Sydney Metro City & Southwest: Crows Nest Over Station Development

Transport, Traffic and Pedestrian Assessment Report

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Executive Summary

This report documents the traffic and transport impact assessment that has been undertaken for the proposed over station development (OSD) at Crows Nest Station. It discusses the forecast impacts on the surrounding road and pedestrian networks from the proposed development of four buildings above the Crows Nest Station and its traffic and pedestrian generation, parking (vehicle and bicycle) and servicing requirements. The OSD site is split across three blocks, between Clarke Street and the Pacific Highway in the vicinity of Oxley Street and Hume Street in Crows Nest. The assessment has been undertaken against the Secretary's Environmental Assessment Requirements for the Crows Nest OSD concept proposal.

This report is based on the OSD concept design drawings provided by Sydney Metro (thereafter referred to as the indicative OSD design), however approval is being sought for the maximum possible envelope on site, which is specifically:

- **Site A** (North and South): residential (approximately 350 apartments) and 125 car parking spaces
- **Site B:** hotel (approximately 250 hotel rooms and associated conference facilities) or approximately 18,300m^2 of commercial space and 25 car parking spaces
- **Site C:** approximately 2,700m^2 of commercial space

Existing Environment

The existing environment at the Crows Nest Station site was reviewed to understand current travel behaviours and travelling conditions. Demolition and construction of the buildings on the site had commenced prior to this assessment being undertaken, and therefore some information is based on estimates or historical information. Throughout this report, "existing" refers to pre-demolition conditions at the Crows Nest station site.

The existing land uses for the Crows Nest OSD site prior to demolition were primarily retail or bulky goods retail stores, with some office space and no residential land uses.

Residents living in the Crows Nest-St Leonards area mostly commute to work by public transport or active travel, while most workers tend to be more evenly split between public transport and private vehicles. Household Travel Survey information shows that areas in inner Sydney with higher levels of public transport amenity tended to have a smaller number of vehicles per household, as well as higher residential densities and smaller household sizes.

The area is currently well serviced by public transport, with frequent rail and bus services in the AM and PM peak to a variety of employment centres. On-street parking in the area is

restricted, particularly during weekday and weekend peak periods, while publicly accessible off street parking is expensive.

Pedestrian amenity in the area is generally good, with suitably wide footpaths, frequent signalised crossings of the Pacific Highway and pedestrian crossings provided on some streets. An existing on-street bike network through the area provides connections to St Leonards, North Sydney and Sydney CBD via a mixture of shared paths, separated cycle ways and mixed-traffic routes.

Assessment

The assessment of the site takes into consideration the location of the OSD buildings above Crows Nest Station, and the impact this would have on minimising private vehicle ownership and trip generation. It is expected that the provision of high quality public transport options from existing and future Metro services will allow for OSD residents and workers to elect to travel primarily by public transport, reducing car ownership rates and therefore the number of car spaces required on site and the number of trips generated by the site.

The proposed number of parking spaces for the site under the concept proposal complies with the North Sydney DCP, for all land uses and scenarios identified in this proposal. Under the proposed arrangements contained within the indicative design, there is an approximately 75% chance that there will either be no cars queuing (50%) or 1 car queuing (25%) in Clarke Lane to access either Site A or Site B during the PM peak hour via car lift to the parking area. When vehicles are queuing in Clarke Lane, sufficient width has been provided for other vehicles and service vehicles to pass. Net traffic generated by the site has been assessed as being less than that of the existing land uses on the Crows Nest Station site. As such, modelling was not undertaken for nearby intersections and the local road network.

Bicycle parking and storage on site will be accommodated within dedicated bicycle storage areas on common property and also within individual apartments. The proposed upgrades to the cycle network as part of the SSI proposal for Crows Nest station will improve access and amenity for people to access the OSD by bicycle.

The loading dock for Site A has been designed to adequately accommodate expected service vehicle volumes throughout the day, however the loading dock should still be managed by building concierge (or similar) to avoid queuing in Clarke Lane. The Site B loading dock will similarly need to be managed by the building concierge. Deliveries and service vehicles for Site C will be able to utilise the Site A loading dock due to the lack of available space on Site C to accommodate this within the site. Waste removal for Site A would occur within the loading dock, while for Site B and Site C, will occur within Clarke Lane, on areas that have been set aside for medium rigid vehicles to safely pull in and stand. Spaces for tradespeople will need to be provided in the parking garages of each of the buildings due to the longer dwell time of these vehicles.

Pedestrian trips generated by the proposed OSD will benefit from improvements to the urban environment that will be carried out as part of the Crows Nest Station SSI, however it is noted that the significant bulk of pedestrian movements once the OSD buildings are constructed will be from Crows Nest Station and that the OSD buildings will have minimal impact on pedestrian volumes in the area.

Coach parking options exist within existing bus zones in the immediate vicinity of the OSD site. Similarly, proposed taxi facilities through the Crows Nest Station SSI will enable hotel guests to use taxis locally. However, it is not expected that the number of taxi trips generated by hotel guests in the peak periods will be significant.

Emergency vehicle access around the OSD sites will continue to be possible via existing streets.

Mitigation Measures

The following mitigation measures are proposed to help address issues identified through this assessment:

- Provision of car share spaces either within the building or on nearby streets to allow residents and businesses to have access to private vehicles for trip purposes that cannot be met by the public transport network.
- Development of a Construction Traffic Management Plan for adoption during the OSD construction phase.
- A formalised dock management system to minimise delays to service and delivery vehicles accessing building docks.
- Sustainable travel plans for distribution to future businesses and residents to encourage more sustainable travel behaviour
- Creation of a Voluntary Planning Agreement between proponent of the Stage 2 Development Application for the OSD site and North Sydney Council which specifically includes clauses that address improvements to the local pedestrian and cycling network.

Conclusion

This assessment has determined that the proposed OSD at Crows Nest Station has a limited impact to traffic, transport and parking conditions on its local environment.

1.0 Introduction

1.1 Purpose of this report

This report supports a concept State Significant Development application (concept SSD Application) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The concept SSD Application is made under Section 4.22 of the EP&A Act.

Sydney Metro is seeking to secure concept approval for a mixed use development comprising four buildings above the Crows Nest Station, otherwise known as the over station development (OSD). The concept SSD Application seeks consent for building envelopes and land uses, maximum building heights, maximum gross floor areas, pedestrian and vehicular access, circulation arrangements and associated car parking and the strategies and design parameters for the future detailed design of the development.

Sydney Metro proposes to procure the construction of the OSD as part of an Integrated Station Development package, which would result in the combined delivery of the station, OSD and public domain improvements. The station and public domain elements form part of a separate planning approval for Critical State Significant Infrastructure (CSSI) approved by DPE on 9 January 2017.

As the development is within a rail corridor, is associated with railway infrastructure and is for commercial premises and residential accommodation with a Capital Investment Value of more than $30 million, the project is identified as State Significant Development (SSD) pursuant to Schedule 1, 19(2)(a) of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). The development is therefore, State significant development for the purposes of Section 4.36 of the EP&A Act.

This report has been prepared to specifically respond to the Secretary's Environmental Assessment Requirements (SEARs) issued for the concept SSD Application on 26 September 2018 which states that the Environmental Impact Statement (EIS) is to address the following requirements:

Table 1: Transport Related Assessment Criteria

No.	SEARs
18.1	Accurate details of the current daily and peak hour vehicle, public transport, point to point transport services, pedestrian and bicycle movements from existing or former buildings/uses on the site using the adjacent and surrounding road network.
18.2	Forecast total daily and peak hour trips likely to be generated by the proposed development including vehicle, public transport, point to point transport services, pedestrian and bicycle trips, together with cumulative impacts of existing, proposed and approved developments in the area and any transport/traffic upgrades. Traffic generation assessment is to ensure that accurate background growth rates are included in modelling.
18.3	Detailed assessment of the existing and future performance of key intersections providing access to the site, supported by appropriate modelling and analysis to the satisfaction of RMS and TfNSW, including

No.	SEARs
	key intersections of Pacific Highway/Oxley Street, Pacific Highway/Hume Street and Pacific Highway/Shirley Road/Falcon Street.
18.4	Measures to mitigate impacts of the proposed development on the operation of existing and future traffic, public transport, pedestrian and bicycle networks including any required upgrades. Provide information regarding the impact of future pedestrian demands on traffic performance of the Pacific Highway including detailed pedestrian modelling.
18.5	Measures to be implemented to encourage users of the development to make sustainable travel choices, including walking, cycling, public transport and car sharing, such as the integration with rail and bus infrastructure and provision of adequate bicycle parking and end of trip facilities.
18.6	Proposed car and bicycle parking provision for future occupants and visitors to the development, including consideration of the availability of public transport and the requirements of the relevant parking codes and Australian Standards
18.7	Any provision to support transport mode interchange and pedestrian connections to the metro station, including an assessment of the public domain surrounding the site to accommodate the future pedestrian demands safely and adequately and mitigation measures identified.
18.8	Proposed vehicle access arrangements and management, including for service and loading activities and measures to mitigate impacts to bus services and passengers interchanging between bus and rail. Make allowances and provide information to demonstrate that on-site loading/servicing is achieved.
18.9	Describe preliminary construction traffic arrangements and management measures, including consideration of the cumulative construction traffic impacts from infrastructure works in the surrounding road/transport network.

1.2 Overview of the Sydney Metro in its context

Sydney Metro is Australia's biggest public transport project. A new standalone metro railway system, this 21st century network will deliver 31 metro stations and 66km of new metro rail for Australia's biggest city — revolutionising the way Sydney travels. Services start in the first half of 2019 on Australia's first fully-automated railway.

Sydney Metro was identified in *Sydney's Rail Future*, as an integral component of the *NSW Long Term Transport Master Plan*, a plan to transform and modernise Sydney's rail network so it can grow with the city's population and meet the future needs of customers. In early 2018, *the Future Transport Strategy 2056* was released as an update to *the NSW Long Term Transport Master Plan* and *Sydney's Rail Future*. Sydney Metro City & Southwest is identified as a committed initiative in the *Future Transport Strategy 2056*.

Sydney Metro is comprised of three projects, as illustrated in **Figure 1**:

- **Sydney Metro Northwest** — formerly the 36km North West Rail Link. This $8.3 billion project is now under construction and will open in the first half of 2019 with a metro train every four minutes in the peak.

- **Sydney Metro City & Southwest** — a new 30km metro line extending the new metro network from the end of Sydney Metro Northwest at Chatswood, under Sydney Harbour, through the CBD and south west to Bankstown. It is due to open in 2024 with an ultimate capacity to run a metro train every two minutes each way through the centre of Sydney.

- **Sydney Metro West** – a new underground railway connecting the Parramatta and Sydney central business districts. This once-in-a-century infrastructure investment will double the rail capacity of the Parramatta to Sydney CBD corridor and will establish future capacity for Sydney's fast growing west. Sydney Metro West will serve five key precincts at Westmead, Parramatta, Sydney Olympic Park, The Bays and the Sydney CBD. The project will also provide an interchange with the T1 Northern Line to allow faster connections for customers from the Central Coast and Sydney's north to Parramatta and the Sydney CBD.

Sydney's new metro, together with signalling and infrastructure upgrades across the existing Sydney suburban rail network, will increase the capacity of train services entering the Sydney CBD – from about 120 an hour currently to up to 200 services beyond 2024. That's an increase of up to 60 per cent capacity across the network to meet demand.

Sydney Metro City & Southwest includes the construction and operation of a new metro rail line from Chatswood, under Sydney Harbour through Sydney's CBD to Sydenham and on to Bankstown through the conversion of the existing line to metro standards.

The project also involves the delivery of six (6) new metro stations, including at Crows Nest, together with new underground platforms at Central. Once completed, Sydney Metro will have the ultimate capacity for a train every two minutes through the CBD in each direction - a level of service never seen before in Sydney.

On 9 January 2017, the Minister for Planning (the Minister) approved the Sydney Metro City & Southwest - Chatswood to Sydenham application lodged by TfNSW as a Critical State Significant Infrastructure project (reference SSI 15_7400), hereafter referred to as the CSSI Approval.

The CSSI Approval includes all physical work required to construct the CSSI, including the demolition of existing buildings and structures on each site. Importantly, the CSSI Approval also includes provision for the construction of below and above ground structures and other components of the future OSD (including building infrastructure and space for future lift cores, plant rooms, access, parking and building services, as relevant to each site). The rationale for this delivery approach, as identified within the CSSI application is to enable the OSD to be more efficiently built and appropriately integrated into the metro station structure.

The EIS for the Chatswood to Sydenham alignment of the City & Southwest project identified that the OSD would be subject to a separate assessment process.

Figure 1: Sydney Metro alignment map

Since the CSSI Approval was issued, Sydney Metro has lodged five modification applications to amend the CSSI Approval as outlined below:

- **Modification 1** - Victoria Cross and Artarmon Substation which involves the relocation of the Victoria Cross northern services building from 194-196A Miller Street to 50 McLaren Street together with the inclusion of a new station entrance at this location referred to as Victoria Cross North. The modification also involves the relocation of the substation at Artarmon from Butchers Lane to 98 – 104 Reserve Road. This modification application was approved on 18 October 2017.

- **Modification 2 -** Central Walk which involves additional works at Central Railway Station including construction of a new eastern concourse, a new eastern entry, and upgrades to suburban platforms. This modification application was approved on 21 December 2017.

- **Modification 3** - Martin Place Station which involves changes to the Sydney Metro Martin Place Station to align with the Unsolicited Proposal by Macquarie Group Limited (Macquarie) for the development of the station precinct. The proposed modification

involves a larger reconfigured station layout, provision of a new unpaid concourse link and retention of the existing MLC pedestrian link and works to connect into the Sydney Metro Martin Place Station. It is noted that if the Macquarie proposal does not proceed, the original station design remains approved. This modification application was approved on 22 March 2018.

- **Modification 4** - Sydenham Station and Sydney Metro Trains Facility South which incorporated Sydenham Station and precinct works, the Sydney Metro Trains Facility South, works to Sydney Water's Sydenham Pit and Drainage Pumping Station and ancillary infrastructure and track and signalling works into the approved project. This modification application was approved on 13 December 2017.

- **Modification 5** - Blues Point acoustic shed modification which involves the installation of a temporary acoustic shed at Blues Point construction site and retrieval of all parts of the tunnel boring machines driven from the Chatswood dive site and Barangaroo through the shaft at the Blues Point temporary site. This modification application was approved on 2 November 2018.

The CSSI Approval as modified allows for all works to deliver Sydney Metro between Chatswood and Sydenham Stations and also includes upgrade of Sydenham Station.

The remainder of the City & Southwest alignment (Sydenham to Bankstown) proposes the conversion of the existing heavy rail line from west of Sydenham Station to Bankstown to metro standards. This part of the project, referred to as the Sydenham to Bankstown upgrade, is the subject of a separate CSSI Application (Application No. SSI 17_8256) for which an EIS was exhibited between September and November 2017, and a Submissions and Preferred Infrastructure Report was exhibited in June and July 2018. This application is currently being assessed by DPE.

1.3 Planning relationship between Crows Nest Station and the OSD

While Crows Nest Station and the OSD will form an Integrated Station Development, the planning pathways defined under the *Environmental Planning & Assessment Act 1979* require separate approval for each component of the development. In this regard, the approved station works (CSSI Approval) are subject to the provisions of Part 5.1 of the EP&A Act (now referred to as Division 5.2) and the OSD component is subject to the provisions of Part 4 of the EP&A Act.

For clarity, the approved station works under the CSSI Approval included the construction of below and above ground structures necessary for delivering the station and also enabling construction of the integrated OSD. This includes but is not limited to:

- demolition of existing development
- excavation
- integrated station and OSD structure (including concourse and platforms)
- lobbies
- retail spaces within the station building
- public domain improvements
- pedestrian through-site link
- access arrangements including vertical transport such as escalators and lifts
- space provisioning and service elements necessary to enable the future development of the OSD, such as lift cores, plant rooms, access, parking, retail, utilities connections and building services.

The vertical extent of the approved station works above ground level is defined by the 'transfer level' level, above which would sit the OSD. This delineation is illustrated in **Figure 2**.

The CSSI Approval also establishes the general concept for the ground plane of Crows Nest Station including access strategies for commuters, pedestrians, workers, visitors and residents.

Since the issue of the CSSI Approval, Sydney Metro has undertaken sufficient design work to determine the space planning and general layout for the station and identification of those spaces within the station area that would be available for the OSD. In addition, design work has been undertaken to determine the technical requirements for the structural integration of the OSD with the station. This level of design work has informed the concept proposal for the Crows Nest OSD. It is noted that ongoing design development of the works to be delivered under the CSSI Approval would continue with a view to developing an Interchange Access Plan (IAP) and Station Design Precinct Plan (SDPP) for Crows Nest Station to satisfy Conditions E92 and E101 of the CSSI Approval.

All public domain improvement works around the site would be delivered as part of the CSSI Approval.

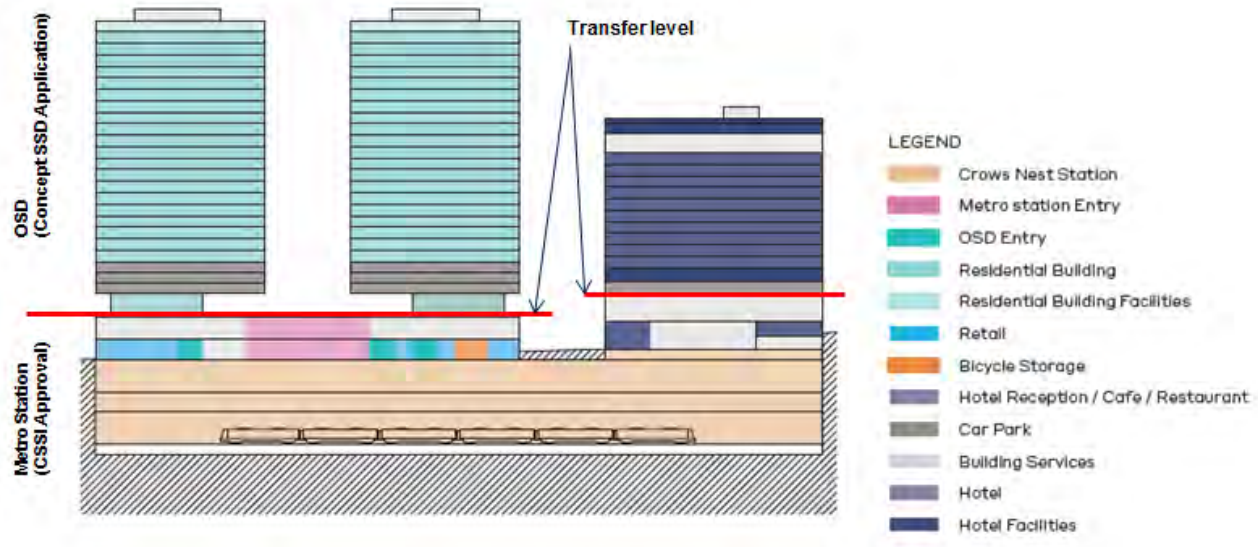

Figure 2: Delineation between the Metro station and OSD (based on indicative OSD design)

1.4 The strategic planning context

DPE is currently undertaking strategic planning investigations into revitalising the area surrounding St Leonards railway station and the metro station at Crows Nest. In August 2017, DPE released the *St Leonards and Crows Nest Station Precinct Interim Statement* and in October 2018 DPE released the *St Leonards and Crows Nest 2036 Draft Plan* (2036 Draft Plan) and supporting documents which detail recommended changes to land use controls in the precinct. These documents recommend new developments be centred around the Pacific Highway corridor and the Crows Nest Station while protecting the amenity of Willoughby Road.

In October 2018, DPE also placed on public exhibition the *Crows Nest Sydney Metro Site Rezoning Proposal* (Planning Proposal). The Planning Proposal outlines the State led rezoning of the subject site, on the basis that the current planning controls in the *North Sydney Local Environmental Plan 2013* do not reflect the opportunities for improved accessibility associated with the new metro station enabling people to live, work and spend time close to public transport. This concept SSD Application is aligned with the planning controls proposed in the Planning Proposal.

1.5 The site

Crows Nest Station precinct is located between the Pacific Highway and Clarke Street (eastern side of the Pacific Highway) and Oxley Street and south of Hume Street, Crows Nest (**Figure 3**).

The site is located within the North Sydney Local Government Area.

The Crows Nest Station precinct is divided into three separate sites as illustrated in Figure 4 and described below:

- **Site A:** Six lots in the block bound by the Pacific Highway, Hume Street, Oxley Street and Clarke Lane (497-521 Pacific Highway, Crows Nest)
- **Site B:** Three lots on the southern corner of Hume Street and Pacific Highway (477-495 Pacific Highway, Crows Nest)
- **Site C:** One lot on the north-western corner of Hume Street and Clarke Street (14 Clarke Street, Crows Nest).

Sites A, B and C have a combined site area of 6,356 square metres.

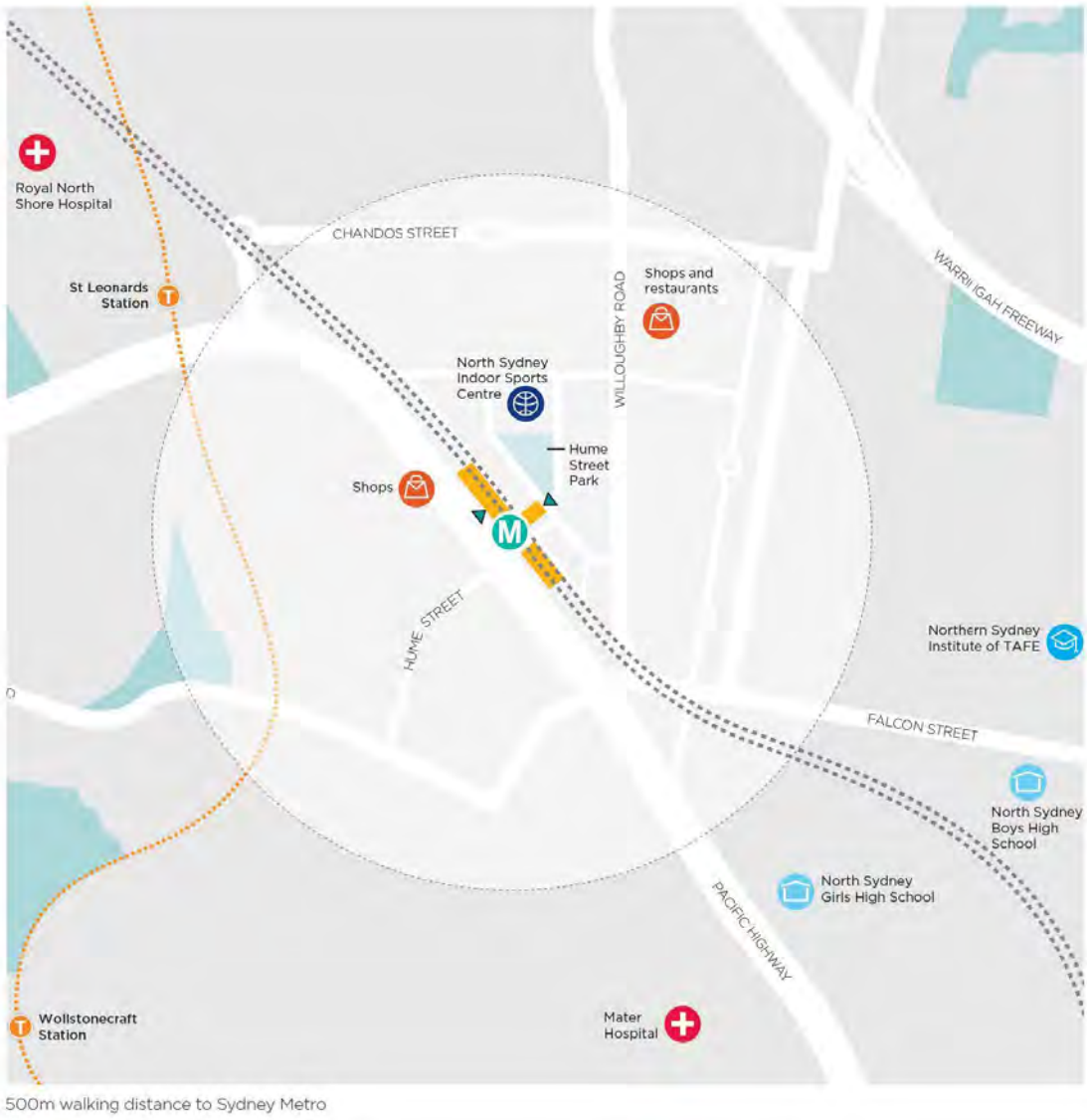

Figure 3: Crows Nest Station location plan

Figure 4: The subject site

The site comprises the following properties:

- **Site A:**
  - 497 Pacific Highway (Lot 2 in DP 575046)
  - 501 Pacific Highway (Lot 1 in DP 575046)
  - 503-505 Pacific Highway (Lot 3 in DP 655677)
  - 507-509 Pacific Highway (Lot 4 in DP 1096359)
  - 511-519 Pacific Highway (SP 71539)
  - 521-543 Pacific Highway (Lot A and Lot B in DP 374468)
- **Site B:**
  - 477 Pacific Highway (Lot 100 in DP 747672)
  - 479 Pacific Highway (Lot 101 in DP 747672)
  - 491-495 Pacific Highway (Lot 100 in DP 442804)
- **Site C:**
  - 14 Clarke Street (Lot 1 in SP 52547)
  -

1.6 Overview of the proposed development

This concept SSD Application comprises the first stage in the Crows Nest OSD project. It will be followed by a detailed SSD Application for the design and construction of the OSD to be lodged by the successful contractor who is awarded the contract to deliver the Integrated Station Development.

This concept SSD Application seeks approval for the planning and development framework and strategies to inform the future detailed design of the Crows Nest OSD.

The concept SSD Application specifically seeks approval for the following:

- maximum building envelopes for Sites A, B and C, including street wall heights and setbacks as illustrated in the plans prepared by Foster + Partners for Sydney Metro
- maximum building heights:
  - **Site A:** RL 183 metres or equivalent of 27 storeys (includes two station levels and conceptual OSD space in the podium approved under the CSSI Approval)
  - **Site B:** RL 155 metres or equivalent of 17 storeys (includes two station levels and conceptual OSD space approved under the CSSI Approval)
  - **Site C:** RL 127 metres or 8 storeys (includes two station levels and conceptual OSD space approved under the CSSI Approval)

    Note 1: the maximum building heights defined above are measured to the top of the roof slab and exclude building parapets which will be resolved as part of future detailed SSD Application(s)
  - maximum height for a building services zone on top of each building to accommodate lift overruns, rooftop plant and services:
    - **Site A:** RL 188 or 5 metres
    - **Site B:** RL 158 or 3 metres
    - **Site C**: RL 132 or 5 metres

    Note 1: the use of the space within the building services zone is restricted to non-habitable floor space.

    Note 2: for the purposes of the concept SSD Application, the maximum height of the building envelope does not make provision for the following items, which will be resolved as part of the future detailed SSD Application(s):
    - communication devices, antennae, satellite dishes, masts, flagpoles, chimneys, flues and the like, which are excluded from the calculation of building height pursuant to the standard definition in NSLEP 2013
    - architectural roof features, which are subject to compliance with the provisions in Clause 5.6 of NSLEP 2013, and may exceed the maximum building height, subject to development consent.
- maximum gross floor area (GFA) of 55,400sqm for the OSD comprising the following based on the proposed land uses:
  - **Site A:** Residential accommodation - maximum 37,500 square metres (approximately 350 apartments)
  - **Site B:** Hotel / tourist accommodation and associated conference facilities or commercial office premises GFA - maximum of 15,200 square metres (approximately 250 hotel rooms)
  - **Site C:** Commercial office premises GFA - maximum of 2,700 square metres

- **Site A or C**: social infrastructure GFA inclusive of the GFA figures nominated above for each site, with provision optional as follows:
  - Site A: podium rooftop (approximately 2,700 square metres)
  - Site C: three floors and rooftop (approximately 1,400 square metres)

  Note 1: GFA figures exclude GFA attributed to the station and station retail space approved under the CSSI Approval

- a minimum non-residential floor space ratio (FSR) for the OSD across combined Sites A, B and C of 2.81:1 or the equivalent of 17,900 square metres
- the use of approximate conceptual areas associated with the OSD which have been provisioned for in the Crows Nest station box (CSSI Approval) including areas above ground level (i.e. OSD lobbies and associated spaces)
- a maximum of 150 car parking spaces on Sites A and B associated with the proposed commercial, hotel and residential uses
- loading, vehicular and pedestrian access arrangements
- strategies for utilities and services provision
- strategies for managing stormwater and drainage
- a strategy for the achievement of ecological sustainable development
- a public art strategy
- indicative signage zones
- a design excellence framework
- the future subdivision of parts of the OSD footprint, if required.

As this is a staged development pursuant to section 4.22 of the EP&A Act, future approval would be sought for the detailed design and construction of the OSD.

The proposed location of the buildings on the site is illustrated in the location plan provided at Figure 5.

Figure 5: Proposed location of buildings on the Crows Nest OSD site.

The total GFA for the integrated station development, including the station GFA (i.e. retail, station circulation and associated facilities) and the OSD GFA is 60,400 square metres, equivalent to a floor space ratio (FSR) of 9.5:1.

The concept proposal includes opportunities for community uses in the development on either Site A or Site C. This space has the potential to be used for a range of uses including community facilities, child care centre, recreational area/s, library, co-working space, which can take advantage of the sites accessibility above the metro station.

Through design development post the CSSI Approval, pedestrian access to the metro station is proposed from the Pacific Highway and from Clarke Street, opposite the Hume Street Park. Vehicular access to the site including separate access to the loading docks and parking is proposed from Clarke Lane.

Public domain works around the site would be delivered as part of the CSSI Approval. Notwithstanding, the OSD will be appropriately designed to complement the station and activate the public domain. Provision for retail tenancies to activate the public domain are included in the ground floor of Sites A, B and C, as part of the CSSI Approval. Future detailed development applications will seek approval for the fitout and specific use of this retail space.

Drawings illustrating the proposed building envelopes are provided in Figure 6 and Figure 7. The concept SSD Application includes an indicative design for the OSD to demonstrate one potential design solution within the proposed building envelope (refer to Figure 8).

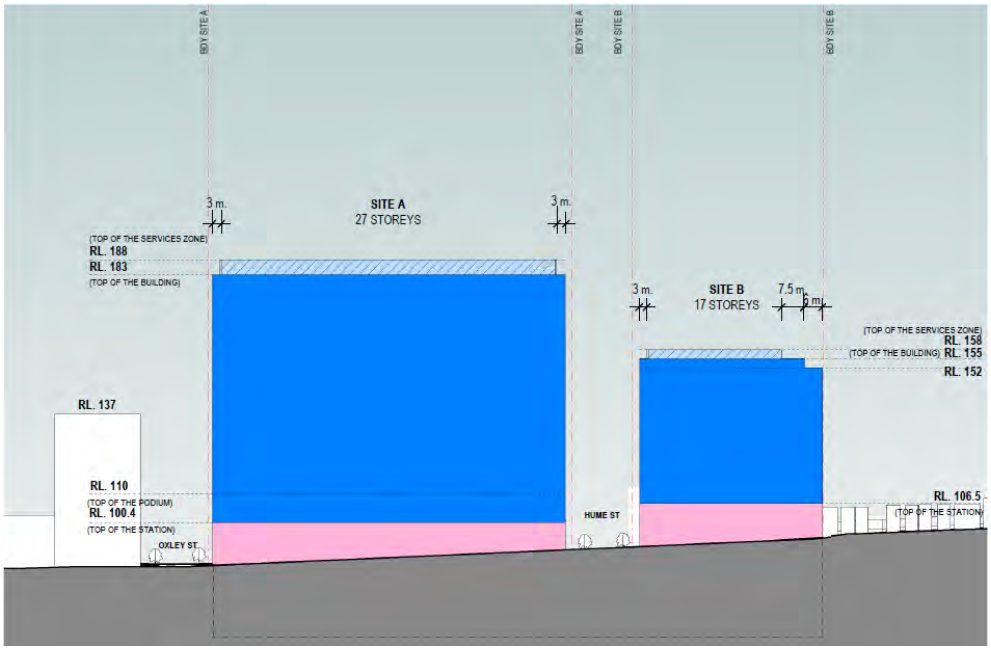

Figure 6: Proposed Crows Nest OSD building envelopes – west elevation (Pacific Highway)

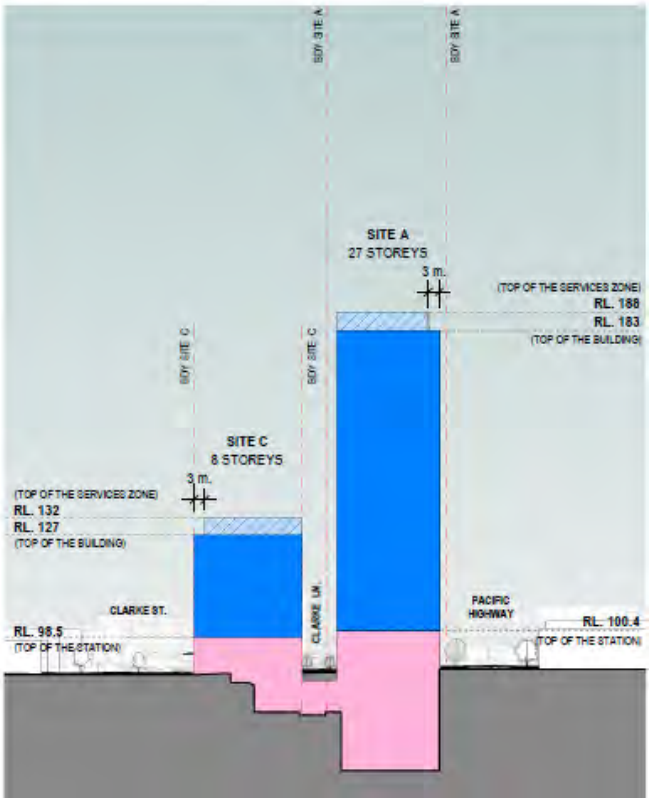

Figure 7: Proposed Crows Nest OSD building envelopes – cross section through the site (east-west)

Figure 8: Crows Nest OSD indicative design.

1.7 Staging and framework for managing environmental impacts

Sydney Metro proposes to procure the delivery of the Crows Nest Integrated Station Development in one single package, which would entail the following works:

- station structure fit-out, including mechanical and electrical
- OSD structure fit-out, including mechanical and electrical.

Separate delivery packages are also proposed by Sydney Metro to deliver the excavation of the station boxes/shafts ahead of the Integrated Station Development delivery package, and linewide systems (e.g. track, power, ventilation) and operational readiness works prior to the Sydney Metro City & Southwest metro system being able to operate.

Three possible staging scenarios have been identified for delivery of the Integrated Station Development:

1. Scenario 1 – the station and OSD are constructed concurrently by constructing the transfer slab first and then building in both directions. Both the station and OSD would be completed in 2024.
2. Scenario 2 – the station is constructed first and ready for operation in 2024. OSD construction may still be incomplete or soon ready to commence after station construction is completed. This means that some or all OSD construction is likely to still be underway upon opening of the station in 2024.

3. Scenario 3 – the station is constructed first and ready for operation in 2024. The OSD is built at a later stage/s, with timing yet to be determined. This creates at least two distinct construction periods for the station and OSD.

Scenario 1 represents Sydney Metro preferred option as it would provide for completion of the full Integrated Station Development and therefore the optimum public benefit at the site at the earliest date possible (i.e. on or near 2024 when the station is operational). However, given the delivery of the OSD could be influenced by property market forces, Scenarios 2 or 3 could also occur, where there is a lag between completion of the station component of the ISD (station open and operational), and a subsequent development.

The final staging for the delivery of the OSD would be resolved as part of the future detailed SSD Application(s).

For the purposes of providing a high level assessment of the potential environmental impacts associated with construction, the following have been considered:

- Impacts directly associated with the OSD, the subject of this SSD Application
- Cumulative impacts of the construction of the OSD at the same time as the station works (subject of the CSSI Approval).

Given the integration of the delivery of the Sydney Metro City & Southwest metro station with an OSD development, Sydney Metro proposes the framework detailed in Figure 9 to manage the design and environmental impacts, in relation to noise and vibration, consistent with the framework adopted for the CSSI Approval.

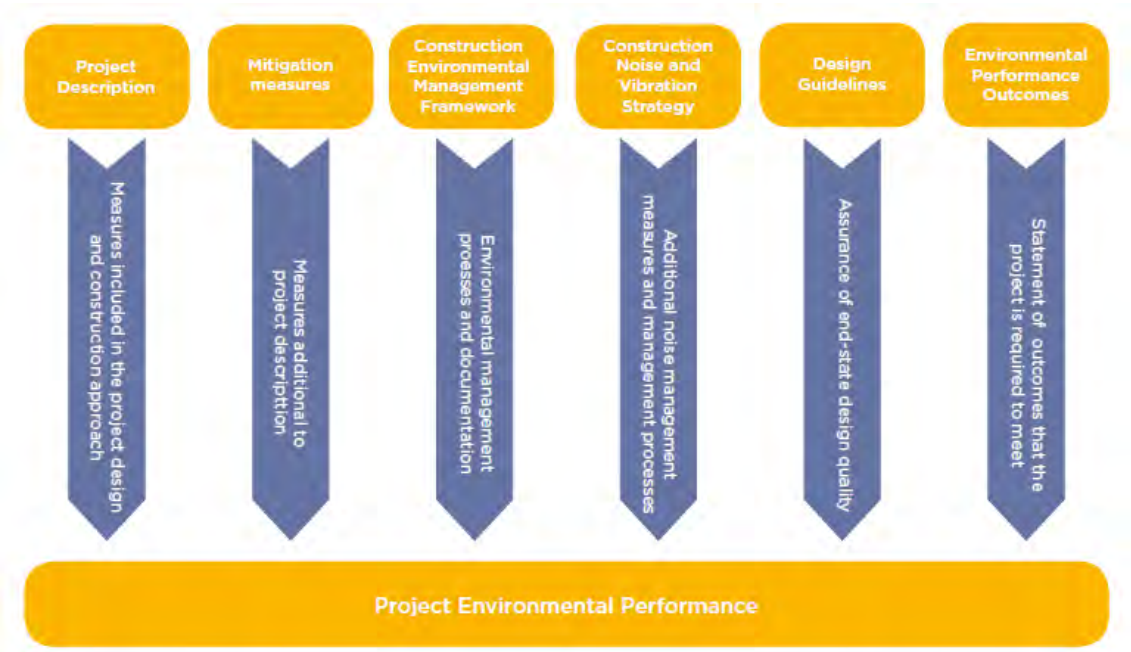

Figure 9: Project approach to environmental mitigation and management.

This approach would be implemented until such time as practical completion of the station works (i.e. works under the CSSI Approval) is achieved. Beyond that point, standard construction environmental management practices would be implemented by the OSD developer in accordance with relevant guidelines and any conditions of approval.

2.0 Scope of assessment

This report is based on the OSD concept proposal and the design drawings provided by Sydney Metro (thereafter referred to as the indicative OSD design).

This report documents the traffic and transport impact assessment that has been undertaken for the OSD. It discusses the forecast impacts on the surrounding road and pedestrian networks from the proposed concept and its traffic and pedestrian generation, parking (vehicle and bicycle) and servicing requirements.

Owing to the OSD's location above the CSSI approved Crows Nest Station, a series of collaboration workshops have been undertaken with Sydney Metro's Stage 1 Technical Advisor to coordinate the designs, identify challenges and propose solutions. This occurred as Sydney Metro's Stage 1 Technical Advisor advanced towards their Stage 1 design deliverable (approximately a 40% level of definition).

The report includes the traffic and transport assessment required to service the residential apartments, hotel development, and the commercial floor space in the Indicative OSD design, and as described in Section 1.5. The assessment incorporated:

- Review of relevant legislation, policies and guidelines associated with traffic and transport;
- Consultation with Sydney Metro regarding traffic and pedestrian modelling, parking and servicing requirements for the station;
- Consultation with the Sydney Coordination Office regarding parking, cycle access and servicing requirements for the OSD;
- Consultation with Roads and Maritime Services as a key stakeholder regarding vehicular trip generation and service vehicle access to the OSD;
- Analysis of the forecast traffic and pedestrian impacts resulting from the operation of the proposed Indicative OSD design and retail concessions associated with the station; and
- Assessment of the car parking, access and service dock design layout illustrated in the Indicative OSD design.

2.1 Assumptions and Limitations

The assessment is based on the following assumptions and limitations:

- The traffic generation rates as stated in the RMS Guide to Traffic Generating Developments (2002) and the more recent RMS Technical Direction 2013/04a: Guide to Traffic Generating Developments – Updated Traffic Surveys (RMS, 2013) are generally conservative given the characteristics of the planned uses.
- The assessment is based on an existing situation and full development of the site as an Integrated Station Development and is limited by the data obtained and identified in this report.

3.0 Relevant Standards and Guidelines

The following documents provide several transport planning provisions, goals and strategic planning objectives which are relevant to the proposal.

3.1 North Sydney Local Environment Plan 2013 & North Sydney Development Control Plan 2013

The *North Sydney Local Environment Plan (LEP) 2013* is the principal legal document for controlling development and guiding planning decisions within the North Sydney Council area. The North Sydney Development Control Plan 2013 (DCP) provides guidance which supports the implementation of the LEP.

Although the DCP is not technically applicable to the SSD, it provides a guide to the maximum number of on-site car parking spaces that can be provided for new developments based on their location and level of transport accessibility. It also recommends the minimum number of bicycle parking spaces to be provided by new developments.

The application of the DCP car parking requirements to the proposed Crows Nest OSD is considered and assessed in Section 5 of this report.

3.2 State Environmental Planning Policy (Infrastructure) 2007

The aim of the *Infrastructure SEPP* is to facilitate the provision of infrastructure across NSW. Clauses relevant to the proposal include:

Clause 88B: Development near proposed metro stations

A consent authority must not grant consent to development on land to which this clause applies unless it has taken into consideration:

- Whether the proposed development will adversely affect the development and operation of a proposed metro station, including by impeding access to, or egress from, the proposed metro station; and
- Whether the proposed development will encourage the increased use of public transport.

The proposed development is to be constructed above the entrance to Crows Nest Station and will not adversely affect access / egress to the proposed Sydney Metro Station. Furthermore, the station is likely to encourage and facilitate the increased use of public transport to and from the development.

Clause 104: Traffic-generating development

This clause sets out thresholds for the scale of new or extended development, above which the consenting authority must:

a) Give written notice of the application to Roads and Maritime Services (Roads and Maritime) within 7 days after the application is made, and

b) Take into consideration:

i.) Any submission that RMS provides in response to that notice within 21 days after the notice was given (unless, before the 21 days have passed, RMS advises that it will not be making a submission), and

ii.) The accessibility of the site concerned, including:

- The efficiency of movement of people and freight to and from the site and the extent of multi-purpose trips, and

- The potential to minimise the need for travel by car and to maximise movement of freight in containers or bulk freight by rail, and

iii.) Any potential traffic safety, road congestion or parking implications of the development.

The consent authority must follow these steps when assessing the development application submitted for this development.

This Traffic Impact Assessment has been prepared to assess how the proposed OSD impacts these criteria, and where necessary describe possible mitigation measures to ensure the efficiency of movement, reduce the need for private car travel and address any traffic safety, congestion and parking impacts.

3.3 Sydney Metro: Integrated Station Development (NSW Government, November 2017)

The NSW Government's *Sydney Metro: Integrated Station Development (ISD)* (November 2017) strategy outlines its vision for integrated station developments for the Sydney Metro projects and acknowledges the 'once-in-a-century' opportunity to shape the future growth of Sydney for generations to come. The strategy notes the importance of the St Leonards and Crows Nest precinct as a key employment centre which, combined with the new Metro station, is identified as a key area for housing growth, as well as a unique opportunity for renewal and activation.

The ISD includes a range of 'Excellence in Design' principles to support the place making and urban design requirements of integrated station developments of which a number are relevant to the indicative OSD and will be incorporated into the assessment in Section 6.

3.4 St Leonards and Crows Nest Precinct Strategic Transport Study (DPE, October 2018)

A Strategic Transport Study was completed to support the St Leonards and Crows Nest Precinct 2036 Plan. The transport study, together with the Draft Precinct Plan, indicates that by 2036, the number of residents living in St Leonards and Crows Nest is expected to grow from 15,000 residents to anywhere between 24,500 residents and 40,600 residents. The number of jobs in the precinct are expected to grow from 45,600 to up to 63,500.

The study found that the capacity of most of the road network would be able to absorb such growth, except for some sections along the Pacific Highway, which would act as a bottleneck to the rest of the local network.

The study recommended that the following strategic interventions be made through transport infrastructure (as apply to Crows Nest station and surrounds):

- Car parking rates for future development, particularly close to the provision of high capacity and frequency public transport services should adopt a minimalist approach to reduce the impact of additional vehicle traffic in the Precinct;
- Improvements to pedestrian infrastructure, including new pedestrian connections where currently lacking, particularly at intersections, and improvements to footpath and pedestrian walkway treatments to cater for future growth;
- Improvements to the bicycle network, including filling in missing links and ensuring that major trip generators are connected to the cycle network;
- Enhancing access to existing and proposed rail and metro stations; and
- Consolidation of bus stops and consideration of pedestrian and bus customer conflict points near Crows Nest station.

3.5 Greater Sydney Region Plan

In March 2018, the Department of Planning and Environment released *A Metropolis of Three Cities – the Greater Sydney Region Plan*. The plan, along with Transport for NSW's Future Transport 2056 and Infrastructure NSW's State Infrastructure Strategy 2018-36 will bring to life the vision of Greater Sydney as a vibrant and sustainable metropolis of the Eastern Harbour City, Central River City and Western Parkland City. It provides strategic direction for Sydney's productivity, environmental management, and liveability; and for the location of housing, employment, infrastructure and open space. The Plan's vision is to maintain Sydney's position as a strong global city and a great place to live.

The indicative OSD design will contribute to the implementation of a world class transport system that is connected, accessible and can accommodate the future demands of a growing population.

3.6 North District Plan (GSC, 2018)

The Greater Sydney Regional Plan nominates six districts of Sydney, the district plans have been released by the Greater Sydney Commission (GSC).

The *North District Plan* (Greater Sydney Commission, 2018) sets out priorities and actions for the North District, where the proposal is located. The vision includes strengthening the transport connections from North Sydney CBD to the Eastern Economic Corridor and the Harbour CBD and is illustrated in Figure 10.

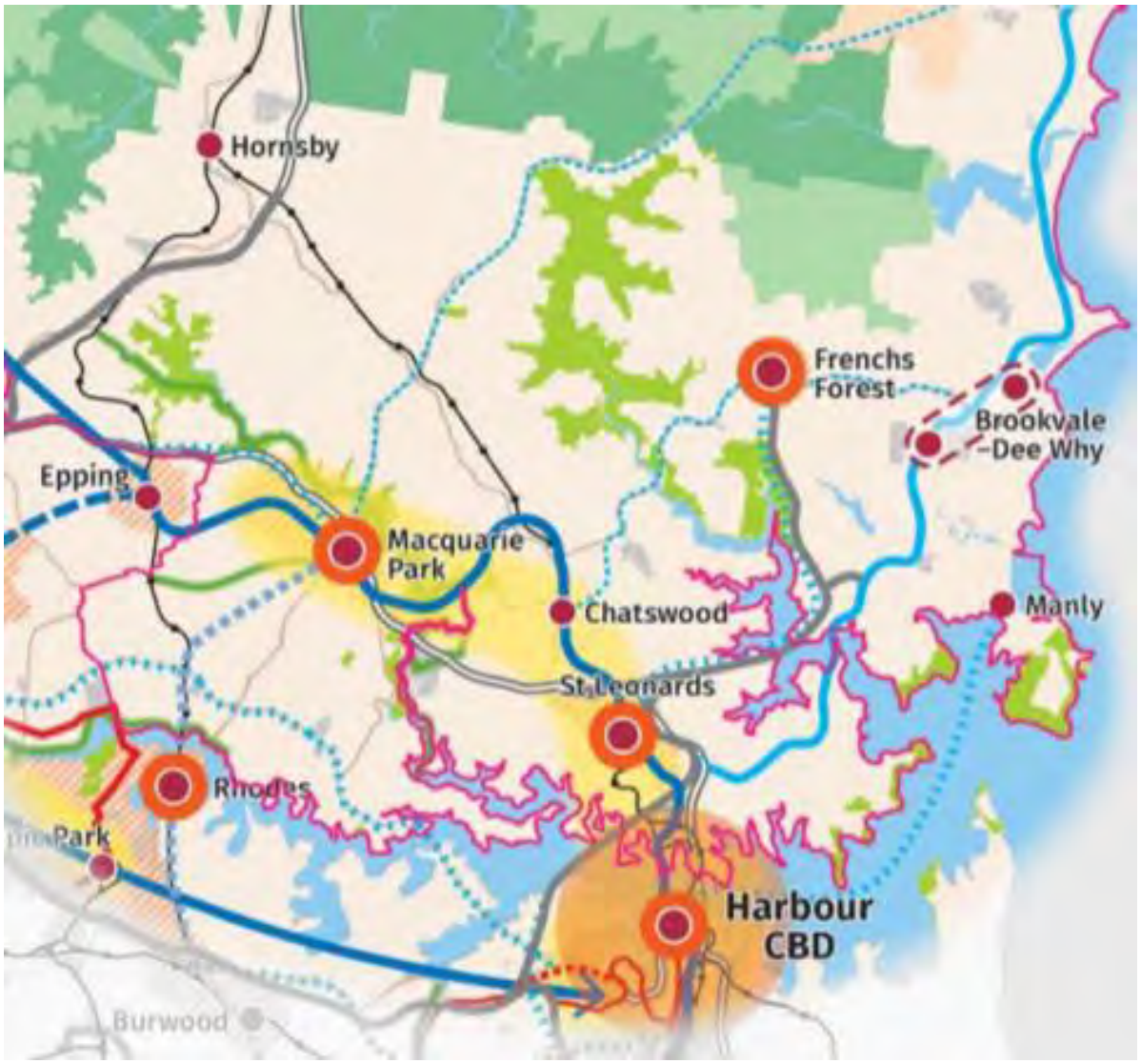

Figure 10: Excerpt of structure plan from North District Plan, showing Crows Nest location within the Eastern Economic Corridor (shown in yellow). Source: Greater Sydney Commission, *North District Plan*, 2018. Note minor additions made to figure for purpose of report.

The introduction of the new Crows Nest Station will help strengthen the transport connection from the area to the Eastern Economic Corridor and the Harbour CBD through more frequent and better-connected rail services. Being located above the Crows Nest Station, it will help expand the catchment of accessibility through non-car modes of travel by taking advantage of this important transport connection.

3.7 Future Transport Strategy 2056 (March 2018)

The *Future Transport Strategy 2056* (NSW Government, March 2018) is the NSW Government's framework for planning and improving NSW transport system and was developed as part of the 5-year update to the 2012 Long Term Transport Master Plan for NSW. The plan enables Sydney to prepare for a period of population growth with a vision for setting a pathway up to 2056. This vision is based on Greater Sydney being a metropolis of three cities (Eastern Harbour City, Central River City and Western Parkland City).

The strategy to accommodate population growth seeks to take advantage of technological enabled mobility that offers opportunities to maximise travel by car free alternatives within Sydney. This includes the transformation of the mass transit network to align with a 30 minute trip to services and employment. It also recognises the role of automation and how it can help to improve safety, travel choices and mode concepts, service frequency, reliability and travel times for customers when travelling within and around Sydney's transport network.

Sydney Metro City and Southwest and the proposed Crows Nest station form a key part of this future vision. It offers a modern technologically advanced public transport system solution, which through the provision of a strategic public transport hub, supports both place making and efficient connections to and from the Crows Nest. Future activity generated by the indicative OSD (this application) will directly benefit from Sydney Metro, which will help to appropriately manage its impacts through its proximity within Crows Nest and its alignment with the objectives of this strategy.

3.8 Greater Sydney Services and Infrastructure Plan

The *Greater Sydney Services and Infrastructure Plan* (NSW Government, March 2018) supersedes the Sydney's Bus Future (TfNSW, 2013), Sydney's Cycling Future (TfNSW, 2013), and Sydney's Walking Future (TfNSW, 2013) suite of documents.

The Greater Sydney Services and Infrastructure Plan (GSSIP) forms part of Future Transport 2056, and focuses on the specific policy, service and infrastructure initiatives to achieve the overall state-wide transport outcomes outlined in Future Transport 2056. These include a range of 'committed' and 'for investigation' projects, developed in line with the following network view of transport:

- **City-shaping network:** Provides high capacity turn-up-and-go services (every five minutes or less) across Greater Sydney and between the three cities - the Sydney Metro network is identified as a key element of this network, highlighting that the residents, tenants, guests, and visitors to the Crows Nest OSD will have exceptional public transport service levels.
- **City-serving network:** Provides on-demand or high frequency services to customers within the 10km area around the metropolitan centres – greater prioritisation of bus

services to improve 30-minute access (Bus Priority Infrastructure Program) and investing in priority walking and cycling networks around the centres in partnership with local councils.

- **Centre-serving network** – Connects local areas to their nearest centres. Committed improvements over the next 10 years are focused on investing in the cycling and walking network (including the Principal Bicycle Network and Priority Cycleways), and trialling and implementing new technology to enable more on-demand services. Provision for these opportunities will be an important consideration for the Crows Nest OSD.

The Crows Nest OSD supports the committed initiatives and the ongoing development of future initiatives outlined in the GSSIP.

3.9 North Sydney Transport Strategy

The *North Sydney Transport Strategy* (NSTS, North Sydney Council, 2017) acknowledges that:

'Sydney Metro will connect Sydney's north-western suburbs to the Bankstown Line via Chatswood, Crows Nest, North Sydney and the Sydney CBD. Sydney Metro will accommodate 20-30,000 trips in the peak hour with potential to accommodate approximately 40% of the road based trips that currently utilise the Metro corridor. This has the potential to deliver a paradigm shift in the way Sydney's residents and workers travel to, from and through North Sydney.'

This highlights North Sydney Council's recognition that the Sydney Metro project will be the catalyst for significant mode shift in North Sydney Local Government area.

The NSTS defines the following modal hierarchy for North Sydney LGA:

- Priority 1 – Walking
- Priority 2 – Cycling
- Priority 3 – Public transport
- Priority 4 – Local deliveries and freight
- Priority 5 – Private vehicles

This broadly aligns with State Government access priorities for transport interchanges (such as the Crows Nest Station) and will be used to prioritise the provisions for access, facilities, and space for the indicative OSD.

The NSTS flags the preparation of a number of mode-specific strategies, and includes some of Council's initial aims and objectives for these strategies:

- North Sydney Walking Strategy
- North Sydney Integrated Cycling Strategy (completed 2014)
- North Sydney Public transport and Advocacy Strategy
- **North Sydney Local Deliveries and Freight Action Plan** – set area-based delivery infrastructure based on sharing of assets by multiple delivery destinations, encourage deliveries to be undertaken outside of peak pedestrian and traffic periods, support increase in rail freight, identify preferred road freight/ delivery/ construction routes through the LGA and investigate delivery options that minimise impacts on the road network (for example, last mile by bicycle or drones).
- **North Sydney Parking and Traffic Action Plan** – area-based parking rates based on walkability to key destinations and public transport accessibility and services, amendments to residential parking permit schemes, consideration of emerging technologies and transport trends (for example. Car-share requirements, autonomous vehicles, road-user charging).

These will be used to support the assessment discussions (Chapter 6) and mitigation measures (Section 7) in this report.

3.10 Other policies and guidelines

The following documents have also been referenced in the development of this report:

- Roads and Maritime Services Guide to Traffic Generating Developments.
- Australian Standard - AS2890 Parking Facilities Parts 1 - 6
- North Sydney Council's Central Laneways Masterplan proposals
- North Sydney Council's Development Control Plan 2013

4.0 Existing Environment

All existing environmental conditions described below are prior to demolition and construction starting on the Crows Nest Station site.

4.1 Land Use

The existing land uses for the Crows Nest OSD site prior to demolition were primarily retail or bulky goods retail stores. A summary of the pre-existing lots and their uses is presented in Table 2.

Table 2: Existing land uses on Crows Nest OSD site.

Property Address	Approx GFA (sqm)	Use	Site
14-20A Clarke St, Crows Nest (Lot 1 only)	922.50	Car tyre retail outlet	C
477 Pacific Hwy Crows Nest	893.75	Furniture Store	B
479 Pacific Hwy Crows Nest	0.00	Vacant	B
491-495 Pacific Hwy Crows Nest	850.00	Post Office	B
497 Pacific Hwy Crows Nest	875.00	Furniture Store	A
501 Pacific Hwy Crows Nest	875.00	Furniture Store	A
503-505 Pacific Hwy Crows Nest	875.00	Furniture Store	A
507-509 Pacific Hwy Crows Nest	875.00	Furniture Store	A
511-519 Pacific Hwy Crows Nest	3750.00	Office	A
521-543 Pacific Hwy Crows Nest	0	Vacant	A

4.2 Existing travel patterns

4.2.1 Method of Travel to Workplace

The 2016 Australian Bureau of Statistics (ABS) census data for method of travel to work place was analysed for the area around the proposed Crows Nest OSD, including areas generally to be considered part of St Leonards due to similarities in future urban form. The following ABS Level 1 Statistical Areas were considered for this analysis: 1141407, 1141435, 1141444, 1140110, 1140117, 1140119, 1140120 and 1140123. Within the Level 1 Statistical Areas analysed, there were 3,109 residents.

The main mode of travel for employees who work in the following ABS Destination Zones were also considered for this study: 114013269 and 114143316. Within the Destination Zones analysed, there were 11,571 workers.

The physical geography or catchment of these areas is shown below in Figure 11 for residents and in Figure 12 for employees.

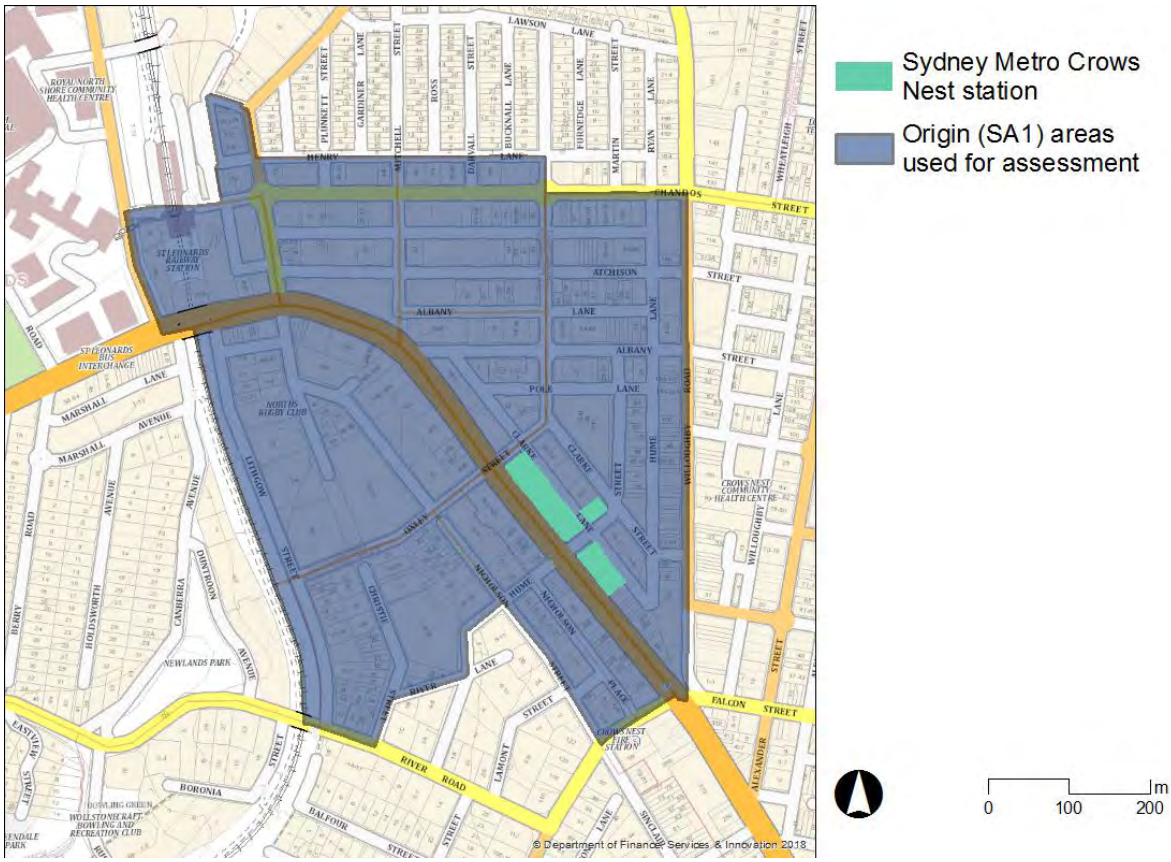

Figure 11: ABS Level 1 Statistical Areas around the proposed Crows Nest Station.

Source: ABS Geography, 2016

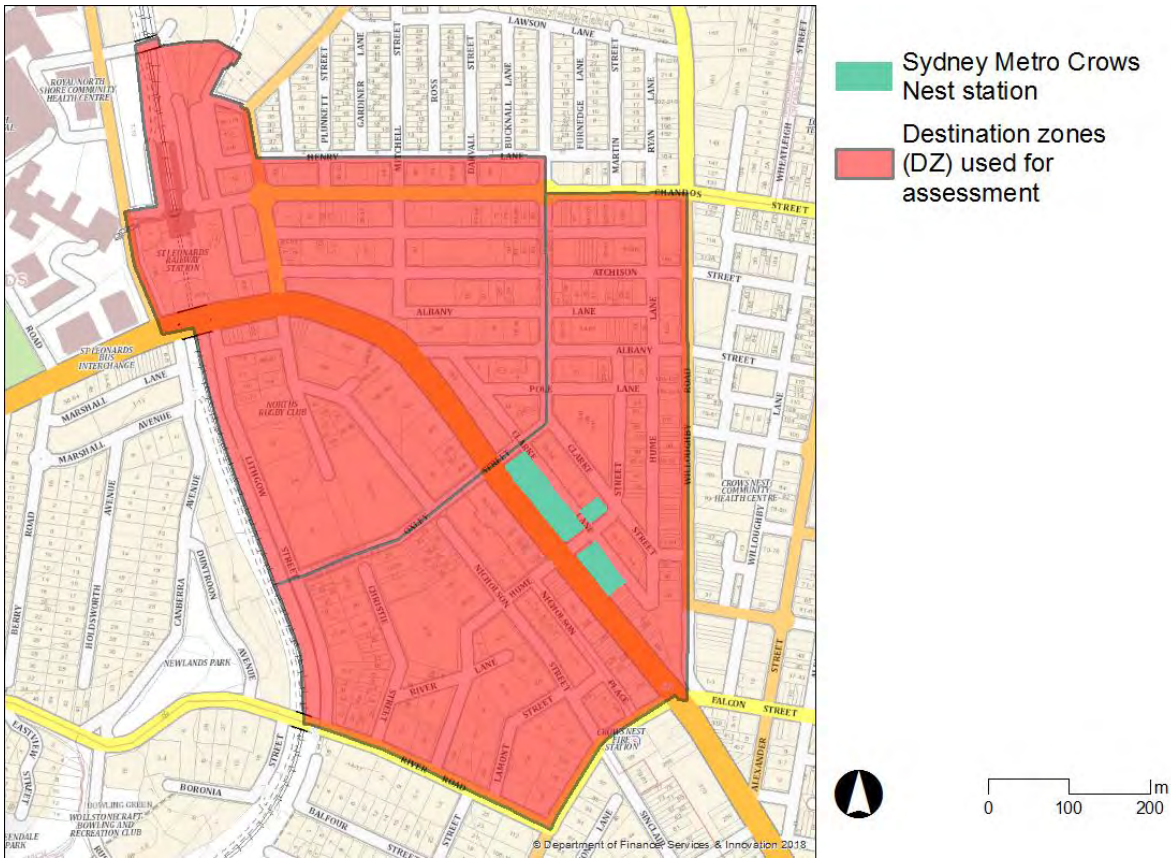

Figure 12 : ABS Destination Zones around the proposed Crows Nest Station

Source: ABS Geography, 2016

The mode split for commute to work for residents living in the vicinity of the proposed Crows Nest OSD is shown in Figure 13. The mode split for commute to work for employees working in the vicinity of the proposed Crows Nest OSD is shown in Figure 14.

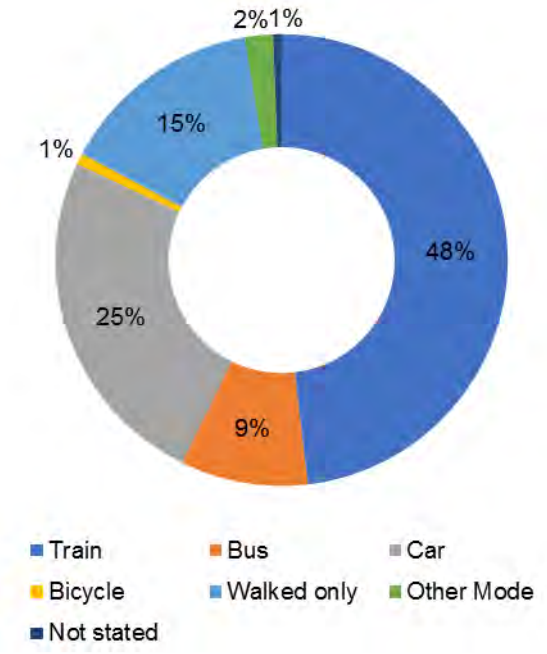

Figure 13: Mode split for commute to work for residents living near the proposed Crows Nest Station.
Note: "Other" includes census responses for Ferry, Light Rail, Truck, Motorbike and Other. Data excludes "Not applicable" and "Did not go to work".

Source: ABS, Method of Travel to Workplace 2016

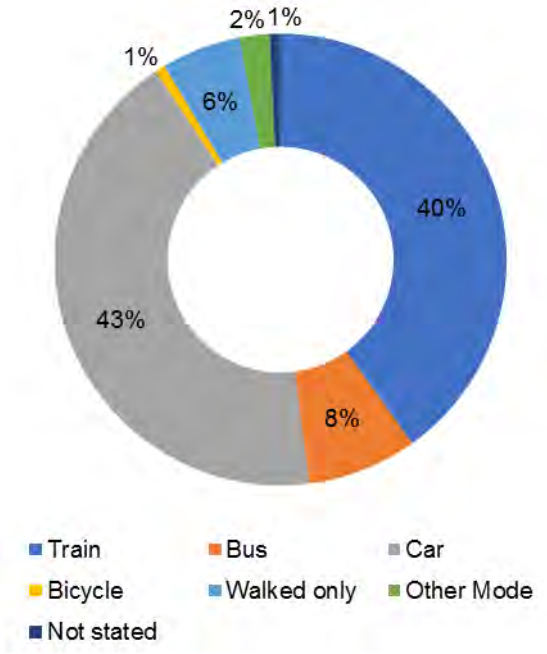

Figure 14: Mode split for commute to work for employees working near the proposed Crows Nest Station.
Note: "Other" includes census responses for Ferry, Light Rail, Truck, Motorbike and Other. Data excludes "Not applicable" and "Did not go to work".

Source: ABS, Method of Travel to Workplace 2016

From Figure 13, it can be seen that:

- Train is the main mode of travel to work for the largest proportion of residents (48 per cent) near the proposed Crows Nest OSD;
- 15 per cent of residents reported walking only as their main mode of travel;
- Public transport and active transport comprise a total of 73 per cent of all trips to work for residents in the area; and
- Private vehicle is the main mode of travel for one quarter (25 percent) of residents in the vicinity of the proposed Crows Nest OSD.

For workers travelling to the area, it can be seen from Figure 14 that:

- Private vehicle is more prevalent in the mode split for workers, with 43 per cent of workers travelling to work by private vehicle;
- 54 per cent of workers in Crows Nest – St Leonards travel to work by public transport or active transport;
- Train is the most popular form of public transport to Crows Nest – St Leonards, with 40 per cent of workers reporting that their main mode of travel was by train.

4.2.2 All trips (Household travel survey)

Transport for NSW Household Travel Survey (HTS) data has been reviewed for North Sydney Council LGA to understand the patterns of trip purposes of precinct residents.

The HTS results indicate several things for inner city urban areas:

- Consideration must be given for non-commute related travel. For North Sydney LGA, 30 per cent of all trips are for social or recreational purposes and 16 per cent of all trips are for shopping purposes, while only 13 per cent of all trips are for commuting to work
- The number of vehicles per household and vehicles per person decrease in areas with higher levels of public transport amenity
- People living in areas that experience higher levels of public transport service amenity tend to take trips for a lower variety of reasons
- More densely populated urban areas tend to feature households containing more single people or couples, compared to families in more suburban areas, which typically rely on car trips to make a wider variety of trips in areas that are less well serviced by public transport.

Assuming these patterns were to be applied to the Crows Nest OSD area given its higher density and higher public transport amenity, residents in the vicinity of the Crows Nest OSD are less likely to require a car.

A more detailed analysis of the HTS is contained in Appendix A.

4.2.3 Trends in transport

Data from the website *Charting Transport* has been reviewed to understand how car use has changed and is projected to change in Australia's five largest cities.

The data has shown that:

- mass transit use is currently outpacing growth in car travel; and
- car travel growth is significantly lower than the rate of population growth.
- a 2.9% mode shift away from private transport in Sydney over the 2011 to 2016 Census years.

In the case of Sydney, it is expected that these trends are a result of:

- increasing job density in employment centres which are well-served by public transport
- increasing population density in places well served by public transport.

Transport trends and their potential impact on the Crows Nest OSD trip generation include:

- flexible working and 'gig' economy;
- reduced private living areas and growth in social/ recreational trips, with an increased demand for better weekend public transport (bus, metro, rail);
- growth in car share use;
- increase demand for bike parking;
- growth in online shopping and meal deliveries leading to an increase in demand for loading zones for a range of different types of vehicles;
- reduced car ownership rates;
- increased demand for electric vehicles charging stations; and
- growth in point-to-point transport and the need for appropriate pick-up/ set-down locations.

A more detailed analysis of trends in transport is contained in Appendix A.

4.2.4 Trip Generation – All Modes

The RMS *Guide to Traffic Generating Development* was used to provide estimates on the number of person trips generated across the OSD site under the previously existing land use and scale conditions. The person trip generation rates, per sqm of GFA, used are presented in Table 3.

Table 3: Person trip generation rates, per sqm of GFA, used to estimate number of trips on OSD site previously

Land Use	AM Peak	PM Peak	Daily	Unit
Car tyre retail outlet	0.010	0.01	0.1	Per sqm
Furniture Store	0.043	0.0168	0.2452	Per sqm
Vacant	0.000	0	0	Per sqm
Post Office	0.031	0.0772	1.0578	Per sqm
Furniture Store	0.043	0.0168	0.2452	Per sqm
Furniture Store	0.043	0.0168	0.2452	Per sqm
Furniture Store	0.043	0.0168	0.2452	Per sqm
Furniture Store	0.043	0.0168	0.2452	Per sqm
Office	0.013	0.0108	0.0947	Per sqm

The estimated number of person trips generated across the OSD site were then proportionally split into different modes, based on the mode share for the site presented in Section 4.2.1. The resulting estimate of number of people previously travelling to the OSD site, by mode, is presented in Table 4.

Table 4: Volumes of workers previously travelling to the Crows Nest Station site, by mode (based on ABS Method of Travel to Work statistics for Crows Nest-St Leonards).

Mode	AM Peak	PM Peak	Daily
Train	109	76	972
Bus	21	15	191
Car	116	81	1035
Bicycle	2	1	17
Walked only	16	11	138
Other Mode	6	4	51
Not stated	2	1	19
Total	**273**	**189**	**2424**

4.3 Rail access

The St Leonards train station is located approximately 550m north west of the indicative OSD site. The station is serviced by the T1 North Shore and Northern Line services. Service frequencies for the station are shown in Table 5.

Table 5: Service destinations and frequencies for services departing St Leonards train station.

Destination	Service Frequency (trains per hour)				
	AM Peak	PM Peak	Interpeak	Evening	Weekend
Sydney CBD	19	19	8	8	8
North Sydney CBD	19	19	8	8	8
Chatswood	20	16	8	8	8
Macquarie Park & Epping	8	4	4	4	4
Parramatta	12	15	4	5	6

Source: T1 North Shore and Northern Line Timetable, Transport for NSW, March 2018.

Note: service changes will occur once Sydney Metro Northwest opens in 2019 and when Sydney Metro City and Southwest opens in 2024. It is assumed that service frequencies will either be maintained or increased to all destinations listed across all time periods.

The station provides a high level of service for people accessing various locations, with frequent, direct services to major employment centres such as the Sydney CBD, North Sydney CBD, Chatswood and Macquarie Park during the weekday peak periods. During the morning peak, 40 services pass through the station in total, while 35 services pass through the station in the evening peak. Additionally, a good service (8 trains per hour) is provided in

off peak periods to major centres such as the Sydney CBD, North Sydney and Chatswood, representing a turn-up-and-go level of frequency.

4.4 Road access

4.4.1 Traffic conditions/ Network performance

The roads around the proposed Crows Nest OSD site are classified according to the functional hierarchy described in Table 6 and shown in Figure 15.

Table 6: Road hierarchy around Crows Nest Station.

Street	Hierarchy	Description
Pacific Highway	Primary Arterial	Two way road with three lanes of traffic in each direction. Parking is generally permitted in the kerbside lane outside of peak hours.
Oxley Street	Local Road	Two way road with one lane of traffic in each direction. Parking is generally permitted in kerbside areas.
Hume Street	Local Road	Two way road with one lane of traffic in each direction. Parking is generally permitted in kerbside areas.
Hume Lane	Local Road	One way laneway, with traffic permitted northbound north of Clarke Street and southbound south of Clarke Street.
Clarke Street	Local Road	Two way road with one lane of traffic in each direction. Parking is generally permitted in kerbside areas. Classified as an on-road cycle route, with some on-road and some segregated cycle lanes installed.
Clarke Lane	Local Road	One way laneway, with traffic permitted northbound only.
Willoughby Road	Distributor Road	Two way road with one lane of traffic in each direction and kerbside parking. Frequent traffic calming measures have been installed. Partly classified as an on-road cycle route, with on-road pavement markers installed

Figure 15: Road hierarchy around Crows Nest Station.

4.4.1.1 Existing Trip Generation Volumes

Private vehicle trip generation rates for the pre-existing buildings on the OSD sites were not recorded prior to demolition occurring for construction of the Crows Nest Station. An estimate of trips generated has been produced based on the floor space of each of the buildings on the OSD sites and the associated use, as well as estimated trip generation rates based on the RMS Guide to Traffic Generating Development, 2013. The trip rates used are presented in Table 7 and the resulting trips are summarised in Table 8. Given the commercial natural of the previous uses, the peak hour distribution for all sites was assumed to be:

- AM: 90% In / 10% Out
- PM: 10% In / 90% Out

Table 7: Trip rates used to estimate existing trip generation

Use	Trip Rate (AM) per sqm	Trip Rate (PM) per sqm
Car tyre retail outlet	0.01	0.01
Furniture Store	0.024	0.01
Vacant	0.00	0.00
Post Office	0.0096	0.0257
Office	0.002	0.0014

Source: Guide to Traffic Generating Developments, RMS 2013.

Table 8: Estimated vehicle trip generation for existing developments on OSD sites.

Property Address	Site	Approx GFA (sqm)	Use	Estimated AM In	Estimated AM Out	Estimated PM In	Estimated PM Out
14-20A Clarke St, Crows Nest (Lot 1 only)	C	922.50	Car tyre retail outlet	8	1	1	8
477 Pacific Hwy Crows Nest	B	893.75	Furniture Store	20	2	1	8
479 Pacific Hwy Crows Nest	B	0.00	Vacant	0	0	0	0
491-495 Pacific Hwy Crows Nest	B	850.00	Post Office	7	1	2	20
497 Pacific Hwy Crows Nest	A	875.00	Furniture Store	19	2	1	8
501 Pacific Hwy Crows Nest	A	875.00	Furniture Store	19	2	1	8
503-505 Pacific Hwy Crows Nest	A	875.00	Furniture Store	19	2	1	8
507-509 Pacific Hwy Crows Nest	A	875.00	Furniture Store	19	2	1	8
511-519 Pacific Hwy Crows Nest	A	3750.00	Office	6	1	1	5
521-543 Pacific Hwy Crows Nest	A	0	Vacant	0	0	0	0
Total				**118**	**13**	**8**	**73**

4.4.2 Intersection performance

The operation of the existing intersections during the AM and PM peak hour was modelled in LinSig Version 3.2 for the Sydney Metro City and Southwest EIS Technical Paper 1. A summary of these results is shown below in Table 9.

The level of service is defined by the values shown in Table 10, below.

Table 9: Existing intersection performance.

Intersection	Demand flow	Average delay (seconds per vehicle)	Level of Services
Oxley St / Pacific Hwy			
AM peak	3403	13	A
PM peak	3530	15	B
Hume St / Pacific Hwy			
AM peak	3244	13	A
PM peak	3298	12	A
Falcon St / Shirley St / Pacific Hwy			
AM peak	3958	50	D
PM peak	4022	52	D

Source: Sydney Metro Chatswood to Sydenham EIS Technical Paper 1, pg 180 (Jacobs, May 2016)

Table 10: Intersection Level of Service definitions.

LoS	Control delay per vehicle in seconds (d) (including geometric delay)
A	d < 14
B	d < 15 to 28
C	d < 29 to 42
D	d < 43 to 56
E	d ≤ 57 to 70
F	d > 70

The analysis shows that both signalised intersections adjacent to the proposed Crows Nest Station currently operate to a Level of Service (LoS) A during the AM peak. The intersection of Falcon Street, Shirley Street and Pacific Highway currently operates to a LoS D.

4.4.3 Car parking (on-street and off-street)

4.4.3.1 Private off-street parking on OSD site

The existing (pre-demolition) off-street parking provisions on the OSD sites are shown in Table 11.

Table 11: Existing private off-street parking spaces.

Property Address	Existing off-street parking spaces
14-20A Clarke St, Crows Nest (Lot 1 only)	6
477 Pacific Hwy, Crows Nest	17
479 Pacific Hwy, Crows Nest	0
491-495 Pacific Hwy, Crows Nest	0
497 Pacific Hwy, Crows Nest	2
501 Pacific Hwy, Crows Nest	3
503-505 Pacific Hwy, Crows Nest	4
507-509 Pacific Hwy, Crows Nest	5
511-519 Pacific Hwy, Crows Nest	26
521-543 Pacific Hwy, Crows Nest	75
Total	**138**

In total, 138 private, off-street parking spaces were provided on the sites of the proposed Crows Nest OSD.

The number of all-day off-street spaces provided for workers in Crows Nest is limited, encouraging current workers to travel to work by public transport or active transport.

4.4.3.2 Public off-street parking

Several off-street publicly accessible parking garages are in the vicinity of the proposed Crows Nest OSD site. Four of these car parks are operated by North Sydney Council and offer free parking for up to 2 hours, while the remaining four are privately operated and charge by the hour, up to a daily maximum. These parking stations are summarised in Table 12.

Table 12: Off-street public car parking in the vicinity of the proposed Crows Nest Station.

Car Park	Location	Cost
North Sydney Council Nicholson Street car park	Nicholson Street, Crows Nest	Monday – Saturday: Free parking up to 2 hours, fees apply thereafter up to $56.00 each day (applies for hours 7am to 11pm only) Sunday: Free

Car Park	Location	Cost
North Sydney Council Hume Street car park	Hume Street, Crows Nest	Monday – Saturday: Free parking up to 2 hours, fees apply thereafter up to $56.00 each day (applies for hours 7am to 6pm only). Flat rate of $8 after 6pm. Sunday: Free
North Sydney Council Holtermann Street car park	Holtermann Street, Crows Nest	Monday – Saturday: Free parking up to 2 hours, fees apply thereafter up to $56.00 each day (applies for hours 7am to 11pm only) Sunday: Free
North Sydney Council Alexander Street car park	Alexander Street, Crows Nest	Monday – Saturday: Free parking up to 2 hours, fees apply thereafter up to $56.00 each day (applies for hours 7am to 11pm only) Sunday: Free
Wilson Parking Oxley Street	40 Oxley Street, Crows Nest	Monday – Friday: Up to $35.00 per day Saturday – Sunday: $8.00 flat rate
Charter Grove Car Park	29-57 Christie Street, St Leonards	Monday – Friday: Up to $35.00 per day Closed weekends
Norths Rugby Club Car Park	80 Christie Street, St Leonards	Monday – Friday: Up to $35.00 per day Saturday – Sunday: $8.00 flat rate

The limited supply and cost of parking in public car parks, including those privately owned, is a likely disincentive for employees travelling to Crows Nest for work, and contributes to the higher-than-average use of public transport for workers commuting to Crows Nest.

4.4.3.3 On-street parking

On-street car parking near the proposed Crows Nest OSD site is typically time restricted and/or ticketed during weekday business hours and during some time periods at the weekend. Areas in the immediate vicinity of the site also do not permit parking, except for residential parking permit holders. The limited number of on-street all day parking spaces in Crows Nest limits current workers from travelling to Crows Nest by vehicle as part of their daily commute, encouraging high public transport mode share.

Additionally, while there is a Clearway in operation on Pacific Highway during peak hours, paid, time restricted on-street parking is available outside of Clearway hours.

Figure 16: Pre-existing on-street parking restrictions in the immediate vicinity of Crows Nest station. *Source: Mott MacDonald, 2018.*

4.5 Service vehicle access

Pre-demolition service vehicle access routes and loading areas around the proposed Crows Nest OSD sites are shown in Figure 17, below.

Figure 17: Service vehicle routes and docks in the vicinity of Crows Nest OSD.

Prior to construction commencing on the Crows Nest Station site, there were approximately 32 service vehicle loading areas to properties off Clarke Lane. This comprised a variety of different loading areas including driveways with off-street spaces, dedicated loading docks and on-street space adjacent to rear property access points. Once the station has been built and is operational, 22 of these service vehicle access points will remain in operation, not including those proposed for the Crows Nest Station and OSD.

Clarke Lane traffic is one-way from Clarke Street, running first southbound, then makes an acute angle turn, to head approximately northbound to Oxley Street. Clarke Lane is then two-way between Oxley St and Pole Lane, then one-way northbound again from Pole Lane to Albany Street.

The access routes for service vehicles to loading areas on Clarke Lane are generally divided into the following blocks:

- **North of Oxley Street:** Vehicles access these properties by turning into Clarke Lane (northbound) from Oxley Street, or by turning left (southbound) into Clarke Lane from Pole Lane. Vehicles can then exit via Oxley Street for properties south of Pole Lane, or via Albany Street, for properties north of Pole Lane.
- **Between Oxley Street and Hume Street:** Vehicles access these properties by turning into Clarke Lane from Hume Street. Vehicles can exit via Oxley Street.
- **Between Hume Street and Clarke Street:** vehicles access these properties by turning into Hume Lane from Clarke Street and following the laneway around to Clarke Lane.

4.6 Bus access

Numerous bus stops are located close to the Crows Nest OSD site, with buses serving a variety of destinations across the North Shore, Northern Beaches, Northern Suburbs and Inner City. A summary of where bus routes operate and locations of bus stops in the vicinity of the site are shown in Figure 18.

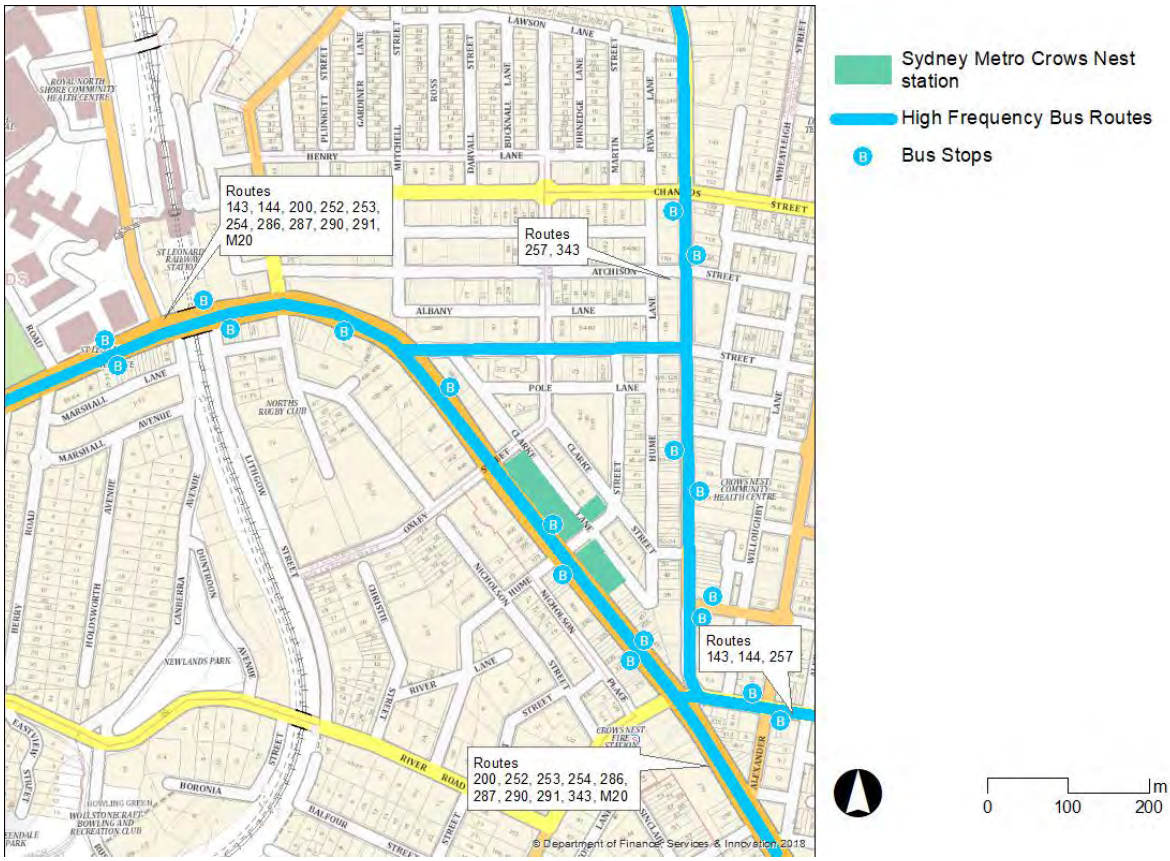

Figure 18: Existing bus conditions in the vicinity of Crows Nest Station.

Source: Sydney Metro Authority, 2018.

A summary of the destinations serviced by bus routes which operate in the vicinity of the site is included in Table 13.

Table 13: Bus routes through Crows Nest.

Destination	Serviced By	AM Peak Frequency (mins, average)	PM Peak Frequency (mins, average)	Weekend Frequency (mins, average)	Time to destination (mins, approximate)
Sydney CBD	252, 343, M20	2	4	6	20-30
North Sydney CBD	252, 254, 291, M20, 343	<1	3	6	5-10
Chatswood	143, 144, 200, 257, 343	3	4	6	20-30
Manly	143, 144	15	6	15	45
Green Square	343, M20	4	5	8	50-60
Castle Hill	612X	-	6	-	60
Bella Vista, Rouse Hill	602X	-	10	-	45-60
Balmoral	257	30	15	30	25
Neutral Bay	143, 144, 257, 263	10	5	10	10-15
Willoughby Shops	257, 267, 343	7	6	10	15-20
Lane Cove	252, 253, 254, 286, 287, 290, 291	10	5	12	15
Ryde	286, 287	-	12	-	40-45
Macquarie Park	291	30	30	60	30-35

Source: Transport for NSW, 2018. Note: AM peak was taken as 8am to 9am weekdays, PM peak was taken as 5pm to 6pm weekdays, and Weekend was taken as 12pm to 1pm Saturday.

Table 13 shows that bus services to most destinations are focused heavily on providing weekday peak direction services, with some bus services to destinations not provided in the non-peak direction on weekdays (for example outbound in AM peak) or at weekends. Service frequencies at weekends are also generally lower than during weekdays, however trunk routes to major destinations such as the Sydney CBD, North Sydney, Chatswood, Lane Cove, Neutral Bay and Green Square maintain a reasonably high frequency through the weekend, across various services.

A summary of the bus stops near the proposed Crows Nest OSD are listed in Table 14.

Table 14: Bus stops and amenities in Crows Nest.

Bus Stop Location	Bus Stop Number	Routes	Stop Amenity
Pacific Highway at Hume Street	206515	143, 144, 252, 254, 257, 265, 286, 287, 290, 291, M20	Covered, partially covered seating provided, timetable provided.
Pacific Highway at Hume Street	206512	143, 144, 252, 254, 286, 287, 290, 291, M20	Covered, covered seating provided, timetable provided (pre-Metro construction)
Pacific Hwy after Shirley Rd	206524	143, 144, 200, 252, 254, 286, 287, 290, 291, 602X, 612X, 622, 653, M20	Covered, partially covered seating provided, timetable provided.
Pacific Hwy after Albany St	206514	143, 144, 252, 254, 257, 265, 286, 287, 290, 291, M20	Covered seating, timetable provided
Crows Nest, Burlington St, Stand 1	206546	257, 343	Covered seating, timetable provided
Crows Nest, Burlington St, Stand 3	206544	265	Weather protection available, uncovered seating, timetable provided
Crows Nest, Burlington St, Stand 4	206540	263, 267	Covered seating, timetable provided
Crows Nest, Burlington St, Stand 5	206541	343	Covered seating, timetable provided
Willoughby Rd opposite Holtermann St	206547	257, 343	Weather protection available, uncovered seating, timetable provided
Willoughby Rd after Holtermann St	206538	263, 267, 343	Weather protection available, uncovered seating, timetable provided

Source: Mott MacDonald, 2018.

Existing bus stops throughout Crows Nest are generally of good quality and provide a combination of shelter, seating, covered seating and service information at all stops, with most containing all four.

4.7 Pedestrian access

The pedestrian network around the proposed Crows Nests OSD site is shown in Figure 19.

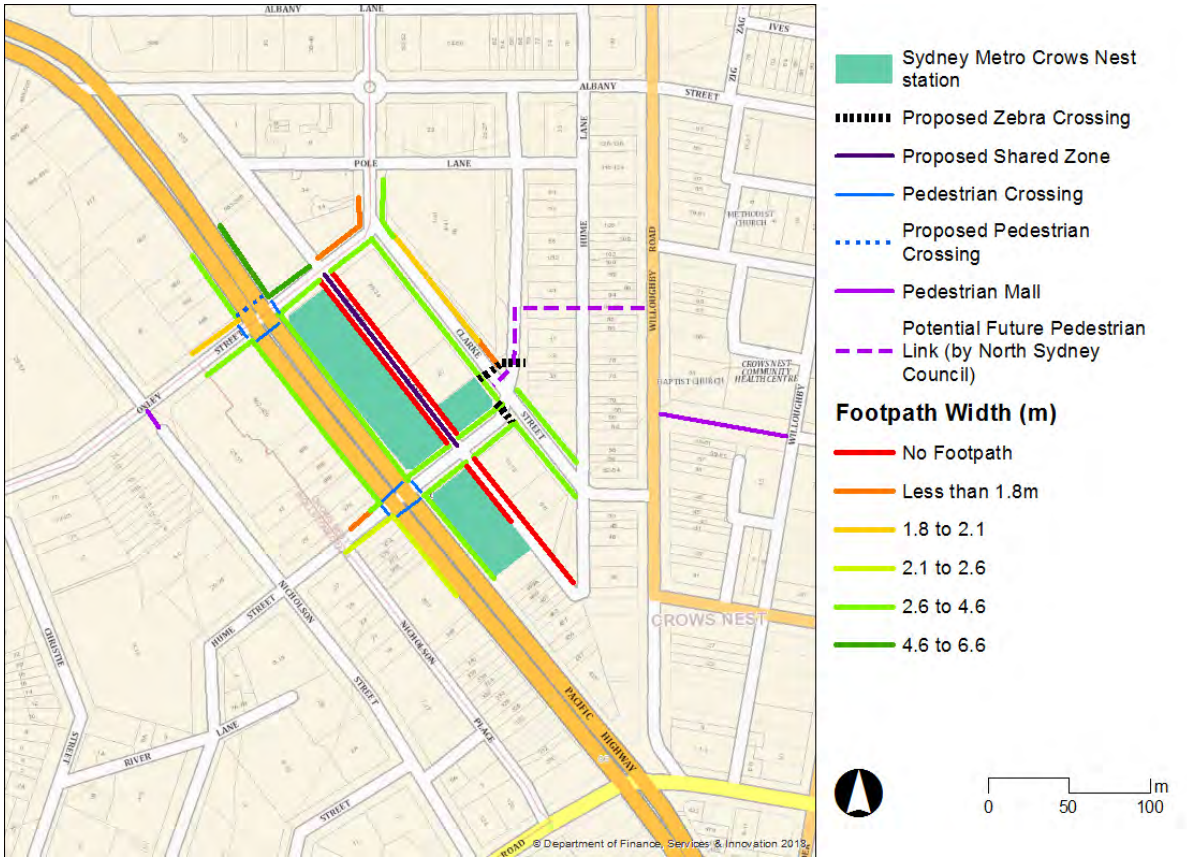

Figure 19: Proposed Pedestrian network around Crows Nest.

The key features of the pedestrian network around the proposed Crows Nest OSD include:

- predominantly covered footpaths along the Pacific Highway
- frequent signalised pedestrian crossings along the Pacific Highway provide appropriate crossing facilities near the site
- signalised crossings on the Pacific Highway at Oxley Street and Hume Street
    - no pedestrian leg on the north-west side of the Oxley Street / Pacific Highway intersection
- widened footpaths on the western frontage and part of the eastern frontage of Clarke Street, including covered sections at the south eastern ends. This is a result of new developments along the Pacific Highway being required to have a three metre public domain set back, and is expected to produce a wider footpath along this section of the Pacific Highway over time.

- partly widened footpaths on Oxley Street with partly sheltered sections of footpath
- sporadic placement of trees for shade along footpaths without awnings
- inconsistent and narrowing sections of footpath on Clarke Street at Hume Street park
- pedestrian fencing around the intersection of Pacific Highway and Falcon Street
- a lack of zebra crossings within the blocks bound by the Pacific Highway, Albany Street and Willoughby Road (excluding the crossing at Clarke Street / Willoughby Road)
- no pedestrian footpaths or amenity provided along Hume Lane or Clarke Lane (south of Oxley Street).

A summary of pedestrian volumes at key intersections around the proposed OSD is shown in Figure 20.

Figure 20: Existing pedestrian volumes at crossings between 7am and 10am.

Date of count: 25 October 2016.

As can be seen, there are generally low pedestrian volumes in the existing environment around the proposed OSD site. A summary of pedestrian desire lines from the proposed Crows Nest OSD are shown in Figure 21. Key desire lines from the proposed Crows Nest OSD site include to:

- St Leonards train station;
- Royal North Shore and North Shore Private Hospital campus;
- shops and workplaces along the Pacific Highway (north and south);
- St Leonards office precinct;
- North Sydney CBD;
- Crows Nest town centre, primarily Willoughby Road between Albany Street and Falcon Street;
- local schools including North Sydney Girls High, Cammeraygal High School and North Sydney Boys High; and
- the Mater hospital.

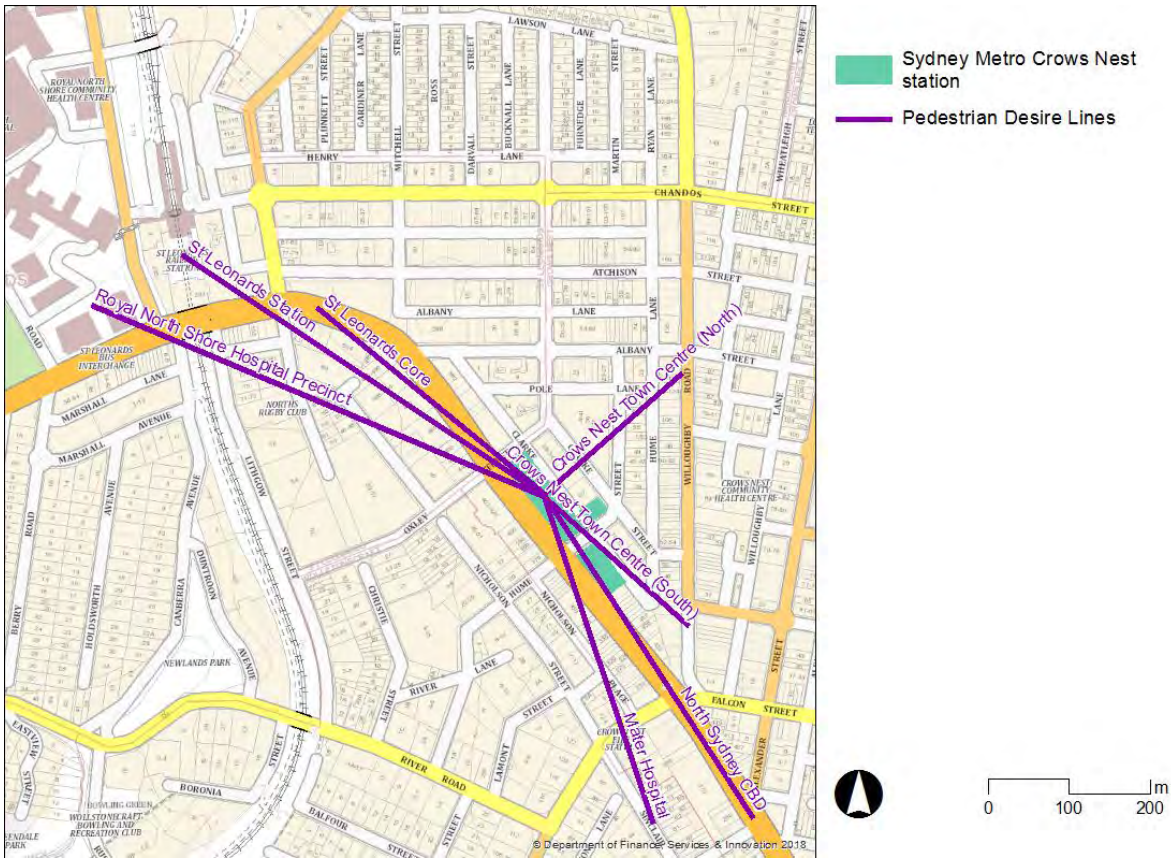

Figure 21: Pedestrian desire lines from the Crows Nest Station OSD.

However, it should be noted that the new metro station and associated bus stops are likely to be the preferred transport node for OSD residents, employees and visitors, resulting in changes to existing pedestrian trip patterns, including a large proportion of pedestrian trips between the OSD and the metro station below.

Key pedestrian congestion points were observed on the Pacific Highway at bus stops in both directions between Oxley Street and Falcon Street, where the volume of passengers waiting for buses during peak periods can partially block the footpath, however these regularly cleared with bus arrivals and did not prevent other pedestrians passing or require any pedestrians to step onto the road carriageway to pass.

It should be noted that North Sydney Council is in the process of implementing its proposed upgrades for Hume Street Park, which will provide new pedestrian connections from Hume Street and Clarke Street through to Willoughby Road, including the pedestrianisation of Hume Street north of Clarke Street, and a new mid-block pedestrian link from Hume Street to Willoughby Road.

As part of the Crows Nest Station works, pedestrian movements and access will be improved by the insertion of new crossing points on nearby streets and the widening of footpaths along the OSD site through increased ground floor setbacks.

4.8 Taxi servicing and facilities

No secure taxi ranks are currently located in the immediate vicinity of the proposed site.

The nearest noted taxi zone is located on Alexander Street, between Burlington Street and Falcon Street, providing space for two taxis to service Crows Nest town centre.

4.9 Bicycle access

There is a limited cycling network through the Crows Nest town centre, which provides a partial connection to the proposed Crows Nest OSD site. The existing cycling network is shown in Figure 22, note that the description and level of difficulty identified is based on the Roads and Maritime Services' dataset and other local routes exist in the area. Figure 22 also represents the worst-case scenario for cyclists on these routes for both directions of traffic, assuming that the hierarchy of cycle route type is:

1. Physically separated, bike-only lane
2. Shared path
3. Marked on-road bike lane
4. Mixed traffic with markings and signage
5. Mixed traffic with no cycle route marking

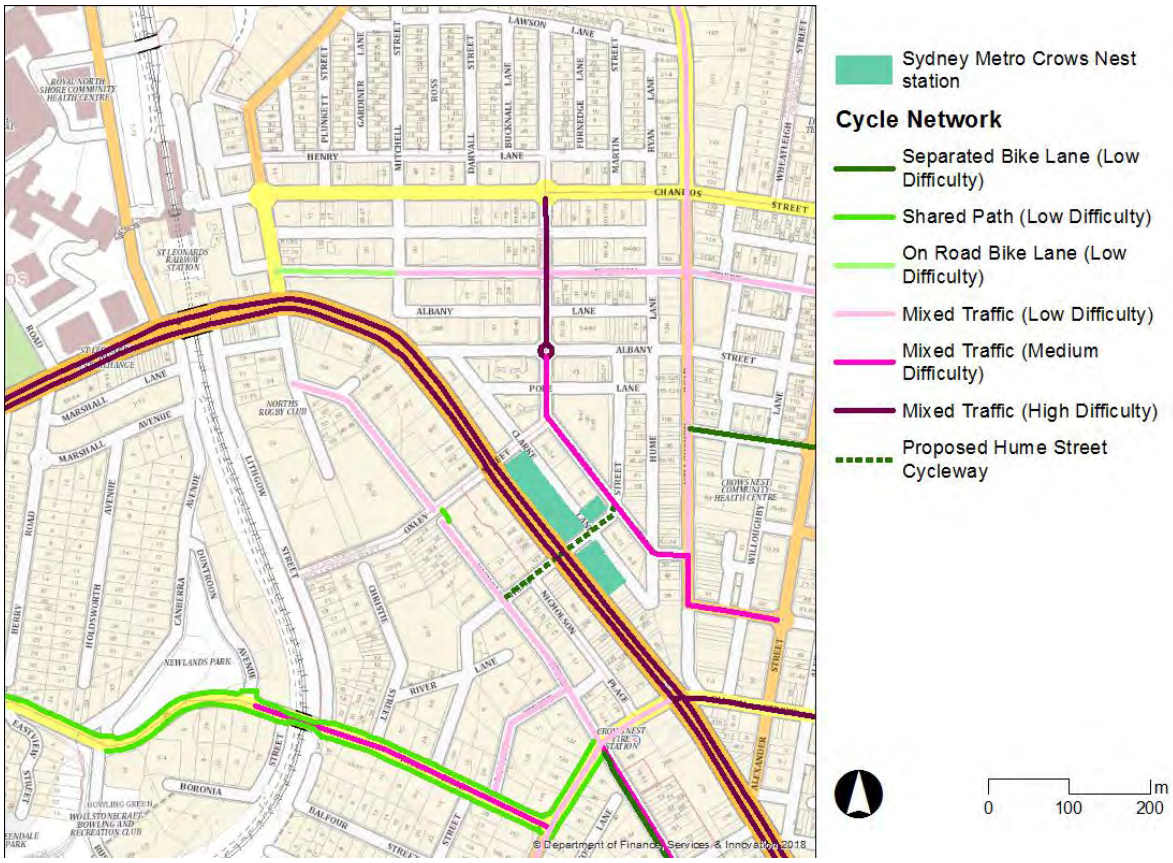

Figure 22: Crows Nest cycling network and infrastructure.

Source: Roads and Maritime Services, 2018.

The cycling network along these routes is incomplete and of moderate difficulty, with some gaps, circuitous routes and steep grades. The cycle network provides a connection through Crows Nest, connecting to St Leonards Station and North Sydney CBD via a series of mixed traffic roads, marked lanes and small sections of separated cycleways and shared paths. Also note that Figure 22 only shows cycle routes contained within the RMS cycle route finder. Other local routes on local roads exist in the area of the station.

The North Sydney Integrated Cycle Strategy (GTA for North Sydney Council, 2014) summarises the current challenges for greater cycle access in North Sydney LGA as being

- tapping into latent interest in cycling for potential users
- providing safe, separated cycleways for potential users, including children
- insufficient bicycle facilities to cope with current demand or to encourage future demand
- filling gaps in the network and connecting a discontinuous cycle network

- addressing poor or varying cycle infrastructure along cycle routes making them difficult to navigate.

Some public bike racks are installed along Willoughby Road for cyclists accessing Crows Nest town centre, however these do not feature weather protection and there are none currently installed in the immediate vicinity of the proposed Crows Nest OSD site.

It is noted that as part of the broader Crows Nest Station development, a separated cycleway will be installed on Hume Street, connecting the cycle route on Clarke Street to the cycle route on Nicholson Street.

The North Sydney Council DCP requires new development to make provision for secure bicycle facilities and end of trip facilities which is expected to address deficiencies in secure cycle parking facilities over time.

5.0 Assessment Criteria

Table 15 below lists where the SEARs – listed in Section 1.1 – are addressed within this report.

Table 15: Assessment Criteria

No.	SEARs	Section reference
18.1	Accurate details of the current daily and peak hour vehicle, public transport, point to point transport services, pedestrian and bicycle movements from existing or former buildings/uses on the site using the adjacent and surrounding road network.	Section 4.1 Section 4.4.1
18.2	Forecast total daily and peak hour trips likely to be generated by the proposed development including vehicle, public transport, point to point transport services, pedestrian and bicycle trips, together with cumulative impacts of existing, proposed and approved developments in the area and any transport/traffic upgrades. Traffic generation assessment is to ensure that accurate background growth rates are included in modelling.	Section 6.5.1 Section 6.5.2 Section 6.8
18.3	Detailed assessment of the existing and future performance of key intersections providing access to the site, supported by appropriate modelling and analysis to the satisfaction of RMS and TfNSW, including key intersections of Pacific Highway/Oxley Street, Pacific Highway/Hume Street and Pacific Highway/Shirley Road/Falcon Street.	Section 4.4.2 Section 6.5.1.4
18.4	Measures to mitigate impacts of the proposed development on the operation of existing and future traffic, public transport, pedestrian and bicycle networks including any required upgrades. Provide information regarding the impact of future pedestrian demands on traffic performance of the Pacific Highway including detailed pedestrian modelling.	Section 6.6 Section 7
18.5	Measures to be implemented to encourage users of the development to make sustainable travel choices, including walking, cycling, public transport and car sharing, such as the integration with rail and bus infrastructure and provision of adequate bicycle parking and end of trip facilities.	Section 6.7 Section 6.8.2 Section 7
18.6	Proposed car and bicycle parking provision for future occupants and visitors to the development, including consideration of the availability of public transport and the requirements of the relevant parking codes and Australian Standards	Section 6.2 Section 6.3 Section 6.8.2
18.7	Any provision to support transport mode interchange and pedestrian connections to the metro station, including an assessment of the public domain surrounding the site to accommodate the future pedestrian demands safely and adequately and mitigation measures identified.	Section 6.6 Section 6.8.1
18.8	Proposed vehicle access arrangements and management, including for service and loading activities and measures to mitigate impacts to bus services and passengers interchanging between bus and rail. Make allowances and provide information to demonstrate that on-site loading/servicing is achieved.	Section 6.5.1.2 Section 6.4 Section 6.7 Section 6.8.3

No.	SEARs	Section reference
18.9	Describe preliminary construction traffic arrangements and management measures, including consideration of the cumulative construction traffic impacts from infrastructure works in the surrounding road/transport network.	Section 7.2

6.0 Assessment

6.1 Description

This assessment will review the traffic and transport impacts associated with the proposed concept Crows Nest OSD, including the proposed provisions for site access and parking for private vehicles, bicycles, pedestrians, service vehicles, coaches, taxis, emergency vehicles and any other network impacts.

Parking provisions for the site will be considered based on the unique set of circumstances of the site, including its location above a metro station and within an increasing density neighbourhood well served by public transport. The local development control plan for North Sydney Council, which guides provision of on-site parking and transport access, is referenced along with guidelines from other DCPs and LEPs for Sydney based councils that have similar urban environments to the future Crows Nest – St Leonards area are used to benchmark the suitability of the proposed development.

The assessment has also been conducted with consideration given to the mode share of public transport increasing above the current scenario that was reported in Section 4.2.1. It is anticipated that once high frequency train services are available from both Crows Nest station and St Leonards station, providing high quality public transport access to many employment areas in Sydney, weekday car use will decrease. The mode share for private vehicle use and public transport use in the OSD buildings once Crows Nest station is operational is expected to be similar to that of current mode splits recorded for Sydney CBD.

The proposed concept for the Crows Nest OSD development is summarised below in Table 16. As part of the proposed concept being submitted, approval is being sought for Site B to be used as a commercial building as an alternative use to hotel use, contained within the same envelope as the hotel concept design considered in this assessment. The details of this are included in the table below.

Table 16: Proposed internal land use and quantities (in the concept proposal). Items in italics are a potential alternative use for the corresponding site.

Building	Land Use	Scale (total units, sqm NLA)	Studio	1 bedroom	2 bedroom	3 bedroom
A North	Residential	175 units	35	38	63	38
A South	Residential	175 units	35	38	63	38
B	Hotel	250 rooms	-	-	-	-
	Commercial	*18,300m^2*	-	-	-	-
C	Commercial	2700m^2	-	-	-	-

Additionally, it is noted that this assessment has been undertaken for the **proposed concept** (i.e. maximum envelope) for the OSD site. The indicative design for the OSD development submitted as part of this proposal contains fewer parking spaces and a different mix of apartment sizes.

6.2 Car parking and vehicular access

6.2.1 Car Ownership Rates

Car ownership rates for households which were apartments in multi-dwelling buildings of four storeys or more in the 2016 census have been analysed for selected suburbs that present living characteristics of similar density, inner city suburbs with good access to public transport and/or that are highly walkable. It should be noted that these rates reflect suburbs and buildings constructed over a range of different eras and with different corresponding regulatory environments. As such they do not represent a standard to be applied on a site-by-site basis, but rather as a benchmark of trends for car ownership for different sized dwellings in similar urban environments. The results are shown in Table 17, below.

Table 17: Average car ownership rates per unit in multi-dwelling buildings in high density, well connected inner city Sydney suburbs.

Suburb	Studio	One bedroom	Two bedrooms	Three bedrooms
Bondi Junction	0.3	0.65	0.8	1
Darlinghurst	0.25	0.45	0.85	1.4
Elizabeth Bay	0.2	0.5	0.8	1.25
Haymarket	0	0.25	0.45	0.6
Milsons Point	0	0.5	0.9	1.4
Potts Point	0.15	0.35	0.7	1.2
St Leonards	0.15	0.5	0.95	1.3
Sydney	0.15	0.3	0.55	0.85
Proposed Crows Nest OSD parking space rate	0	0.25	0.5	0.5

Source: 2016 Census, Australian Bureau of Statistics, 2017.

By providing a minimal number of parking spaces per apartment, residents will be discouraged from owning and using private vehicles, reducing the impact of the development on the local and broader road network. This is in line with the recommendation in the Department of Planning and Environment's Strategic Transport Study: St Leonards and

Crows Nest Station Precinct, where car parking spaces surrounding the rail and metro stations will be minimised or not provided to catalyse a shift to sustainable transport modes[1].

6.2.2 Patterns of vehicle use

The Crows Nest OSD will have good public transport links to major employment hubs throughout the North Shore, Macquarie Park, North West, Sydney CBD and Inner City. As such it is expected that most residents of the proposed Crows Nest OSD site will elect to travel to work by public transport due to both the convenience of the metro and the faster journey times expected on the metro network.

Similarly, due to the high provision of public transport and restricted parking space provision, it is expected that workers travelling to the proposed commercial building and hotel building will use public transport to access the site. The hotel is likely to be a business hotel, which will attract guests without access to private vehicles who will likely rely on the public transport network or point to point transport, such as taxis or ride sharing services.

As such, it is expected that most peak hour trips being generated from the OSD site will be by public transport, with a minimal number of trips being taken by car.

However, as noted in Section 4.2.2, a significant number of trips each week are taken within North Sydney LGA that are not commute to work trips. For residents living in the OSD buildings, these will be shopping or social and recreational trips that may reasonably require the use of a private vehicle, either due to the nature of the trip (eg shopping for bulky goods) or due to lack of public transport options to these areas. A mitigation measure to address this issue is provided in Section 7.0.

[1] Cardno, for Department of Planning and Environment, *Strategic Transport Study: St Leonards and Crows Nest Station Precinct*, 2018, pg 96

6.2.3 Parking Assessment

Residents of the OSD are expected to have less desire for car travel compared to suburban style development, and this has been considered as part of the parking assessment for the proposed OSD.

The parking and access provisions for the proposed developed are listed in Table 18. Note that:

- the number of parking spaces assessed is the maximum number proposed as part of the design concept for the OSD, and that the indicative design has a lower number of parking spaces;
- the number of parking spaces listed for Building A North and Building A South are indicative and assume that parking is evenly split between two potential buildings on site A; and
- no parking spaces are provided for non-residential uses in Site A.

The number of car parking spaces, by usage type, for the proposed concept is slightly lower and is distributed as follows:

- Site A residential units: 125 spaces
- Site B hotel: 25 spaces
- Site C commercial: 0 spaces

Table 18: Parking provisions

Building	Existing Parking Spaces	Proposed Parking Spaces	Proposed Accessible Car Spaces	Motorcycle Spaces	Bicycle Spaces	Service Vehicles	Car Lift	Car Share
A South	115	56	6	6	176	1 MRV	1 in, 1 out	0
A North		57	6	18	176	3 SRV	1 in, 1 out	0
B	17	25	0	2	73	1 SRV	1 in, 1 out	0
C	6	0	0	0	0	-	-	0
Total	**138**	**150**		**26**	**198**	**-**	**-**	**0**

Overall, there has been a reduction in the number of parking spaces provided on the OSD sites, when compared to the number of parking spaces provided across all lots prior to station construction commencing. There is also a change in nature of the use of the parking spaces, with the previously existing spaces likely to be used primarily for car trips to work at Crows Nest, while the proposed OSD car spaces will be used for residents travelling from home at Crows Nest. It is also expected that due to the high level of public transport connectivity from the site, week day peak period car trips will be minimised, with residents expected to take advantage of the public transport options available near the site.

For both Site A and Site B, vehicle access to loading docks and to OSD parking areas will be via Clarke Lane, as can be seen in Figure 23. There are no vehicle access or parking arrangements proposed for Site C due to space constraints.

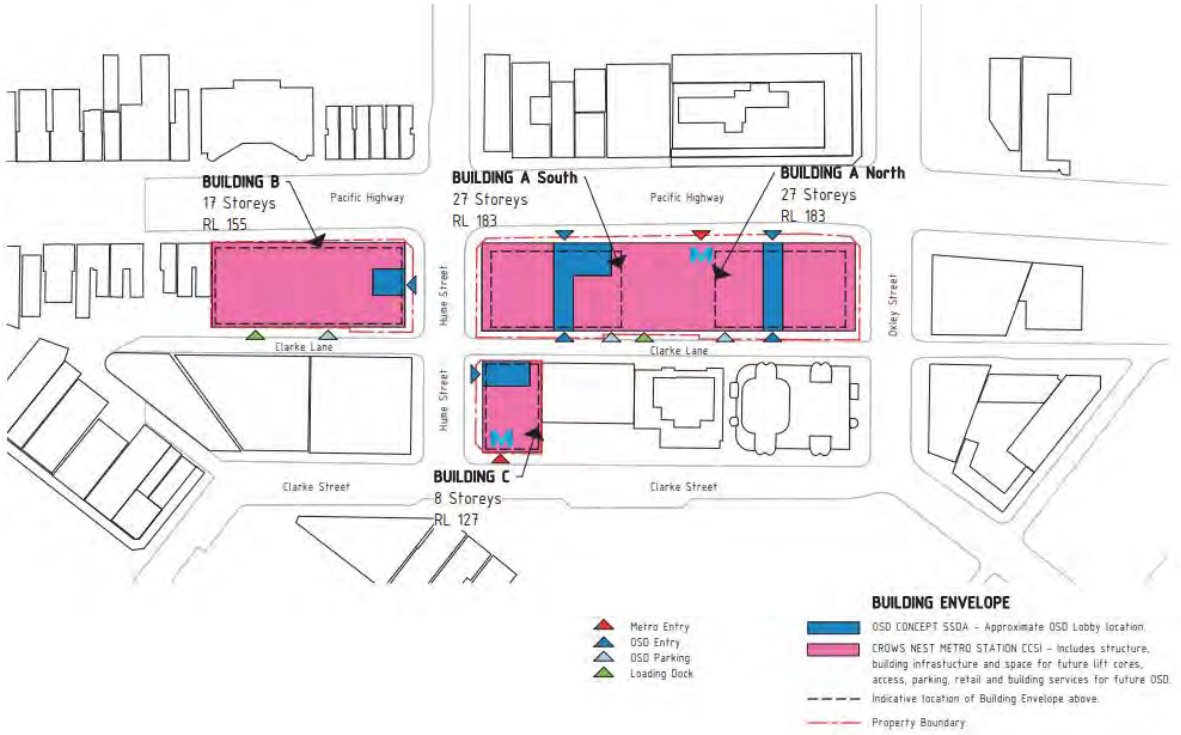

Figure 23: Overview of access arrangements to proposed Crows Nest OSD development.

6.2.3.1 Site A - Residential Buildings

This parking assessment has been undertaken with consideration given to the location of the proposed residential buildings above an operational metro station and with excellent public transport links to numerous employment and retail areas.

Appropriate rates of parking space provision for different apartment sizes have been assumed for the purposes of this assessment. Studio apartments will not be allocated a parking space, while one-bedroom apartments will be allocated 0.25 parking spaces per apartment, two-bedroom apartments will be allocated 0.5 parking spaces per apartment and three-bedroom apartments will be allocated 0.5 parking spaces per apartment. These parking rates have been determined based on a reduced need for car ownership for residents living in the Crows Nest OSD due to its location above a metro station. The purpose of this is to frame the number of parking spaces that will be provided in the OSD residential buildings in a meaningful way to benchmark against nearby developments and against relevant development control plans. This comparison is shown in Figure 24, below.

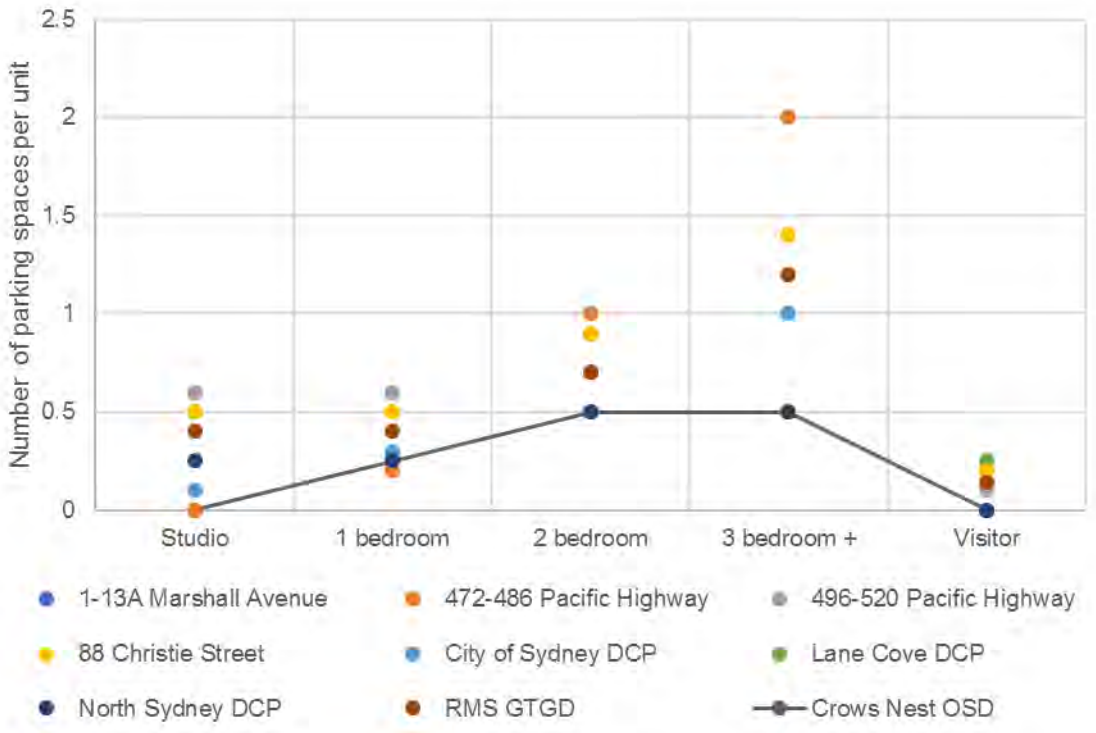

Figure 24: Comparison of parking rates per unit type for nearby developments of similar scale

Sources: Lane Cove Council, North Sydney Council, City of Sydney Council, Roads and Maritime Services, Department of Planning and Environment.

The North Sydney DCP outlines a maximum level of parking spaces to be allocated to units in multi-dwelling residential units in the St Leonards precincts in which the proposed OSD is situated. The maximum number of parking spaces for residential buildings under the North Sydney DCP is presented below in Table 19.

Table 19: Required number of parking spaces for proposed residential buildings per North Sydney DCP.

Dwelling Type	Maximum number of parking spaces as per DCP	Provided parking spaces	Difference in parking spaces from DCP to proposed	Maximum number of motorcycle parking spaces as per DCP	Provided motorcycle spaces	Difference in motorcycle spaces from DCP to proposed
Studio	18	0	-18	2		
One bedroom	19	19	0	2		
Two bedroom	63	63	0	6		
Three bedroom	38	38	0	8		
Total	**138**	**120**	**-18**	**18**	**24**	**+6**

The provision of 0.25 parking spaces per one-bedroom apartment and 0.5 parking spaces per two-bedroom and three-bedroom apartment follows the trend of apartments with a higher number of bedrooms being allocated a higher number of parking spaces. This is also on par with the North Sydney DCP maximum rate of 0.25 parking spaces per one-bedroom apartment and 0.5 parking spaces per two-bedroom and three-bedroom apartment.

The provision of no parking spaces for visitors is in line with the North Sydney DCP. Short stay parking for visitors who drive to the OSD site will be possible utilising nearby public carparks (both free and paid) or limited, paid nearby on-street parking.

It should also be noted that site constraints impact the ability to provide additional parking spaces, including its location over a metro station, which minimises ground floor space for vehicle access and eliminates potential for underground parking. The ability to provide additional parking spaces in the OSD building podium is also restricted given the streetscape requirements for the building, as it would require increases in height, bulk and shadowing

With consideration given to the increased accessibility and public transport provision that will be available once the Crows Nest Station is open, and the requirements of the North Sydney DCP stipulating maximum parking space rates, the above parking rates and number of spaces proposed are considered appropriate for the site.

6.2.3.2 Site B - Hotel Building

Parking rates for hotels in nearby or comparable LGAs are shown in Table 20. LGAs other than North Sydney council have been included for benchmarking purposes.

Table 20: Parking rates for hotels or serviced apartments for nearby LGAs.

LGA	Car Space Rate	Scale	Number of spaces as applied to proposed hotel
North Sydney DCP	0.2	per room (max.)	50
City of Sydney LEP	0.2	per room (max.)	50
Willoughby DCP	0.25	per room	62.5

The proposed parking provision for the hotel development on Site B is presented in Table 21.

Table 21: Effective parking rate for Crows Nest OSD site B.

Crows Nest OSD Site	No. Rooms	Parking Spaces	Effective Rate
Building B	250	25	0.1

As both North Sydney and the City of Sydney councils specify a maximum number of parking spaces for hotels and serviced apartments, the number provided for the hotel is suitable as it is below the maximum number of spaces permitted, and therefore considered suitable for the development.

It is expected that the hotel component operates as a 3-star business-oriented hotel, based on market evaluations completed by Sydney Metro and the strategic location of the hotel adjacent to Crows Nest station. As it is likely to be operated as a business hotel, guests are less likely to require private vehicles for the duration of their stay at the hotel as Sydney Metro will offer high quality direct public transport access to a wide range of business destinations along the Eastern Economic Corridor.

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6.2.3.2.1 Site B – as Commercial Building

Mixed-use parking rates from the North Sydney DCP for Crows Nest are shown in Table 22. Note that these are included for benchmarking purposes and the North Sydney DCP is a guideline document only.

Table 22: Parking rates for St Leonards - Crows Nest.

Land Use Zone	Location	Maximum Parking Rate
B4 – Mixed Use	St Leonards	1 space / 400m^2 non-residential GFA
	Crows Nest	1 space / 60m^2 non-residential GFA

Source: North Sydney DCP, North Sydney Council, 2013, pg B10-3.

The number of parking spaces required on Site B should it be used as a commercial building within the full envelope under the proposed concept is presented in Table 23.

Table 23: Maximum number of parking spaces with Site B used as Commercial building.

Site	Maximum number of parking spaces as per DCP	Provided parking spaces	Difference in parking spaces from DCP to proposed	Maximum number of motorcycle parking spaces as per DCP	Provided motorcycle spaces	Difference in motorcycle spaces from DCP to proposed
B – as commercial	46	25	-21	5	2	-3

As the development control plan includes maximum parking rates for non-residential uses, the provision of a reduced amount of parking spaces is within the guidelines set out for the North Sydney Council area.

Workers travelling to the OSD who are unable to use active or public transport will be able to use nearby, all day parking garages that are established in St Leonards and Crows Nest. A summary of these parking garages is provided in Section 4.4.3.2.

Given the location of the commercial building above the metro station and nearby to other high quality public transport services, as well as availability of off-street parking options nearby, the provision of a reduced amount of parking spaces for workers within Building B if used as commercial land use is considered acceptable.

6.2.3.3 Site C - Commercial Building

No parking is proposed to be provided on Site C, due to the spatial constraints on the small site footprint, and the need to allocate a large amount of street level and underground space to the Crows Nest station entry.

As the development control plan includes maximum parking rates for non-residential uses, the provision of no parking spaces is within the guidelines set out for the North Sydney Council area.

Workers travelling to the OSD who are unable to use active or public transport will be able to use nearby, all day parking garages that are established in St Leonards and Crows Nest. A summary of these parking garages is provided in Section 4.4.3.2.

Given the location of the commercial building above the metro station and nearby to other high quality public transport services, as well as availability of off-street parking options nearby, the provision of no parking spaces for workers within Building C is considered acceptable.

6.2.4 Car Lift Assessment

6.2.4.1 Queuing Analysis

A summary of the expected round-trip time for a car lift in Building A North and South, and Building B is presented below Table 24.

Table 24: Summary of round-trip for car lift in Site A and Site B

Component	Site A Lift (sec)	Site B Lift (sec)
Doors opening	4	4
Vehicle manoeuvring	15	15
Movement of vehicle lift car to required floor	128	80
Door opening	4	4
Manoeuvring vehicle out of lift	15	15
Doors closing	4	4
Movement of lift car back to ground floor.	128	80
Total	**299**	**203**
Cycles per hour	**12**	**18**

The PM peak has been assessed for vehicle queuing as this presents the peak scenario for vehicles arriving at the sites, potentially queuing on Clarke Lane to enter the OSD parking garages.

Under the proposed concept design, it is estimated that 12 vehicles would arrive to enter Site A (either Building A South or Building A North) during the PM peak hour, and 9 vehicles would arrive to enter Building B. Queue length probabilities have been calculated using Steady State Queuing analysis, and are presented in Table 25, below. The queuing analysis for Site A has been treated as one queue due to the nature of the concept proposal for the site.

Table 25: Queue length probabilities for Site A and Site B.

Queue Length (vehicles)	0	1	2	3	4	5	6	7
Site A north	50%	25%	13%	6%	3%	2%	1%	0%
Site B	51%	25%	12%	6%	3%	1%	1%	0%

As shown, it is more likely than not that there would be no vehicles queuing for any of the car lifts during the PM Peak hour for Site B, and equally likely that there would be vehicles queuing or not queuing for Site A. There is a 75 per cent or more probability that only one or no cars would be queuing at both sites during the PM peak hour. There is a negligible chance that the queue would be 7 vehicles or longer in length for either Site A or Site B. Mitigation measures to address any queuing in Clarke Lane are included in Section 7.0.

The car lift speed has been specified by the EIS Architect as operating at 0.15 m/s, which is noted as being at the low end of operating speeds for vehicle lifts. Higher speed options will be investigated as part of the Stage 2 development proposal design process. Any improvements in car lift speeds will improve the servicing rate for queuing vehicles, and therefore increase the probability of reduced car queues forming during peak periods in Clarke Lane.

It should also be noted that this represents a limiting factor for private vehicle trip generation from the site of 42 vehicles per hour, however as noted in Section 6.5.1.1, it is expected that only 22 private vehicle trips will be generated by the site in the AM peak hour, and 20 private vehicle trips will be generated by the site in the PM peak hour.

6.2.4.2 Access

Cars queuing for any of the car lifts located off Clarke Lane will need to pull into the kerbside space on the left (south-western) side of Clarke Lane while queuing.

As shown in Figure 25 and Figure 26, below, vehicles are unable to access the lift from the roll-kerb area adjacent to the car lifts, due to the tight turning circle required from this

location. Vehicles waiting in a kerbside space on Clarke Lane are able to access the car lift, as well as enabling other vehicles to pass.

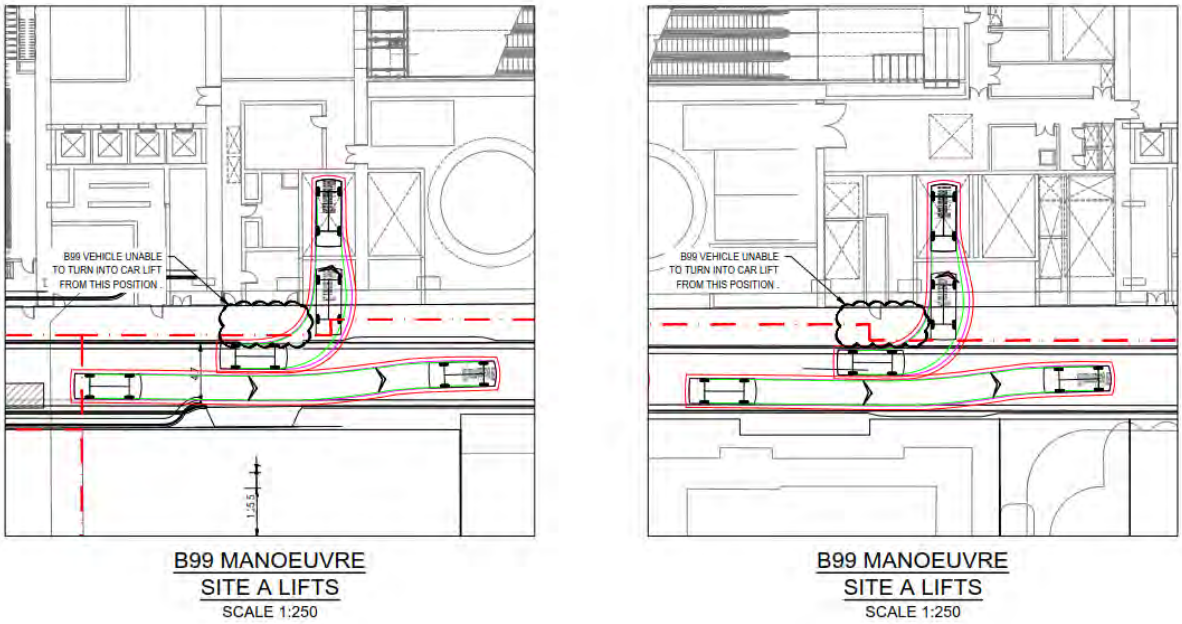

Figure 25: Swept path diagram for vehicles queuing for the car lift for Site A in Clarke Lane, showing that other vehicles are able to maintain through movement while vehicles queue.

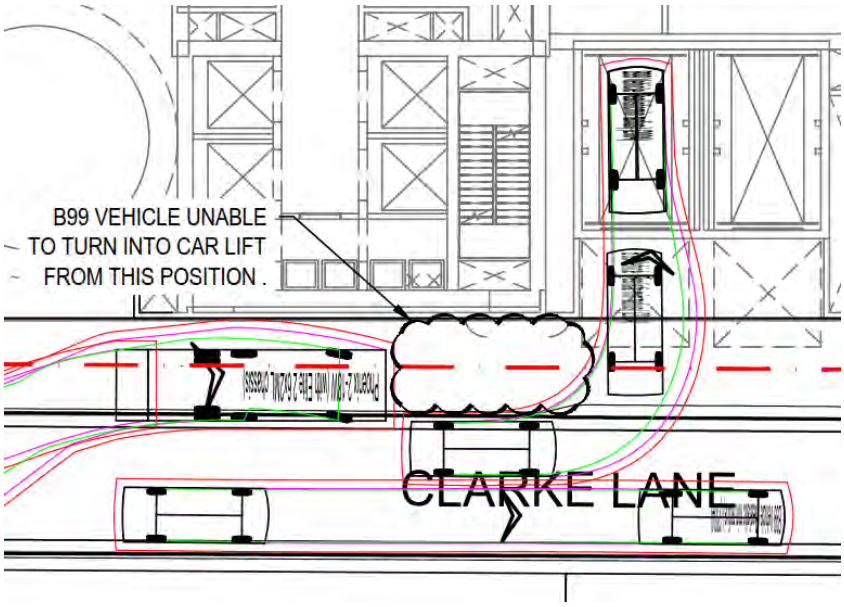

Figure 26: Swept path diagram for vehicles queuing for the car lift for Site B in Clarke Lane, showing that other vehicles can maintain through movement while vehicles queue.

6.3 Bicycle parking and access

The proposed bicycle parking and associated facilities have been assessed against the North Sydney DCP given the location of the OSD within the North Sydney LGA and the high benchmark for cycling facilities that the DCP requires, which encourages the use of cycling as a sustainable mode of transport. Required bicycle facilities from the North Sydney DCP that apply to the location of the proposed OSD are presented below in Table 26.

Table 26: Bicycle parking provision and requirements

Site	Land use	[1]Type	Rate (/unit or /GFA)	No. of units/ GFA	Required Spaces	Proposed spaces
Building A-North	Residential – occupants	Class 1/2	1/ unit	175	175	175
	Residential – visitors	Class 3	0.1/ unit	175	18	18
Building A-South	Residential – occupants	Class 1/2	1/ unit	175	175	175
	Residential – visitors	Class 3	0.1/ unit	175	18	18
Building B	Hotel - guests & visitors	Class 3	0.03/ room	250	20	65
	Hotel - staff	Class 2	0.05/ room	250	8	8
	Hotel – staff EoT facilities[2]	shower & change room	1 shower per 10 secure bike spaces	8	1	TBC – stage 2 design
Building C	Commercial - customers	Class 3	0.0025/ m^2GFA	2,700	7	7
	Commercial - staff	Class 2	0.0067/ m^2GFA	2,700	18	18
	Commercial - staff EoT facilities[2]	shower & change room	1/ 10 lockers	18	2	TBC – stage 2 design

1. Types of bicycle parking are: Class 1 = bicycle lockers; Class 2 = bicycle cage; Class 3 = bicycle racks., as outlined in AS 2890.3

2. Changing/ shower facilities requirements specified in AS 2890.3..

As presented in Table 26, the proposed OSD buildings will provide the required level of cycle parking, in line with the North Sydney DCP 2013 and the requirements of AS 2890.3, via a mixture of caged cycle parking on car parking levels and some residential cycle storage within oversized apartments on Site A (apartments within the proposed indicative design are larger than the minimum size required under SEPP 65 / Apartment Design Guide). Within Site C, cycle parking will be situated on level one, with exact location(s) to be confirmed during the Stage 2 proposal.

The site is situated between the North Sydney CBD and St Leonards CBD, and located along the existing cycle network between North Sydney and St Leonards, with the OSD site located to take advantage of the existing and planned cycleway facilities in Crows Nest. This includes extensions to the cycle network to provide direct separated access to the metro station site.

It is proposed to install a separated cycleway on Hume Street connecting the Nicholson Street cycleway to the Clarke Street cycleway as part of the Crows Nest Station project, to improve access to the station.

The access and egress routes for pedestrians and cyclists to the OSD buildings is shown in Figure 27.

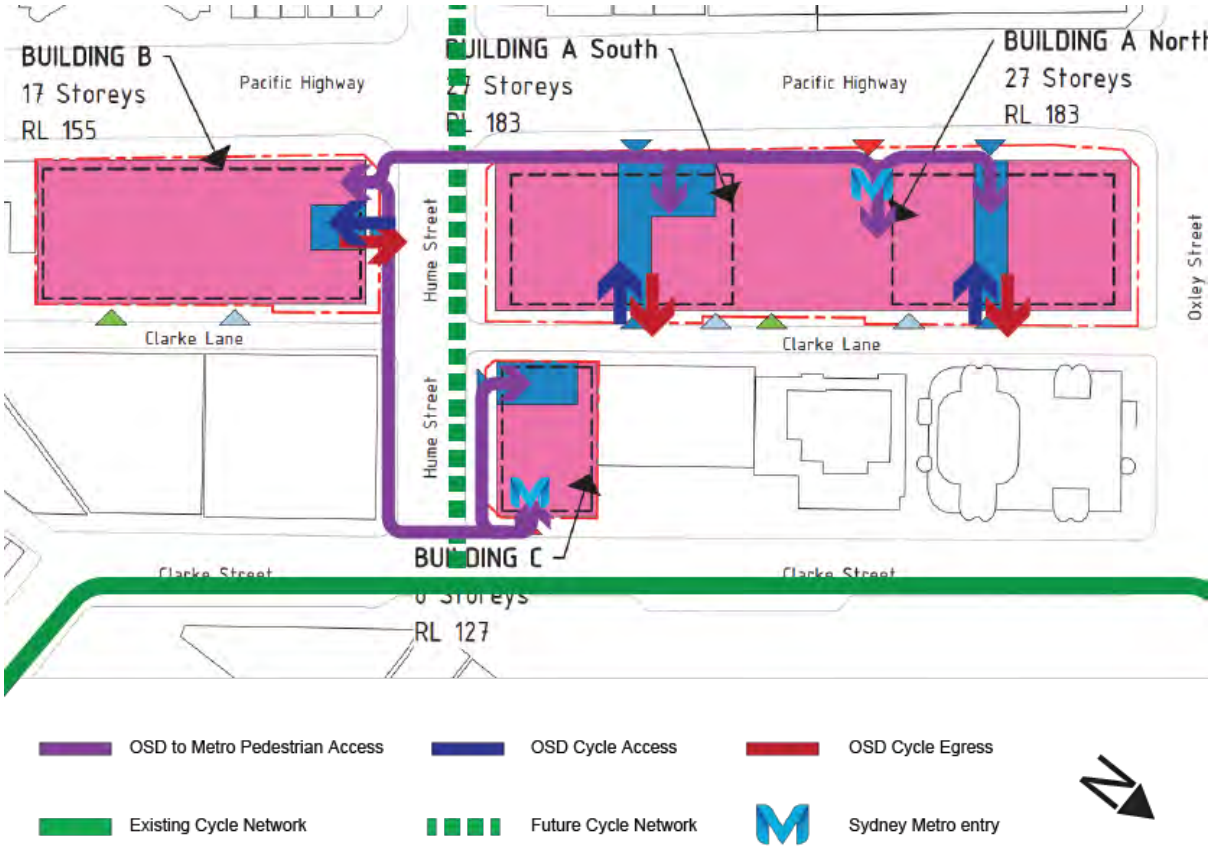

Figure 27: Access and egress routes to OSD for cyclists and pedestrians.

Cyclists will be able to access the OSD buildings and the cycle parking areas via the following means:

- Building A North: Pacific Highway OSD entry or Clarke Lane OSD entry
- Building A South: Pacific Highway OSD entry or Clarke Lane OSD entry
- Building B: Hume Street OSD entry
- Building C: Hume Street OSD entry

These entry points enable safe access from the local cycle network via the proposed cycleway on Hume Street. For cyclists accessing buildings on site A, this will involve a short journey on Clarke Lane, which will likely carry very low traffic volumes.

Once inside the respective OSD buildings, elevators will provide access to the parking levels of Buildings A North, A South and B, where cyclists will be able to store their bike.

Cyclist egress from the buildings to the cycle network will be as follows:

- Building A North: Pacific Highway OSD entry or Clarke Lane OSD entry
- Building A South: Pacific Highway OSD entry or Clarke Lane OSD entry
    - Note for Building A North and Building A South, cyclists can also walk their bike to Hume Street from either entry and join the separated cycle network at this location.
- Building B: Hume Street OSD entry
- Building C: Hume Street OSD entry

Clarke Lane is proposed to be reverted to one way northbound once construction of the Metro and OSD is complete. Cyclists exiting from Building A North and South will be able to cycle north along Clarke Lane to Oxley Street and then to access the cycle network on Clarke Street. Cyclists may also chose to walk their bikes southbound along Clarke Lane to the Hume Street cycle path.

These access provisions are considered acceptable in providing safe access to the future cycle network around the Crows Nest OSD and are likely to contribute to a mode shift to more sustainable transport options such as cycling.

6.4 Service vehicle access and loading dock provision

6.4.1 Service vehicle access provision

Table 27 lists the proposed provisions to access the various buildings of the Crows Nest OSD for service vehicles.

Table 27: Proposed Service vehicle provisions

Site	Land uses to be served	Location	Loading dock access & management
Site A (Building A-North and Building A-South)	Shared Residential and Metro	• Loading Dock: ○ 1 medium rigid vehicle ○ 3 small rigid vehicles ○ vehicle turntable for access to spaces • 1 medium rigid vehicle on rolled kerb in Clarke Lane	• Shared loading dock for residential (Building A-North and A-South) and metro use. • Access loading dock and loading zone off Clarke Lane (one way northbound) • Private refuse collection via rolled kerb space in Clarke Lane
Site B/ Building B	Hotel/ Conference facilities or Commercial	• Loading Dock: ○ 2 Small rigid vehicle • 1 medium rigid vehicle on rolled kerb in Clarke Lane	• Access loading dock via Clarke Lane (one way northbound) • Private refuse collection via driveway space in Clarke Lane
Site C/ Building C	Commercial	• Lay-by in Clarke Lane for waste collection	• Deliveries and loading will be undertaken via Site A dock • Private refuse collection from Clarke Lane

Swept path analyses for each of the vehicle type and loading locations described above are listed in Appendix B. Note that these swept path analyses will be updated prior to the final report being issued due to changes in the ground floor architectural plans.

As per the Dock Activity Assessment (DAA) for Site A, prepared by the Sydney Coordination Office (SCO), it is expected that the peak number of vehicles using the docks for Site A/Site C will be four vehicles per hour. A DAA for Site B as a commercial building, also prepared by SCO, shows that the peak number of vehicles using the Site B dock will be 19 between 9am and 12pm.

Long stay trade services vehicles will utilise up to 2 spaces in the garages of each of the buildings across the OSD site. In the case of the indicative design developed, these will be accommodated within the number of parking spaces indicatively proposed.

6.4.2 Site A (Residential/ Community) Servicing assessment

6.4.2.1 Requirements

The forecast dock activity on a typical weekday, calculated in the DAA prepared by SCO, for the indicative design proposed for the Crows Nest Station OSD for Site A and Site C is presented in Figure 28 and Figure 29, below.

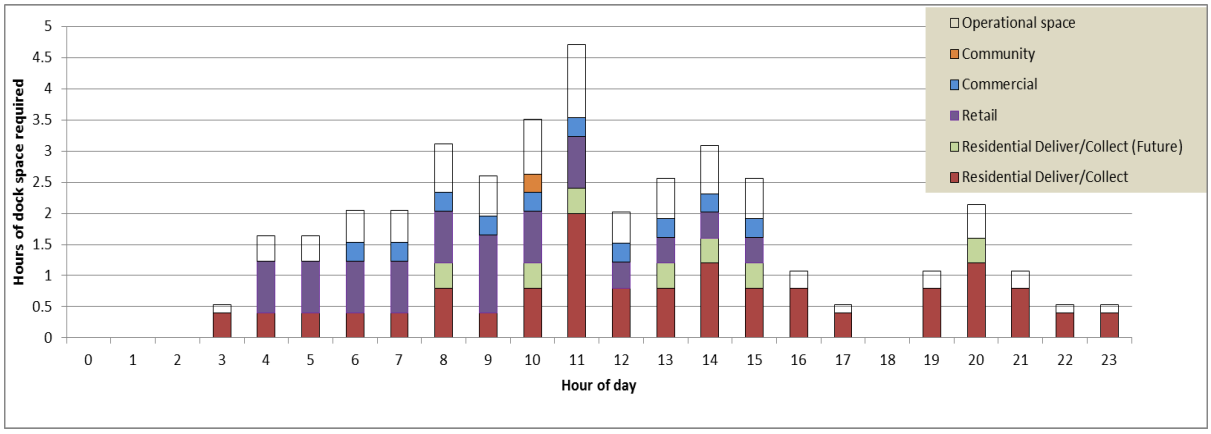

Figure 28: Forecast for number of dock space for residential community and commercial delivery activity.

Source: *Crows Nest Dock Activity Assessment,* Sydney Coordination Office, 2018

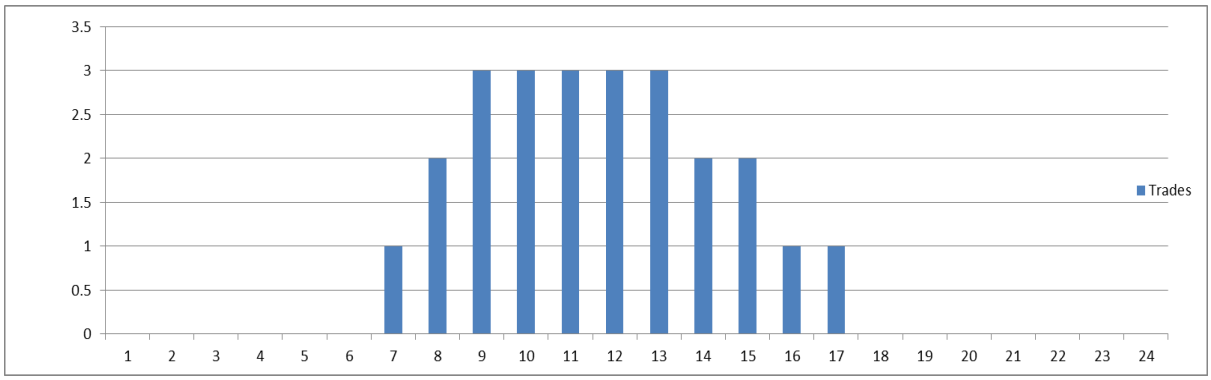

Figure 29: Forecast of trades vehicle parking requirement (long dwell time).

Source: *Crows Nest Dock Activity Assessment*, Sydney Coordination Office, 2018

The DAA concludes:

- A loading dock of 4 spaces (1 MRV and 3 SRV) can accommodate the demands of Building A for deliveries with minor queuing potential at the peak time.
- An additional provision will need to be made for trades and service vehicles requiring a longer dwell time.
- A Loading Dock Management Plan with a booking system is to be considered as part of the building operation.

These factors have been considered in the assessment of the proposed loading dock and service vehicle facilities as discussed below, and constitute the assumed servicing requirements for each of the loading docks.

Additionally, this assessment does not include consideration for loading and servicing requirements for the retail spaces being constructed as part of the Crows Nest station podium building.

6.4.2.2 Provisions & Mitigations

Under the proposed design for Site A, the number of spaces provided in the loading dock is considered generally suitable, however there may be occasional queuing due to fluctuations in demand, particularly during peak periods.

To accommodate this, space has been provided off-carriageway adjacent to the dock driveways in Clarke Lane, through the installation of a rolled kerb, where queuing SRVs and MRVs can wait and allow vehicles to pass along Clarke Lane. This space will additionally enable waste removal trucks to collect rubbish from Site A without entering the loading dock. This arrangement enables through traffic on Clarke Lane under various servicing demand scenarios, minimising the impact on other traffic. The location of this external waiting area for site A is shown in Figure 30, below.

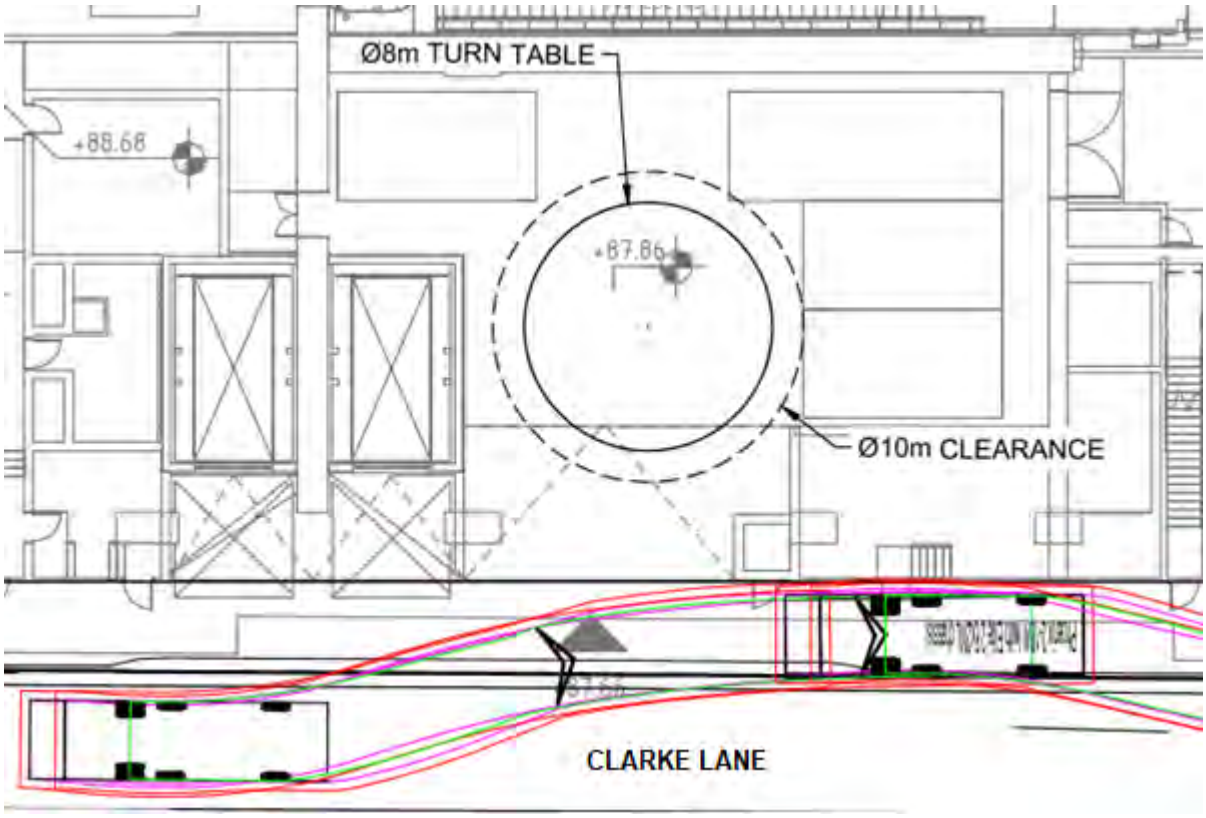

Figure 30: Queuing space in Clarke Lane for SRVs and MRVs waiting to enter the Building A loading dock.

The DAA notes that tradespersons visiting Site A for maintenance and longer-stay servicing are not included in the activity assessment provided. As these service vehicles are more likely to require longer term parking, parking spaces within the general car garage of Buildings A North and A South should be allocated to trade vehicles. These spaces would be managed by a Dock Manager.

The internal arrangement of the loading dock in Site A has been shown to accommodate MRVs in allocated space off the loading dock turntable, as can be seen in Figure 31. Additional figures showing swept paths for design vehicles accessing each of the allocated spaces are also presented in Appendix B.

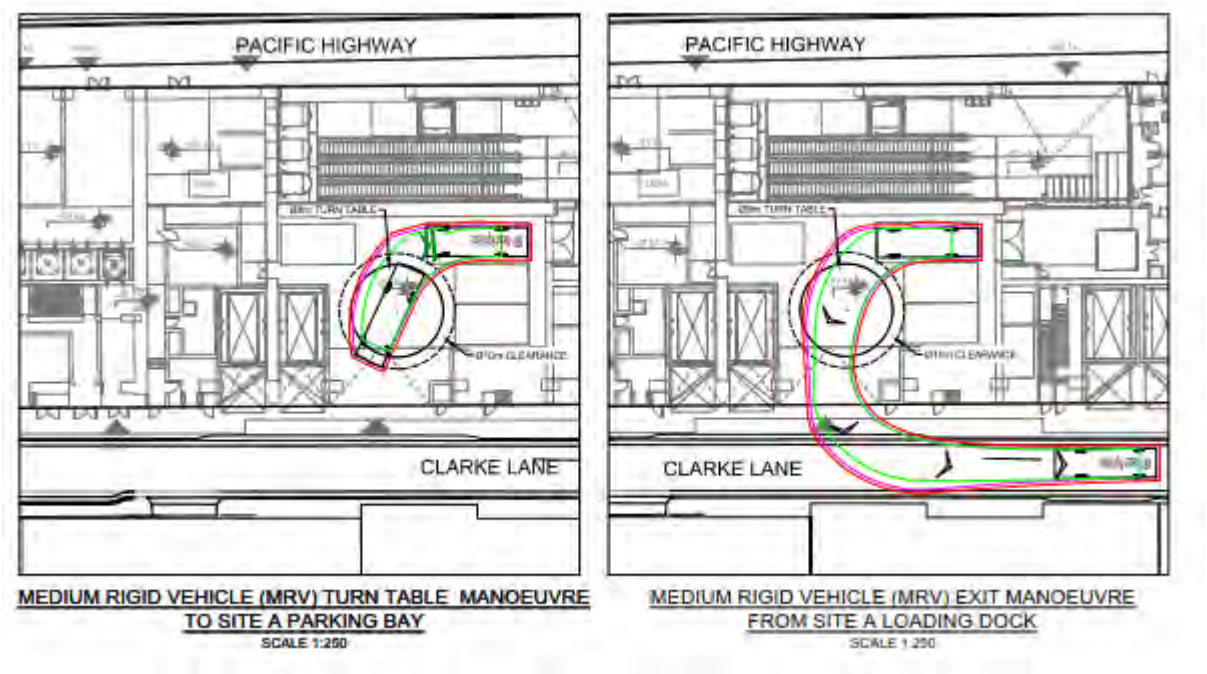

Figure 31: Swept paths for MRVs accessing the allocated space loading dock in Site A.

It should be noted that due to the construction of the station and OSD on Site A, the number of service access points on Clarke Lane is reduced, compared to the pre-existing scenario, also reducing the number of conflict points between oncoming traffic and other vehicles access service points in Clarke Lane.

Finally, retail spaces within the podium for Crows Nest station will need to have their delivery and servicing requirements considered. Delivery and service hours for these stores may be addressed through on-street parking, by restricting delivery times and location of delivery. As these matters are flexible, details around this will need to be considered by the Dock Manager or Building Concierge once the site is operational. This could also include enabling delivery and service vehicles for these retail spaces to use the Site A loading dock.

6.4.3 Site B (Commercial) Servicing assessment

6.4.3.1 Requirements

The number of dock spaces for Site B is considered acceptable for the amount of dock activity that is likely to be generated as per the DAA prepared by SCO. The DAA, which was completed for an assumed use of Commercial (considered the worst-case scenario with regard to servicing), shows that there is likely to be approximately 55 service vehicle movements per day (not including trades vehicles), with a peak of 19 vehicles between 9am and 12pm. This translates to just under six hours of dock space required on site, which is possible using the two internal dock spaces and one external loading space off Clarke Lane.

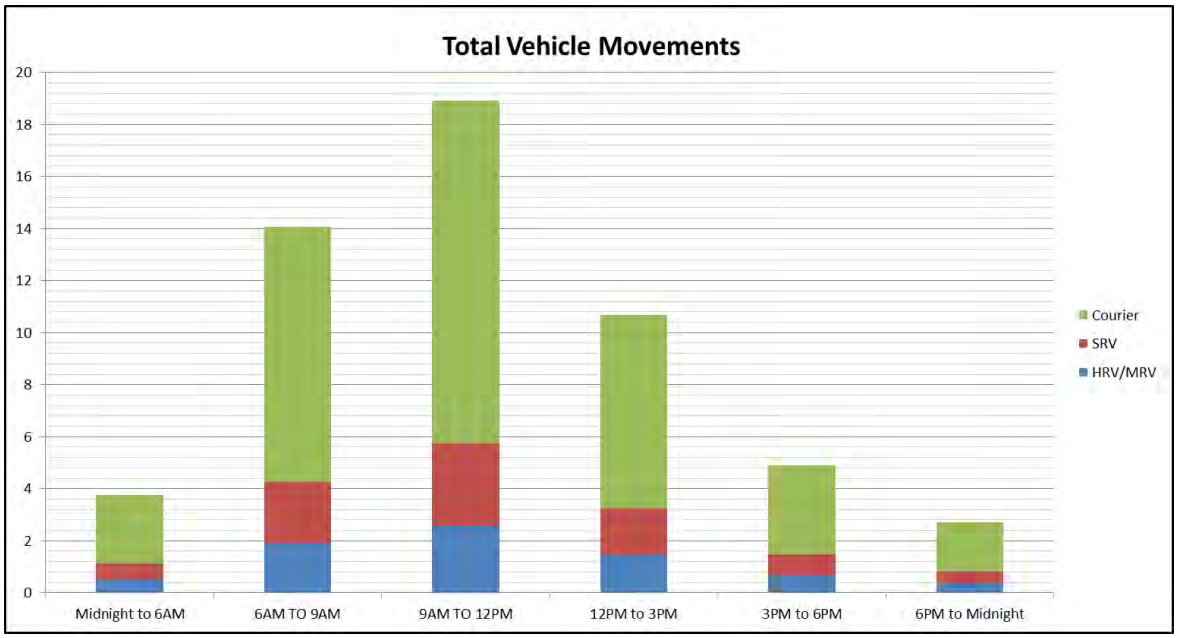

Figure 32: Forecast number of vehicle movements for commercial delivery activity for Site B.

Source: *Crows Nest Dock Activity Assessment Site B,* Sydney Coordination Office, 2018

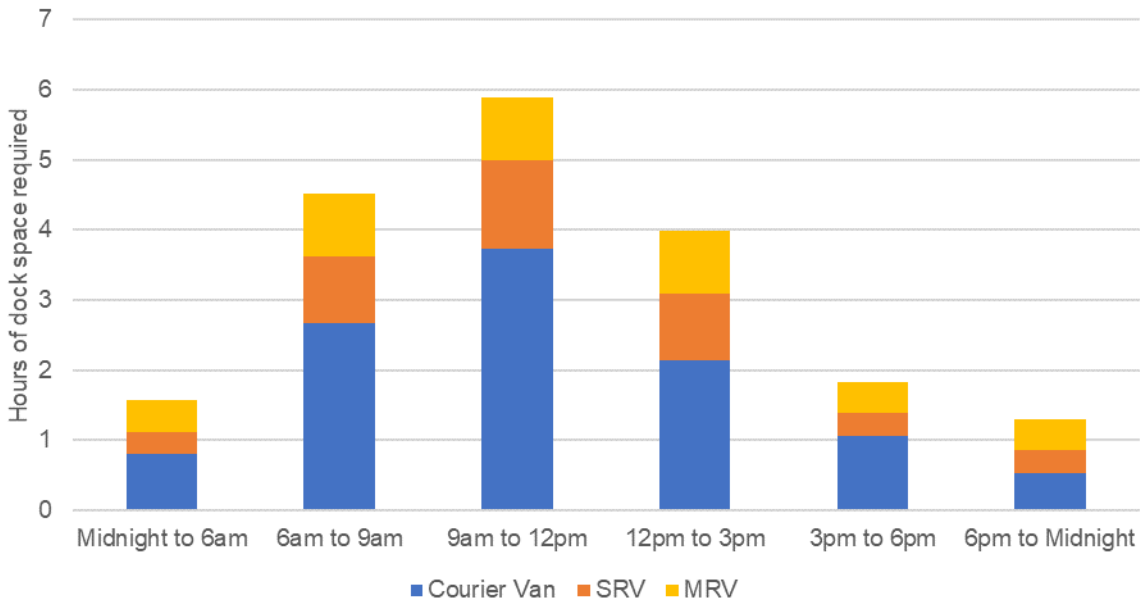

Figure 33: Forecast number of dock spaces required for commercial delivery activity for Site B.

Source: *Crows Nest Dock Activity Assessment Site B,* Sydney Coordination Office, 2018

The DAA for Site B concludes that:

- Any provision of less than two SRV spaces and one MRV space will be insufficient for the site. Providing no MRV space and only one SRV space will result in queuing during peak periods.
- An additional provision will need to be made for trades and service vehicles requiring a longer dwell time.
- A Loading Dock Management Plan with a booking system is to be considered as part of the building operation.

These factors have been considered in the assessment of the proposed loading dock and service vehicle facilities as discussed below and constitute the assumed servicing requirements for each of the loading docks.

Additionally, this assessment does not include consideration for loading and servicing requirements for Site B if used as a Hotel.

6.4.3.2 Provisions & Mitigations

Under the proposed design for Site B, the number of spaces provided in the loading dock is considered generally suitable, however there may be occasional queuing due to fluctuations in demand, particularly during peak periods.

To accommodate this, space has been provided off-carriageway adjacent to the dock driveway in Clarke Lane, through the installation of a rolled kerb, where queuing SRVs can

wait and allow vehicles to pass along Clarke Lane. This space will additionally enable waste removal trucks to collect waste from Site B without entering the loading dock, and also enable MRVs to deliver to Site B, neither of which are able to enter the dock due to spatial constraints. This arrangement enables through traffic on Clarke Lane under various servicing demand scenarios, minimising the impact on other traffic.

The location of this external waiting area for Site B is shown in Figure 34, below.

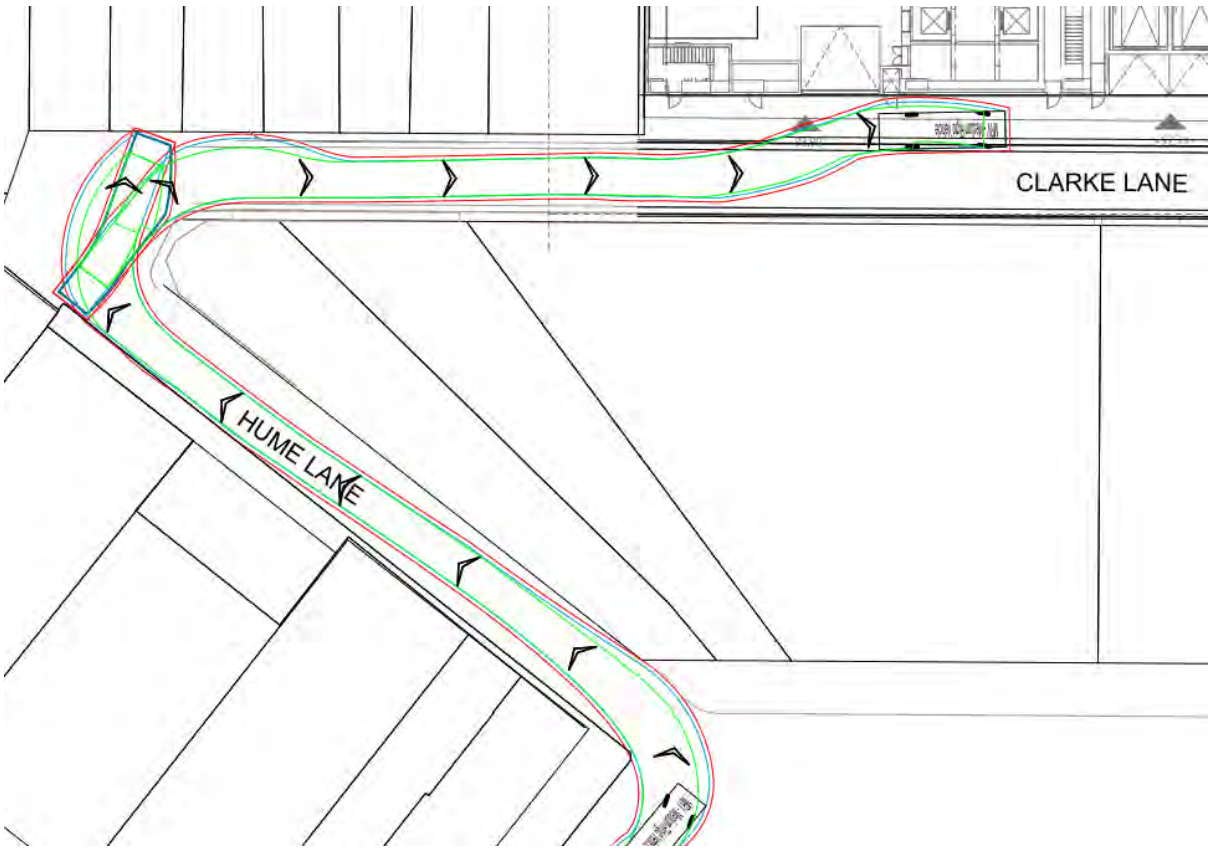

Figure 34: Queuing space in Clarke Lane for SRVs and MRVs waiting to enter the Site B loading dock.

Note: MRVs may be required to make a 3-point turn to pass the Hume Lane and Clarke Lane corner.

The sharp corner from Hume Lane to Clarke Lane may restrict movement of longer vehicles trying to access the Site B loading dock. Swept path analyses showing MRV and waste removal vehicles successfully navigating this corner are presented in Appendix B. It should be noted that MRVs may have to complete a three-point turn should a single manoeuvre around the corner be unsuccessful.

The DAA notes that tradespersons visiting Site B for maintenance and longer-stay servicing are not included in the activity assessment provided. As these service vehicles are more

likely to require longer term parking, parking spaces within the general car garage of Site B should be allocated to trade vehicles. These spaces would be managed by a Dock Manager.

To minimise the amount of potential queuing on Clarke Lane, a dock management system will need to be in place while the dock is operational. This should be managed by an appointed dock manager or building concierge. A Preliminary Delivery Service Plan outlining such an operation for the proposed OSD is contained in Appendix C.

The internal arrangement of the loading dock in Site B has been shown to accommodate vehicles in each of the spaces, as can be seen in Figure 35. These figures are also presented in Appendix B.

Figure 35: Swept path analysis for vehicles accessing and egressing the loading dock in Site B.

It should be noted that due to the construction of the station and OSD on Site B, the number of service access points on Clarke Lane is reduced, compared to the pre-demolition scenario, also reducing the number of conflict points between oncoming traffic and other vehicles access service points in Clarke Lane.

6.4.4 Site C (Commercial) Servicing assessment

Deliveries and service vehicles accessing Site C will be able to use the Site A loading dock for servicing requirements in Site C, and as such the Site A DAA detailed in Section 6.2.3.1 incorporates Site C servicing requirements. Utilisation of this dock is to be via the Site A dock management system.

Longer stay services vehicles for tradespersons will be managed by the Dock Manager within Site A.

A lay-by will be provided in Clarke Lane to enable waste removal vehicles to stop on Clarke Lane adjacent to Site C and access the waste room for Building C. This will enable vehicles to continue to pass in Clarke Lane, as shown in Figure 36. Waste removal vehicles and MRV accessing the Site A loading dock will need to be managed to ensure that these vehicles do not access the dock at the same time as Site C waste collection, and this will be detailed in the Loading Dock Management Plan. Note that these figures are also provided in Appendix B.

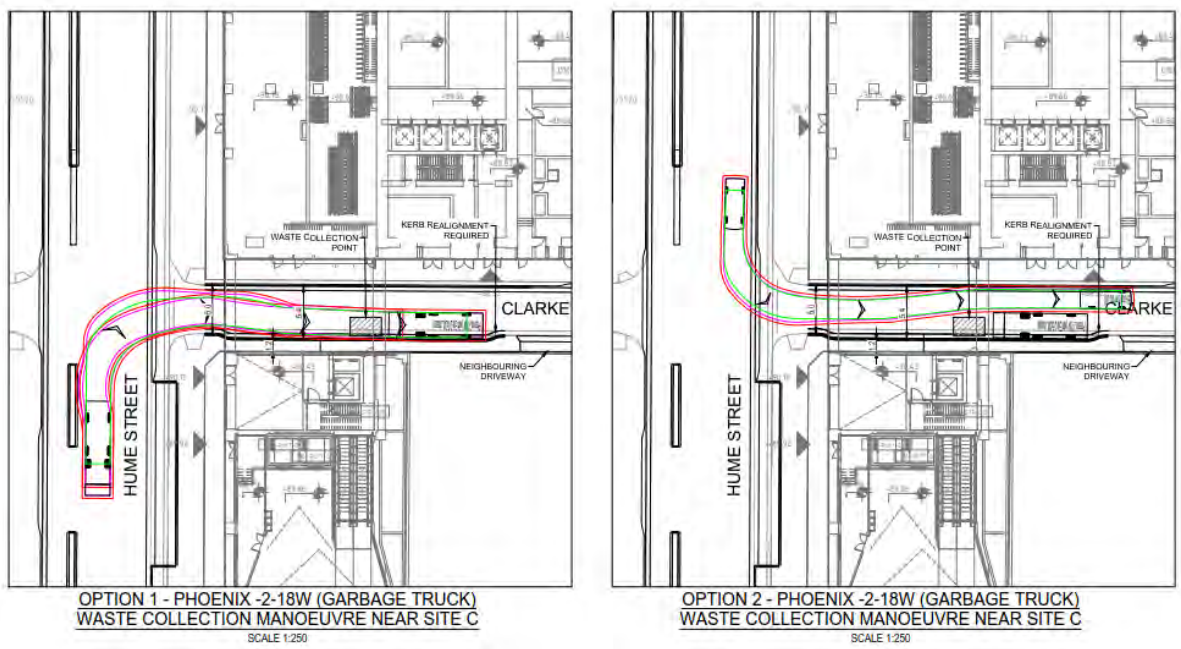

Figure 36: Site C waste removal

6.5 Traffic assessment

6.5.1 Traffic generation

6.5.1.1 Passenger vehicles

The impact of passenger vehicle trip generation will be limited by the number of parking spaces provided in the proposed OSD buildings. A comparison of existing and future parking provisions is presented in Table 28.

Table 28: Existing and future parking provisions.

Site	Existing Parking Spaces	Proposed Maximum no. Parking Spaces
A	115	125
B	17	25
C	6	0
Total	**138**	**150**

Vehicle trip generation rates for the AM and PM peak hours were estimated for the proposed OSD buildings based on the number of parking spaces proposed. Given the highly accessible location of the OSD, directly above Crows Nest Station, it is anticipated that the majority of AM and PM peak period trips will not be undertaken by car.

Using the RMS *Guide to Traffic Generating Development* (GTGD), a car space trip generation rate of 0.1 for high density residential buildings was adopted for AM peak trip generation. A trip rate of 0.38 was adopted for the hotel, assuming all trips arriving by private vehicle were hotel staff and therefore represent office-block style of trip generation. The trip generation rate for the hotel was based on the data provided for in the 2014 update of GTGD, which presented the number of private vehicle trips generated compared to number of parking spaces provided for an office in North Sydney.

The vehicle trip generation estimates for the OSD site are presented in Table 29.

Table 29: Estimate traffic generated in the AM and PM peak hours and Daily for the proposed OSD buildings based on number of parking spaces provided.

Building	Spaces	Peak 1 Hr Generation	AM			PM			Daily		
			Total	In	Out	Total	In	Out	Total	In	Out
A North	62	6.2	**6**	1	5	**6**	5	1	**35**	17	17
A South	63	6.3	**6**	1	5	**6**	5	1	**35**	18	18
B	25	10	**10**	9	1	**9**	1	8	**71**	36	36
		Total	**22**	**11**	**11**	**20**	**10**	**10**	**141**	**71**	**71**

Trip generation rates were also estimated for the AM and PM peak hours for the proposed OSD buildings based on land use and scale. The 3.5 hour to 1-hour peak conversion rate and AM to PM peak conversion rates used were the same as those used for the park space trip generation estimate. The trip generation estimates are presented in Table 30.

Table 30: Estimate traffic generated in the AM and PM peak hours for the proposed OSD buildings based on land use and scale.

Building	Land Use	Scale (unit,sqm GFA)	AM				PM				Daily			
			Rate	Total	In	Out	Rate	Total	In	Out	Rate	Total	In	Out
A North	Resi.	174	0.14	24	5	19	0.07	12	10	2	0.77	134	67	67
A South	Resi.	174	0.14	24	22	2	0.07	12	1	11	0.77	134	67	67
B	Hotel	250	0.05	13	6	6	0.05	13	6	6	0.05	13	6	6
C	Com.	2160	0.0017	5	4	0	0.0014	4	0	3	0.0123	33	17	17
			Total	**61**	**33**	**28**	**Total**	**37**	**17**	**20**	**Total**	**280**	**140**	**140**

Source: RMS Guide to Traffic Generating Development, 2013.

The total number of AM and PM trips generated for the proposed OSD sites in both estimates is lower than that estimated for the pre-existing land uses on the OSD sites prior to demolition commencing for the Crows Nest Station as noted in Section 4.4.1.1. Under the pre-existing conditions for the buildings on the Crows Nest OSD sites prior to demolition commencing, it was estimated that there were approximately 131 trips in the AM peak and 81 trips in the PM peak. This compares to an estimated maximum of 61 trips in the AM peak and 37 trips in the PM peak for the proposed concept OSD development, when determining vehicle trip generation rates based on generic trip generation rates.

If consideration is given to the location of the OSD above a metro station, which is likely to encourage more residents and workers of the proposed OSD to utilise public transport for their commute, as well as the restriction on the provision of parking spaces for residents and workers of the OSD buildings, the number of trips generated per parking space should be adopted for this assessment. This means that the site is likely to generate 22 vehicle trips in the AM peak and 20 vehicle trips in the PM peak.

Future traffic generation for the proposed Crows Nest OSD is expected to be lower than the existing site conditions, due to:

- Estimated trip generation rates assuming conservatively that all parking spaces are generating trips in the AM peak periods;
- The proposed level of parking over the three sites being less than the pre-demolition level of car parking. Therefore, the vehicular trip generation for the proposed development will be less than that generated by the pre-demolition uses on the sites;
- A significant increase in accessibility to the site with the introduction on the Metro, improved cycle connectivity, in addition to existing train and bus services will promote a greater use of public transport and active travel modes;

- A change in land uses from retail and bulky goods to predominantly residential use, which has an associated lower turnover of vehicles associated with this type of land use.

As such no adverse traffic impacts are expected on the local road network as a result of the Crows Nest OSD development.

6.5.1.1.1 Site B as Commercial Building

As part of this concept proposal, approval is also being sought for Site B to be operated alternatively as a commercial building within the same envelope as for the hotel proposal.

The number of trips generated with site B used as a commercial building is summarised by land use and scale in Table 31, and by number of parking spaces provided in Table 32.

Table 31: Estimated vehicle trips generated with Site B used as Commercial building based on land use and scale.

Building	Land Use	Scale (unit,sqm NLA)	AM				PM				Daily			
			Rate	Total	In	Out	Rate	Total	In	Out	Rate	Total	In	Out
B	Com.	18300	0.0017	31	28	3	0.0014	26	3	23	0.0123	225	203	23
Total with B as Commercial				**84**	**59**	**25**		**54**	**14**	**40**		**526**	**353**	**173**

Source: RMS Guide to Traffic Generating Development, 2013.

Table 32: Estimated trip generation for Site B used as Commercial building based on number of parking spaces provided.

Building	Spaces	Peak 1 Hr Generation	AM			PM			Daily		
			Total	In	Out	Total	In	Out	Total	In	Out
B (as Commercial)	25	10	10	2	8	9	7	2	71	36	36
Total with B as Commercial			**22**	**4**	**18**	**20**	**16**	**4**	**141**	**71**	**71**

Source: RMS Guide to Traffic Generating Development, 2013.

The total number of trips generated with Building B used as a Commercial building is still lower than the existing number of trips estimated to be generated on site during the morning peak, regardless of whether estimated by number of parking spaces provided, or by land use and scale. It should be noted that assessing by land use and scale coincidentally represents a parking space utilisation rate of 1.0, and therefore the maximum number of trips generated by the proposed concept for Site B. However, it is not expected that this number of trips will be generated in the morning peak for site B due to the excellent public transport connectivity for the site.

6.5.1.2 Service Vehicle Traffic

Demolition of the pre-existing buildings on the Crows Nest Station site occurred prior to the traffic assessment taking place and pre-demolition service vehicle data was not recorded prior to demolition.

However, it is noted that under pre-existing conditions there were 32 service vehicle access points along Clarke Lane, 10 being service vehicle access points (such as loading docks), that were located within all three Crows Nest Station sites.

A number of the retail spaces with loading spaces on Clarke Lane were bulky goods and furniture stores, which were likely to have a high turnover of MRVs accessing these sites to deliver and receive bulky items.

SCO has prepared a DAA for the indicative design proposed for the Crows Nest Station OSD, and the forecast dock activity on a typical weekday for Site A is presented in Figure 28.

The assessment estimates that there will be consistent activity throughout the day, with peak activity occurring between 11am and 12pm.

SCO has also prepared a DAA for the proposed concept commercial building on Site B, and the forecast dock activity for the concept commercial building is shown in Figure 32.

The assessment estimates that there will be a peak in deliveries between 9am and 12pm, reducing to a minimal amount during evening periods.

The expected frequency of removalists using the dock for Site A is an average of 1.74 per week. This is based on average changes in residential address for people living in North Sydney LGA over a five-year period, as shown in Table 33.

Table 33: Assumed frequency of removalists using Site A loading dock each week.

Proportion of residents who have moved in last 5 years	63%
Proportion of residents who have not moved in last 5 years	37%
Average percent of residents relocating each year in five-year period	12.58%
Number of Apartments in proposed concept	360
Expected number of residents moving to and from Crows Nest OSD each year	90.6
Expected average number of removalists using Site A dock each week	1.74

Source: id Profile, 2018. Accessed at https://profile.id.com.au/north-sydney on 18 September 2018.

Given the size of the Site A and Site B loading docks, a formalised management system will need to be established through the building owner or ownership corporation to manage dock usage and minimise queuing in Clarke Lane.

6.5.1.3 Intersection Performance

As the traffic generated by the proposed development is estimated to be lower than previously existing development on the OSD site, it can be assumed intersection performance at the following intersections will not be negatively impacted by the proposed development:

- Pacific Highway / Oxley Street
- Pacific Highway / Hume Street
- Pacific Highway / Falcon Street / Shirley Road

6.5.2 Cumulative traffic impact

The EIS document for Sydney Metro Chatswood to Sydenham identified that Crows Nest station will not attract any park and ride trips, and therefore it is expected that the impact on traffic congestion to the road network due to the metro station will be negligible. It also identified that future land use changes and growth will be heavily tied to workers and residents using the Metro station to access their workplaces and homes. As such the impact on intersection performance by vehicle journeys to work will similarly be minimal.

However, it is expected that 7% of journeys to Crows Nest station will be kiss and ride trips, which will have a minor impact on intersection performance around Crows Nest station, however these trips are distinct and separate from trips generated by the OSD buildings.

Additionally, St Leonards-Crows Nest has been identified as a priority growth precinct by the Department of Planning and Environment, and as such the DPE is supporting rezoning proposals for the area around the Crows Nest Station to increase residential dwelling densities. These planning proposals are likely to yield significant developments that will need to be considered together in order to understand the cumulative impact high density residential development will have on the local transport network near the Crows Nest Station up to 2036.

Identified major developments in the St Leonards-Crows Nest area that are either under construction or are a credible development proposal are presented in Table 34.

Table 34: Sample of credible development proposals or developments under construction in St Leonards-Crows Nest.

Address	Land Use & Scale	Parking Spaces	Bicycle Spaces	AM Peak trips generated	PM Peak trips generated	Increase on previous traffic generation
472-494 Pacific Highway	535 residential apartments, retail and commercial space	663	284	148 vph	186 vph	Yes
496-498, 500-520 Pacific Highway	429 residential apartments, retail and commercial space	492 (9 car share)	230	180 vph	140 vph	Unknown
88 Christie Street	654 residential apartments, 19,297m^2 office space, retail spaces	1,245 total (316 public parking spaces)	563	325 vph	525 vph	Unknown
1-13A Marshall Street	269 residential apartments	345 (1 car share)	104	39 vph	20 vph	Unknown

Source: North Sydney Council, Lane Cove Council.

In addition to the impact of nearby developments, it is expected that Western Harbour Tunnel / Beaches Link will have an impact on traffic volumes and flows on Falcon Street, particularly at the intersection of Pacific Highway and Falcon Street.

A state significant infrastructure application (SSIA) has been lodged with the Department of Planning and Environment for the Western Harbour Tunnel and Beach Link (WHTBL) project.

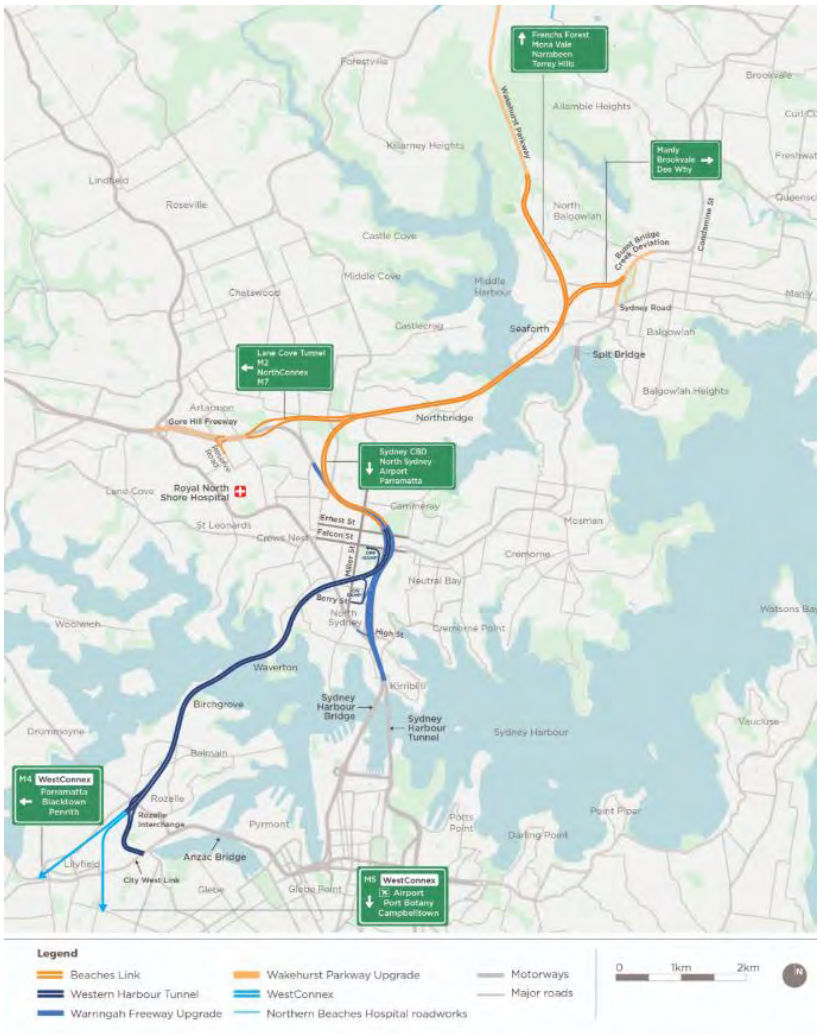

Figure 37: Western Harbour Tunnel and Beaches Link Summary.

Source: Western Harbour Tunnel and Beaches Link, Roads and Maritime Services, 2018.

The project in this application highlights that the 'Western Harbour Tunnel will connect to Westconnex at the Rozelle Interchange, cross under Sydney Harbour between the Birchgrove and Waverton areas and connect with the Warringah Freeway at North Sydney'. The Beaches Link is a tunnel, which will connect the Warringah Freeway, cross under Middle Harbour and join with the Burnt Bridge Creek Deviation at Balgowlah and the Wakehurst Parkway. The project description also highlights that it will improve 'east-west connectivity' with links to the Lane Cove Tunnel and M2 Motorway via a Gore Hill Freeway Extension.

The key objectives of the Western Harbour Tunnel and Beaches Link project are to:

- Improve Northern Beaches public transport

- Future-proof Sydney's transport to meet population and growth challenges
- Provide a 'Step change' for public transport for the Northern Beaches and Mosman
- Deliver a new crossing of Sydney Harbour to make Sydney's busiest transport corridor shock-proof
- Cut congestion across northern Sydney and the Sydney CBD
- Better access to jobs, education and community services for northern Sydney
- Provide better east-west, north-south connectivity
- Reduce rat-running on local community roads.

Based on the project objectives, it appears that the purpose of the WHTBL project is to reduce traffic on local roads, help manage congestion through strategic road connections, promote public transport usage and provide additional capacity to help accommodate planned growth. Based on these clear project objectives and known network pinch points around North Sydney CBD, it is expected that any traffic growth along the arterial road network surrounding the site would be mitigated by the construction of the WHTBL.

A detailed assessment of the cumulative impacts of WHTBL, particularly during construction stages, will be completed during the Stage 2 assessment for the OSD, once further details around construction timelines for WHTBL and Crows Nest Station OSD are known.

6.6 Pedestrian Assessment

Pedestrian movement into and out of the OSD buildings has been assessed on a worst-case scenario where all potential trips by residents and workers are taken using pedestrian access to the building and with no access to the building via private vehicle and the proposed parking garages. Assumptions which fed into the number of trips generated by the OSD are presented in Table 35 and Table 36. Other assumptions made for the assessment were:

- 60% of residents of the OSD are employed on a full-time basis[2].
- 60% of hotel staff arrive to work in the AM peak
- All hotel rooms are occupied by 1 guest and all guests depart the hotel by foot during the morning peak.

These assumptions combined present a conservative scenario for a worst-case analysis of the impact of the OSD on footpath pedestrian volumes.

[2] Population and Housing, Australian Bureau of Statistics, 2016

Table 35: General trip generation assumptions.

Element	Value
Sqm GFA per employee	19.8
3.5 Hr to 1 Hr Peak	56%
AM to PM conversion	0.91
Employees per Hotel room (3 star hotel)	0.8

Sources: City of Sydney Floor Space and Employment Survey: CBD Precinct Summary Report 2012; Hotel Staff, City of Hotels, accessed at http://www.city-of-hotels.com/165/hotel-staff-en.html.

Table 36: Average number of residents per dwelling by type.

Site	1 bed	2 bed	3 bed
Crows Nest	1.6	2.1	2.5

Source: Population and Housing, Australian Bureau of Statistics 2016

The estimated number of 1-hour peak trips generated by the proposed OSD are presented in Table 37.

Table 37: Estimated number of trips generated by proposed OSD in 1 hour morning peak.

Building	Land Use	Scale (unit,sqm GFA)	Estimated Population	Pop. Moving in 3.5hr Peak	1 Hr Peak	
					AM	PM
A North	Residential	174	344	206	116	105
A South	Residential	174	344	206	116	105
B	Hotel	250	370	370	207	189
C	Commercial	2700	135	135	76	69
Crows Nest		**Total**	**1193**	**918**	**514**	**468**

The cumulative pedestrian flows from Crows Nest Station, the proposed OSD and background pedestrian flows are shown in Figure 38. Note that these pedestrian flows are as calculated for the Crows Nest Station concept design and are projected for 2036 with a 15% increase in volumes above the forecast for contingency.

The distribution of pedestrian flows represents a conservative scenario for the footpaths surrounding the station.

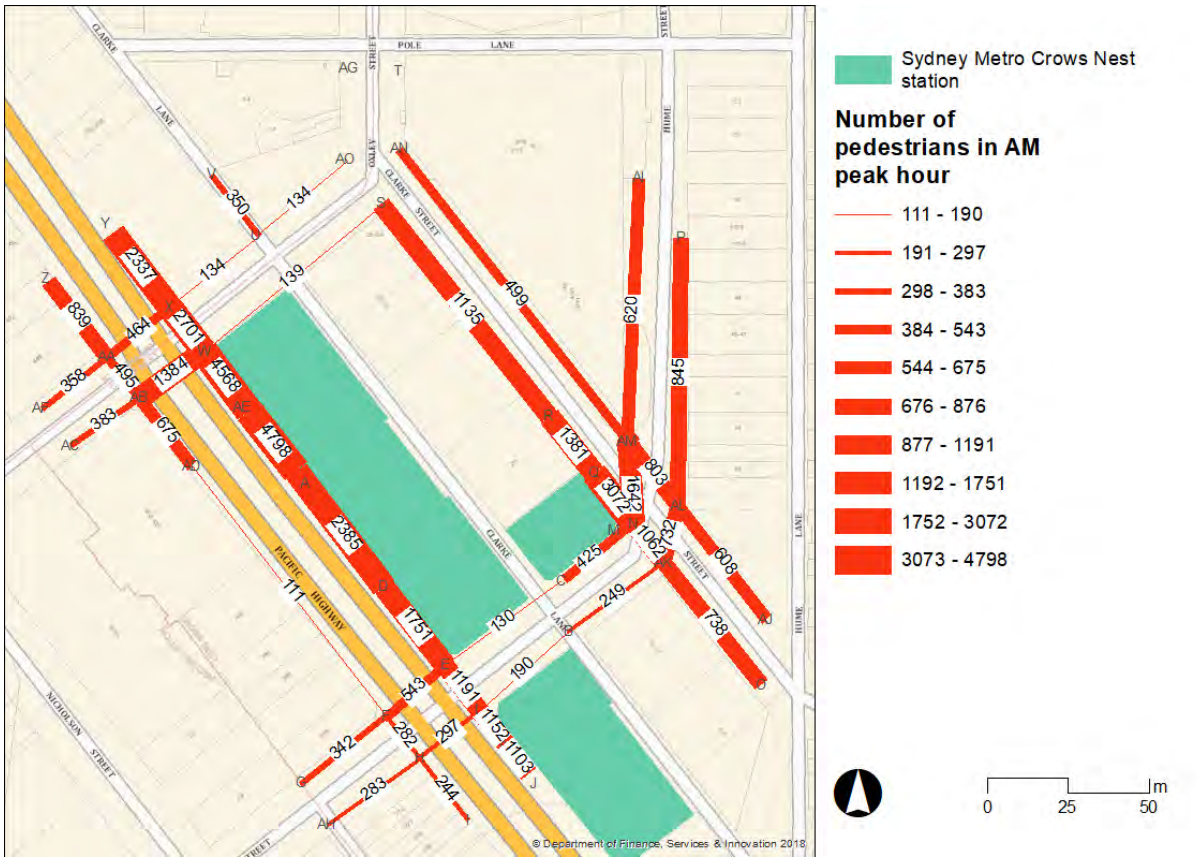

Figure 38: 2036 pedestrian volumes during AM peak hour, including background flows, metro station and OSD flows.

Note that of all pedestrian trips modelled, the proposed OSD is likely to produce a maximum of 4.4% of all pedestrian trips on the pedestrian network around Crows Nest station in 2036. Crows Nest station will generate approximately 87% of pedestrian trips around the station area, while background pedestrian movements will account for approximately 8.6%. As such, the impact of the proposed OSD buildings on pedestrian volumes is minimal.

The corresponding Fruin Level of Service (LoS) for the worst-case period during peak hour ("peak of peak") for the above is shown below in Figure 39. The "peak of peak" scenario was calculated by assuming flows were equal for 15-minute intervals across the peak hour, and then factoring the centre two quartiles up by a factor of 1.2 and reducing the shoulder quartiles down by a factor of 0.8.

A Fruin LoS "C" is considered acceptable for the purposes of this assessment. Footpath widths have been taken as current widths described in Section 4, and pedestrian crossings have conservatively been assumed at 3.6m wide (minimum width for pedestrian crossings).

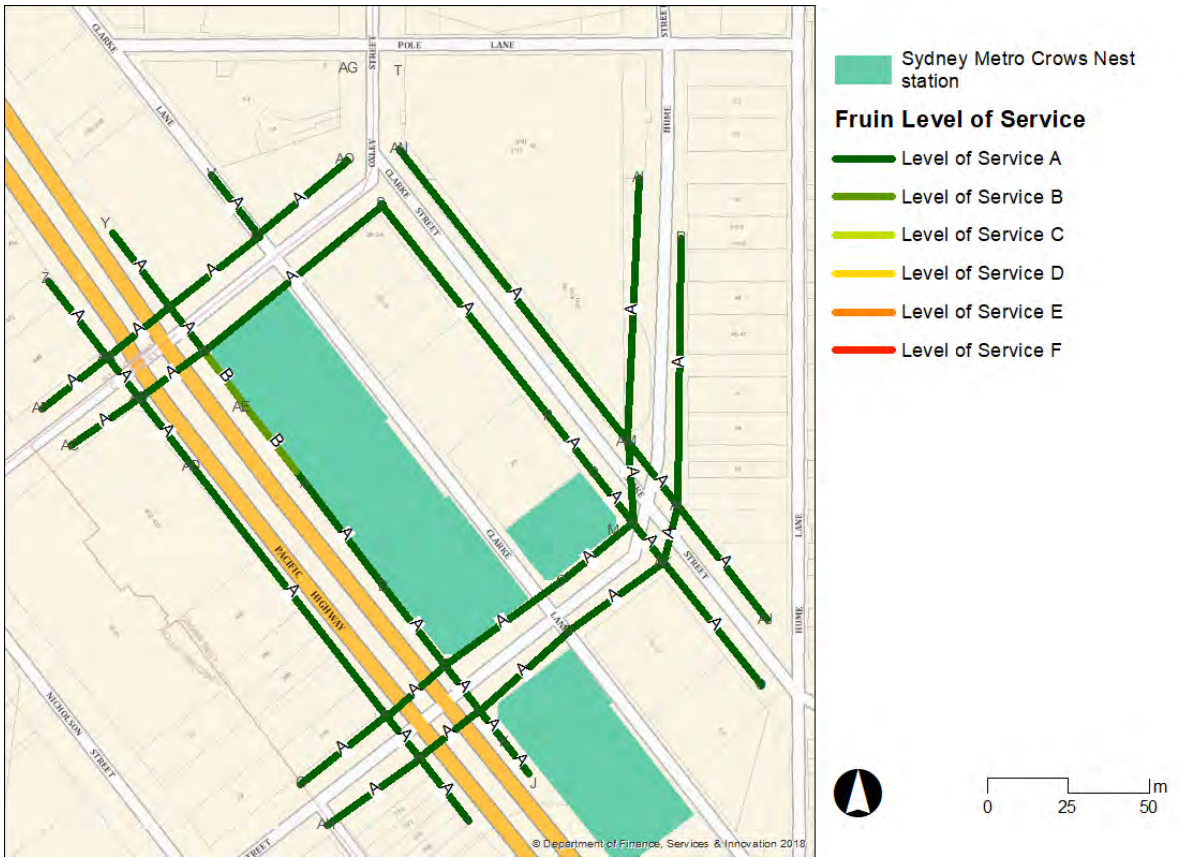

Figure 39: 2036 Fruin Level of Service for footpaths around proposed OSD.

As can be seen, the cumulative impact of pedestrian volumes from background volumes, Crows Nest Station and the proposed OSD achieve a LoS A along all except two segments of the pedestrian network around the proposed OSD. A LoS B is recorded on a segment of footpath between the intersection of Oxley Street and Pacific Highway as well as the Pacific Highway entry to Crows Nest Station. It should be noted that there is an access point to OSD Building A North along this section of footpath, however a LoS B is still regarded as very good level of service for a busy location. Given the very low contributions to passenger flows from the proposed OSD, particularly compared to passenger flows from Crows Nest Station, the impact of the OSD on the pedestrian network is negligible.

Upgrades to the public domain surrounding the OSD as part of the Crows Nest Station State Significant Infrastructure proposal will also benefit pedestrians accessing the OSD, through the installation of additional pedestrian crossings on the Pacific Highway, Hume Street and Clarke Street. This will improve safety outcomes for pedestrians and help encourage walking as the main form of transport for local trips.

Part of these public domain changes include changes to Clarke Lane between Hume Street and Oxley Street to change it to a Shared Zone for pedestrians and vehicles, with one-way

northbound traffic maintained. This will enable pedestrians to safely access OSD access points off Clarke Lane by reducing vehicle speeds and increasing driver awareness of pedestrian activity in Clarke Lane, particularly for drivers accessing the car garages and loading docks off Clarke Lane.

It is not proposed to have any pedestrian access points for the OSD Building B along Clarke Lane.

The assessment for pedestrian movements was also assessed using the RMS *Guide to Traffic Generating Development* (GTGD). The trip generation rates adopted from this guide are presented below in Table 38. Note that the GTGD does not include trip generation rates for hotels. The methodology used above for hotel trip generation rates is replicated as part of the assessment using the GTGD.

Table 38: Trip generation rates for AM 1hr peak adopted from RMS GTGD for Crows Nest OSD assessment.

Type	Rate	Unit	Reference Location
Residential AM Peak Trips	0.29	per bedroom	St Leonards
Residential PM Peak Trips	0.24	per bedroom	St Leonards
Residential Daily	1.56	per bedroom	St Leonards
Office AM Peak	1.26	per 100 sqm	North Sydney
Office PM Peak	1.08	per 100 sqm	North Sydney
Office Daily	9.47	per 100 sqm	North Sydney

Source: RMS Guide to Traffic Generating Developments, 2014.

The number of overall trips generated using these rates is presented in Table 39, below.

Table 39: General trip generation rates for proposed Crows Nest OSD using RMS GTGD rates.

Building	Land Use	Scale (unit,sqm GFA)	AM 1 hr Peak Trip Generation		PM 1 hr Peak Trip Generation		Daily Trip Generation	
A North	Residential	174	91		75		488	
A South	Residential	174	91		75		488	
B	Hotel	250	248		225		1000	
C	Commercial	2700	34		31		256	
		Total	**423**		**370**		**2232**	

It is noted that using this methodology, trip generation rates for the proposed OSD in the AM peak are lower than the alternative method used earlier in this section of the report, confirming that the number of pedestrian trips generated by the Crows Nest OSD will not have a negative impact on footpath capacity around the station.

6.7 Coach and Taxi

Due to the constrained street environment and the anticipated limited demand for a dedicated coach parking area for the Site B hotel, coach parking is intended to be accommodated in the existing bus zone on Clarke Street, north of Hume Street, adjacent to Hume Street Park.

The location of existing bus zones within the vicinity of the proposed OSD are shown in Figure 40.

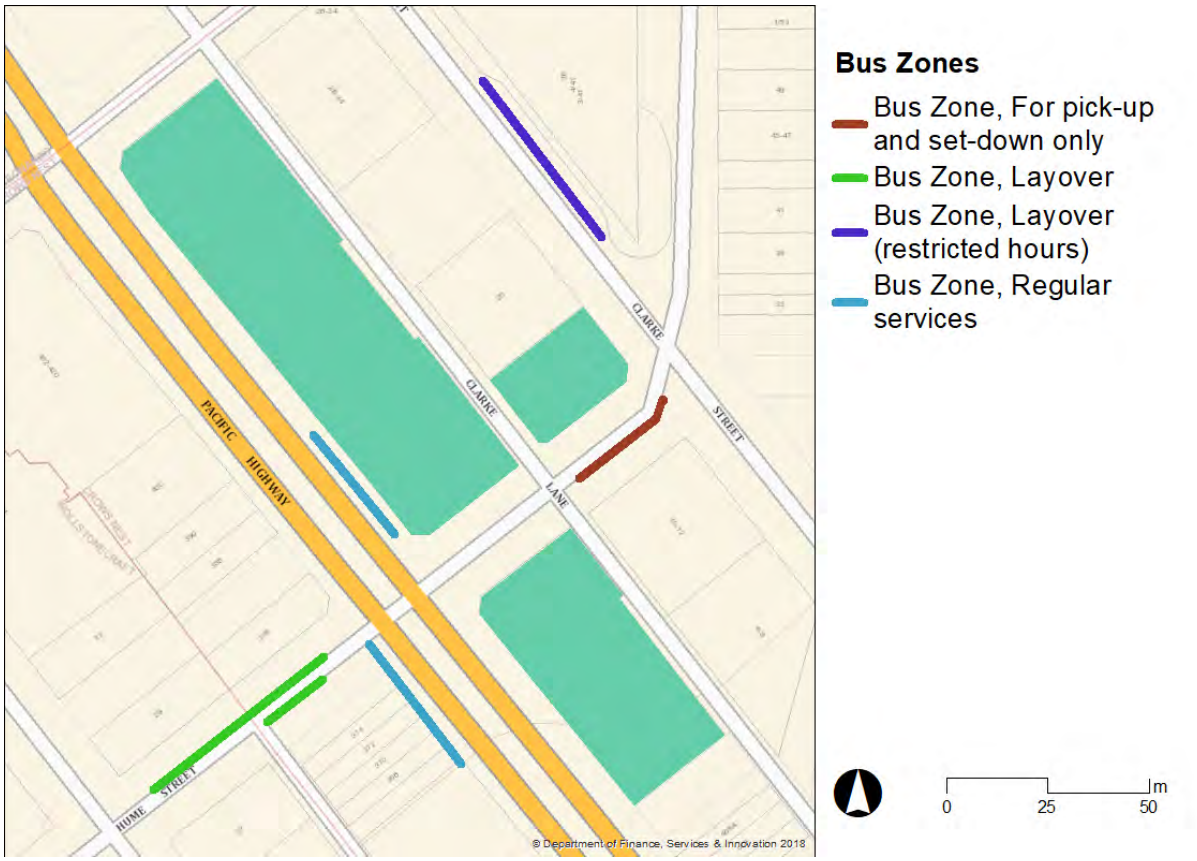

Figure 40: Existing bus zones in the vicinity of Crows Nest Station and proposed OSD buildings.

The following assumptions and measures are proposed:

- Coach standing is not expected to be needed very often due to largely business clientele (rather than tourist groups);
- Coach standing not to be used in peak hours (that is, not during weekdays 6-10am and 4-7pm);
- Coach standing use and demand to be managed by hotel.

Access to the Crows Nest OSD Site B coach standing zone would be via Clarke Street and Hume Street.

The proposed coach standing area is located approximately 130 metres, or 2-minute walk, from the Building B hotel entrance, via Hume Street and requires pedestrians to cross Clarke Lane, Hume Street and Clarke Street. Pedestrian crossings will be provided as part of the proposed road network changes for Crows Nest Station works. Based on current plans, it is expected that this bus zone will be retained as part of the Hume Street park upgrade. The walking distance and route between the proposed coach standing zone and Site B hotel is

considered appropriate, however, it will be possible for coaches to pick up and drop off passengers in Clarke Lane, adjacent to the hotel entry.

Additionally, existing bus zones used for bus layover are also located on Hume Street, west of Pacific Highway, approximately 50 metres south west of the Site B OSD entry point. Coaches will also have the option to utilise these spaces for layover. It is not expected that the bus zone on Hume Street between Clarke Street and Clarke Lane will be reinstated following the urban design upgrades proposed as part of the Crows Nest Station SSI works.

A Taxi zone accommodating three spaces is proposed as part of the Metro Integrated Access Plan on Hume Street between Clarke Street and Clarke Lane. This is located within a 50-200m walk for all three Crows Nest OSD sites.

While residents and workers of Site A and B will generate taxi trips from the OSD site, it is expected that these trips would be irregular and low in numbers. As such it is expected that the proposed hotel use on Site B will be the main driver for taxi trip generation. Given the nature of guest arrival and departures, it is also anticipated that hotel taxi trip generation in the peak periods would be low.

A survey of taxi demand at two Sydney CBD hotels was undertaken for the Pitt Street North OSD proposal. The results of this survey are presented in Table 40 below.

Table 40: Surveyed taxi demand for hotel drop off/ pick up facilities (taxi trips/hour)

Peak Period	QT Hotel (200 rooms)		Swissotel (370 rooms)	
	Guest trips	Non-guest trips	Guest trips	Non-guest trips
AM Peak (8:15-9:15am)	7	8	12	1
PM Peak (4:45-5:45pm)	3	5	14	23

Source: Sydney Metro City & Southwest Pitt Street North Over Station Development Transport and Traffic Impact Assessment Report Appendix T, pg 39 (The Transport Planning Partnership, 2018).

Given that both hotels surveyed are located within a busy, central area of the Sydney CBD, the number of non-guest trips taken at the proposed hotel site of Crows Nest OSD are expected to be lower. Overall, however, the number of taxi trips generated by the proposed Crows Nest OSD hotel site can be expected to be within the ranges identified through the above surveys: between 7 and 12 trips in the AM peak, and between 3 and 14 trips in the PM peak. This represents a low impact to the road network in the area.

6.8 Other network impacts

6.8.1 Public transport

As noted in Section 4.6, the bus network through Crows Nest provides good access to locations throughout the Lower North Shore and further afield, particularly during peak periods. A map of trunk, high frequency bus routes through Crows Nest are shown in Figure 41.

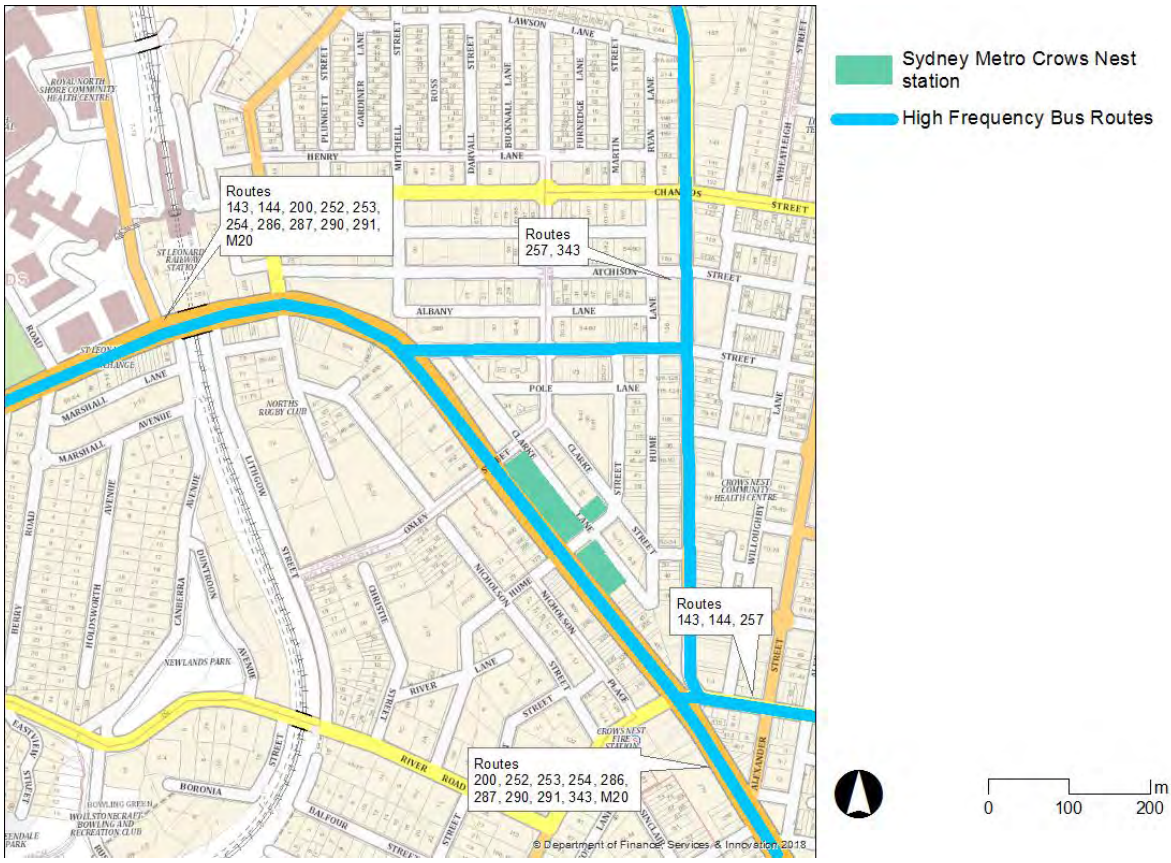

Figure 41: High frequency bus trunk routes through Crows Nest. Source: Transport for NSW.

The bus stops situated on Pacific Highway outside the metro station site are proposed to be retained once metro operations commence, with the northbound bus stop currently located south of Hume Street proposed to be relocated to the south of Oxley Street to improve access and interchange for Crows Nest Station. Assuming the current high frequency of bus services through Crows Nest continues, the number of bus trips generated by the OSD will have minimal demand impact on the bus network during the morning peak hour.

It is assumed that most train journeys taken from and to the OSD will be via Sydney Metro and that there is ample capacity for the foreseeable future on this service through Crows Nest once operations commence.

Impacts on other modes of public transport such as light rail and ferry are negligible.

On this basis, the proposed OSD is considered to offer high levels of public transport accessibility and connectivity for future workers and residents. The existing public transport network will not be negatively impacted by the increase in patronage from the Crows Nest OSD due to available capacity on both bus and future rail/metro networks.

6.8.2 Emergency vehicle access

Emergency vehicle access would continue to be possible via Pacific Highway, Clarke Lane, Hume Street and Clarke Street. It is not anticipated that there would be any impacts to emergency vehicle access as a result of the OSD proposal. An emergency response plan will be prepared for the OSD development which will take into account the Metro station specific emergency response plan.

Vehicles queuing in Clarke Lane will need to circulate on the wider road network if emergency vehicles need to access or pass by on Clarke Lane.

7.0 Mitigation Measures

7.1 Provision of car share spaces

Given the physical constraints of the site, it is not possible to provide additional parking spaces to address this potential peak in weekend vehicle car use noted in section 6.2.

Car share schemes have been shown to directly alter car ownership rates, with one car share vehicle found to remove 9 to 13 vehicles from roads and support 22 to 23 car share scheme members[3]. Additionally, car share schemes are considered to be beneficial in reducing the amount of kerbside space dedicated to parking[4], freeing up more space for bike lanes, clearways, bus lanes or wider pedestrian paths. Concern about increased demand for on-street parking due to OSD has been identified in early community consultation and in this sense inclusion of a car share scheme in the OSD buildings would help to address this concern.

To ensure that the impact to on-street parking is minimised, and assuming that Crows Nest OSD will have car ownership rates similar to Sydney and Haymarket, car share spaces should be provided as part of the residential buildings on Site A of the OSD. Similarly, car share spaces should be provided on Site B of the OSD for the proposed hotel building.

A summary of the recommended number of car share spaces for each building is presented in Table 41. The number of recommended spaces is based on one car share being able to service the needs for nine car parking spaces.

Table 41: Recommended number of car share spaces for Crows Nest OSD buildings.

Building	Car Spaces	Required no. spaces (North Sydney DCP)	Difference	Recommended no. car share spaces to be provided
A South	51	70	-19	2
A North	33	70	-37	4
B	21	50	-29	3
C	0	1	-1	0
Total	**105**	**190**	**-85**	**9**

[3] Benefit-Cost Analysis of Car Share within the City of Sydney, SGS Economics & Planning, 2012, pg 25.

[4] The Impact of Car Share Services in Australia, Phillip Boyle & Associates, 2016, pg 10

7.2 Construction Traffic Management

A separate Construction Traffic Management Plan is being produced which will address construction traffic.

7.3 Service vehicle and loading dock management

To minimise the amount of potential queuing that will occur within Clarke Lane for the loading dock, a dock management system will need to be in place at all times while the dock is operational. This should be managed by an appointed dock manager or building concierge. A Preliminary Delivery Service Plan outlining such an operation for the proposed OSD is contained in Appendix D.

7.4 Travel Plans

The limited private car parking proposed for all of the Crows Nest OSD land uses seeks to demonstrate that exceptional public transport and active transport accessibility can effectively and successfully support the travel needs of a broad range of urban land uses and activities.

To support the success of the sites, it is recommended that Travel Plans (TP) be prepared for each site, held by Council, and provided to owners/ tenants. The following site-specific and customer-specific Travel Plans should be prepared and incorporated into the operational plans of the sites.

- Site A (Residential apartments) – Residential TP
- Site B (Hotel) – Guests and Staff TP.
- Site C (Commercial) – Employees TP

As part of the travel plans, information will need to be distributed to residents regarding queuing for the car lift both inside the OSD buildings and in Clarke Lane, and this should include:

- Warnings about the potential queue times during peak periods in Clarke Lane (dependent on final design)
- A potential booking system for residents who regularly use the car lift as part of their journey to work;
- Considerations for neighbours when queuing, including turning off vehicle engines to reduce vehicle exhaust and noise impacts; and
- Avoiding peak periods if planning to use a car stored in the OSD garages in order to avoid development of queues.

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8.0 Conclusion

This report presents the results of a transport, traffic and parking assessment of the OSD above Crows Nest Station.

This report has been prepared to outline the transport, traffic and parking impacts of the OSD and to specifically respond to the SEARs issued for the concept SSD Application.

The key findings of the assessment of the proposed OSD for Crows Nest Station are that:

- Residents living in high-density, transit-oriented settings in Sydney are less likely to own private vehicles and drive to work and that this is likely to hold true for the proposed Crows Nest OSD;
- The number of parking spaces provided in the concept design and the provided indicative design is in line with that of North Sydney DCP;
- The number of bicycle storage and parking spaces within Site A and Site C are as per the North Sydney DCP;
- The loading docks provided for Site A is suitable for the estimated dock activity within the Site A loading dock, however mitigation methods are recommended to minimise the risk of queuing in Clarke Lane;
- A DDA is to be produced to determine the loading dock activity for Site B;
- Site C will be able to utilise a mixture of on-street space in Clarke Lane for waste removal without impacting traffic flow on Clarke Lane, as well as utilising the Site A loading dock for deliveries.
- The proposed OSD above Crows Nest station will produce less peak hour trips than the pre-existing development across the Crows Nest station site;
- The car lift proposed for use as part of the indicative design will likely result, on average, in minimal or no queuing in Clarke Lane, with a minimum 50% chance that no vehicles will be queuing to access the site during the PM peak period;
- Pedestrian flows from the OSD will not be detrimental to pedestrian flows on footpaths around Crows Nest station;
- Coaches for hotel guests will be able to the bus zone on Clarke Street to drop off or pick up guests, and nearby bus zones on Hume Street as layover areas;
- A taxi zone for Crows Nest station will be able to provide a pick-up point for OSD residents, workers and hotel guests; and
- The proposed OSD will not have a significant impact on public transport services.

To address some of these findings, the following mitigation measures have been suggested:

- Provision of car share spaces in or near the proposed OSD towers to reduce the need for individual car ownership for OSD residents;
- Construction Traffic is managed to minimise impacts on nearby residents and businesses during the course of OSD construction;

- A loading dock management plan is implemented to minimise any queuing issues that may arise during periods of high demand for the loading docks for each of the OSD buildings;
- Travel Plans are developed for each of the buildings to ensure that residents, employees and hotel guests are aware of their travel options to and from the OSD buildings, and how this may help them to make more sustainable travel mode decisions; and

After assessment of the development proposed against the relevant SEAR's transport related requirements, refer Table 1, it is concluded that the proposed development will have a limited environmental impact, during construction and operation.

Appendix A – Household Travel Survey Analysis and Trends in Transport

Household Travel Survey Analysis

Transport for NSW Household Travel Survey (HTS) data has been reviewed for North Sydney Council LGA to understand the patterns of trip purposes of precinct residents. The HTS uses survey data from selected households to provide an estimate of all trips and trip types for an average weekday, with the information broken down by LGA. Estimates and breakdowns of mode share for different trip types are not provided as part of the HTS dataset.

As the boundary for North Sydney Council encompasses areas with significantly different urban composition to the existing St Leonards-Crows Nest area, the results of the HTS was benchmarked against the City of Sydney LGA and Willoughby LGA HTS results.

Table 1: Household Travel Survey results by trip purpose for North Sydney LGA.

Trip purpose	Number of trips	% of Total Trips	Trip Distance (km)	% of Total Distance	Avg. Distance (km)
Commute	40,932	13%	297,532	19%	7
Work related business	15,148	5%	134,821	9%	9
Education/childcare	8,873	3%	16,313	1%	2
Shopping	52,603	16%	112,541	7%	2
Personal business	20,217	6%	56,210	4%	3
Change mode of travel	49,393	15%	271,515	18%	6
Social/recreation	96,358	30%	482,082	31%	5
Serve passenger	24,703	8%	163,097	11%	7
Other	12,801	4%	15,994	1%	1
TOTAL	321,028	100%	1,550,105	100%	4.89[1]

Source: Household Travel Survey (HTS) - Data by LGA, Transport for NSW, 2017. 1 Average distance weighted by percentage of total trips taken.

Table 2: Household Travel Survey results by trip purpose for City of Sydney LGA.

Trip purpose	Number of trips	% of Total Trips	Trip Distance (km)	% of Total Distance	Avg. Distance (km)
Commute	151,354	19%	632,758	17%	4
Work related business	35,215	4%	430,516	12%	12

Trip purpose	Number of trips	% of Total Trips	Trip Distance (km)	% of Total Distance	Avg. Distance (km)
Education/childcare	29,519	4%	73,219	2%	3
Shopping	119,109	15%	192,460	5%	2
Personal business	38,959	5%	167,368	5%	4
Change mode of travel	116,428	15%	892,285	24%	8
Social/recreation	216,518	27%	1,022,327	28%	5
Serve passenger	49,430	6%	192,046	5%	4
Other	37,412	5%	72,761	2%	2
TOTAL	793,944		3,675,740		4.78[1]

Source: Household Travel Survey (HTS) - Data by LGA, Transport for NSW, 2017. 1 Average distance weighted by percentage of total trips taken.

Table 3: Household Travel Survey results by trip purpose for Willoughby LGA.

Trip purpose	Number of trips	% of Total Trips	Trip Distance (km)	% of Total Distance	Avg. Distance (km)
Commute	34,669	12%	323,928	23%	9
Work related business	8,520	3%	47,010	3%	6
Education/childcare	18,853	7%	64,526	5%	3
Shopping	44,427	16%	96,876	7%	2
Personal business	16,514	6%	63,569	5%	4
Change mode of travel	49,923	18%	355,923	26%	7
Social/recreation	62,313	22%	289,413	21%	5
Serve passenger	36,902	13%	132,698	10%	4
Other	6,513	2%	5,182	0%	1
TOTAL	278,634		1,379,125		4.99[1]

Source: Household Travel Survey (HTS) - Data by LGA, Transport for NSW, 2017. 1. Average distance weighted by percentage of total trips taken.

Table 4: LGA profile

Characteristic	North Sydney LGA	City of Sydney LGA	Willoughby LGA
Average no. vehicles per household	1.32	0.92	1.77
Average no. vehicles per person	0.60	0.44	0.68
Average no. people per household	2.2	2.1	2.61
Density (persons per km^2)	6,972	7,082	3,385
Train stations within LGA	4	12	3
Train stations per km^2	0.40	0.44	0.14

Source: Household Travel Survey (HTS) - Data by LGA, Transport for NSW, 2017

The HTS results indicate several things for inner city urban areas:

Firstly, that consideration must be given for non-commute related travel. For North Sydney LGA, 30 per cent of all trips are for social or recreational purposes and 16 per cent of all trips are for shopping purposes, while only 13 per cent of all trips are for commuting to work. Comparatively, in City of Sydney, 27 per cent of trips are for social or recreational purposes and 15 per cent are for shopping purposes. 19 per cent of trips in City of Sydney LGA are for commuting.

Secondly, that the number of vehicles per household and vehicles per person decrease in areas with higher levels of public transport amenity (eg higher numbers of train stations per square kilometre), and in very urban areas such as City of Sydney LGA, these rates are lower than parity. Compared to North Sydney LGA and Willoughby LGA, the City of Sydney LGA is comprised of much larger areas of higher density living along high amenity public transport, including train, light rail and bus corridors, which is more readily comparable to the level of amenity proposed for the future Crows Nest OSD precinct, which will feature high accessibility to bus services, train services and Metro services. As such, the number of vehicles per household could be anticipated to be the same or lower for Crows Nest OSD than for the broader North Sydney LGA.

Similarly, people living in areas that experience higher levels of public transport service amenity tend to take trips for a lower variety of reasons. For example, 76 per cent of all trips in City of Sydney LGA were taken for four reasons: “Social/Recreation”, “Commute”, “Shopping” and “Change mode of travel”. In Willoughby LGA, which experiences lower levels of public transport amenity, those same four categories represent 69 per cent of all trips, while trips such as “Serve passenger” and “Education/childcare” represent 20 percent of trips, compared to just 10 percent in City of Sydney LGA and North Sydney LGA. This corroborates with the lower number of people per household in City of Sydney LGA (2.1 persons/household) and North Sydney LGA (2.2 persons/household) compared to Willoughby (2.6 persons/household), suggesting that higher density urban locations tend to feature households containing more single people or couples, compared to families in more suburban areas. Assuming this pattern were to be applied to the Crows Nest OSD area given its higher density and higher public transport amenity, residents in the vicinity of the Crows Nest OSD are less likely to require a car to serve their smaller variety of trip types.

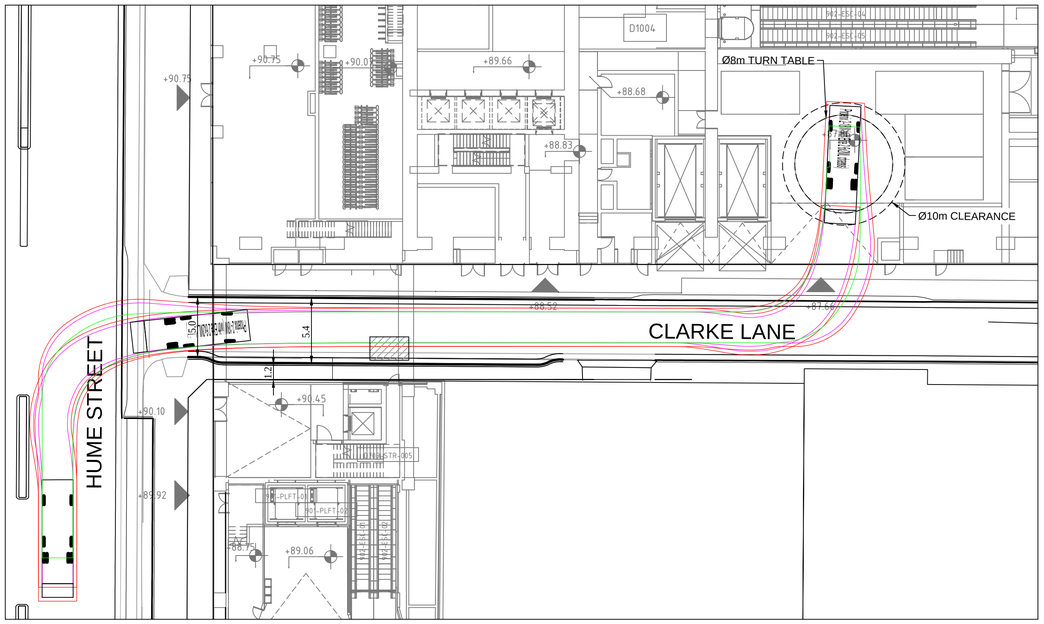
Appendix B – Loading Dock & Car Lift Access Swept Paths

LEGEND

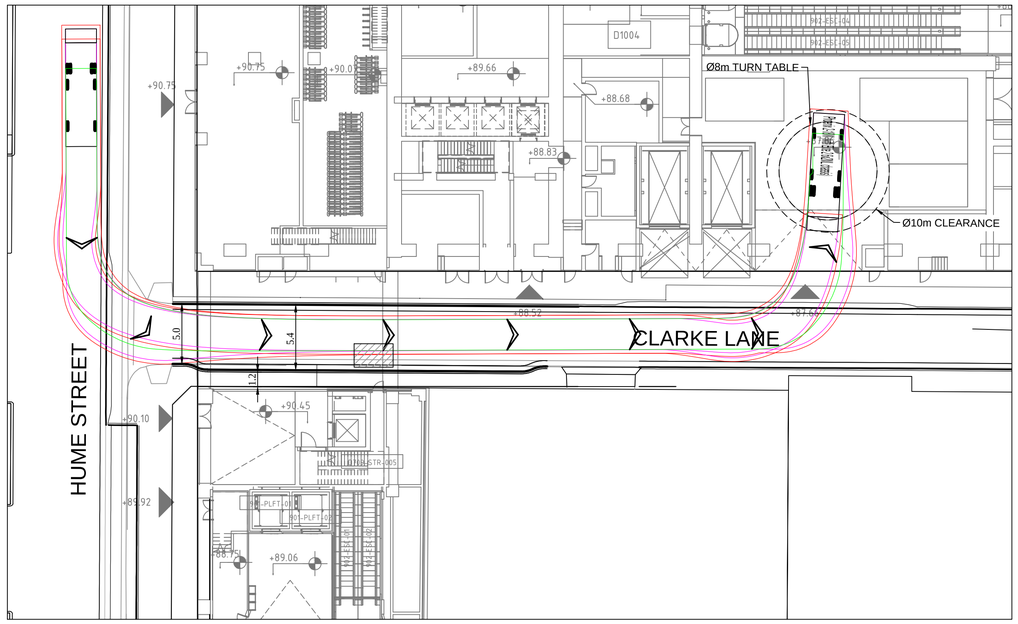
TYRE LINE

VEHICLE BODY LINE

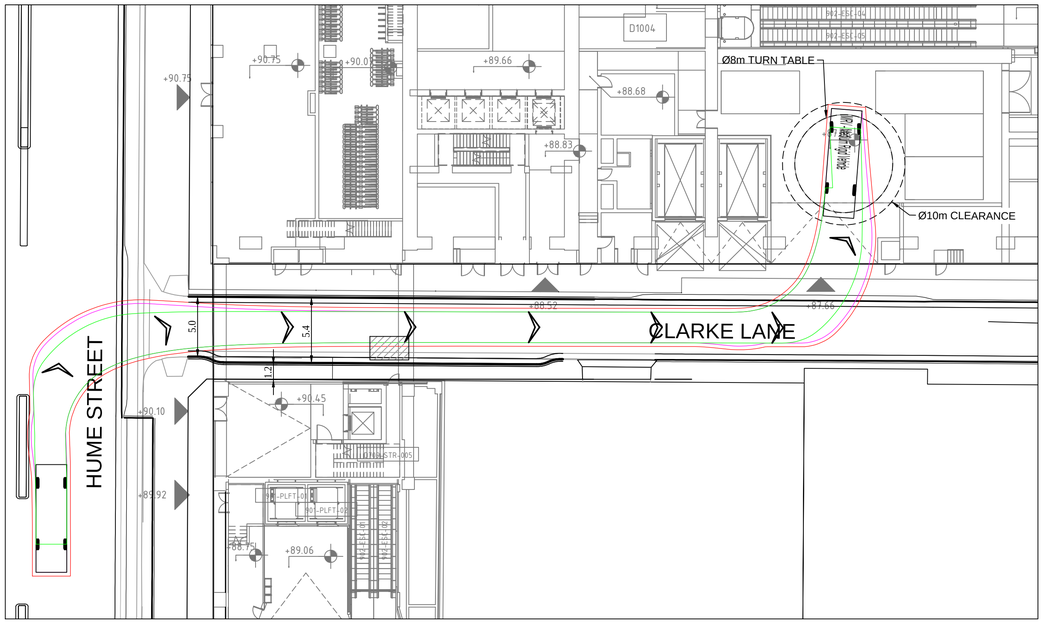
VEHICLE BODY CLEARANCE



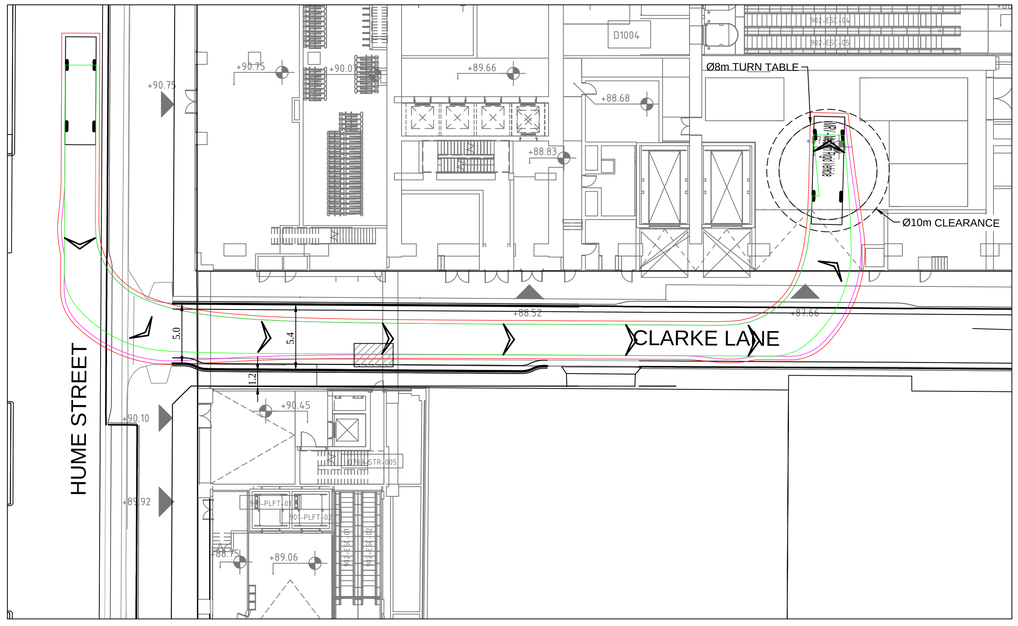
PHOENIX - 2-18W (GARBAGE TRUCK) ENTRY MANOEUVRE
TO SITE A LOADING DOCK
SCALE 1:250



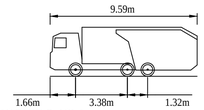
PHOENIX - 2-18W (GARBAGE TRUCK) ENTRY MANOEUVRE
TO SITE A LOADING DOCK
SCALE 1:250



MRV ENTRY MANOEUVRE TO SITE A LOADING DOCK
SCALE 1:250

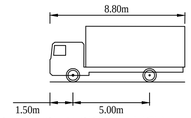


MRV ENTRY MANOEUVRE TO SITE A LOADING DOCK
SCALE 1:250



PHOENIX 2-18W
(WITH ELITE 2 6x2ML CHASSIS)

OVERALL LENGTH	9.595m
OVERALL WIDTH	2.530m
MIN BODY GROUND CLEARANCE	0.410m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	8.950m



MRV - MEDIUM RIGID VEHICLE

OVERALL LENGTH	8.800m
OVERALL WIDTH	2.500m
OVERALL BODY HEIGHT	3.633m
MIN BODY GROUND CLEARANCE	0.428m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	10.000m

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01	MO	30/01/2018	REVISION IN PROGRESS	
P02.3	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 1
SITE A GARBAGE TRUCK AND MRV

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 1 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001031 | REV P02.3

Plot Date & Time: 19 Sep 2018 - 12:25 PM

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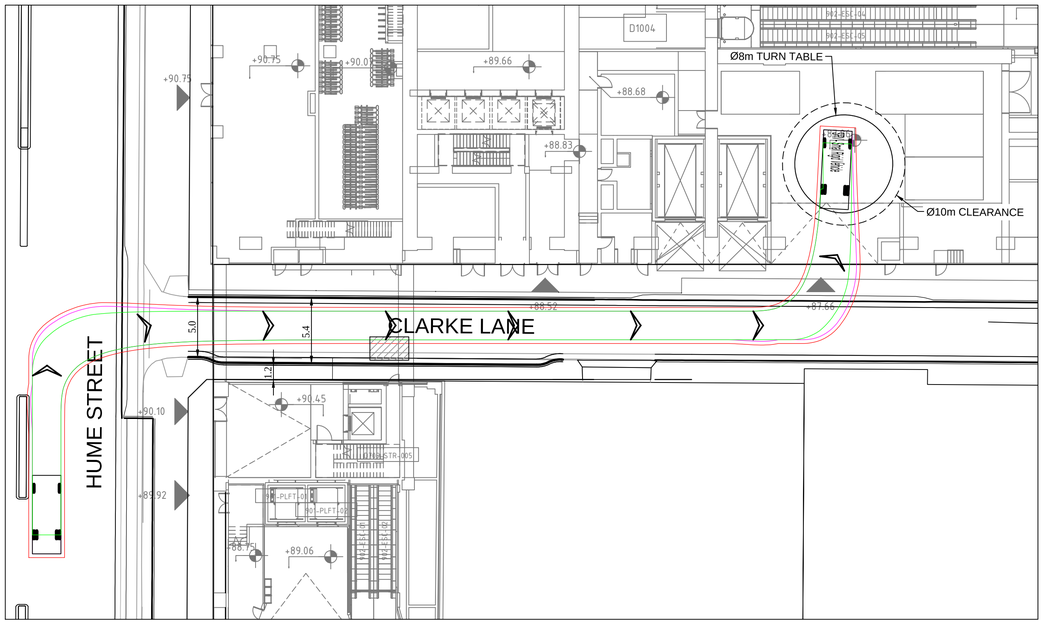
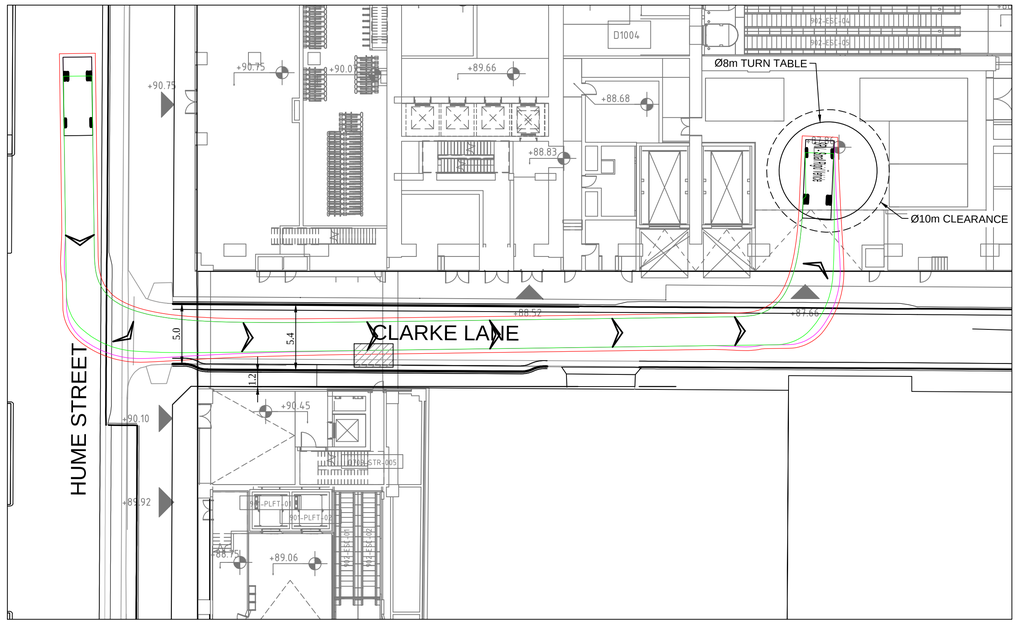


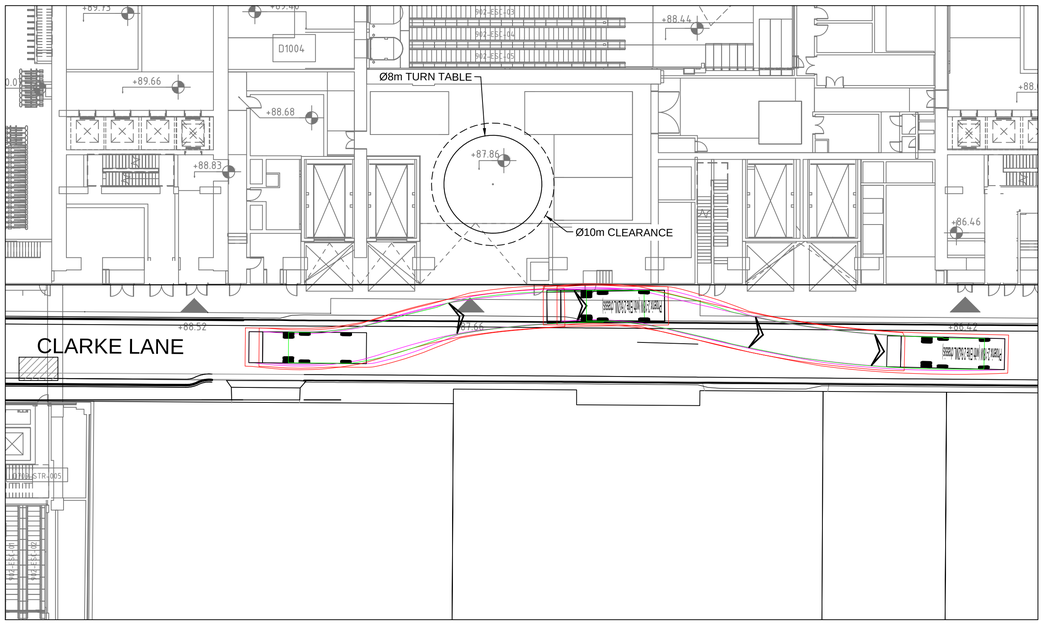
SMALL RIGID VEHICLE (SRV) ENTRY MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250



SMALL RIGID VEHICLE (SRV) ENTRY MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250

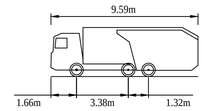


PHOENIX -2-18W (GARBAGE TRUCK) ENTRY MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250

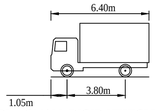
LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE



PHOENIX 2-18W
(WITH ELITE 2 6x2ML CHASSIS)

OVERALL LENGTH	9.595m
OVERALL WIDTH	2.530m
MIN BODY GROUND CLEARANCE	0.410m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	8.950m



SRV - SMALL RIGID VEHICLE

OVERALL LENGTH	6.400m
OVERALL WIDTH	2.330m
OVERALL BODY HEIGHT	3.500m
MIN BODY GROUND CLEARANCE	0.398m
TRACK WIDTH	2.330m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	7.100m

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REV.	BY	DATE	DESCRIPTION	APPD.
P01	MO	30/01/2018	REVISION IN PROGRESS	
P02.3	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

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A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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VEHICLE TURNING MANOEUVRE PLAN SHEET 2
SITE A GARBAGE TRUCK AND SRV

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 2 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001032 | REV P02.3

Plot Date & Time: 19 Sep 2018 - 12:33 PM

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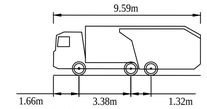
LEGEND

TYRE LINE

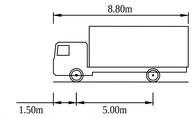
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE



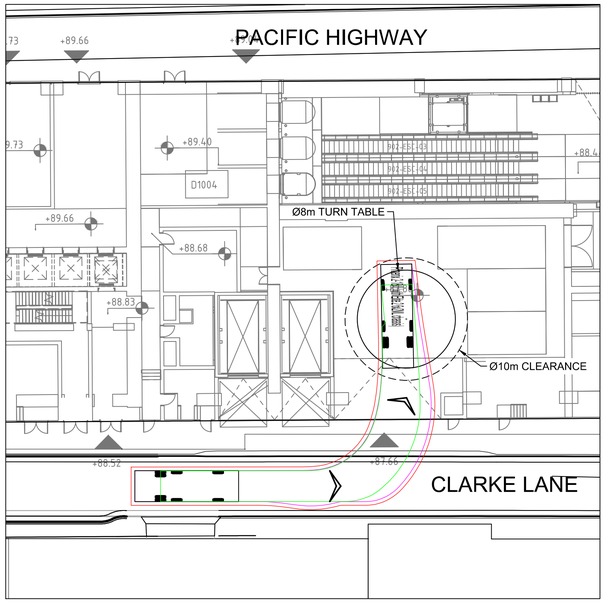
PHOENIX 2-18W
(WITH ELITE 2 6x2ML CHASSIS)

OVERALL LENGTH	9.595m
OVERALL WIDTH	2.530m
MIN BODY GROUND CLEARANCE	0.410m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	8.950m



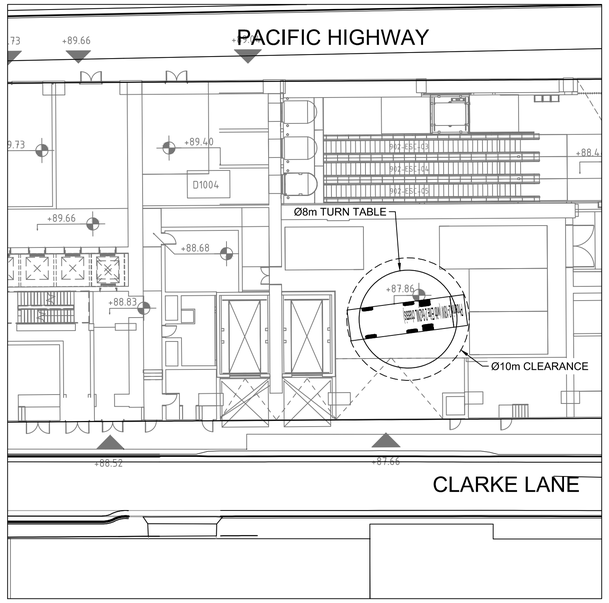
MRV - MEDIUM RIGID VEHICLE

OVERALL LENGTH	8.800m
OVERALL WIDTH	2.500m
OVERALL BODY HEIGHT	3.633m
MIN BODY GROUND CLEARANCE	0.428m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	10.000m



PHOENIX - 2-18W (GARBAGE TRUCK) ENTRY MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250



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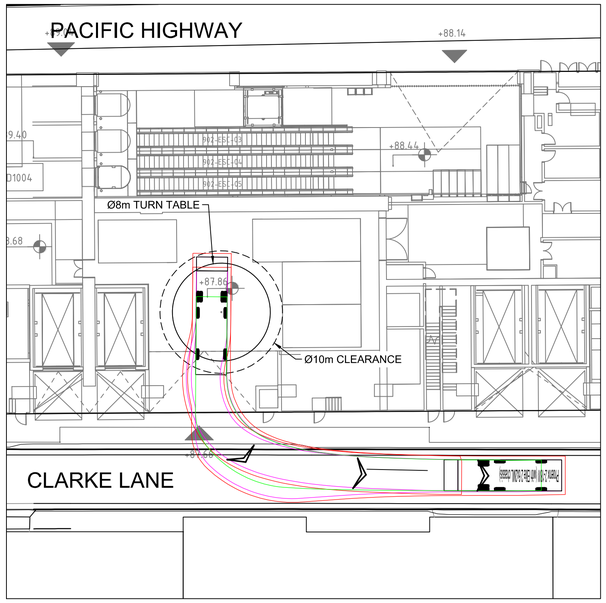
SCALE 1:250



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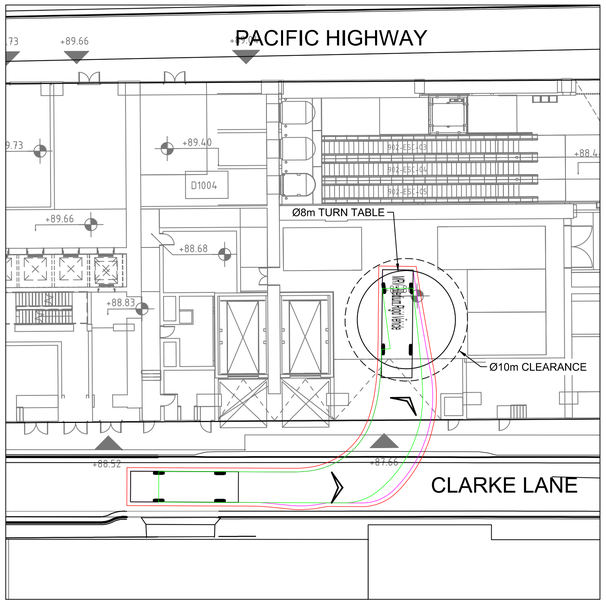
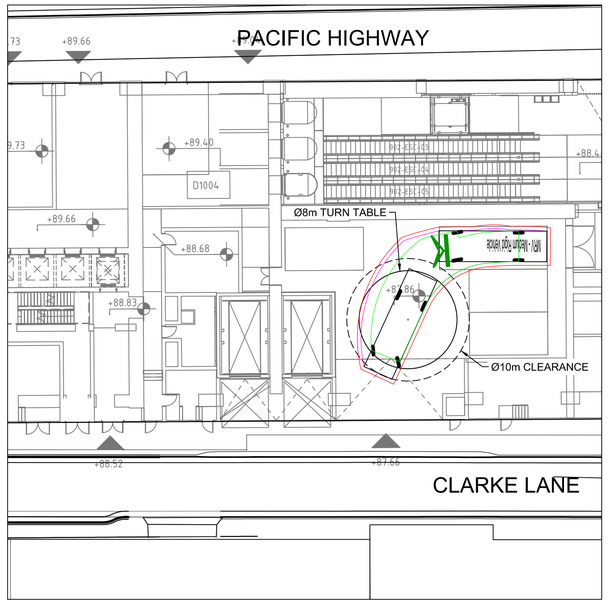


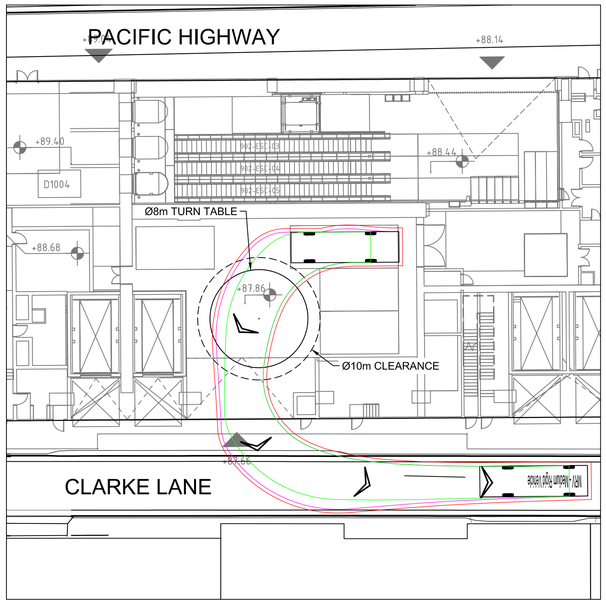
MEDIUM RIGID VEHICLE (MRV) ENTRY MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250



MEDIUM RIGID VEHICLE (MRV) TURN TABLE MANOEUVRE TO SITE A PARKING BAY

SCALE 1:250



MEDIUM RIGID VEHICLE (MRV) EXIT MANOEUVRE FROM SITE A LOADING DOCK

SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01	MO	30/01/2018	REVISION IN PROGRESS	
P02.3	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

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A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 3
SITE A GARBAGE TRUCK AND MRV

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 3 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001033 | REV P02.3

Plot Date & Time: 19 Sep 2018 - 12:38 PM

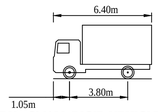
100mm AT FULL SIZE

LEGEND

TYRE LINE

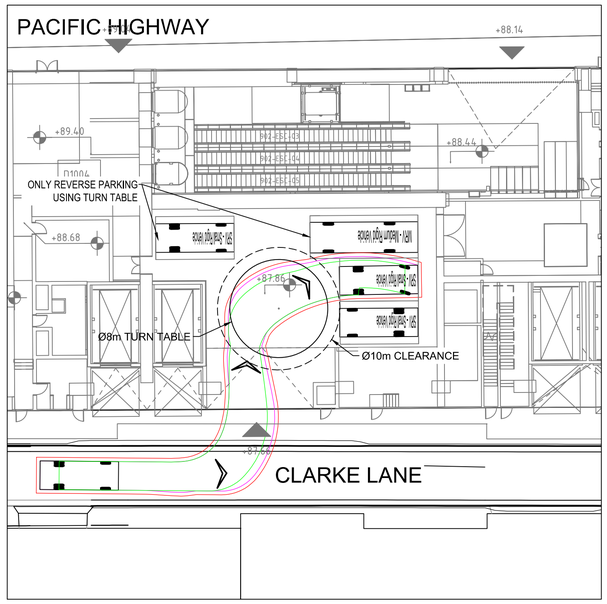
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE

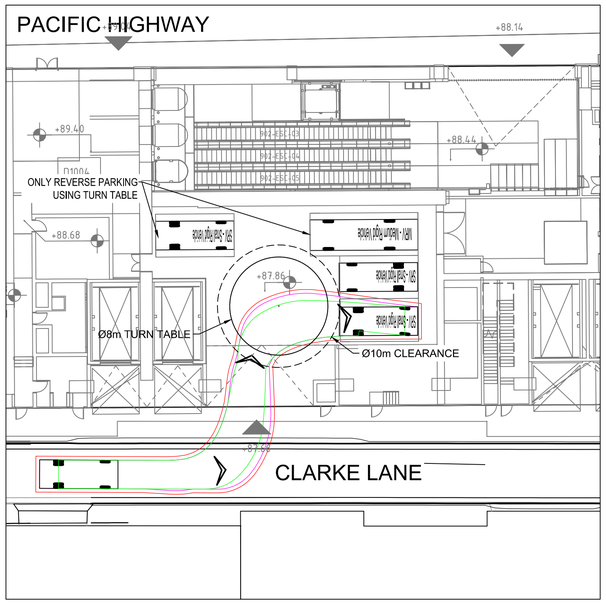


SRV - SMALL RIGID VEHICLE

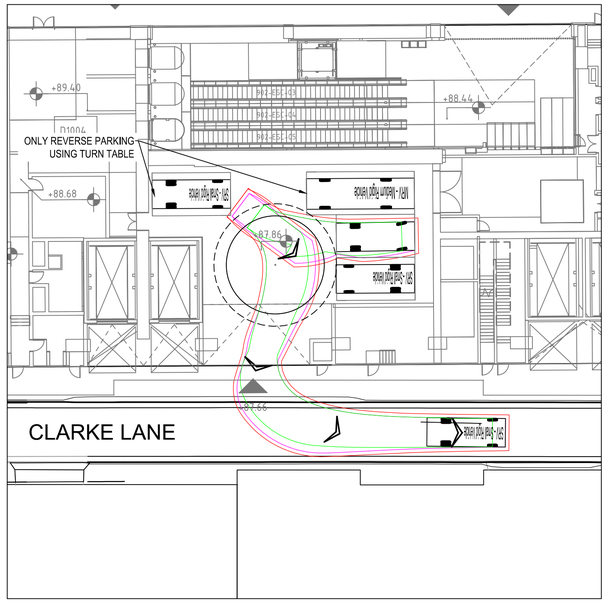
OVERALL LENGTH	6.400m
OVERALL WIDTH	2.330m
OVERALL BODY HEIGHT	3.500m
MIN BODY GROUND CLEARANCE	0.398m
TRACK WIDTH	2.330m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	7.100m



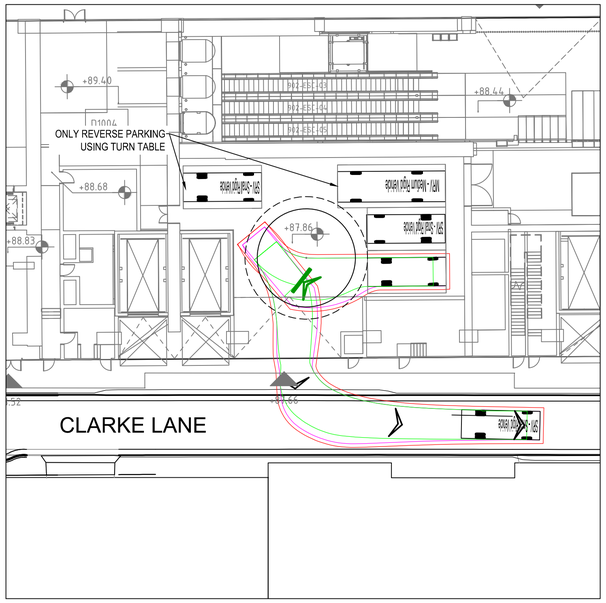
SMALL RIGID VEHICLE (SRV) PARKING
MANOEUVRE TO SITE A LOADING DOCK
SCALE 1:250



SMALL RIGID VEHICLE (SRV) PARKING
MANOEUVRE TO SITE A LOADING DOCK
SCALE 1:250



SMALL RIGID VEHICLE (SRV) EXIT
MANOEUVRE FROM SITE A LOADING DOCK
SCALE 1:250



SMALL RIGID VEHICLE (SRV) EXIT MANOEUVRE
FROM SITE A LOADING DOCK
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01	MO	30/01/2018	REVISION IN PROGRESS	
P02.3	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 4
SITE A SRV FRONT-IN PARKING

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 4 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001034 | REV P02.3

Plot Date & Time: 19 Sep 2018 - 12:39 PM

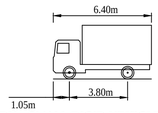
100mm AT FULL SIZE

LEGEND

TYRE LINE

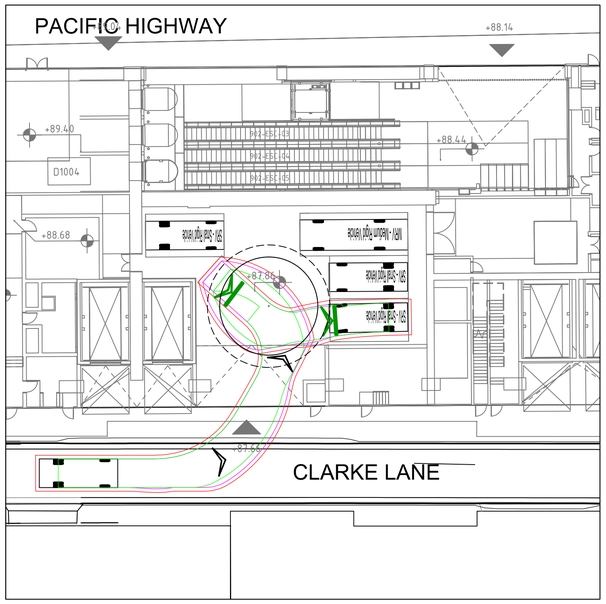
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE



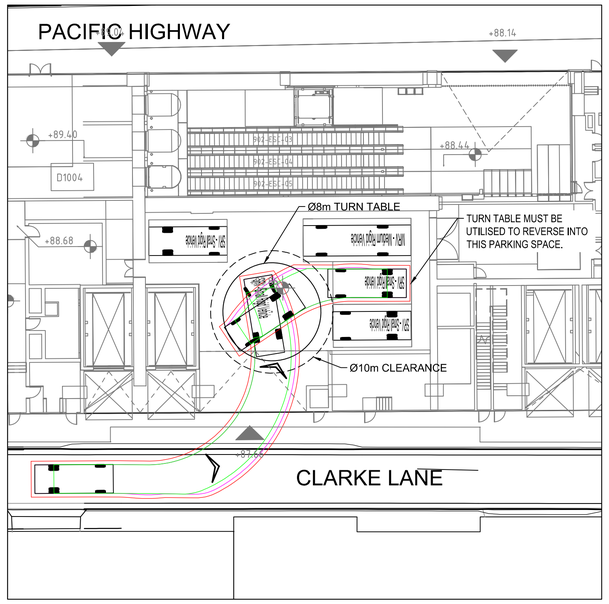
SRV - SMALL RIGID VEHICLE

OVERALL LENGTH	6.400m
OVERALL WIDTH	2.330m
OVERALL BODY HEIGHT	3.500m
MIN BODY GROUND CLEARANCE	0.398m
TRACK WIDTH	2.330m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	7.100m



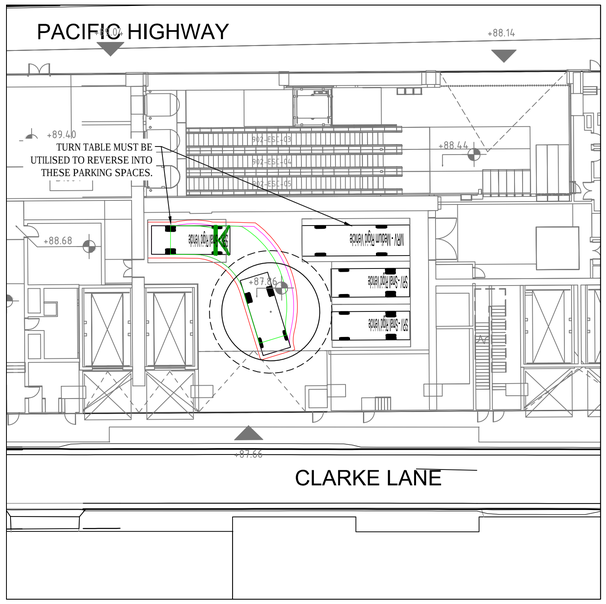
SMALL RIGID VEHICLE (SRV) PARKING MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250



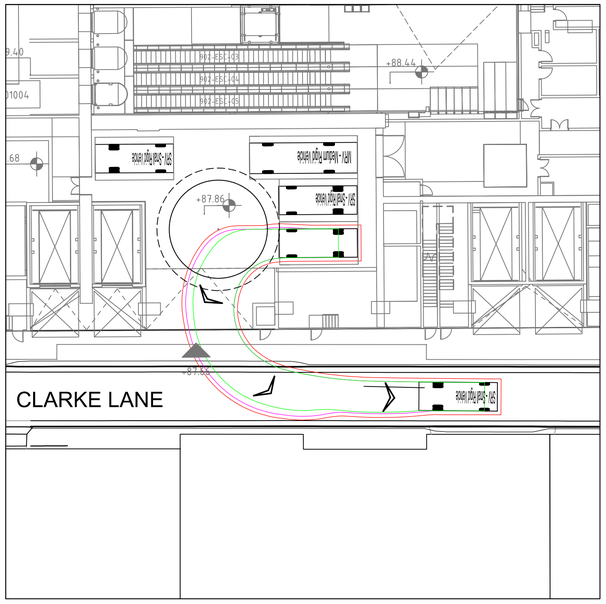
SMALL RIGID VEHICLE (SRV) PARKING MANOEUVRETO SITE A LOADING DOCK

SCALE 1:250



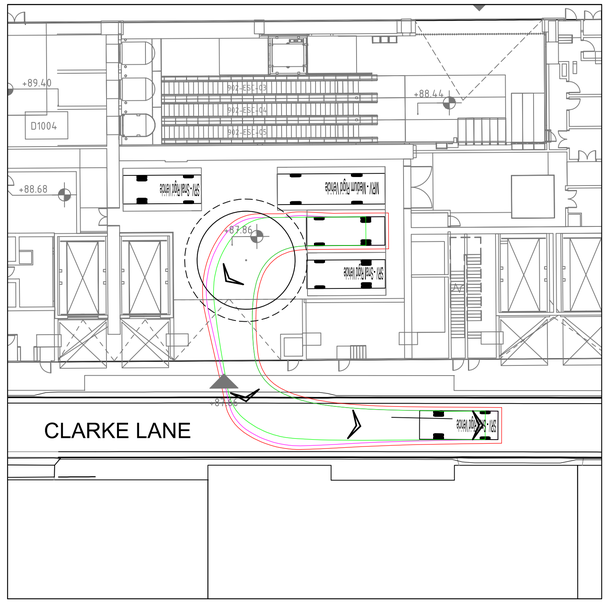
SMALL RIGID VEHICLE (SRV) PARKING MANOEUVRE TO SITE A LOADING DOCK

SCALE 1:250



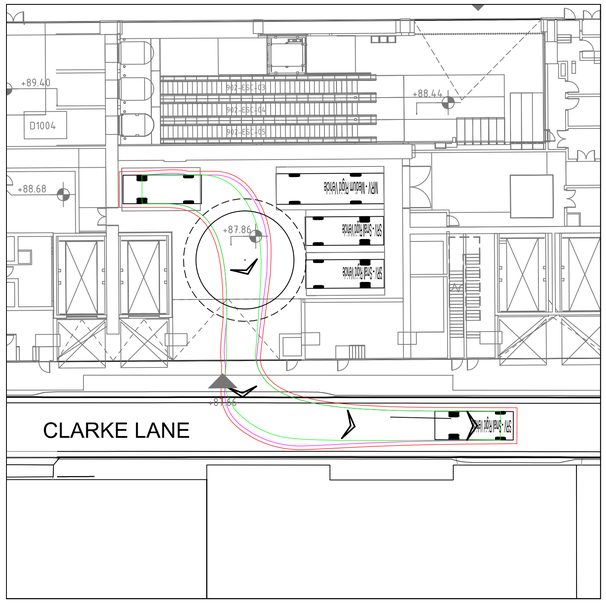
SMALL RIGID VEHICLE (SRV) EXIT MANOEUVREFROM SITE A LOADING DOCK

SCALE 1:250



SMALL RIGID VEHICLE (SRV) EXIT MANOEUVRE FROM SITE A LOADING DOCK

SCALE 1:250



SMALL RIGID VEHICLE (SRV) EXIT MANOEUVRE FROM SITE A LOADING DOCK

SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01	MO	30/01/2018	REVISION IN PROGRESS	
P02.3	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA

DESIGNED B TOWNSEND

DRG CHECK

DESIGN CHECK

APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 5
SITE A SRV REAR-IN PARKING

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 5 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001035 | REV P02.3

Plot Date & Time: 19 Sep 2018 - 1:22 PM

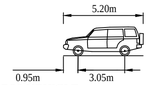
100mm AT FULL SIZE

LEGEND

TYRE LINE

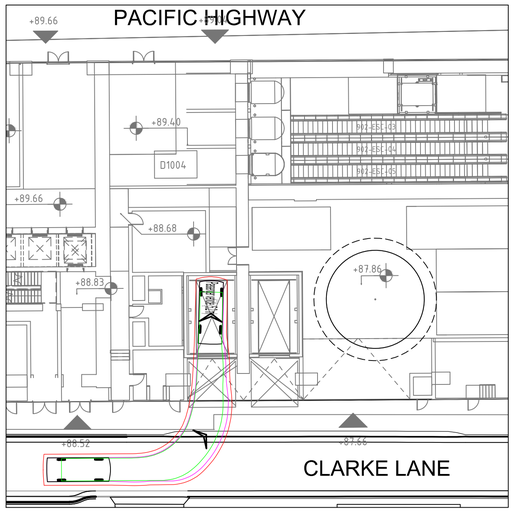
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE

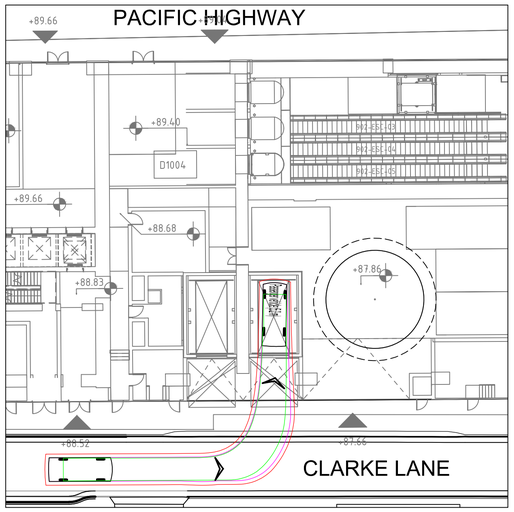


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

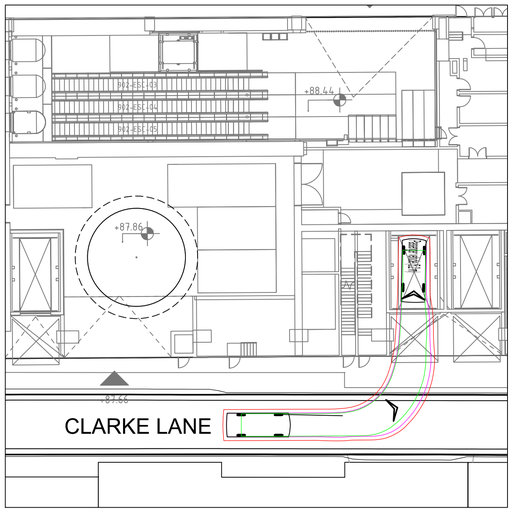
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



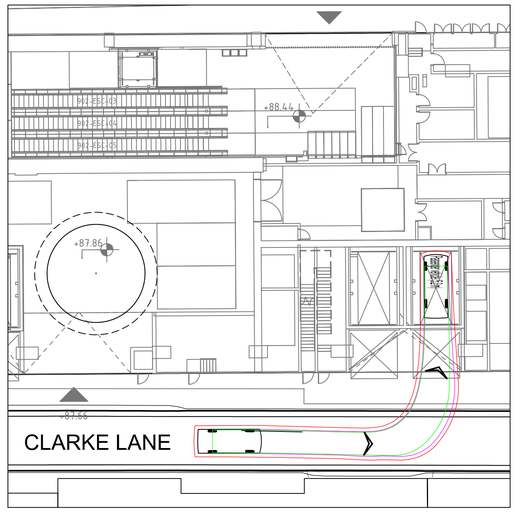
B99 ENTRY MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



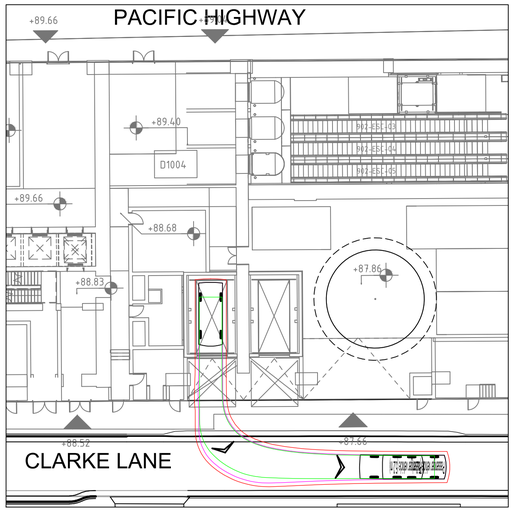
B99 ENTRY MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



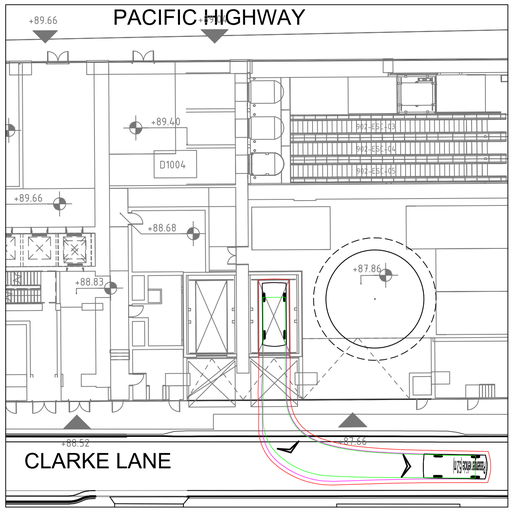
B99 ENTRY MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



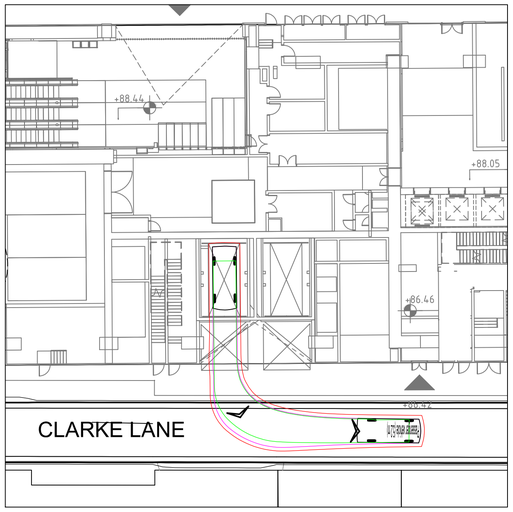
B99 ENTRY MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



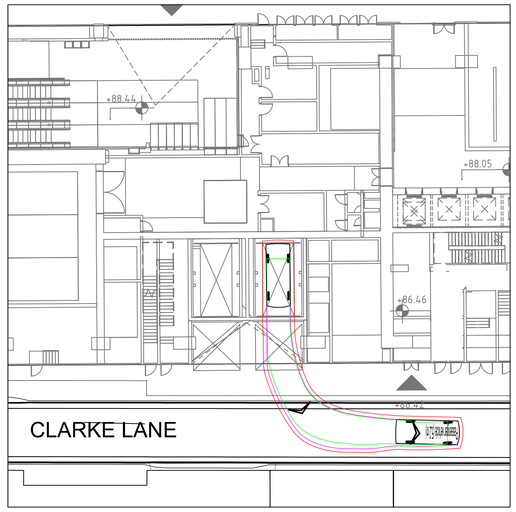
B99 EXIT MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



B99 EXIT MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



B99 EXIT MANOEUVRE
TO SITE A LIFTS
SCALE 1:250



B99 EXIT MANOEUVRE
TO SITE A LIFTS
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01	MO	30/01/2018	REVISION IN PROGRESS	
P02.3	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED R TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 6
SITE A LIFTS B99

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 6 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001036 | REV P02.3

Plot Date & Time: 19 Sep 2018 - 1:23 PM

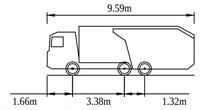
100mm AT FULL SIZE

LEGEND

TYRE LINE

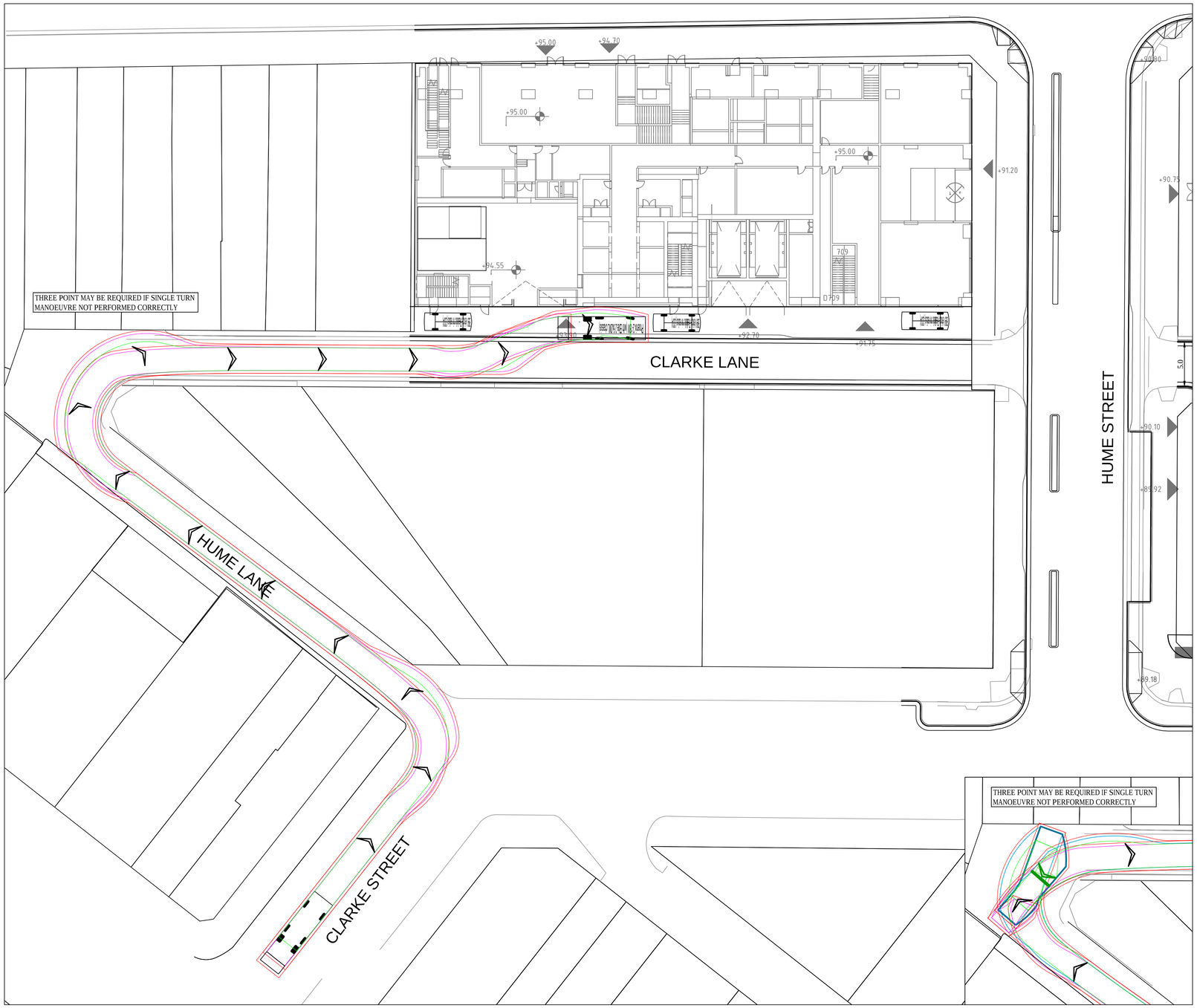
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE



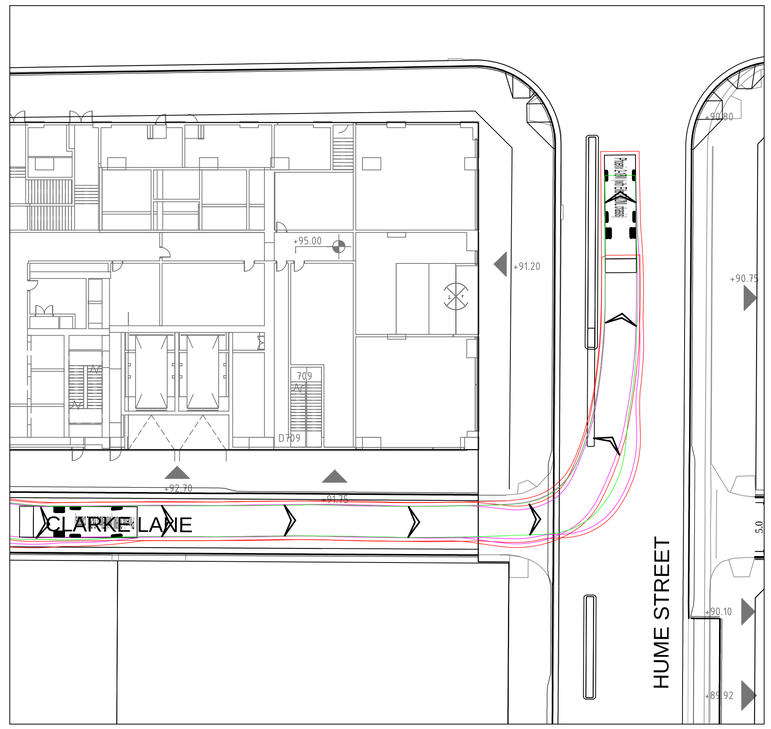
PHOENIX 2-18W
(WITH ELITE 2 6x2ML CHASSIS)

OVERALL LENGTH	9.595m
OVERALL WIDTH	2.530m
MIN BODY GROUND CLEARANCE	0.410m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	8.950m



PHOENIX - 2-18W (GARBAGE TRUCK) ENTRY MANOEUVRE
TO SITE B LOADING DOCK FROM HUME LANE

SCALE 1:250



PHOENIX - 2-18W (GARBAGE TRUCK) EXIT MANOEUVRE
FROM SITE B LOADING DOCK

SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 7
SITE B GARBAGE TRUCK

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 7 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001037 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 1:26 PM

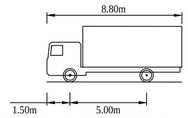
100mm AT FULL SIZE

LEGEND

TYRE LINE

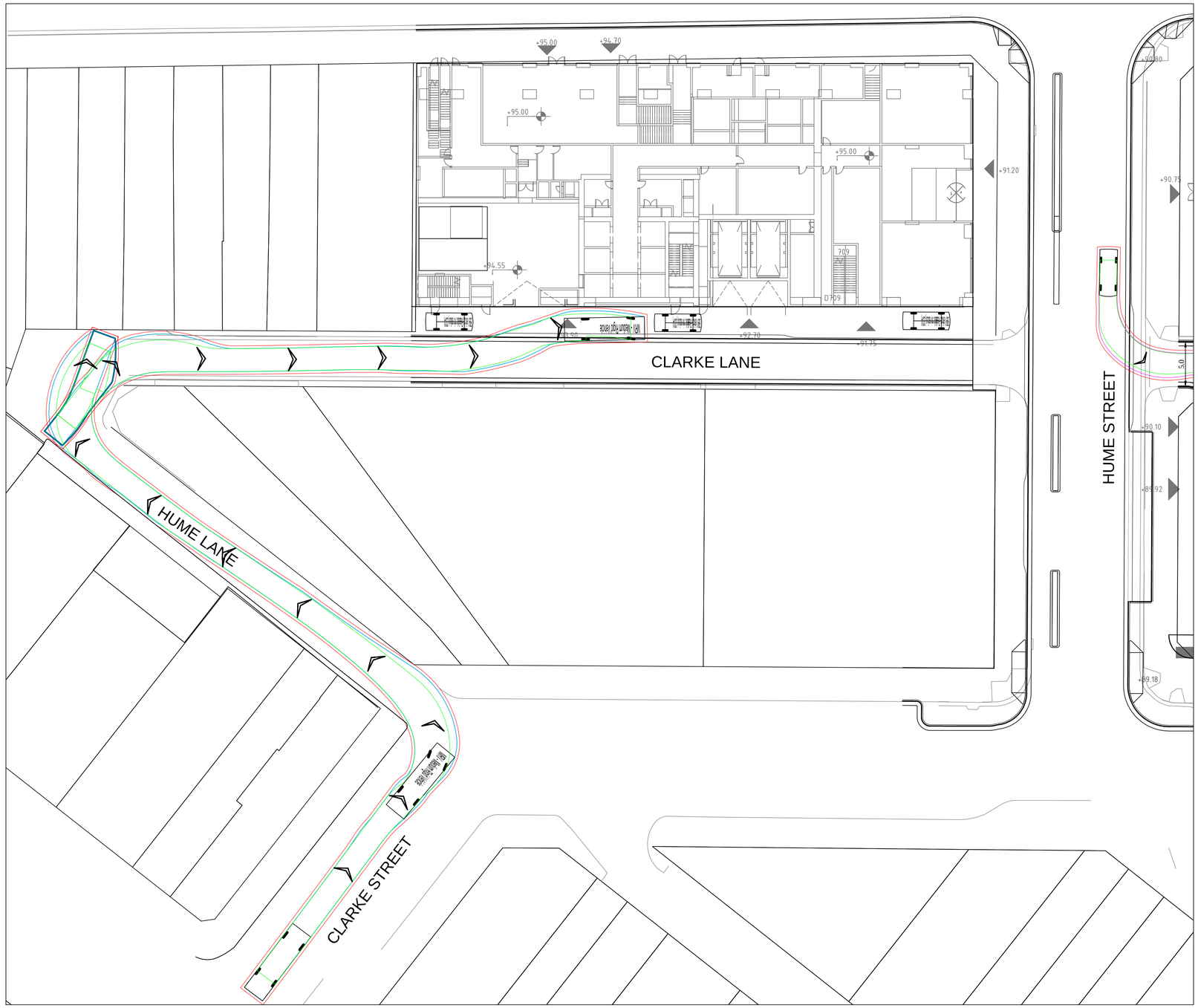
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE

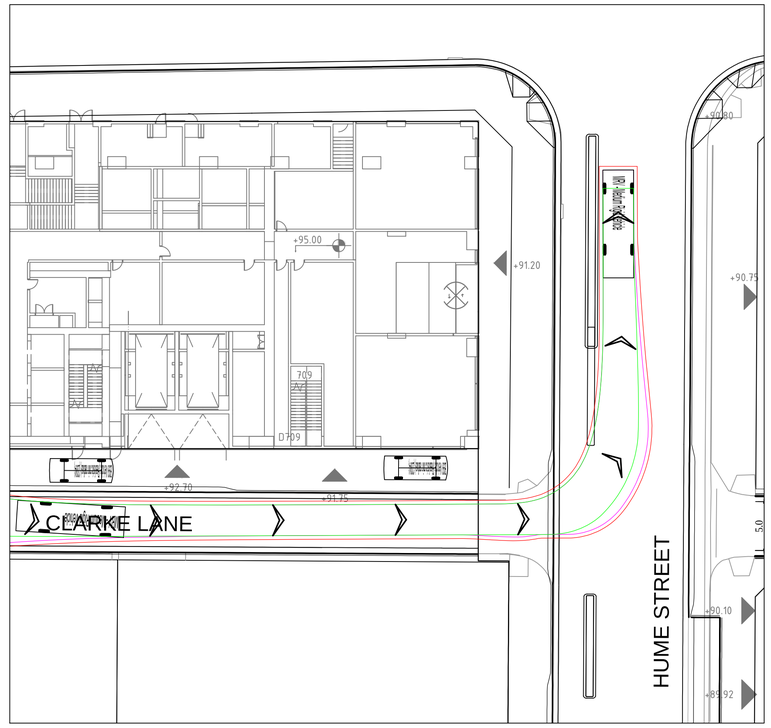


MRV - MEDIUM RIGID VEHICLE

OVERALL LENGTH	8.800m
OVERALL WIDTH	2.500m
OVERALL BODY HEIGHT	3.633m
MIN BODY GROUND CLEARANCE	0.428m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	10.000m



MRV ENTRY MANOEUVRE
TO SITE B LOADING DOCK FROM HUME LANE
SCALE 1:250



MRV EXIT MANOEUVRE
FROM SITE B LOADING DOCK
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 8
SITE B MRV

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 8 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001038 | REV P01.2

100mm AT FULL SIZE

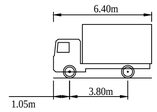
Plot Date & Time: 19 Sep 2018 - 1:33 PM

LEGEND

TYRE LINE

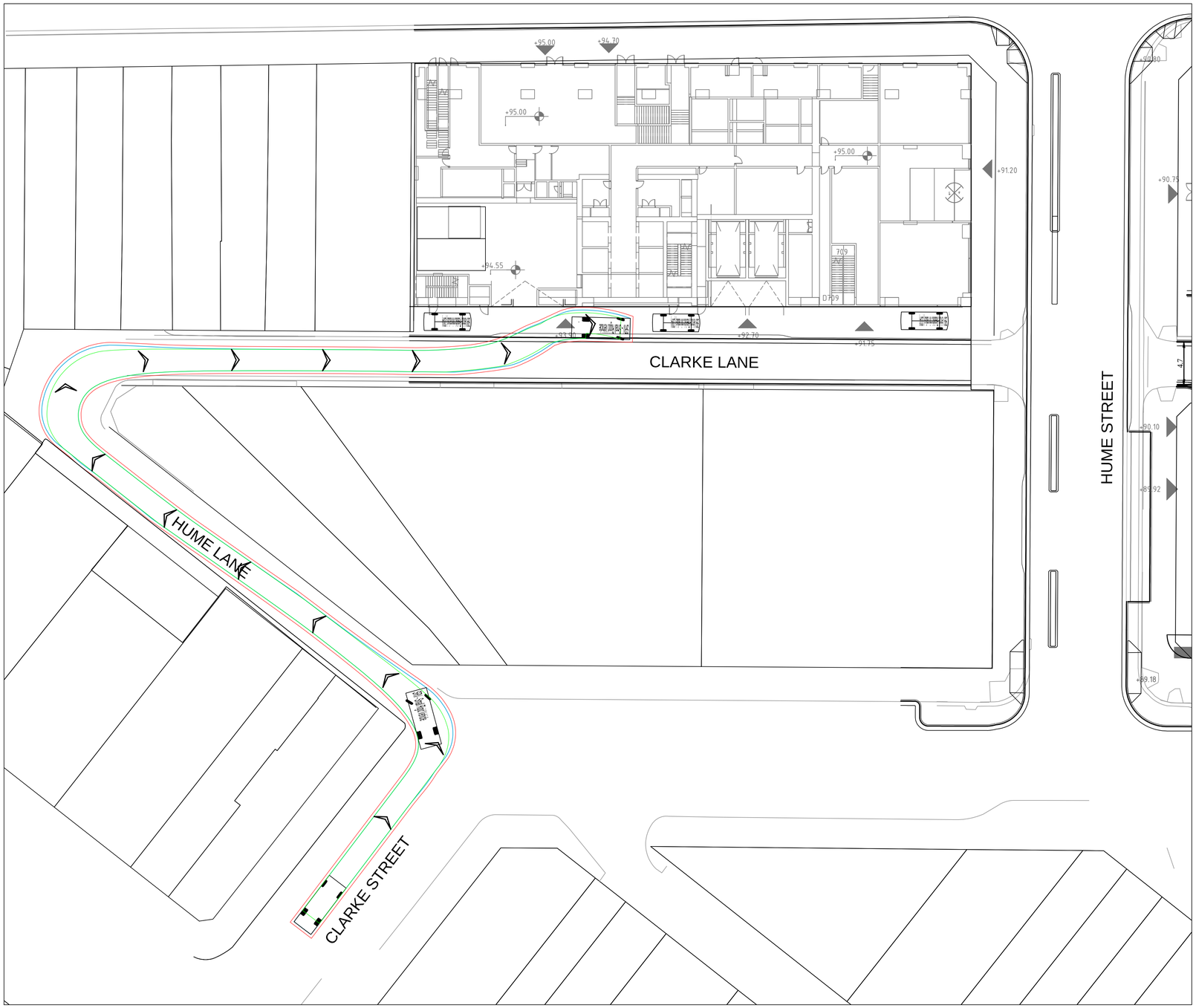
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE



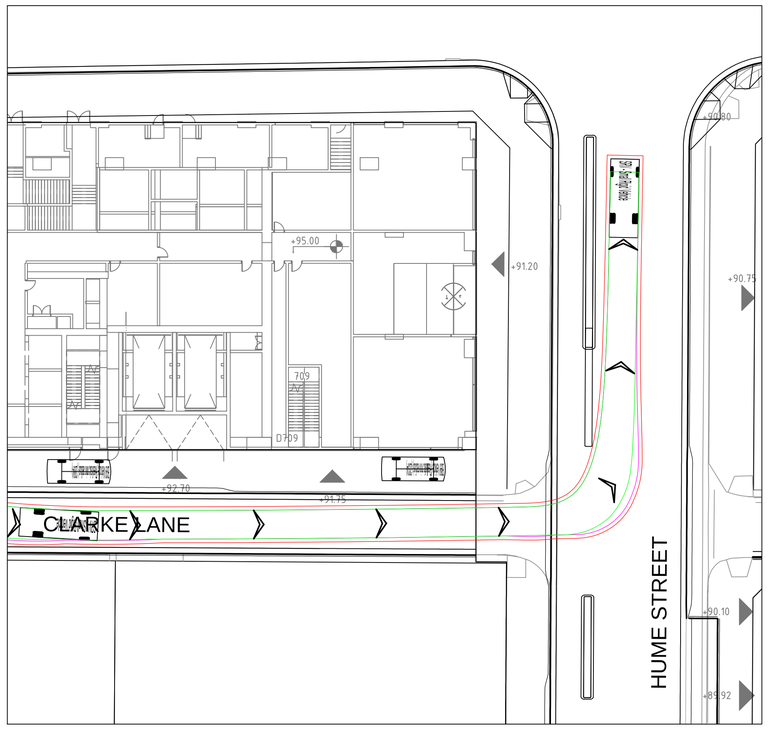
SRV - SMALL RIGID VEHICLE

OVERALL LENGTH	6.400m
OVERALL WIDTH	2.330m
OVERALL BODY HEIGHT	3.500m
MIN BODY GROUND CLEARANCE	0.398m
TRACK WIDTH	2.330m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	7.100m



SMALL RIGID VEHICLE (SRV) ENTRY MANOEUVRE
NEAR SITE B LOADING DOCK FROM HUME LANE

SCALE 1:250



SMALL RIGID VEHICLE (SRV) EXIT MANOEUVRE
FROM SITE B LOADING DOCK

SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA

DESIGNED B TOWNSEND

DRG CHECK

DESIGN CHECK

APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 9
SITE B SRV

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 9 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001039 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 1:35 PM

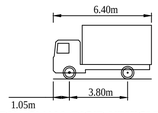
100mm AT FULL SIZE

LEGEND

TYRE LINE

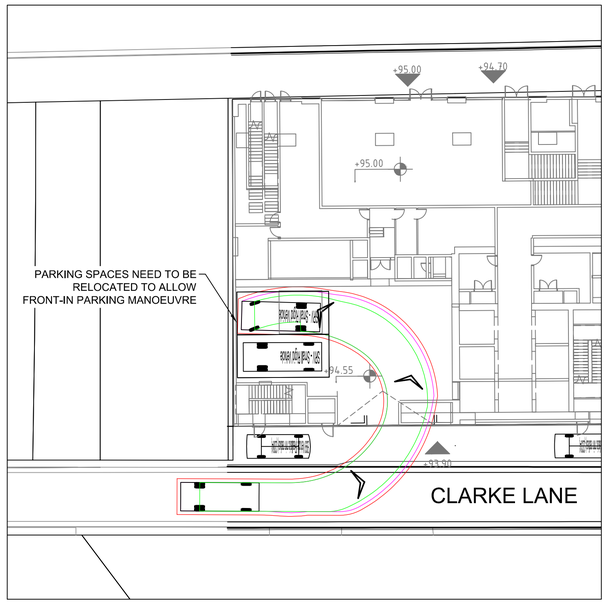
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE

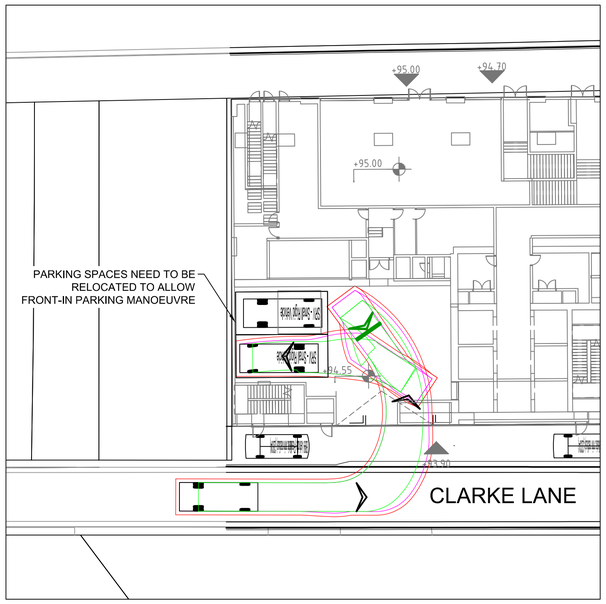


SRV - SMALL RIGID VEHICLE

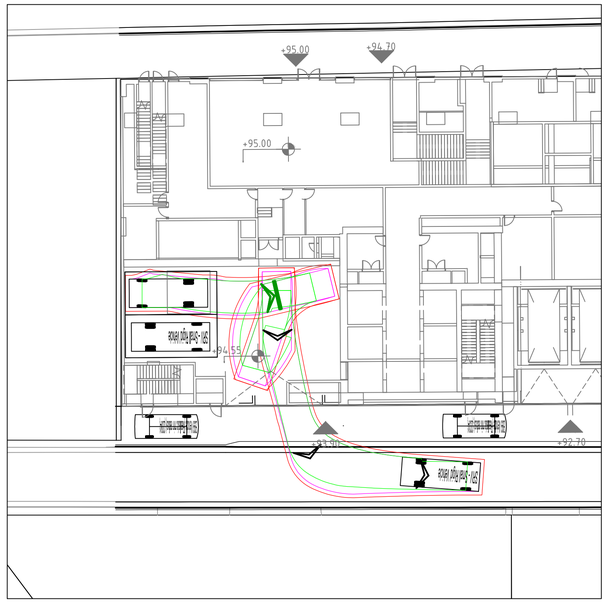
OVERALL LENGTH	6.400m
OVERALL WIDTH	2.330m
OVERALL BODY HEIGHT	3.500m
MIN BODY GROUND CLEARANCE	0.398m
TRACK WIDTH	2.330m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	7.100m



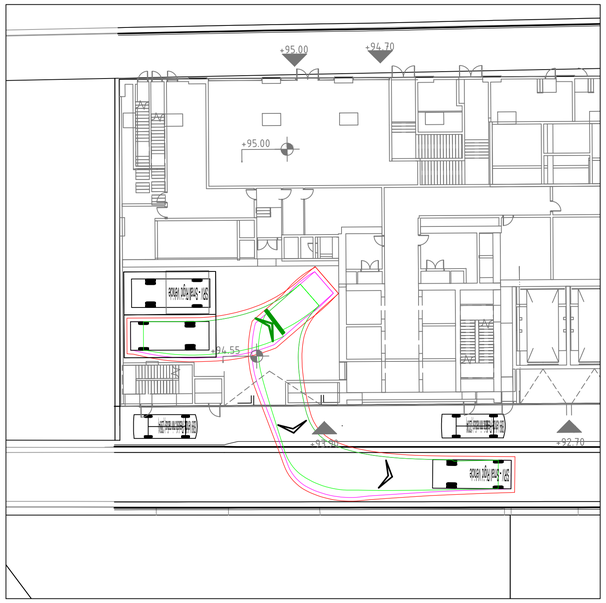
SRV PARKING MANOEUVRE
TO SITE B LOADING DOCK
SCALE 1:250



SRV PARKING MANOEUVRE
TO SITE B LOADING DOCK
SCALE 1:250



SRV EXIT MANOEUVRE
FROM SITE B LOADING DOCK
SCALE 1:250



SRV EXIT MANOEUVRE
FROM SITE B LOADING DOCK
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 10
SITE B SRV FRONT-IN PARKING

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 10 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001040 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 1:36 PM

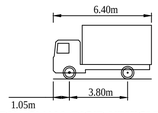
100mm AT FULL SIZE

LEGEND

TYRE LINE

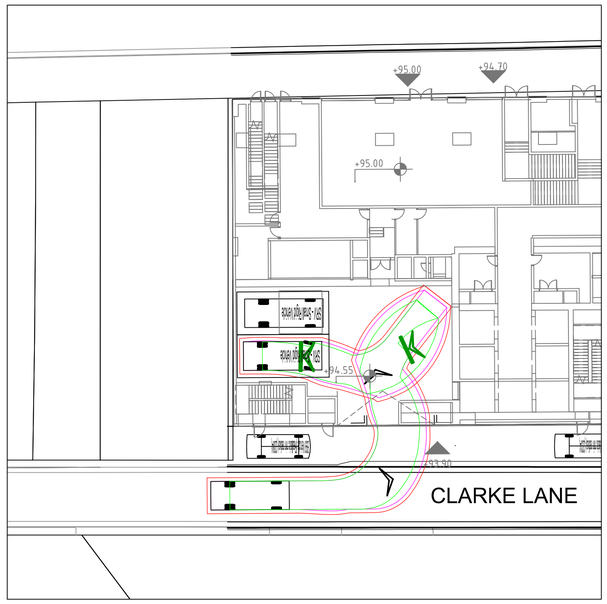
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE

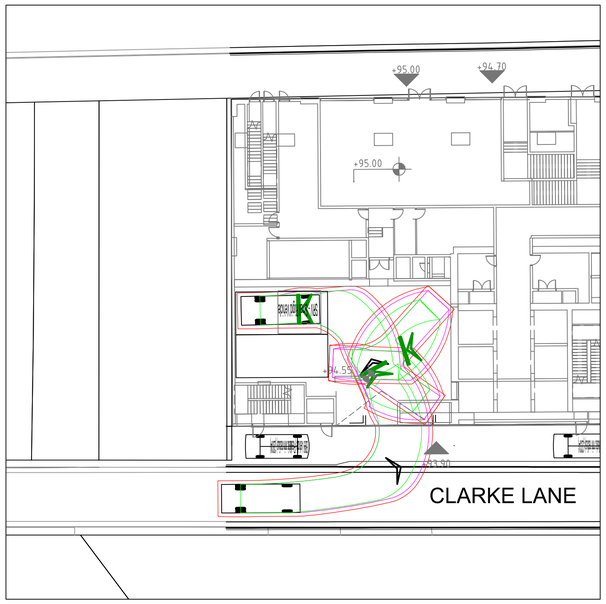


SRV - SMALL RIGID VEHICLE

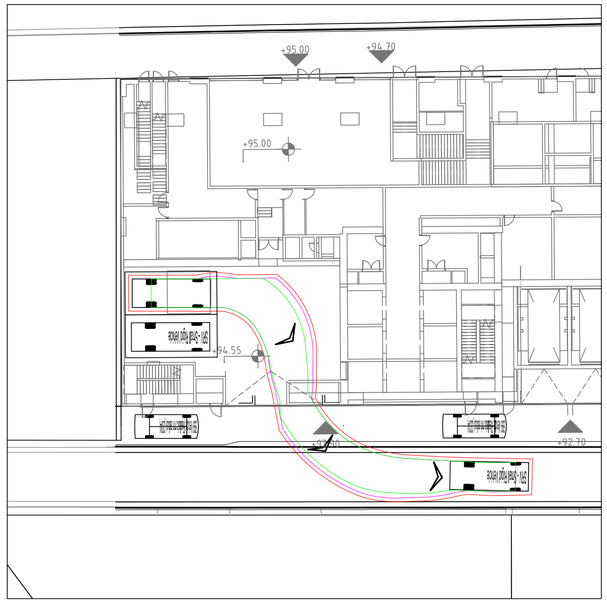
OVERALL LENGTH	6.400m
OVERALL WIDTH	2.330m
OVERALL BODY HEIGHT	3.500m
MIN BODY GROUND CLEARANCE	0.398m
TRACK WIDTH	2.330m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	7.100m



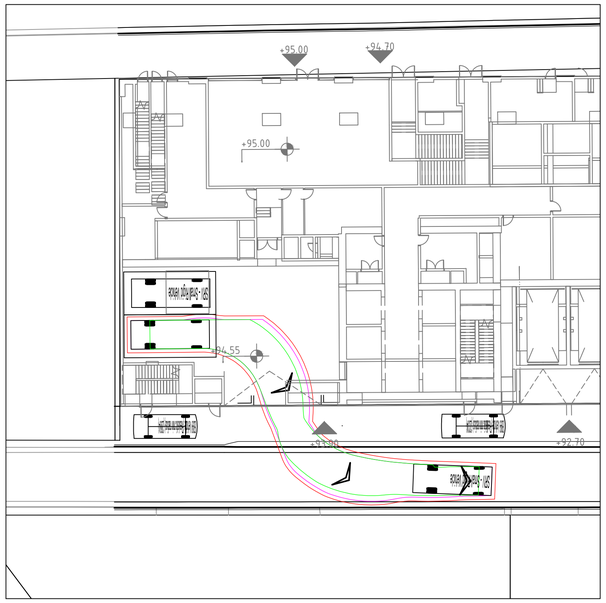
SRV PARKING MANOEUVRE
TO SITE B LOADING DOCK
SCALE 1:250



SRV PARKING MANOEUVRE
TO SITE B LOADING DOCK
SCALE 1:250



SRV EXIT MANOEUVRE
FROM SITE B LOADING DOCK
SCALE 1:250



SRV EXIT MANOEUVRE
FROM SITE B LOADING DOCK
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 11
SITE B SRV REAR-IN PARKING

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 11 OF 19 | ©

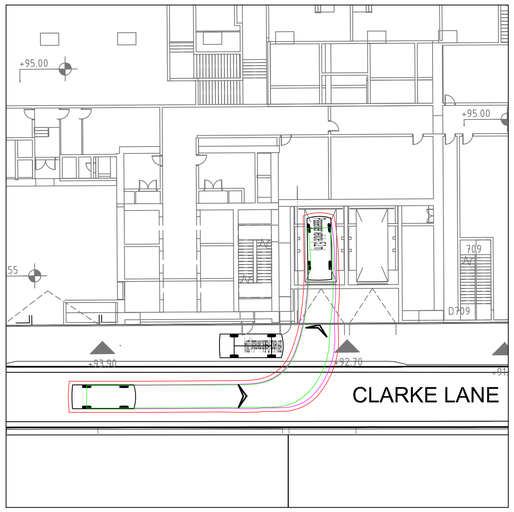
DWG No NWRLSRT-MET-SCN-CE-DWG-001041 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 1:37 PM

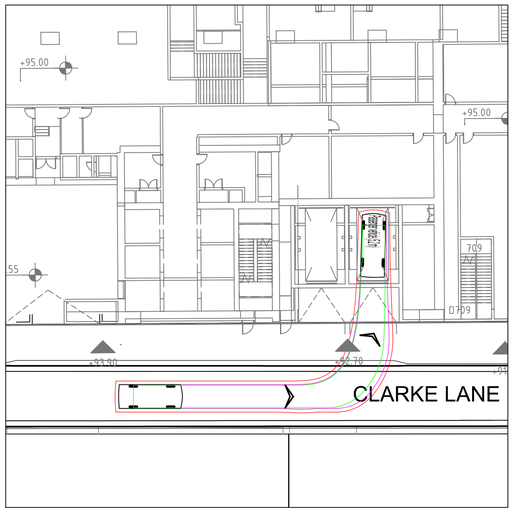
100mm AT FULL SIZE

LEGEND

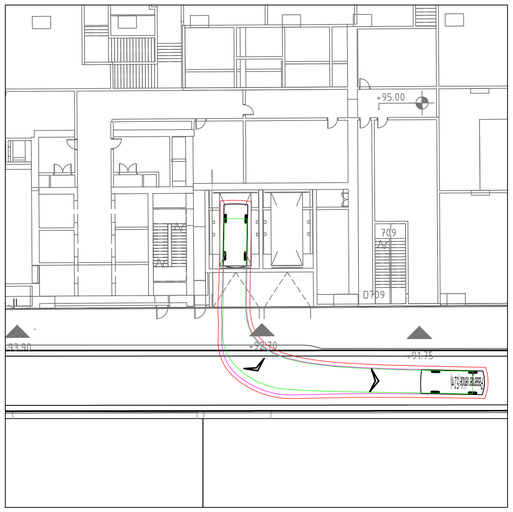
- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE



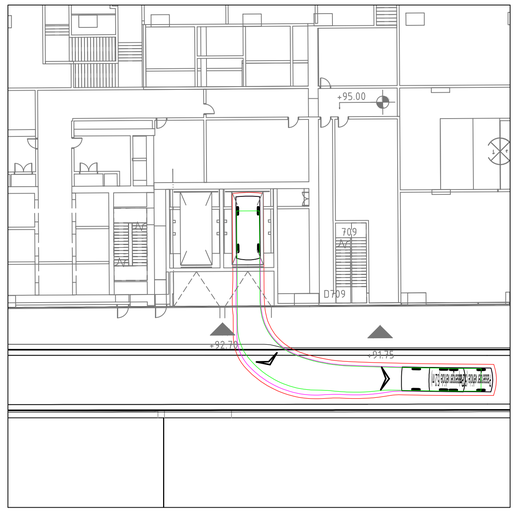
B99 ENTRY MANOEUVRE
TO SITE B LIFTS
SCALE 1:250



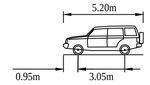
B99 ENTRY MANOEUVRE
TO SITE B LIFTS
SCALE 1:250



B99 EXIT MANOEUVRE
TO SITE B LIFTS
SCALE 1:250

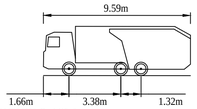


B99 EXIT MANOEUVRE
TO SITE B LIFTS
SCALE 1:250



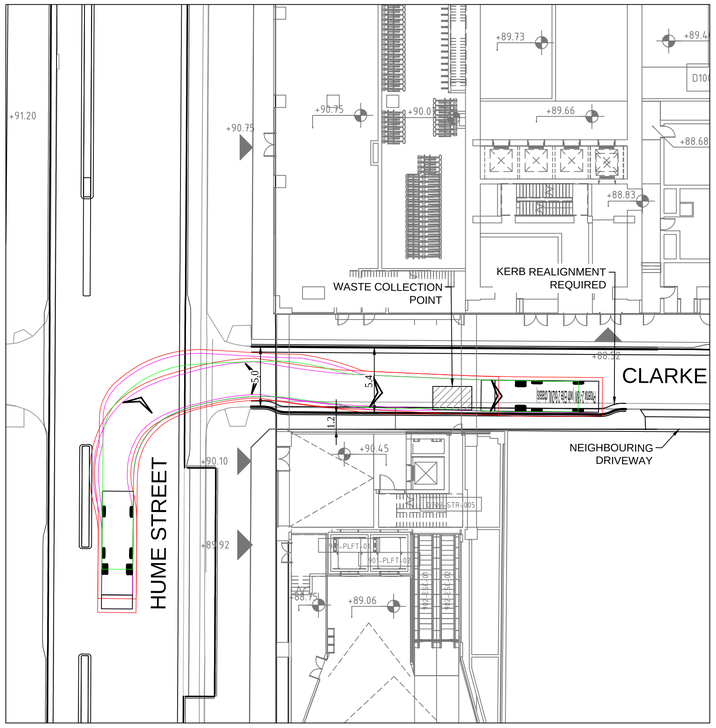
B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m

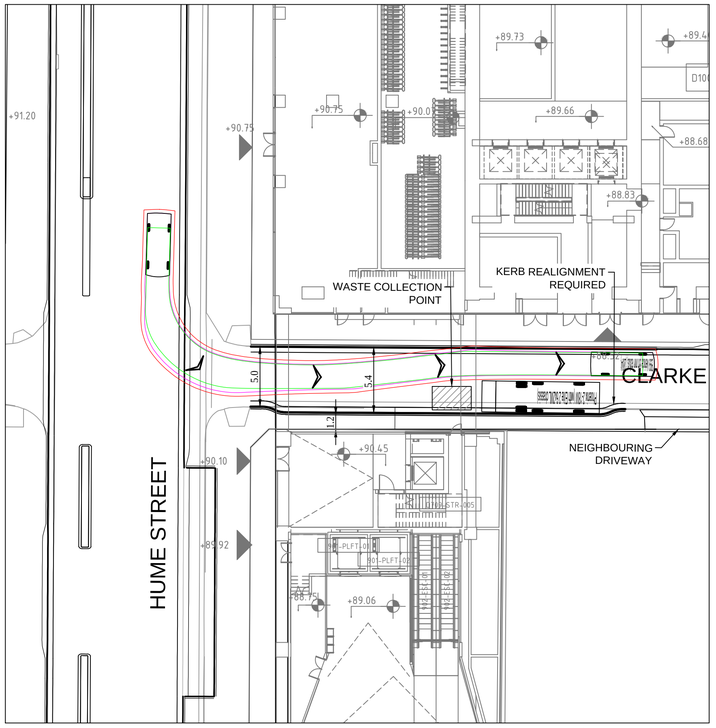


PHOENIX 2-18W
(WITH ELITE 2 6x2ML CHASSIS)

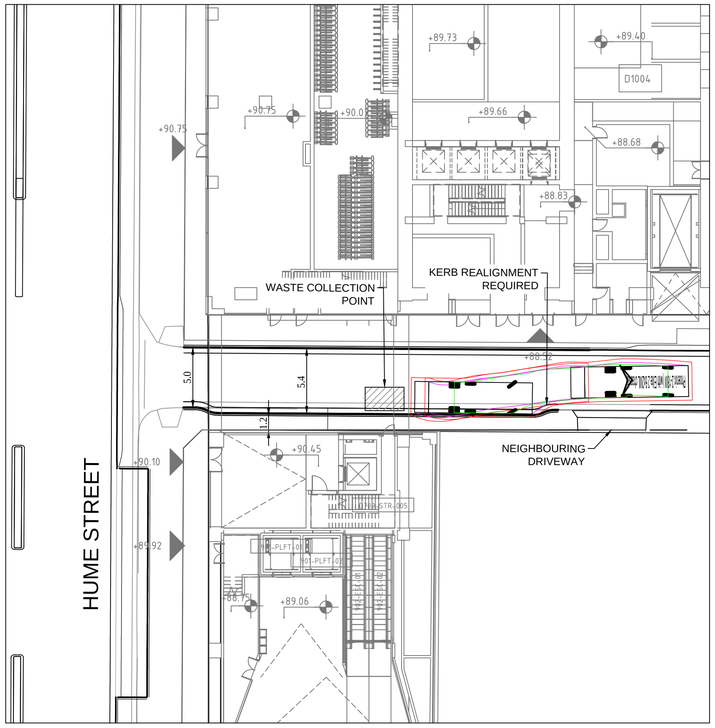
OVERALL LENGTH	9.595m
OVERALL WIDTH	2.530m
MIN BODY GROUND CLEARANCE	0.410m
TRACK WIDTH	2.500m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	8.950m



OPTION 1 - PHOENIX -2-18W (GARBAGE TRUCK)
WASTE COLLECTION MANOEUVRE NEAR SITE C
SCALE 1:250



OPTION 2 - PHOENIX -2-18W (GARBAGE TRUCK)
WASTE COLLECTION MANOEUVRE NEAR SITE C
SCALE 1:250



OPTION 3 - PHOENIX -2-18W (GARBAGE TRUCK)
WASTE COLLECTION MANOEUVRE NEAR SITE C
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS
METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 12
SITE B LIFTS B99 AND WASTE COLLECTION OPTIONS SITE C

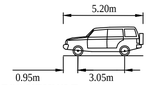
STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 12 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001042 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 1:38 PM
100mm AT FULL SIZE

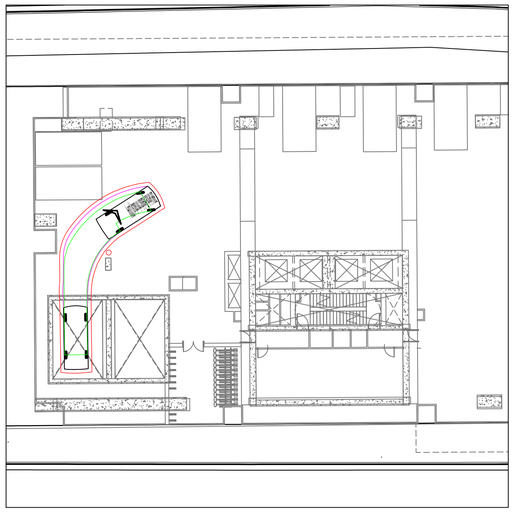
LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE
- PROPOSED BOLLARD

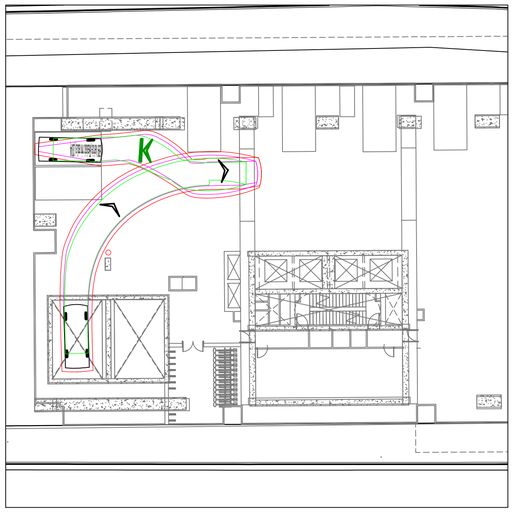


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

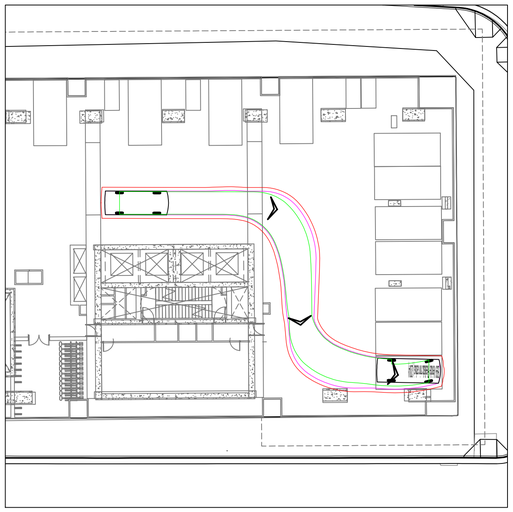
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



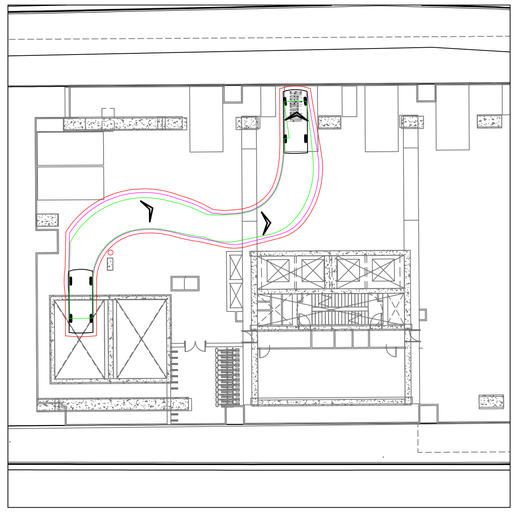
B99 ENTRY MANOEUVRE 1
SITE A NORTH TOWER
SCALE 1:250



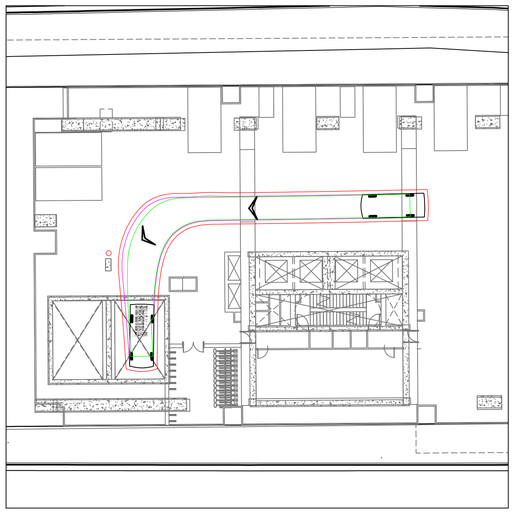
B99 ENTRY MANOEUVRE 2
SITE A NORTH TOWER
SCALE 1:250



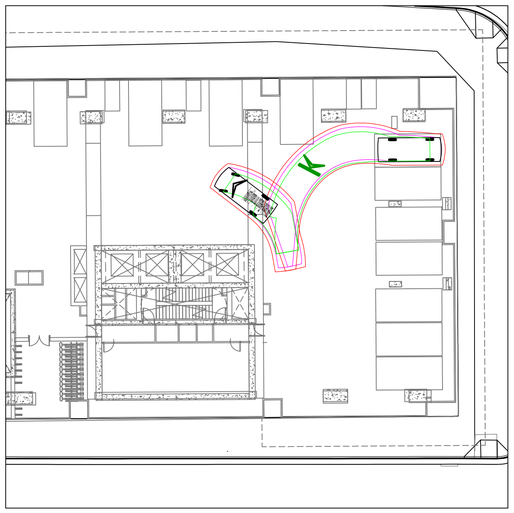
B99 ENTRY MANOEUVRE 3
SITE A NORTH TOWER
SCALE 1:250



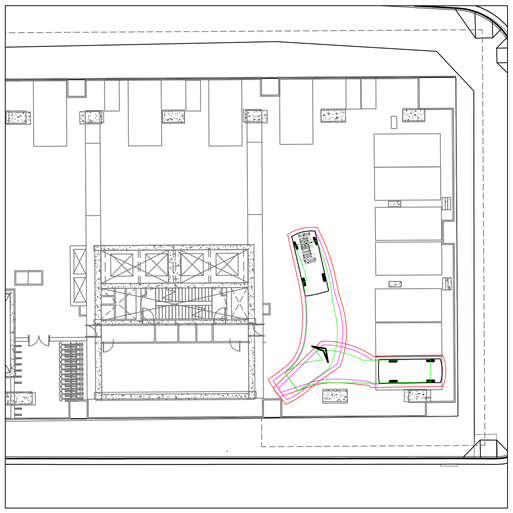
B99 ENTRY MANOEUVRE 4
SITE A NORTH TOWER
SCALE 1:250



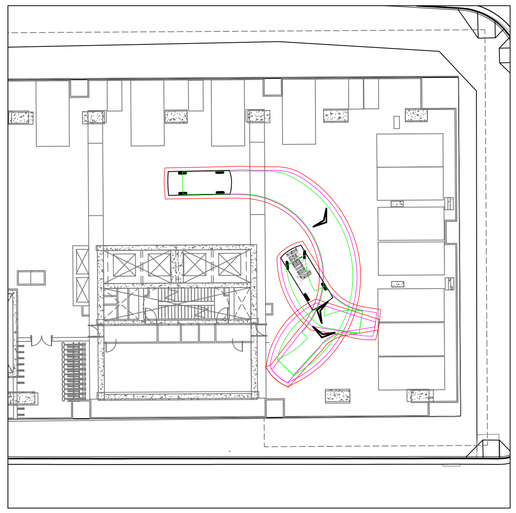
B99 EXIT MANOEUVRE 1
SITE A NORTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 2
SITE A NORTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 3
SITE A NORTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 4
SITE A NORTH TOWER
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS
METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 13
SITE A NORTH TOWER

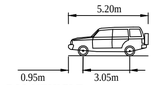
STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 13 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001043 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 1:39 PM
100mm AT FULL SIZE

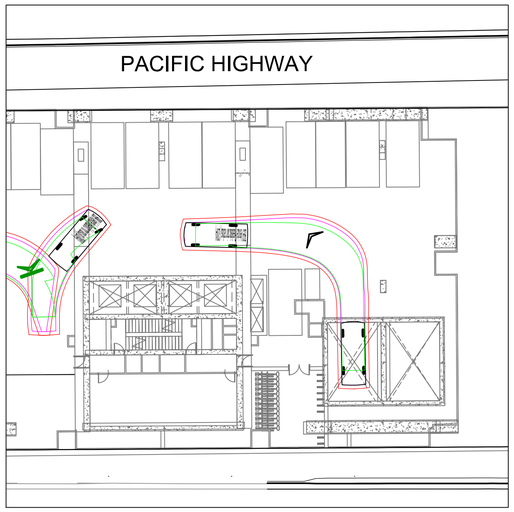
LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE

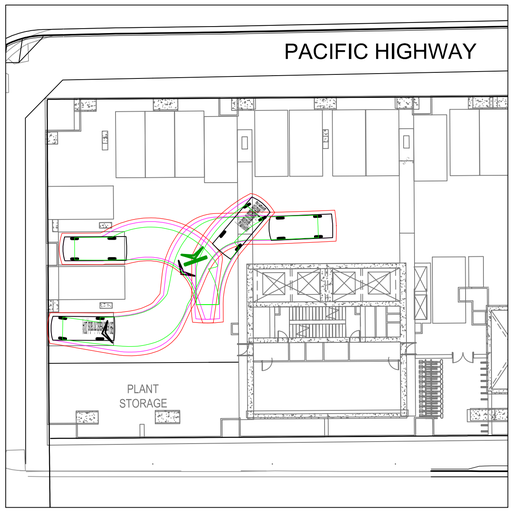


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

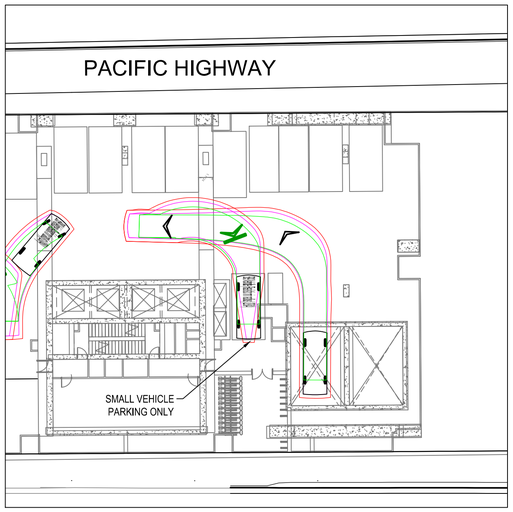
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



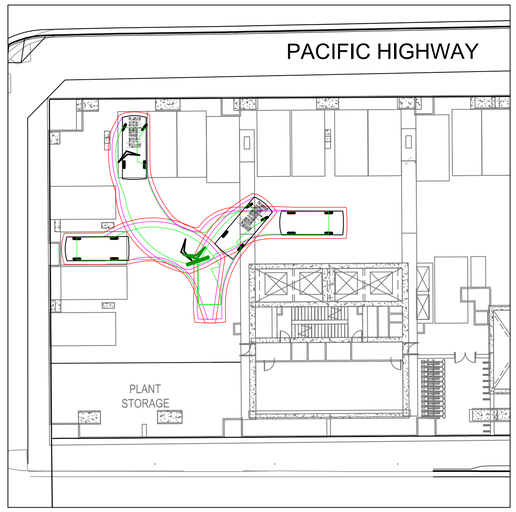
B99 ENTRY MANOEUVRE 1
SITE A SOUTH TOWER
SCALE 1:250



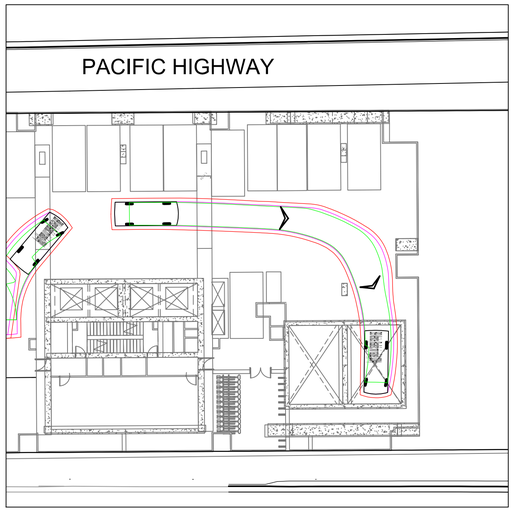
B99 ENTRY MANOEUVRE 2
SITE A SOUTH TOWER
SCALE 1:250



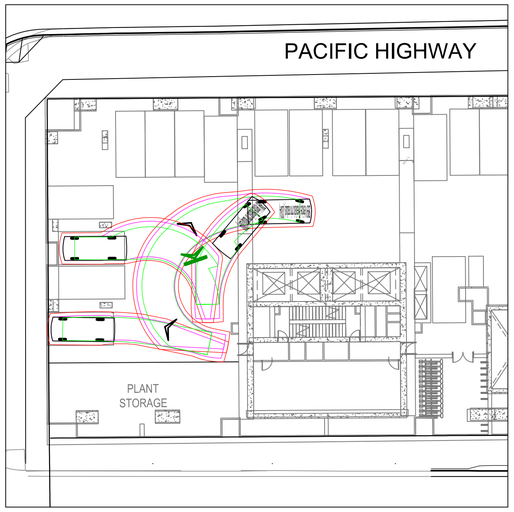
B99 ENTRY MANOEUVRE 3
SITE A SOUTH TOWER
SCALE 1:250



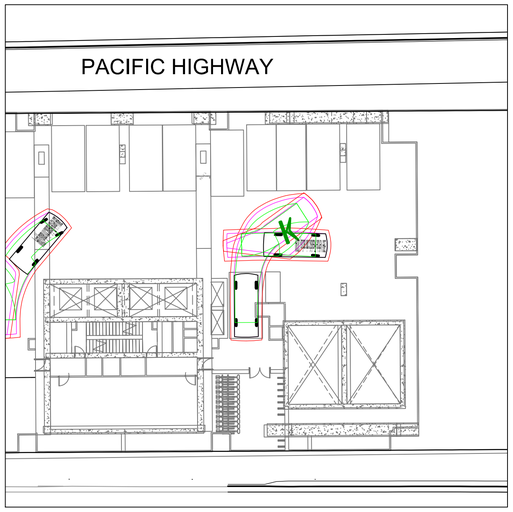
B99 ENTRY MANOEUVRE 4
SITE A SOUTH TOWER
SCALE 1:250



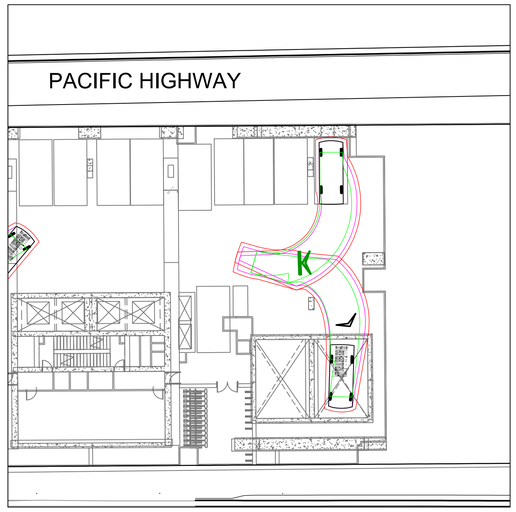
B99 EXIT MANOEUVRE 1
SITE A SOUTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 2
SITE A SOUTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 3
SITE A SOUTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 4
SITE A SOUTH TOWER
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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NSW GOVERNMENT | Transport for NSW

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SERVICE PROVIDERS
METRON

DRAWN M OLAYA
DESIGNED R TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 14
SITE A SOUTH TOWER

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 14 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001044 | REV P01.2

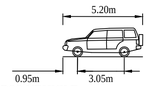
Plot Date & Time: 19 Sep 2018 - 1:40 PM
100mm AT FULL SIZE

LEGEND

TYRE LINE

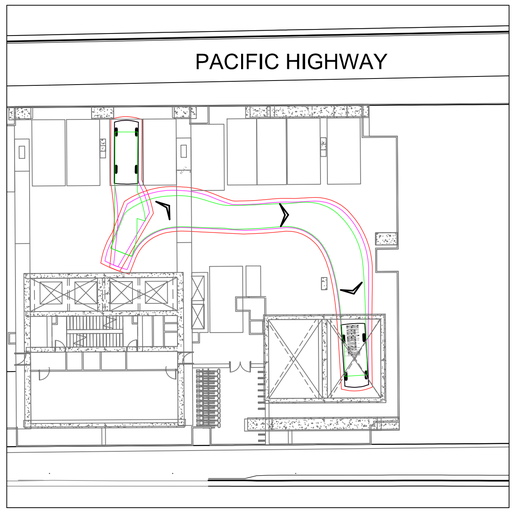
VEHICLE BODY LINE

VEHICLE BODY CLEARANCE

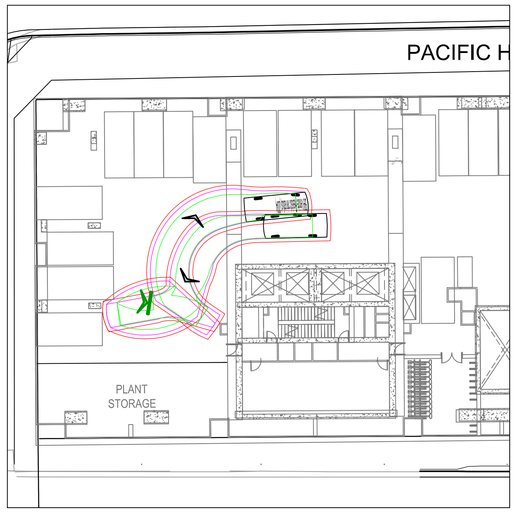


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

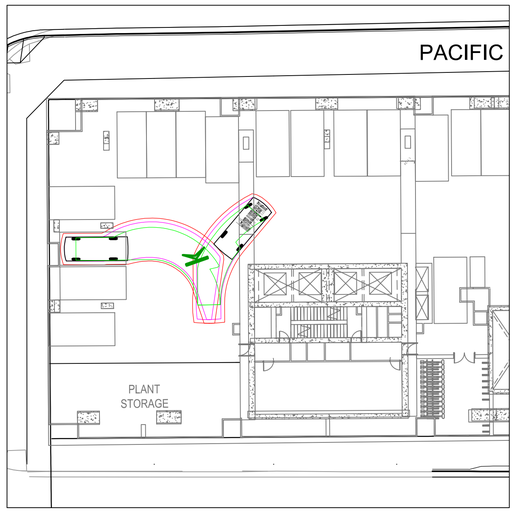
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



B99 EXIT MANOEUVRE 5
SITE A SOUTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 6
SITE A SOUTH TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 7
SITE A SOUTH TOWER
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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METRON

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DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 15
SITE A SOUTH TOWER

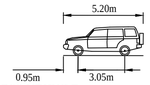
STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 15 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001045 | REV P01.2

100mm AT FULL SIZE

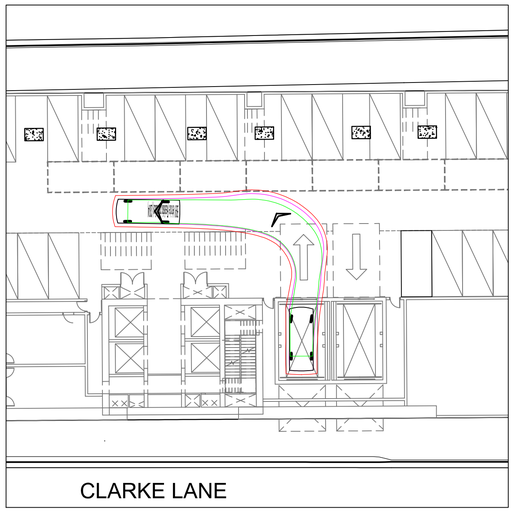
LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE
- POTENTIAL LOCATION FOR VEHICLE STACKING

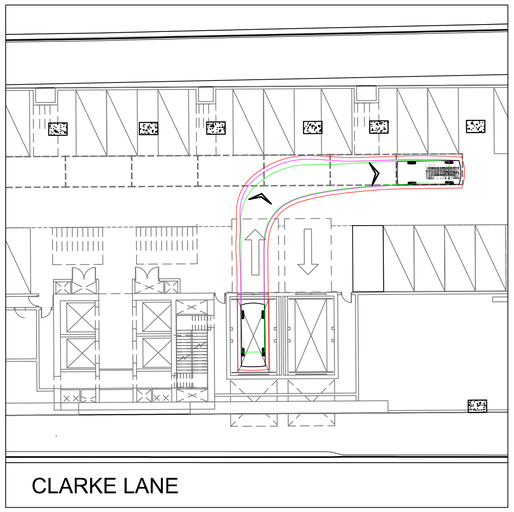


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

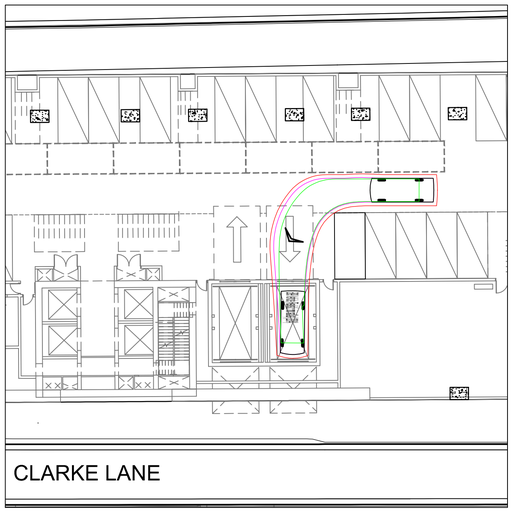
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



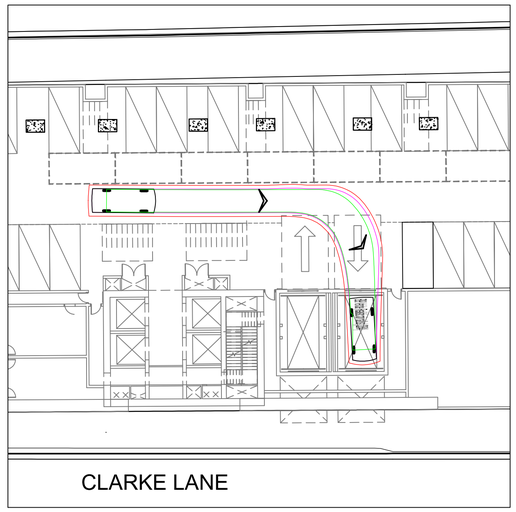
B99 ENTRY MANOEUVRE 1
SITE B TOWER
SCALE 1:250



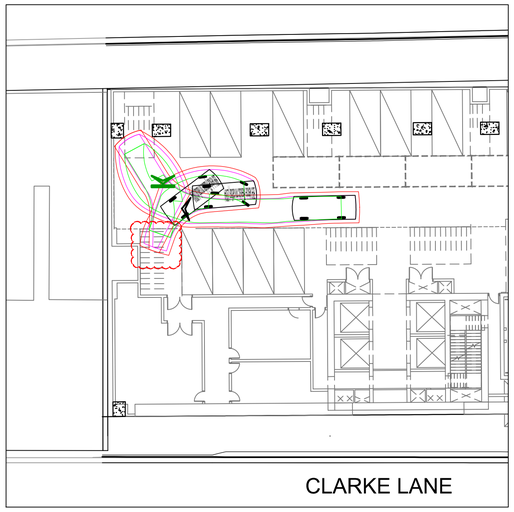
B99 ENTRY MANOEUVRE 2
SITE B TOWER
SCALE 1:250



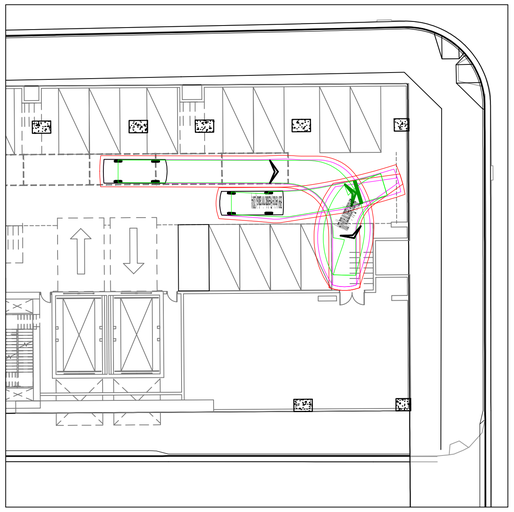
B99 EXIT MANOEUVRE 1
SITE B TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 2
SITE B TOWER
SCALE 1:250



B99 U-TURN MANOEUVRE 1
SITE B TOWER
SCALE 1:250



B99 U-TURN MANOEUVRE 2
SITE B TOWER
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 16
SITE B TOWER

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 15 OF 19 | ©

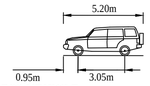
DWG No NWRLSRT-MET-SCN-CE-DWG-001046 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 2:19 PM

100mm AT FULL SIZE

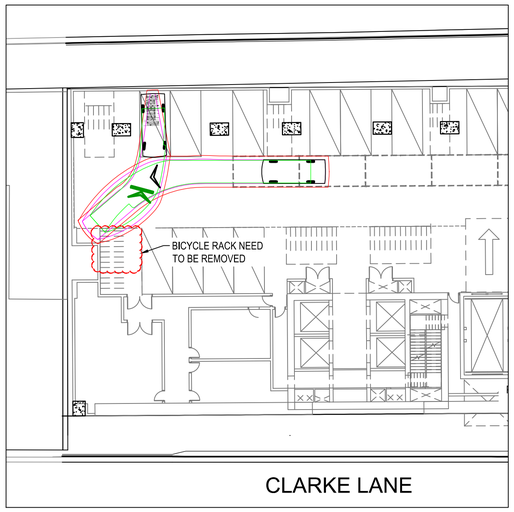
LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE
- POTENTIAL LOCATION FOR VEHICLE STACKING

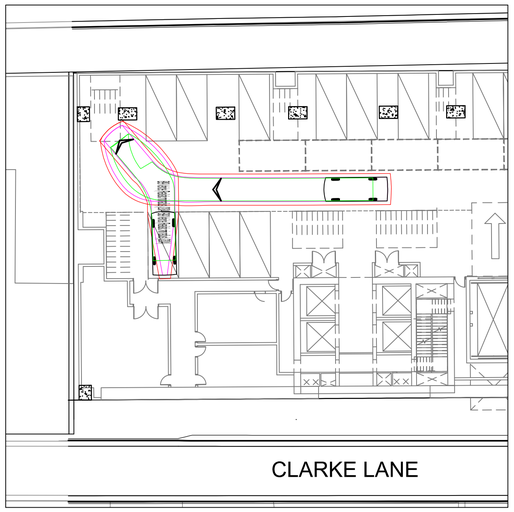


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

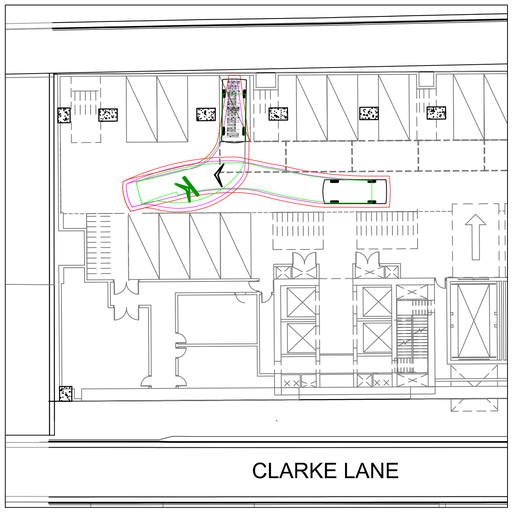
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



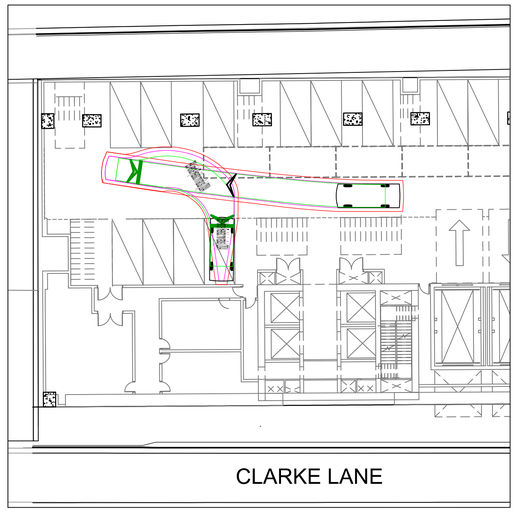
B99 PARKING MANOEUVRE 1
TO SITE B TOWER
SCALE 1:250



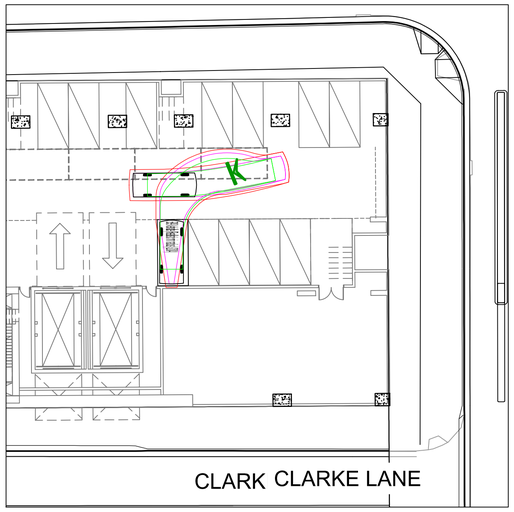
B99 PARKING MANOEUVRE 2
TO SITE B TOWER
SCALE 1:250



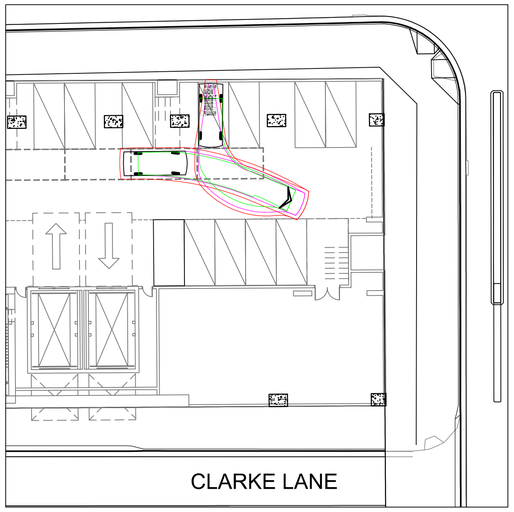
B99 PARKING MANOEUVRE 3
TO SITE B TOWER
SCALE 1:250



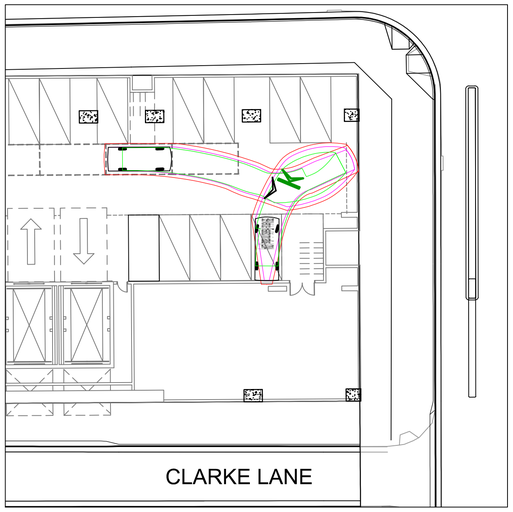
B99 PARKING MANOEUVRE 4
TO SITE B TOWER
SCALE 1:250



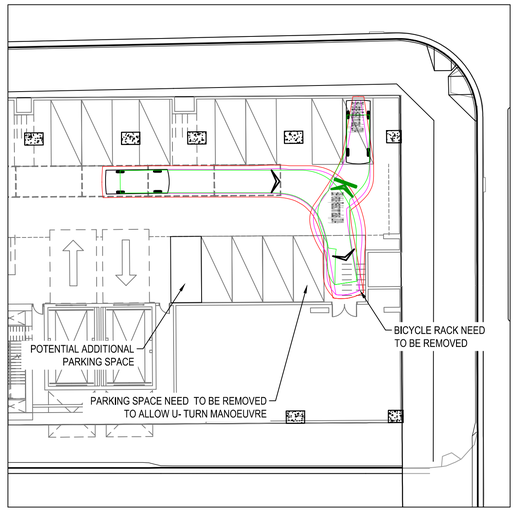
B99 PARKING MANOEUVRE 5
TO SITE B TOWER
SCALE 1:250



B99 PARKING MANOEUVRE 6
TO SITE B TOWER
SCALE 1:250



B99 PARKING MANOEUVRE 7
TO SITE B TOWER
SCALE 1:250



B99 PARKING MANOEUVRE 8
TO SITE B TOWER
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS

METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 17
SITE B TOWER

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 17 OF 19 | ©

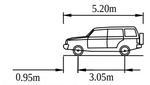
DWG No NWRLSRT-MET-SCN-CE-DWG-001047 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 2:20 PM

100mm AT FULL SIZE

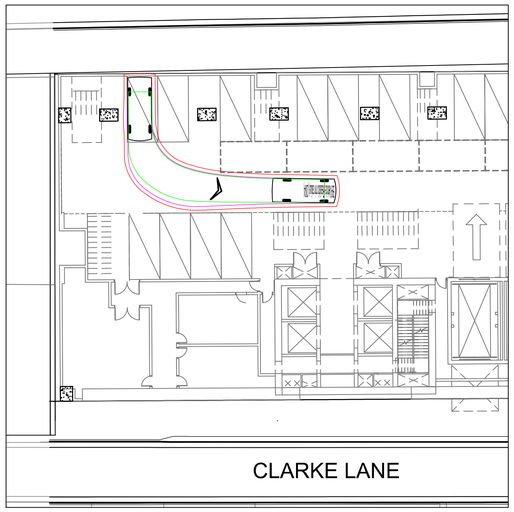
LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE
- POTENTIAL LOCATION FOR VEHICLE STACKING

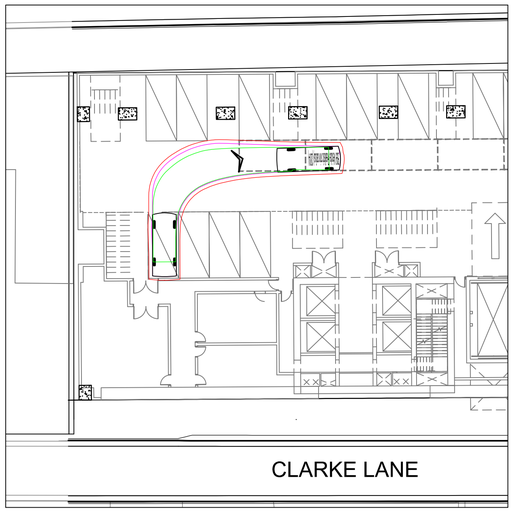


B99 VEHICLE
(REALISTIC MIN RADIUS) (2004)

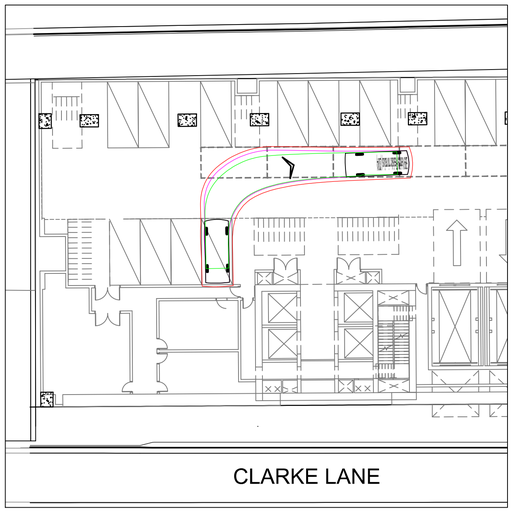
OVERALL LENGTH	5.200m OVERALL
WIDTH	1.940m
OVERALL BODY HEIGHT	1.878m MIN BODY
GROUND CLEARANCE	0.272m
TRACK WIDTH	1.840m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	6.250m



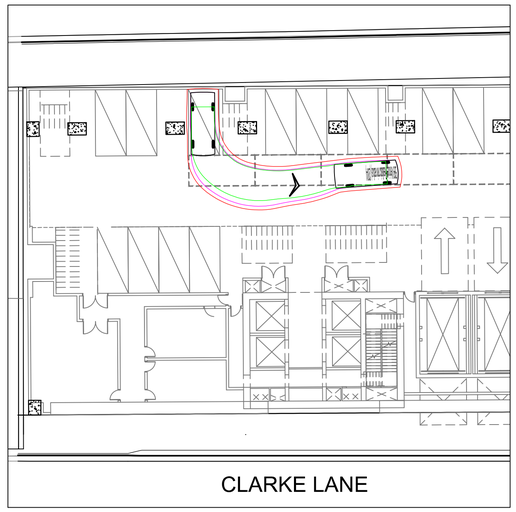
B99 EXIT MANOEUVRE 1
TO SITE B TOWER
SCALE 1:250



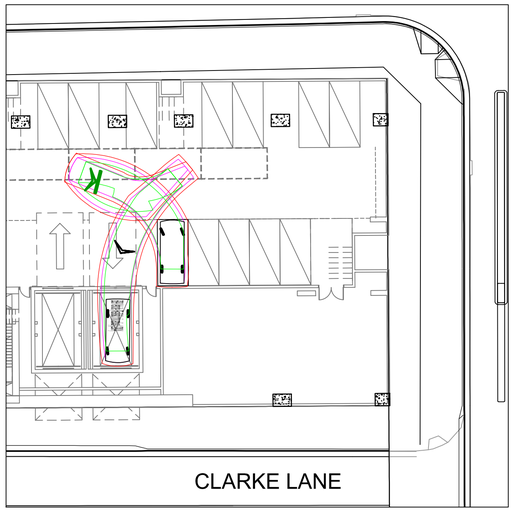
B99 EXIT MANOEUVRE 2
TO SITE B TOWER
SCALE 1:250



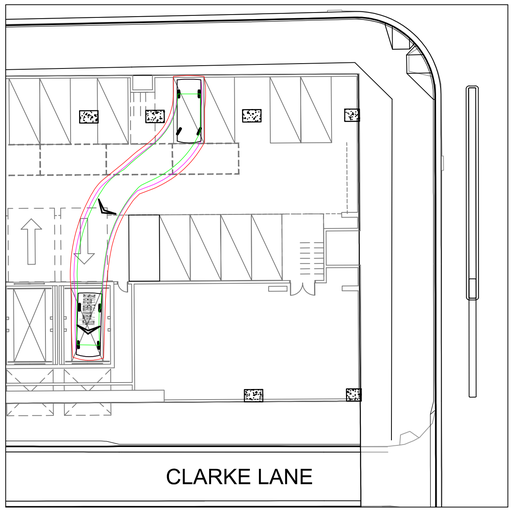
B99 EXIT MANOEUVRE 2
TO SITE B TOWER
SCALE 1:250



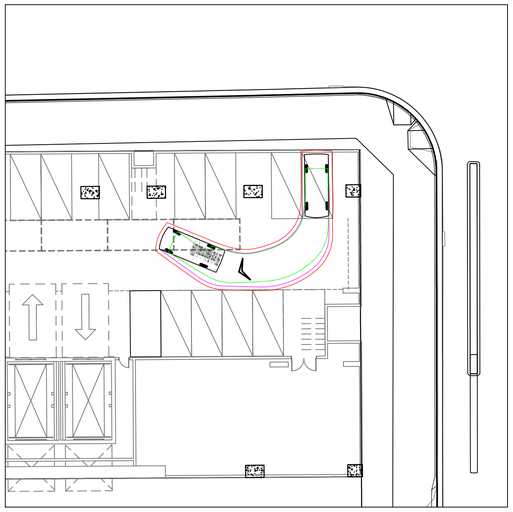
B99 EXIT MANOEUVRE 3
TO SITE B TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 4
TO SITE B TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 5
TO SITE B TOWER
SCALE 1:250



B99 EXIT MANOEUVRE 7
TO SITE B TOWER
SCALE 1:250

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS
METRON

DRAWN M OLAYA
DESIGNED B TOWNSEND
DRG CHECK
DESIGN CHECK
APPROVED

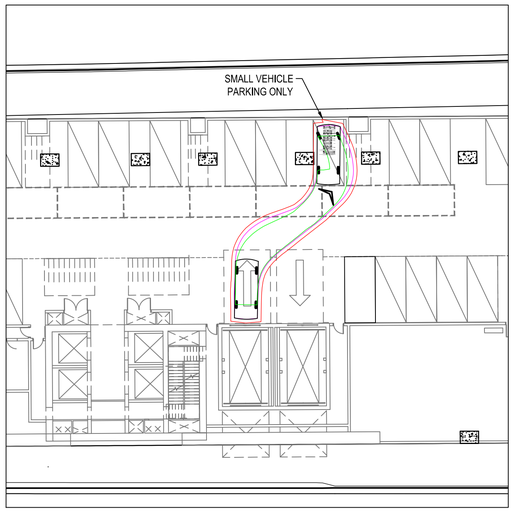
SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 18
SITE B TOWER

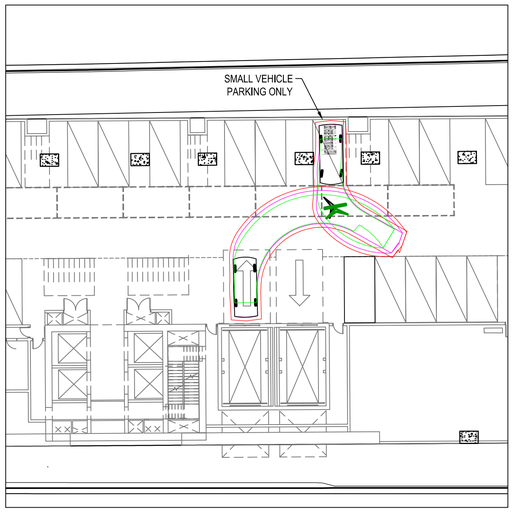
STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 18 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001048 | REV P01.2

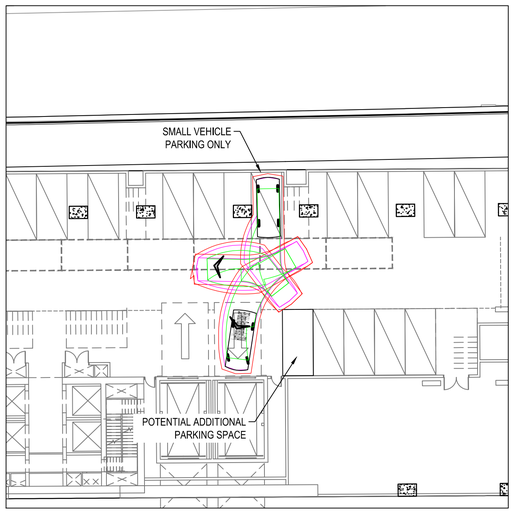
Plot Date & Time: 19 Sep 2018 - 2:21 PM
100mm AT FULL SIZE



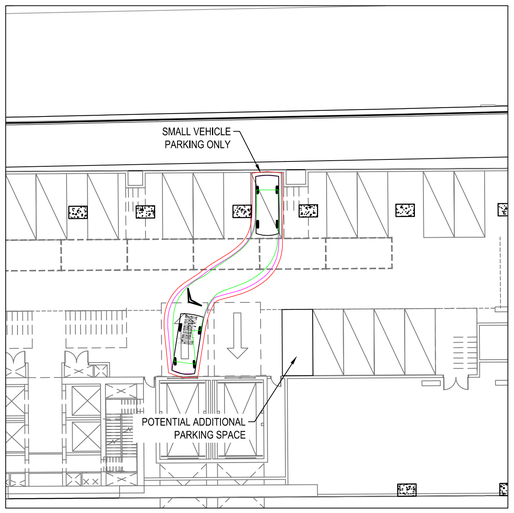
B85 PARKING MANOEUVRE
FROM SITE A LIFTS
SCALE 1:250



B85 REVERSE PARKING MANOEUVRE
FROM SITE A LIFTS
SCALE 1:250



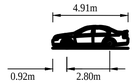
B85 EXIT MANOEUVRE
TO LIFT SITE A
SCALE 1:250



B85 EXIT MANOEUVRE
TO LIFT SITE A
SCALE 1:250

LEGEND

- TYRE LINE
- VEHICLE BODY LINE
- VEHICLE BODY CLEARANCE
- POTENTIAL LOCATION FOR VEHICLE STACKING



B85 VEHICLE

OVERALL LENGTH	4.910m
OVERALL WIDTH	1.870m
OVERALL BODY HEIGHT	1.421m
MIN BODY GROUND CLEARANCE	0.159m
TRACK WIDTH	1.770m
LOCK-TO-LOCK TIME	4.00s
CURB TO CURB TURNING RADIUS	5.750m

FOR INFORMATION

REV.	BY	DATE	DESCRIPTION	APPD.
P01.2	MO	19/09/2018	UPDATE FOR OSD CO-ORDINATION	

1:250 @ A1 2.5 0 2.5 5 10m

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

CLIENT

NSW GOVERNMENT | Transport for NSW

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SERVICE PROVIDERS

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SYDNEY METRO USDTS

CROWS NEST STATION
CIVIL ENGINEERING
VEHICLE TURNING MANOEUVRE PLAN SHEET 19
SITE B TOWER

STATUS: STAGE 1C FINAL PRELIMINARY DESIGN | SHEET 19 OF 19 | ©

DWG No NWRLSRT-MET-SCN-CE-DWG-001049 | REV P01.2

Plot Date & Time: 19 Sep 2018 - 2:23 PM

100mm AT FULL SIZE

Appendix C – Crows Nest OSD – Dock Activity Assessment

Crows Nest OSD - Dock Activity Assessment

For Discussion

Applicable to:

Transport for NSW / Sydney Metro

Status:	Final
Version:	#1.2
Date of Publication:	17 September 2018
Document Owner:	Sydney Coordination Office Planning and Freight
Superseded Documents:	Crows Nest Dock Activity Assessment Version #1.1
Version History:	1.2 Refinements to original, planning comments incorporated

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For Discussion

1 Site Details

The following space is assumed as land use for the Sydney Metro Crows Nest Over Station Development (OSD).

Table 1 Site Usage and Parking facilities

	Usage	Metric	Dock Spaces	Car Spaces
Site A	Residential	350 apartments	1x MRV 3x SRV 1x Turntable	North: 54 (inc 3x disabled) South: 39 (inc 6x disabled, 1x shared, 1x Sydney metro service vehicle/ute)
	Retail Space	*800sqm		
	Childcare Centre	~50 children		
Site B	Hotel	250 rooms	2x SRV	*21 (inc 1x disabled)
	Commercial (possible)	TBD		
Site C	Commercial	2,700sqm	Nil	Nil

Information deemed to be correct as at 10/09/18.

This document assesses the activity for Site A and Site C. Site B would be considered a separate site and assessment advice will be provided at later stage.

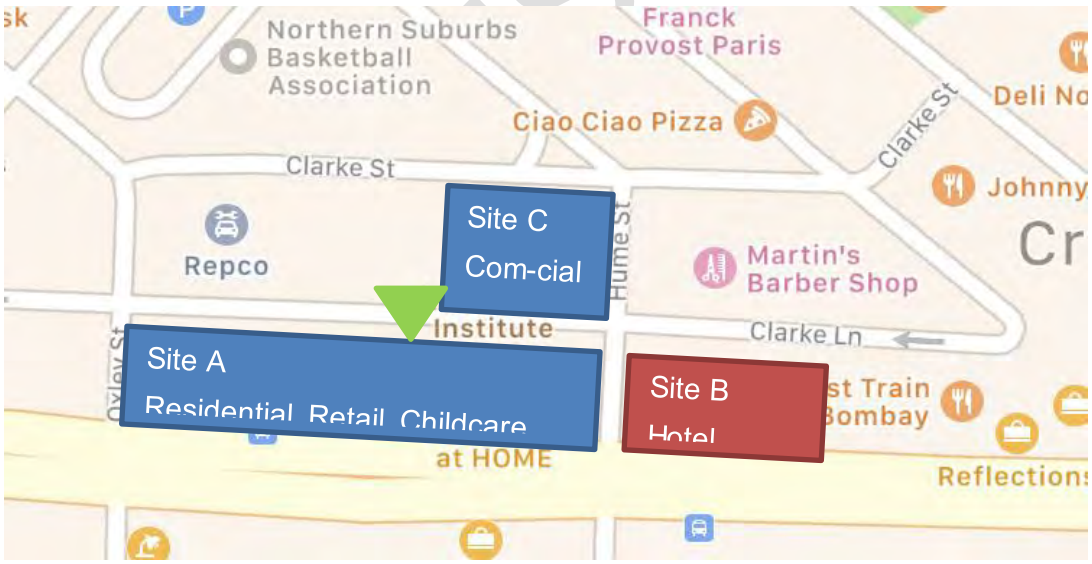

Figure 1 Crows Nest Metro Site

Planned access to the dock of building A is denoted from Clarke Lane by the green triangle.

2 Daily Activity

A profile for dock requirement is formulated by a combination of:

Movement Frequency + Movement Type + Timing of Movement + Vehicle Type

The SCO have combined research into vehicle movements to formulate this forecast for the Crow's Nest OSD requirement. This information is based on various assessments of buildings undertaken by the SCO in 2017 and 2018.

2.1 Movement type and timing

The following table represents a forecast of movement type and the daily timing for Site A and Site C based on the parking model developed from Sydney CBD data.

Table 2 Forecast for Crows Nest OSD Site A and Site C freight and servicing activity

hour	Residential deliveries	Residential (B2C) growth	Trades	Commercial	Community	Retail
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	1	0	0	0	0	0
4	1	0	0	0	0	0
5	1	0	0	0	0	2
6	1	0	1	1	0	2
7	1	0	1	1	0	2
8	2	1	1	1	0	2
9	1	0	1	1	0	2
10	2	1	1	1	1	3
11	5	1	1	1	0	2
12	2	0	1	1	0	2
13	2	1	0	1	0	1
14	3	1	1	1	0	1
15	2	1	0	1	0	1
16	2	0	0	0	0	1
17	1	0	0	0	0	0
18	0	0	0	0	0	0
19	2	0	0	0	0	0

For Discussion

20	3	1	0	0	0	0
21	2	0	0	0	0	0
22	1	0	0	0	0	0
23	1	0	0	0	0	0
	Residential deliveries	**Future residential**	**Trades**	**Commercial**	**Community**	**Retail**
total	**36**	**7**	**8**	**10**	**1**	**21**

The above table:

- Discounts a number of deliveries that may be made by bike or motorbike. These may be courier activity or food deliveries.
- Residential (B2C) growth makes reference to current levels (20 per cent year on year) growth being experienced. Low car ownership is likely to invoke strong demand
- Evening deliveries such as grocery deliveries made by van or ready meal deliveries including those made by car.
- Assumes one daily delivery is made to the childcare centre
- Parcel growth is expected for residential (B2C) deliveries.
- High levels of activity for removal (larger trucks) are expected during initial occupancy of the building. Scheduling of removal activity may be required by the strata/building manager.
- Locker facilities or a concierge service within the building could promote consolidation (fewer) deliveries.
- Waste is expected to occur overnight or early morning. Issues related to waste are highlighted later in this document.
- Assumes no delivery curfews in Crows Nest.
- The forecast does not consider drop off and pick up associated with Day care facilities

2.2 Dwell times

The following average dwell times are considered for different movement types based on the average dwell times in Sydney CBD

Table 3 average Dwell times in Sydney CBD

Vehicle movement purpose	Minutes
Residential	24
Trades and Services	180
Commercial	18
Community (Childcare)	20
Retail	25

For Discussion

2.3 Dock activity profiles

The following profiles illustrate the forecast for dock activity covering deliveries to residential, commercial, community and retail (Figure 2) and a separate requirement for trades vehicles (Figure 3) requiring a longer dwell time. This forecast parking model was developed based on survey from Sydney CBD.

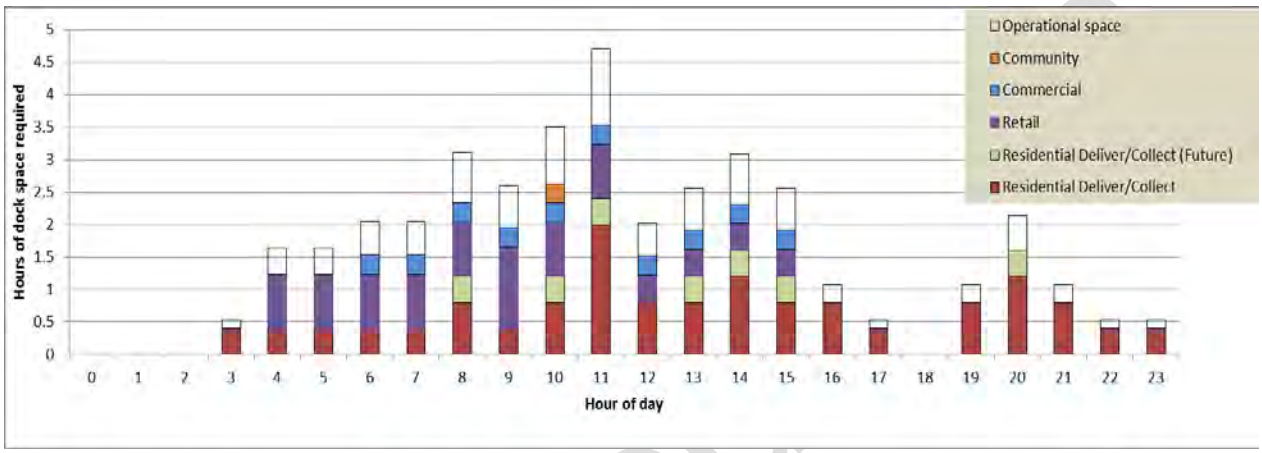

Figure 2 Forecast for number of dock space for residential and commercial delivery activity

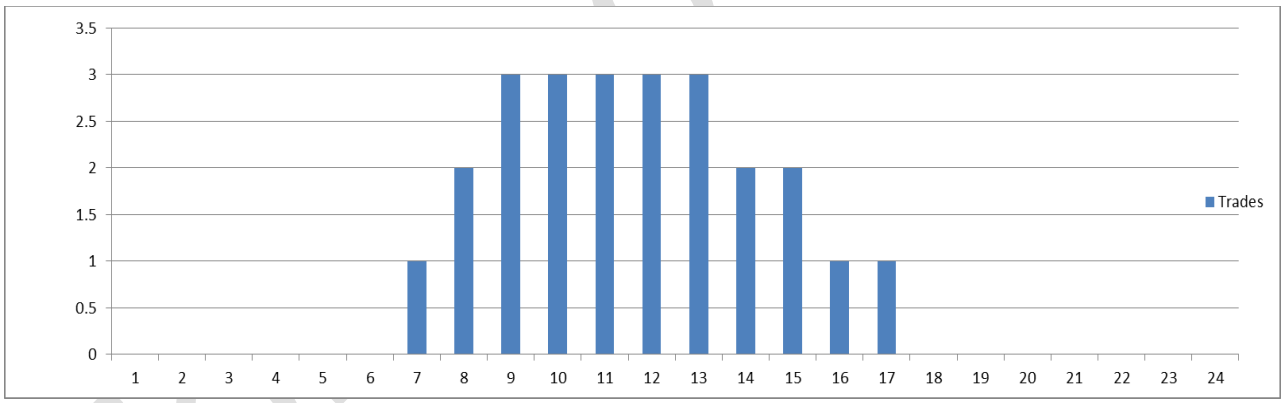

Figure 3 Forecast of trades vehicle parking requirement (long dwell time),

Key aspects of the above profiles:

- As per above figures, total demand at 11am peak is about 7.5 spaces which includes service and delivery vehicles for residential and commercial usage.
- Delivery/service vehicle optimisation is required by the building manager else there is a risk for vehicles queuing onto Clarke Lane or cruise for street parking.
- Analysis shows that 8 trade vehicles are considered per day. However with an average dwell time of 3 hours per trade vehicle, which may pose significant constrain on the service parking space.

2.3.1 Conclusion

- A loading dock of 4 spaces (1 MRV and 3 SRV) can accommodate the demands of the building for deliveries with minor queuing potential and the peak time.
- An additional provision will need to be made for trades and service vehicles requiring a longer dwell time.
- Loading Dock Management Plan with the booking system is to be considered as part of the building operation.

2.4 Potential Constraints

2.4.1 Loading Dock Access

The loading dock is accessible from Clarke Lane. The below design is a schematic which was shared with the SCO on 10/09/18.

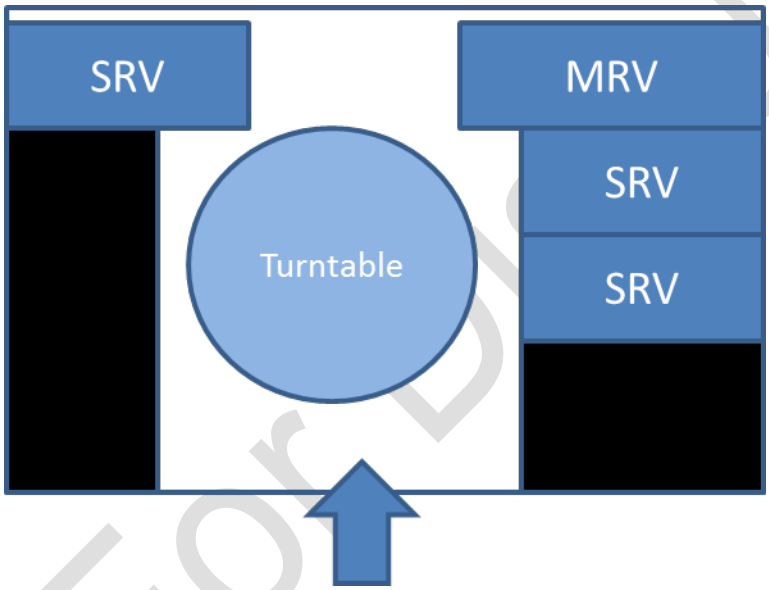

Figure 4 Loading dock design schematic

- This configuration will reduce the usability of the dock with 2 spaces (the MRV and top left SRV) being difficult, or potentially impossible, for a vehicle to access. If space is difficult to access, delays will occur during the movement of vehicles entering and exiting the site which will discourage vehicles from using the dock and give it a poor reputation. Swept path analysis is required to ensure the design vehicles can adequately access the space in a single manoeuvre.
- The MRV space may be used for removal of persons into and out of the building. It should be accessible from both residential towers to the left (north) and right (south) of the vehicles location. A booking schedule will be required for this activity

For Discussion

- The dock should have internal access throughout the building. From designs presented to the SCO on 10/09/18 it does not appear that retail premises will have internal access. Access to retail premises would appear to be via the outside of the building with a delivery person required to walk along Clarke Lane and around the building. Given the lack of alternate locations for on-street parking, External access to retail premises could increase dwell time of vehicles in the loading dock adding to the constraints of the space.

2.4.2 Local Parking

The local road network provides limited opportunity for reliance on street parking.

The following constraints are observed from the roads surrounding the building.

- Clarke Lane is currently designated "No Parking" this permits a vehicle to stop and complete activities such as collection of waste but not to park for any duration.
- Hume Street currently has some ticketed parking on the north side (adjacent to Site A) however the space is designated for a separated cycleway. The south side of Hume Street provides a function to manage traffic turning onto Pacific Highway
- Oxley Street, like Hume Street, has some ticketed parking on the exit (North) side from Pacific Highway but also provides a function to manage traffic turning onto Pacific Highway on the south side (adjacent to Site A).
- Pacific Highway is preserved as a movement corridor, particularly during peak hours. There is currently no parking directly adjacent to Site A but off peak and evening parking is currently provided further along Pacific Highway to the South.
- Metered and timed parking is currently provided in Clarke Street to the east of Site C.

2.4.3 Waste Management

Waste vehicles can access the building via Clarke Lane. Collection services are provided for other local buildings from this lane.

A waste room in Site C backing onto Clarke Lane could be accessed directly without a need to consolidate waste into Site A.

Issues are likely to be faced for retailers in waste management (as well as delivery paths). The external route from the dock to and from each retail premises will require a person to walk along Clarke Lane. This is illustrated in Figure 5.

For Discussion

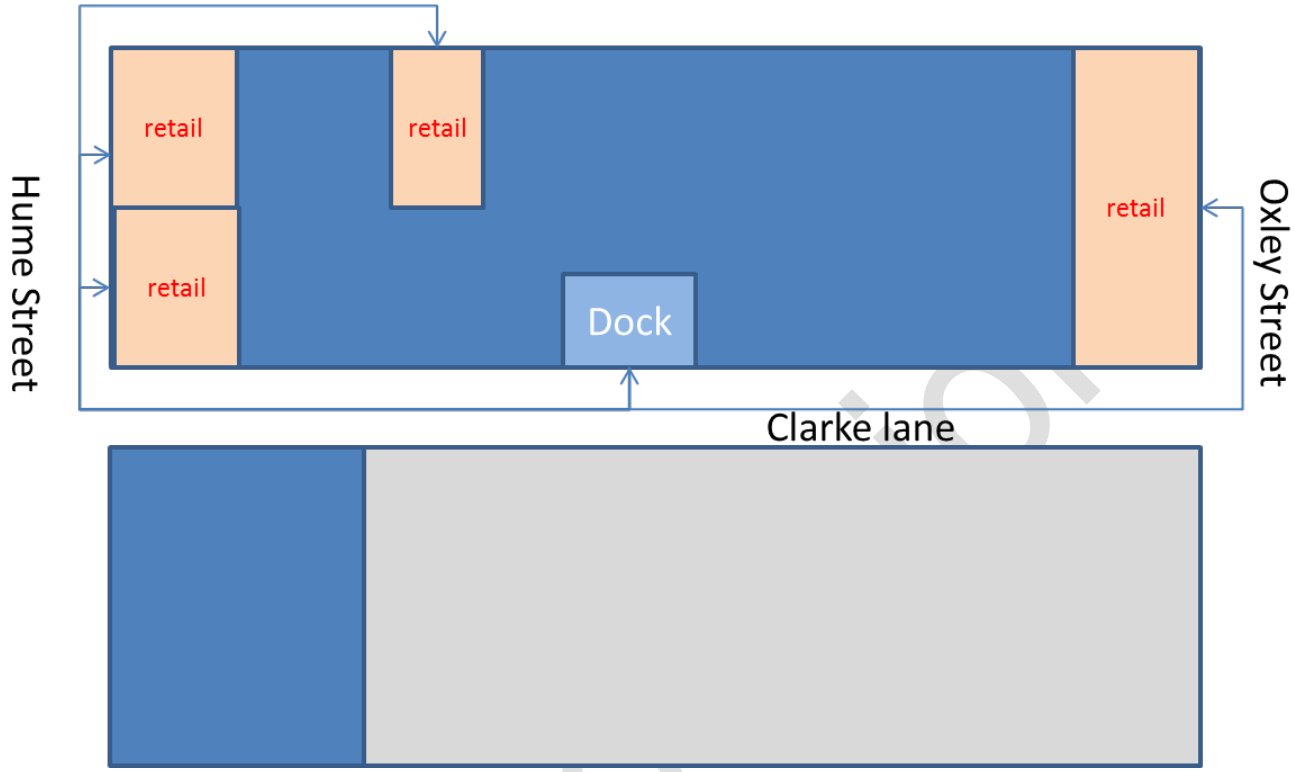

Figure 5 Access to/from Retail in Site A

Retailers will not have easy access to a waste room. This could mean:

- They are required to move waste via the outside of the building, along road ways to the waste room via the loading dock.
- A building services person is required to complete the above task.
- Retailers are required to organise separate contracts for waste management. This would entail the provision of waste management facilities within each premise. However as detailed in section 2.4.2, there are limitations on the local road network.
- A requirement to move waste an excessive distance (multiple bins to be stored and moved) could reduce the likelihood of waste being adequately separated and moved to a waste room.

3 Mitigations

3.1 Parcel lockers

Provision of lockers could reduce the frequency of deliveries to residents. However if the lockers are accessible to persons passing through the station, this could drive additional demand (and revenues).

3.2 Station Servicing

All none essential station servicing activity (facilities maintenance and cleaning, vending machines replenishment) should be conducted out of normal business hours. This activity is likely to require dwell time in excess of an hour. Services to retailers and the commercial building should be encouraged to occur outside of peak hours.

3.3 Parking for Trades vehicles

The dock almost has capacity to function during peak periods. This is on the assumption that alternate parking is provided for trades and service vehicles. They should not be permitted to use the dock during peak periods.

3.4 Dock Accessibility

The dock should be accessible and allow each vehicle to move independently to each other to enter and exit. If this is not the case, the operational capacity of the dock will be inhibited.

3.5 Provisions for delivery bikes and motorbikes

Space at the dock should be provided to encourage courier bike or motorbikes making deliveries.

3.6 Built in Travel Demand Management Strategies

With consideration to the movement of people and goods, the building managers could consider the adoption of Travel Demand Management strategies from the outset of the buildings marketing/sales process for both commercial and residential aspects.

For Discussion

Appendix D – Preliminary Delivery Service Plan

1.0 Introduction

The purpose of this Preliminary Delivery Service Plan (DSP) is to ensure all tenants, residents and owners of the Crows Nest OSD understand the operation of the loading dock and their responsibilities in managing the dock.

The overall goal is to outline measures to:

- Reduce the conflict in use of the loading dock
- Ensure proper safety measures while using the loading dock
- Always maintain the access to the loading dock
- Ensure that there are minimum disruptions in traffic while loading dock operations
- Defining the rules for the use of loading dock

The idea is to guide the loading dock users and the management about the usage requirements and to remain updated about the occupancy to accommodate changes in the activity of the loading dock.

2.0 Rules for occupying the Loading Dock

2.1 Making Appointment

- The Loading Dock is available to use for all the tenants, owners and the occupiers wo pre-book the Dock by making an appointment.
- The Building Management Committee may nominate a person who will be responsible to maintain a booking schedule. He will ensure that all the necessary arrangements are made for the smooth operation of the Loading Dock. The nominated person may be the Strata Manager or Building Manager or whoever nominated by the committee.
- The members are entitled to use the Loading Dock in their specified times only to avoid any conflicts with other bookings.

2.2 Rules

- All the members who are entitled to use the Loading Dock must;
    - Use the Loading Dock for garbage disposal and collection purposes in accordance with the set of rules defined by the Building Management Committee and as mentioned in the Loading Dock Management Plan;
    - Use the Dock only for the loading and unloading purposes and there should not be any material or goods stored in the Loading Dock are at any time;
    - Use only the specified area marked as Loading Dock and should not use any area outside the premises of the Loading Dock;
    - Maintain the necessary cleanliness in the Loading Dock and clear any spills that may occur in result of the use;
    - Understand the car lift and mechanical turntable system to use the are efficiently;
- The Building Management Committee has the authority to change or update the rules for the use of Loading Dock provided that the do not negatively affect the operation or use of the Loading Dock. These rules include but not limited to;
    - The hours of operation of the Loading Dock;
    - The manners of delivering large objects to and from the lots;
    - The use of protective covers for the surfaces of the large objects to and from the Loading Docks and to the lots;
    - The use of trolleys or any other moving devices;
    - Insurance requirements
- Any damage caused by the occupier to the Loading Dock will be rectified by the authorised person from the Building Management Committee and the cost will be covered by the occupier.

2.3 Amendments to the Delivery Service Plan

- The Building Management Committee will time to time review and update the Loading Dock Management Plan by unanimous resolution based on the suggestion and complaints received by the tenants, occupiers.
- The Building Management Committee must not repeal the Loading Dock Management Plan without prior consent and notice to the council.

3.0 Traffic Management of the Loading Dock

3.1 Loading Dock use

The Loading Dock is intended to be used for multiple purposes and for multiple type of vehicles. This includes but not limited to;

- Deliveries for the residential, commercial and retails land use.
- Collection of wastes from all the land use types.
- Furniture removal or new deliveries.

3.2 Loading Dock vehicle limits

The loading dock is the shared facility for the building-A and tenants/owners of both the towers in building-A can use and access this facility. The Loading Dock has following capacity;

- Building A;
    - Small Rigid Vehicle (SRV) up to 6.4 m in length: 3 spaces;
    - Medium Rigid Vehicle: (MRV) up to 9.5 m: 1 vehicle;
    - Mechanical turntable to facilitate turning of vehicles up to 9.5 m in length; and
    - Maximum vehicle height up to 4 m.

- Building B;
    - Small Rigid Vehicle (SRV) up to 6.4 m in length: 2 spaces;
    - Maximum vehicle height up to 4 m.

3.3 Loading Dock access

3.3.1 Building-A

The access arrangements for building-A are described below;

3.3.1.1 Vehicle Access

The ingress and egress of the Loading Dock facility is summarised as below;

- Pre-book the date and time of the dock use.
- Access into the loading dock will be in forward direction from the Clark Lane.
- Vehicle are to use the turntable to reverse into the loading bay.
- Vehicles to exit in forward direction on to Clark Lane and only allowed to turn left.
- Vehicles are not allowed to stand outside the loading dock. And drivers must drive away from the loading dock after the occupancy time is completed.
- Signage to be activated by the occupier once they have entered the loading dock for giving advance warning to the motorists who might want to enter. The sign should say “Dock Full – Do Not Enter”

3.3.1.2 Pedestrian Access

Pedestrian access into the loading dock is provided from the Clarke Lane at South-East corner of the building. This access is located underneath Southern tower.

The second access to the loading dock is provided from Pacific Highway at North-West corner of the building underneath Northern tower and through the main lobby. See Figure 1, below;

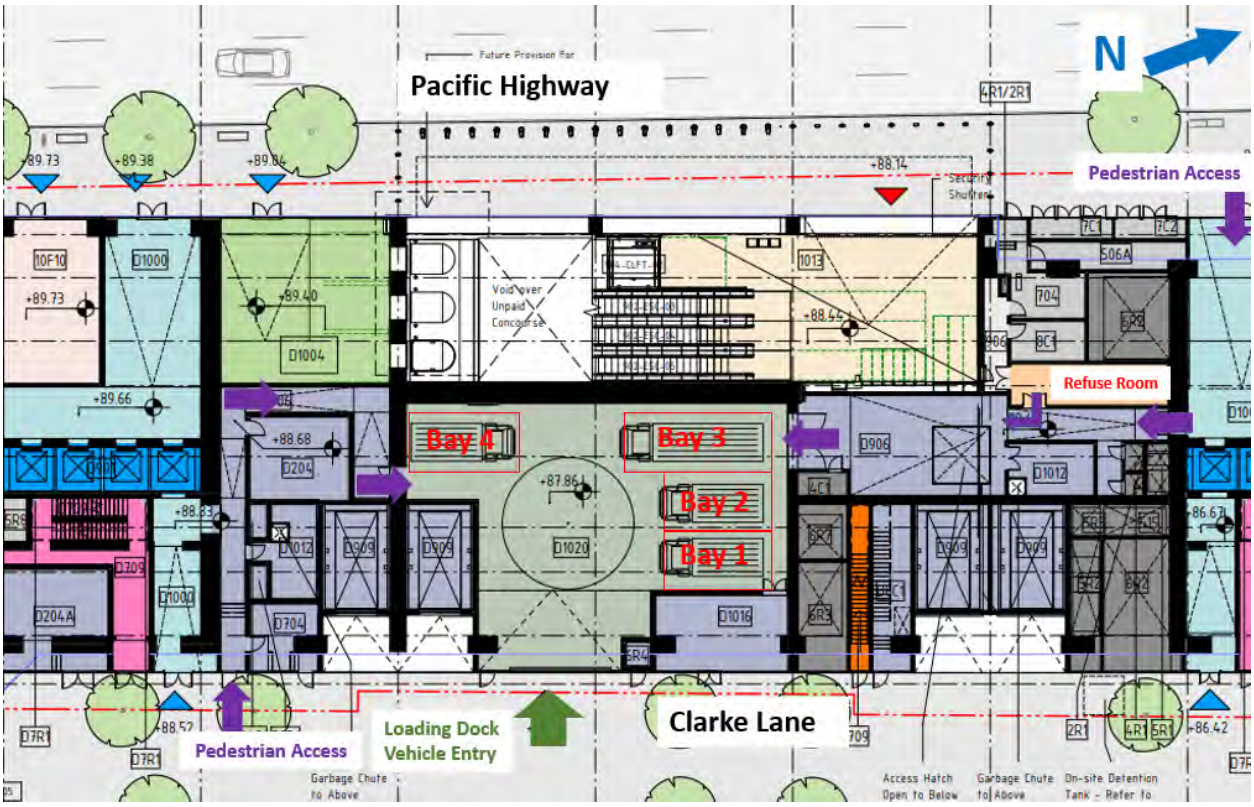

Figure 1: Site A Loading Dock.

It is observed that the loading dock doesn't seem to have any internal access from retail areas and the delivery personnel will have to walk around the building into the Clarke Lane to access the dock which can result in the extended dwell times.

3.3.2 Building-B

3.3.2.1 Vehicle Access

The ingress and egress of the Loading Dock facility is summarised as below;

- Pre-book the date and time of the dock use.
- Access into the loading dock will be in forward direction from the Clark Lane.
- There is no turntable in the loading dock so vehicles have to manoeuvre inside the loading dock and then come out.
- Vehicles to exit in forward direction on to Clark Lane and turn left.

- Vehicles are not allowed to stand outside the loading dock. And drivers must drive away from the loading dock after the occupancy time is completed.

3.3.2.2 Pedestrian Access

Pedestrian access to the loading dock for building-B is from Pacific Highway entry of the building via restaurant kitchen at South-West corner of the building as shown in Figure 2, below.

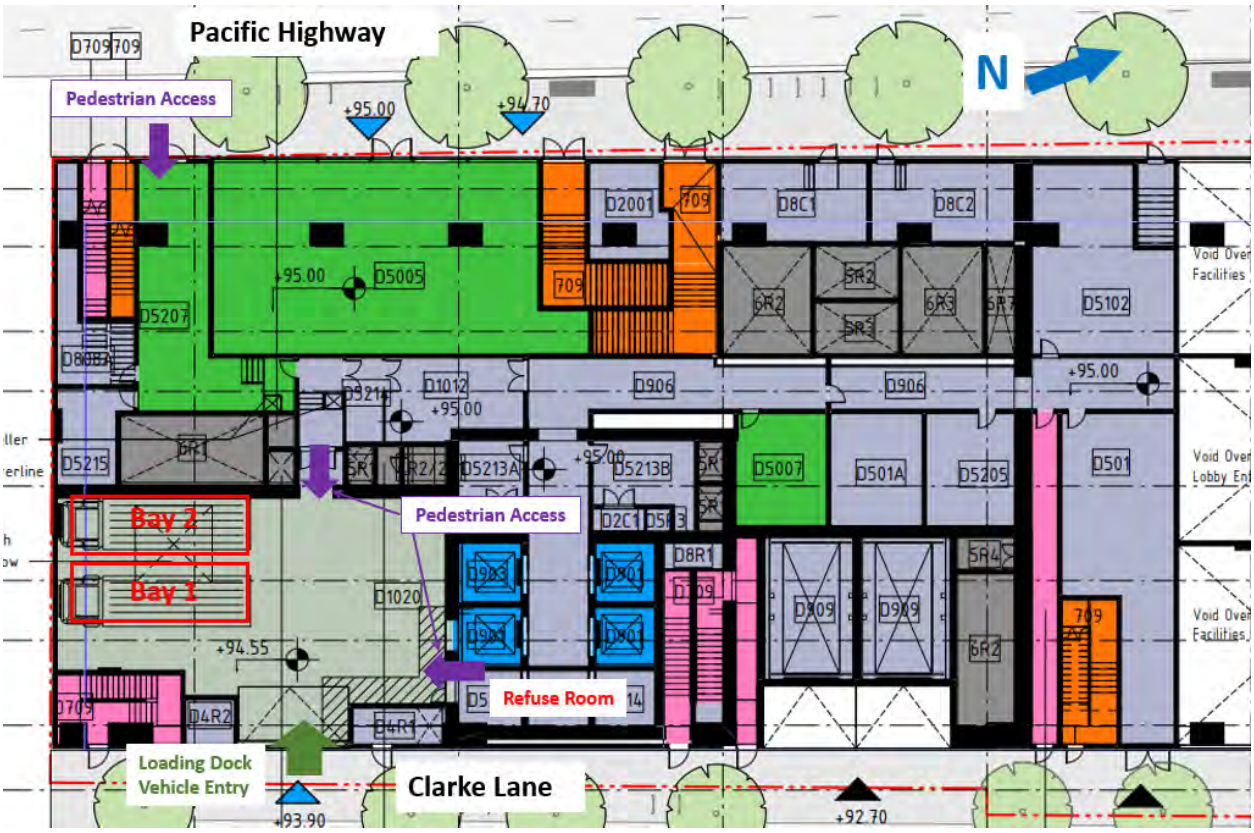

Figure 2: Building B dock layout.

3.4 Hours of Operation

The loading docks will be accessible for all deliveries 24 hours a day and 7 day a week. It is recommended that the loading docks to be staffed between 6am to 6pm. And after this time the loading dock will be managed by the building security and to provide staff based on the schedules bookings.

Use of the loading dock during the PM peak period will need to be managed to ensure that any potential queuing for the vehicle lift systems to the car garages does not interfere with vehicle access to the loading docks.

3.5 Vehicle Booking System

The vehicle intended to use the facility will use a vehicle booking system (VBS) before they arrive at the loading dock.

The VBS is to manage the delivery services such as, but not limited to;

- Building maintenance vehicles
- Waste collection vehicles
- Furniture removals and delivery
- Residential or other worker deliveries

VBS can either be managed online or the bookings can be made by call or email to the authorised person. The booking will generate the bar code which will be used to access the facility.

The timings for the regular vehicles (i.e. waste collection) will be fixed. The vehicles over 6.4m long will occupy the full loading dock.

Bookings during 6am to 6pm will be maximum of 15 minutes duration. But if extended times are required, they can be booked during 6pm to 6am. It is recommended that all long period operations (building or turntable maintenance, furniture removals etc) be conducted during these hours.

3.6 Turntable / Lift Maintenance Periods

Swept paths to be confirmed for the number of parking available during maintenance period.

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0:00							
0:30							
1:00							
1:30							
2:00							
2:30							
3:00							
3:30							
4:00							
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	Legend
	Waste Collection
	Various type within peak hours
	Residential deliveries
	Removalist activity
	Various type outside peak hours

4.0 In-house Managed Solutions

There are a lot of in-house measures that can be employed to make the use of the loading dock more efficient, smooth and safe. These methods will reduce the dwell times of the vehicles his will increase the overall service delivery and enhance the capacity of the loading dock.

4.1 Smart Locker System

A smart locker system can be provided to achieve a short dwell time for the deliveries like groceries. Smart locker can inform the tenant that goods are ready for pick-up. The tenants can pick up he delivery at their ease later. Some of the lockers can be refrigerated ones which keep the perishable items fresh if the delivery is made in after hours and the customers can collect that in the morning. This system can be utilised for residents only.

4.2 Loading Dock personnel

It is proposed that the loading dock manager should manage a team of staff and make a personnel in-charge of loading dock operations at all times. The staff should keep track of all the activities happening in the loading dock and keep the receipts of the deliveries. The staff has to manage the VBS as well. Staff can also help in the storage of goods and coordinate with the tenants / owners for the collection of the deliveries.

The staff and their rosters can be managed based on the flow of deliveries and the timings. Building security can also help manage the loading dock operations outside of peak hours if required.

4.3 Waste Collection

Since the waste collection vehicles have to enter the loading dock to collect the waste for both the buildings A & B and the refuse rooms have direct access to the loading dock so it will not affect the operation of the general traffic. Waste collection vehicles are not allowed to stay outside the loading dock because the car lifts for north tower of building-A and the car lifts for building-B will be accessible to the cars after the cross the loading dock gate located in Clark lane once it will be converted to one-way north bound street, the vehicle standing outside the loading dock for waste collection or for any other reason will block the street.