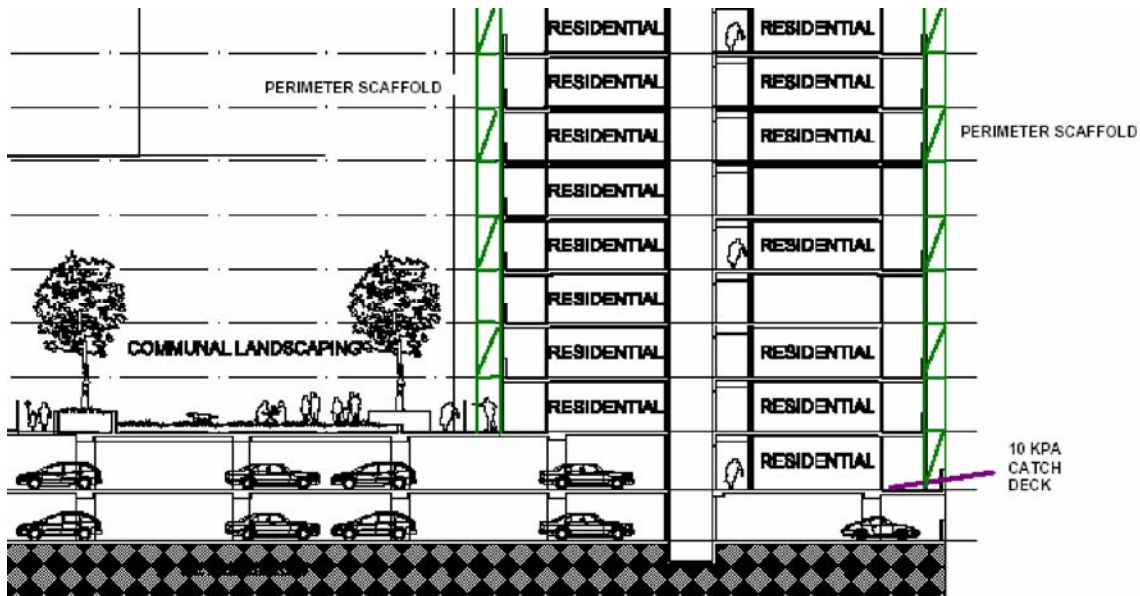


Figure 4: Perimeter and Edge Protection

2.1.2 Potential Identified Impacts

The construction of the residential structures requires the use of two tower cranes (one for each building). This then obviously necessitates the requirement for a construction zone on Tucker Street. Due to the number and configuration of retail Loading docks and ramp entries and exits on Tucker Street, the construction zone potentially have a significant impact on the retail building delivery logistics to the new loading docks, as well as the safety of public vehicles into and out of the basement car park. This situation is present until the crane removal.

From the time of the first retail opening the construction of the residential buildings will have to accommodate major changes in the materials handling logistics of the project, specifically with reference to Tucker Street.

This report recommends a detailed construction management be prepared by the appointed builder, fully coordinating construction deliveries and retail deliveries with the retail operations team. Frequency of delivery should be considered in a traffic management plan prepared during design development of the residential scheme that incorporates a detailed understanding of construction programme.

All of the major back of house entries to service the retail centre are accessed via Tucker Street. As outlined in the Retail Construction Program Report in DA672/2006, the construction zone and materials handling for the development are from Tucker and Pope Streets; these zones

established in Stage 1 retail works are to be utilised for the construction of buildings B & F.

The longest section of the residential site is the Tucker Street elevation, therefore it is imperative to maintain this materials handling solution from Tucker Street, especially once the retail area is open

It is important to note that by constructing these two residential buildings B & F following the retail works the impacts and difficulties that will be experienced on Tucker Street will be minimised due to the continuity of stages and therefore minimise duration the construction zones requirement once the retail areas are open for trade.

During construction of the retail and residential buildings, no pedestrian access will be available on the western side of Tucker Street.

3.0 POTENTIAL IMPACT ON RETAIL & ADJOINING PROPERTIES DUE TO RESIDENTIAL CONSTRUCTION

The potential impact on retail and adjoining properties during construction of the residential buildings have been identified and addressed, these have been identified and mitigation action suggested:

| General identified risk/issue | Mitigation/resolution action |
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| Potential compromise during future construction phases; disruption, noise, dust, vibration, material and waste movements, construction workers. | Best practice construction site management to be applied to construction logistics; separation measures to be applied. |
| Noise and vibration may impact on quieter retail tenants. | Form Level 3 & Level 4 slabs as a separation measure: last retail level served is Level 2 retail car park. |
| Dust may be an issue due to the high RL of the residential construction area. | Provide full scaffolding around residential buildings footprint, provide full shade cloth, provide crash decks to building works perimeter, ensure best practice site tidiness applied. |
| Loose material | As above |
| Safety screening and catch platforms will be visible from the Strada and Plaza, and may reduce natural light; potentially off putting for shoppers as work takes place overhead. | Complete Level 3 & Level 4 slabs & perimeter façade: residential buildings are in-bound away from the retail perimeter. |
| Construction workers will be noticeable due to the scale of the project; management of their conduct must be a condition of contract | Apply best practice construction site management: create a dedicated/managed construction worker ingress/egress route. |
| Loss of full amenity; construction zones in Tucker Street potential to affect normal traffic movement. | Tucker Street construction zones are established in Stage 1 retail works: these zones are to be traffic controlled: the zones will be familiar & consistent with Stage 1 controlled works: clear signage put in place to manage separation of uses. |
| Overhead craneage and material movement; Phase 1 residential will need a crane on the podium area hooking materials from Tucker Street. | Best practice crane management & material movement to be applied: reduce craneage time & movement with prefabrication where possible. |

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| Moisture ingress from the construction zone through construction activity. | Resistance to moisture ingress & drainage measures are to be applied. Level 4 slab to be fully drained to act as a roof over retail: last retail served Level 2 retail car parking, separation created: perimeter façade |
| | completed to 1200mm above Level 4 inclusive of water management components & flashing detailing. |
| Fire in the construction zone has the potential to spread through shared risers. | Risers from retail include: retail rising services, residential services risers, residential lift cores: all are to be treated with fire separation construction materials or intumescent collars/barriers: this separation will be both temporary & permanent dependant on service type & location. |
| Hygiene; the construction zone must be kept immaculate to prevent infestation. This is of high priority to eateries to ensure trade, with regard to waste management. | Best practice construction site management to be applied for site safety, tidiness & cleanliness. |
| Materials & site accommodation. | Level 3 & Level 4 offer an extensive area for site accommodation: materials where possible should not be stored on site: deliveries should be timely to create a single handling environment over double handling: prefabrication & prefinishing should be utilised where possible to reduce frequency of material movement. |
| Services impact on retail identified risk/issue | Mitigation/resolution action |
| Residential buildings and amenities will limit future retail exhaust and other rising requirement. | Rising ducts dedicated to retail should be installed in all residential buildings to provide flexibility in the future. |
| All residential services run through retail areas in risers. | Due to complexity of services source and site shape; these services will need to be run horizontally and vertically. Stage 1 Retail works are to implement additional fire and acoustic treatment to these risers to provide separation whilst also ensuring full accessibility for future adaptability. |

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| Any significant works needed from sub stations, gas rooms, comms rooms etc may involve access to retail areas in particular maintenance and new technologies installations | Access and maintenance panels must be contained in common areas outside of individual strata. |
| Shared services such as drainage, if requiring adaption by retail will need to consider the residents and provide continuity of service and inform of outage periods. | Consider comprehensive design of shared services: implement best practice live working separation measures. |

| Residential construction period identified risk/issue | Mitigation/resolution action |
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| Waterproofing retail areas | Complete Level 3 & Level 4 slabs provide full drainage: create separation between construction & retail area: complete perimeter façade to 1200mm above Level 4 including waterproofing detailing. |
| Lift shafts, fire stairs, residential lobbies at retail levels | Complete the structure & façade treatments of these elements as part of Stage 1 retail works. |
| Security between residential construction & retail areas. | Provide security/physical barriers and clear signage/delineation of construction areas & retail areas. |
| Structure provision for residential buildings | Resolution action |
| Residential building footprints & loads. | Deliver retail in-ground footings, columns, slabs structure that addresses DA672/2006 Masterplan residential approved envelope bulk. |
| Residential lift pits and structural support. | Complete the supporting structure within Level 2 Stage 1: this allows individual residential buildings lifts to serve Level 3 by forming the individual lift pits in retail Level 2. |
| Back-propping structure. | Strengthen Level 3 slab to avoid back-propping on retail Level 2. |
| Services provision for residential buildings identified risk/issue | Resolution action |

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| Supply & discharge service ducting routes. | All routes to be established & formed in Stage 1 retail works: avoid future disturbance of retail by creating routes in back of house (common area) create separation with acoustic & fire treatment where BCA requirement, whilst ensuring accessibility for future adaptability. |
| Residential services: <ul style="list-style-type: none"> o Water; o Electricity; o Gas; o Telecoms; o Cable TV; o Drainage (sewer); o Drainage (stormwater); o Link to retail fire detection; o Link to retail CCTV; o Link to retail fire hydrant riser. | Ensure spatial planning for risers & allowance for separation treatments & future adaptability. |

| Retail services incorporation/provision in & around the residential buildings identified risk/issue | Resolution action |
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| Fire & acoustics. | Intumescent, fire & acoustic barriers will need to be temporarily installed in risers and duct work originating from retail areas to protect retail from fire spread during the residential construction phase: acoustic dampers to be applied at source: spatial planning to be applied at Stage 1 retail works. |
| Separation. | BCA regulation to be applied to separation of retail services & residential amenity. |
| Retail cooling towers. | Location separation & acoustic screening to be applied. |
| Finishes/ systems & signage | Resolution action |
| Security systems. | Retail 24/7 CCTV coverage of residential entry points, entry point intercom link to retail 24/7 security office: car parking barriers separation between residential & retail areas: spatial plan & implement during Stage 1 retail works. |

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| Signage. | Precinct signage strategy to comprehensively incorporate residential directional/identification of areas. |
| Finishes to residential areas in retail. | Residential finishes such as entry lobbies to be themed & create a point of difference to retail theming. |
| Adjacent mixed uses. | Church, cinema, retail atrium to have applied acoustic façade treatment & materials as part of Stage 1 retail works. Provide separation at source. |
| Adjoining properties | Resolution action |
| Location & proximity of adjoining properties | <p>Completion of Level 3 & Level 4 slabs as part of retail Stage including completion of perimeter works provides a significant separation between adjoining properties and in-bound residential buildings on Level 5.</p> <p>Full scaffold, including screening and catch decks contain potential impact at source</p> |

4.0 PROGRAM ASSUMPTIONS

- The retail tower cranes should be utilised to construct Level 3 & 4 prior to being dismantled.
- Program is based on flat slab suitable for use of 'Peri' type formwork system and post tensioned concrete.
- Facades to be lightweight system able to be prefabricated panels off site.
- Site accommodation to be located on Level 3, Level 4, Level 5 where appropriate to construction programming.
- Designated access / egress points to and from the above Levels is required for construction works and project team
- Designated clear access and usage of the Tucker Street ramp and Level 3 Service Bay for materials handling is required
- Construction zones will be located on Tucker Street: established in Stage 1 retail works.
- Nominated areas on Podium Level 5 is required to be designed as a 10Kpa slab to allow for installation and support of tower crane base and general materials handling, movement and storage.
- Each building will be fully scaffolded for edge protection and façade installation.
- Each building will be serviced by its own dedicated tower crane.
- Each building shall be serviced by either a twin or single man / materials hoist until the internal lifts are available.

5.0 SUMMARY OF RECOMMENDATIONS

BLL recommend that as a minimum residential buildings B & F are constructed following completion of Stage 1 works.

With the reliance on Tucker Street as the construction zone for materials handling, it is imperative to utilise the zones that are obtained, established and familiar in Stage 1 works. This report recommends a detailed construction management be prepared by the appointed builder, fully coordinating construction deliveries and retail deliveries with the retail operations team. Frequency of delivery should be considered in a traffic management plan prepared during design development of the residential scheme that incorporates a detailed understanding of construction programme.

Completion of slabs on Level 3 & Level 4 plus completion of flush perimeter façade enables inbound construction of the residential buildings. Completion of Level 4 creates a significant separation to last served retail Level 2 retail car parking. Completion Level 4 slab allows completion of perimeter façade to 1200mm above Level 4 slab allowing waterproofing and flashing details to be completed. Level 4 slab is to be treated with roof capable drainage.

Full scaffold, full coverage shade cloth, and perimeter 10KPA catch decks provide a management technique for dust and loose material containment; this should be reinforced with best practice construction site management of construction workers, materials, installation methodology, tidiness and cleanliness.

Level 3 and Level 4 can be utilised for site accommodation and material storage; application of pre-fabrication and pre-finished materials and systems should implemented where possible to reduce frequency of materials and construction workers movement.

Separation of retail and residential components is to be comprehensively addressed in Stage 1 retail works through design of dedicated and shared services spatial planning, route and riser forming and maintenance accessibility planning. The use of back of house (common area) in retail will be implemented. Acoustic and fire treatments will be put in place at source and spatially allowed for in horizontal and vertical rising spatial planning and forming.