Traffic and Transport Assessment

Site 68 - Sydney Olympic Park

80014010

Prepared for
Ecove Group

19 September 2014

Cardno
Shaping the Future

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Contact Information

Cardno Victoria Pty Ltd
Trading as Cardno
ABN 47 106 610 913

150 Oxford Street, Collingwood
Victoria 3066 Australia

Telephone: (03) 8415 7777
Facsimile: (03) 8415 7788
International: +61 3 8415 7777

victoria@cardno.com.au
www.cardno.com

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F01	18/09/14	Matthew Duffy		Matthew Ballard	

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1 Introduction

Cardno has been engaged by Ecove Group to undertake a traffic and transport assessment of a proposed mixed-use development on land identified as Site 68 of the Sydney Olympic Park precinct.

In the course of preparing this assessment, the subject site and its environs have been inspected, plans of the development have been examined, and all relevant traffic and parking data has been collected and analysed.

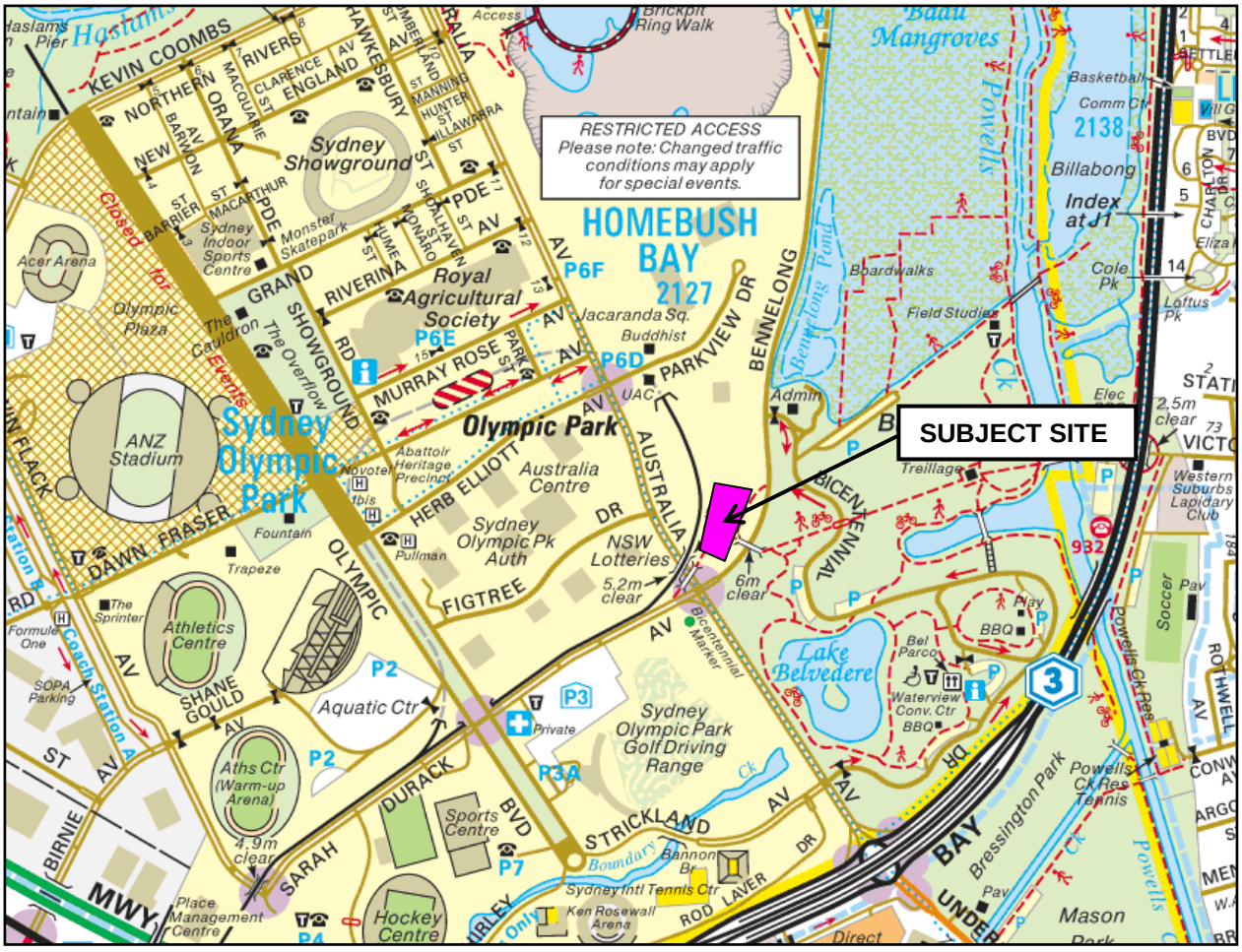
2 Background and Existing Conditions

2.1 Location and Land Use

The subject site is located on a parcel of land within the Sydney Olympic Park precinct which is bounded by Bennelong Parkway to the east, Australia Avenue to the south-west and the Olympic Park Railway Line to the west.

Figure 2-1 shows the location of the site and the surrounding street network.

Figure 2-1 Site Location



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The subject site currently accommodates a dam and some vegetation but is otherwise predominantly vacant. No vehicular access is currently provided.

Land use in the vicinity of the site is mixed. Several business parks are located to the north of the site and sporting facilities constructed as part of the Sydney 2000 Olympic Games are located to the south and west of the site

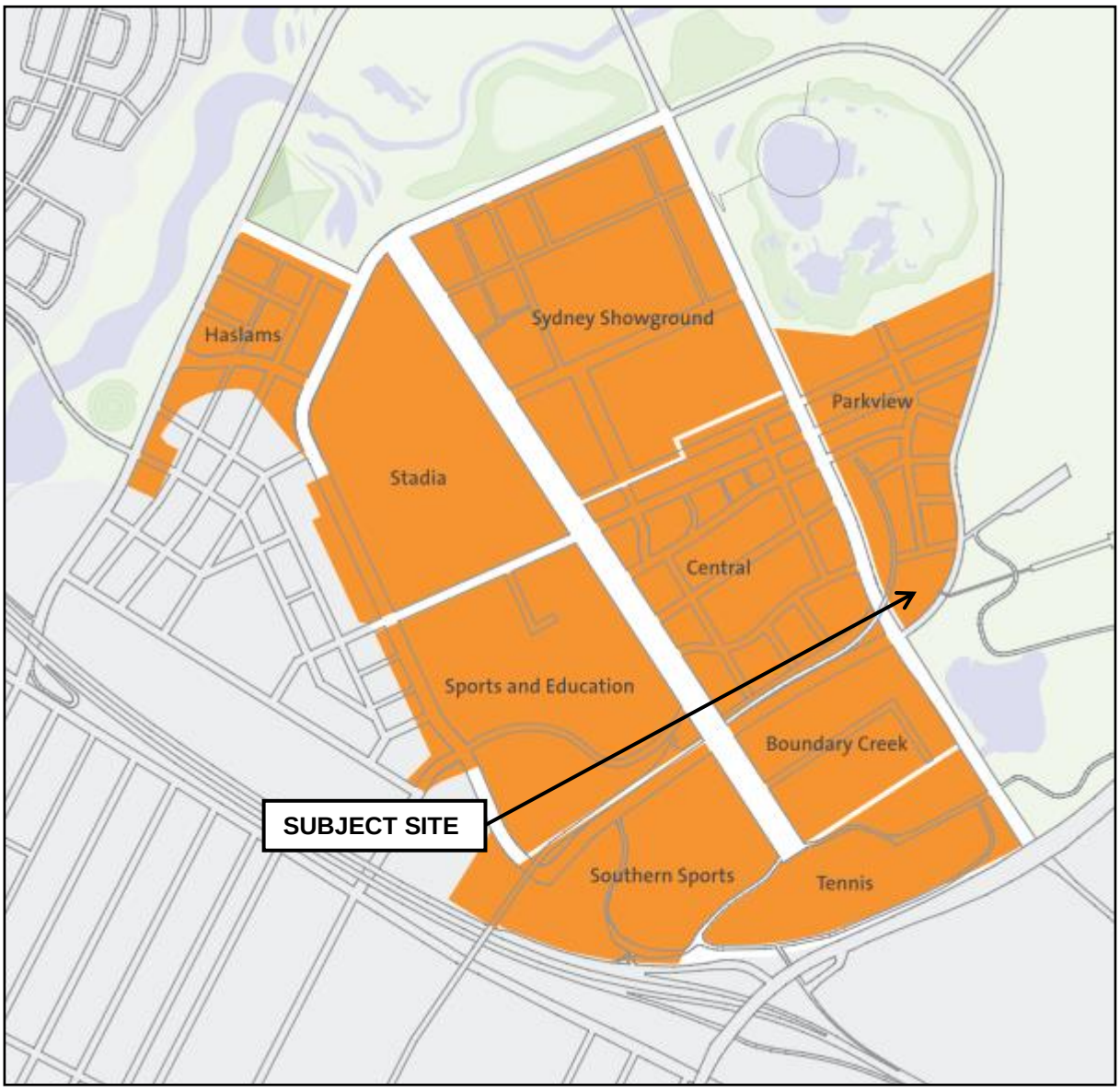
Bicentennial Park is a large recreational space located directly east of the site which is accessible via a pedestrian bridge over Bennelong Parkway.

2.2 Planning Zones

The subject site is located in Sydney Olympic Park.

A masterplan has been prepared (Sydney Olympic Park Master Plan 2030) which divides Sydney Olympic Park into 9 precincts. The subject site is located within the Parkview Precinct, as shown in Figure 2-2 below.

Figure 2-2 Location of Subject Site within Sydney Olympic Park



The Parkview Precinct is proposed to accommodate a pedestrian friendly residential neighbourhood, with commercial and community land uses concentrated in the centre of the precinct.

An extract from the masterplan is presented in Figure 2-3, which indicates the subject site has been designated for residential land use.

Figure 2-3 Land Uses Within Parkview Precinct

The extract also identifies that a new roadway is to be constructed along the northern boundary of the site from Bennelong Parkway to the railway line. The new roadway will provide vehicular access to the subject site and the land parcels to the north of the roadway, as well as to a north-south road that will provide connectivity to the commercial facilities of the Central Precinct.

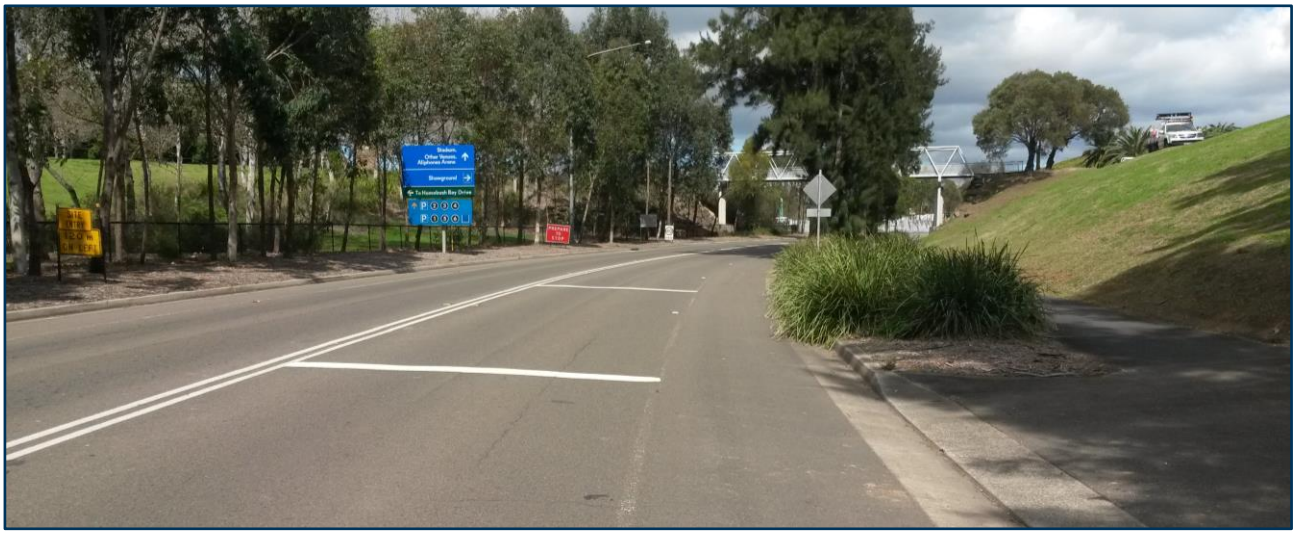
2.3 Road Network

2.3.1 Bennelong Parkway

Bennelong Parkway is a local road which extends northeast from the intersection of Australia Avenue and Sarah Durack Avenue and forms the eastern boundary of the subject site. The posted speed limit along the frontage of the site is 60 km/h.

Bennelong Parkway accommodates a single two-way carriageway which at the frontage of the subject site provides a central travel lane and kerbside bicycle lane in each direction. No parking is permitted on either side of the carriageway, which are separated by solid double lines as shown in Figure 2-4.

Figure 2-4 Bennelong Parkway, looking south-west beyond the subject site



2.3.2 Australia Avenue

Australia Avenue is a main road which forms the south-western boundary of the subject site.

Australia Avenue accommodates dual carriageways which are separated by a median of approximately 4 metres width. Each carriageway typically provides two travel lanes, with ancillary lanes provided for turning movements at some intersections. The posted speed limit along the frontage of the site is 60 km/h.

Figure 2-5 shows Australia Avenue along the south-western site frontage.

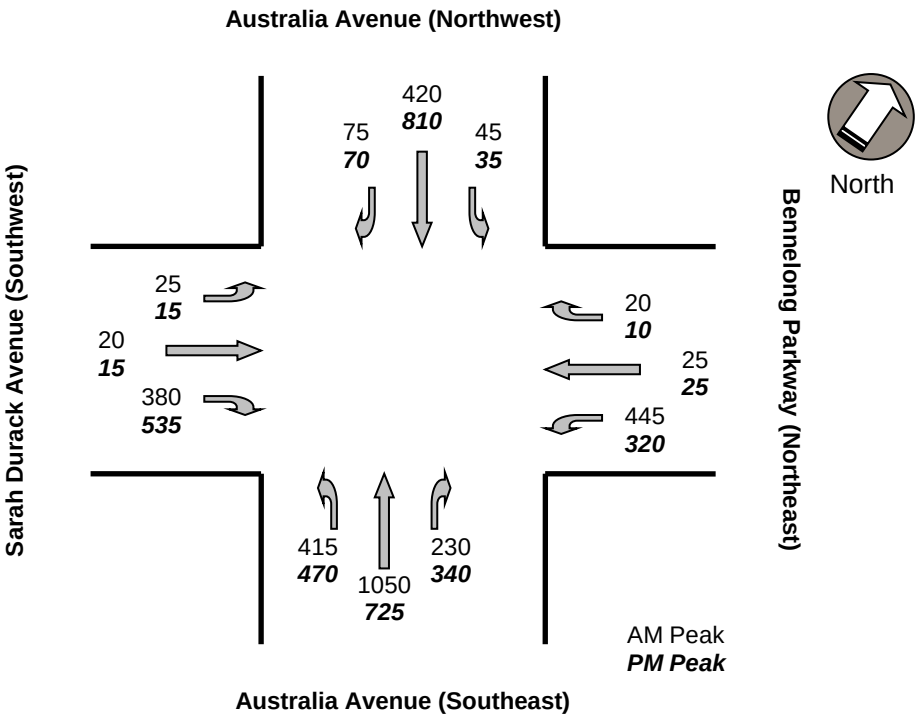
Figure 2-5 Australia Avenue, looking south-east beyond the subject site

2.4 Traffic Volumes

Traffic volumes at the intersection of Australia Avenue and Bennelong Parkway have been sourced from a 2011 traffic impact assessment prepared by Colston Budd Hunt & Kafes Pty Ltd for a proposed mixed-use development application at Site 3 of the Sydney Olympic Park Master Plan.

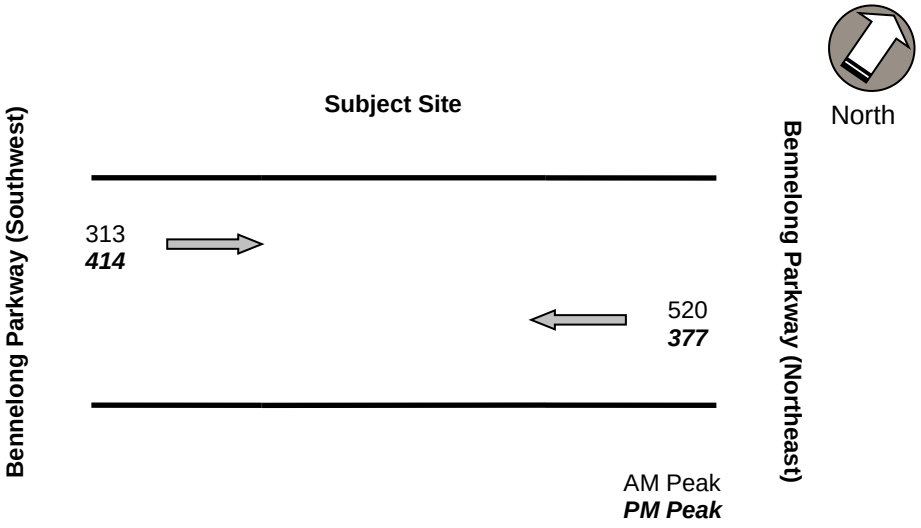
The peak hour traffic volumes from that report are shown in Figure 2-6

Figure 2-6 Existing Traffic Volumes (2011) inclusive of post development traffic generated by Site 3



Allowing for 3 years of traffic growth at 2% per annum, the current (2014) traffic volumes along the Bennelong Parkway frontage of the site are estimated as shown in Figure 2-7 below:

Figure 2-7 Estimated 2014 Traffic Volumes Along Bennelong Parkway Frontage



Based on peak hour traffic accounting for around 10% of the daily traffic stream, it is estimated that Bennelong Parkway along the frontage of the site carries in the order of 8,000 vehicle movements a day.

2.5 Sustainable Transport

2.5.1 Public Transport

The site is located within convenient walking distance of a number of public transport facilities which are shown in Figure 2-8 and detailed in Table 2-1.

Figure 2-8 Public Transport Map

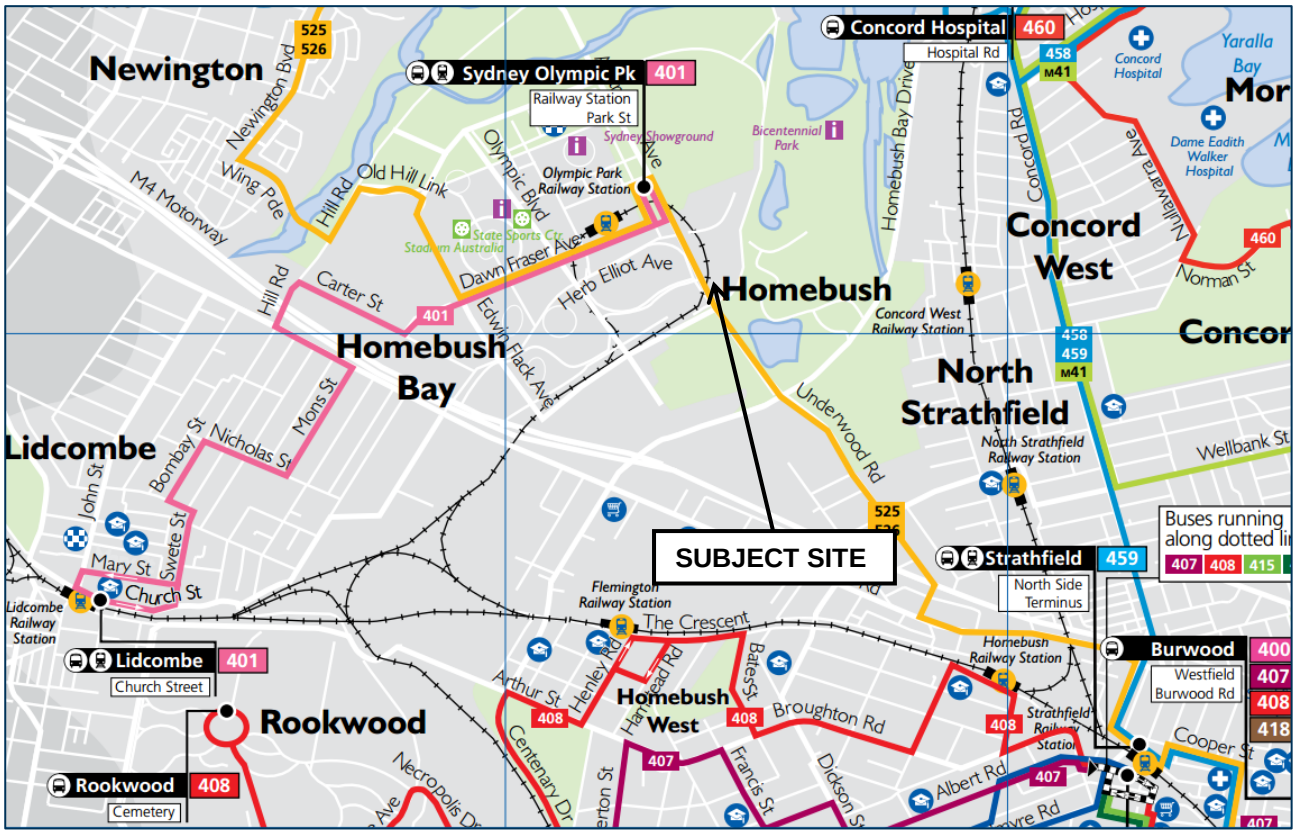


Table 2-1 Public Transport Provision

Service	Route No's	Route Description	Nearest Stop
Train	Olympic Park Railway Station		Approx. 500m
	Concord West Railway Station		Approx. 1km
Bus	401	Sydney Olympic Park Station - Lidcombe	Approx. 500m
	525	Parramatta – Newington – Burwood	Approx. 250m
	526	Sydney Olympic Park Warf – Newington – Strathfield	Approx. 250m

3 Proposed Development

3.1 General

It is proposed that a multi-storey mixed-use development with 3 basement car parking levels be constructed upon the subject site.

Based on the plans prepared by Bates Smart Architects, the development will comprise a residential tower of 369 apartments with a café and childcare facilities located at ground level. Thirty-seven (37) of the proposed apartments on the site will be designed as adaptable apartments.

Table 3-1 provides a detailed breakdown of all components of the development.

Table 3-1 Proposed Development

Component	Area / No.	
Residential		
- 1 Bedroom Apartments	171	(including 26 adaptable apartments)
- 2 Bedroom Apartments	162	
- 3 Bedroom Apartments	27	(including 9 adaptable apartments)
- 4 Bedroom Apartments	9	(including 2 adaptable apartments)
Commercial		
- Café	100m^2	
Childcare Centre	80 Children (Approx. 14 staff *)	

*Based on 13 Educators and 1 Administrative staff member

3.2 Car Parking & Access

It is proposed that 482 parking spaces be constructed on the site, comprising

> 472 spaces located across the 3 basement levels, &

> 10 at-grade parking spaces that will be constructed as indented on-street parking spaces along the northern site boundary.

Of the 472 spaces within the basement parking levels, 455 are located behind an access controlled boom gate. These spaces will be allocated to residents, resident visitors and café staff. The 17 spaces located in front of the boom gate will be allocated to the Childcare Centre.

The 10 at-grade spaces at the northern boundary of the site will be for the shared use of resident visitors and the Childcare Centre.

Table 3-2 summarises the allowance of on-site car parking spaces to the various uses on the site.

Table 3-2 On-Site Parking Allowance

Component	Spaces	
Residents	408	(including 37 accessible spaces)
Resident Visitor	52	(including 2 accessible spaces)
Commercial (Café)	2	
Childcare	20	(including 1 accessible space)
Total	**482**	**(including 40 accessible spaces)**

Each of the adaptable apartments will be allocated 1 accessible parking space.

Resident visitors will be allocated 2 accessible parking spaces (3.8% of parking provision) and the childcare centre will be allocated 1 accessible parking space in line with relevant Master Plan and BCA requirements.

Vehicular access to the on-site parking areas will be from the new roadway that will be constructed along the northern site boundary as per the masterplan.

Vehicular access from the new roadway to the basement levels is proposed via the construction of a two-way vehicle crossover located 30 metres from the Bennelong Parkway intersection. The crossover will enter the basement levels at 'Basement Level 2'.

The 10 at-grade parking spaces will be located east of the main building and will be constructed as indented parking bays along the southern side of the new carriageway.

3.3 Bicycle Parking

It is proposed that 246 bicycle parking spaces be provided on the site, comprising 156 spaces within basement level 1 for residential use and 90 spaces at ground level for the use of staff and visitors.

Further space for an additional 42 bicycles is provided at ground level to enable the cafe to offer bicycle rental facilities to the general public if desired.

3.4 Loading

It is proposed that a loading dock be provided inside the main building near the car park entrance on Basement Level 2. The loading dock will be 10 metres wide by 12 metres long and will provide two loading bays.

4 Design Considerations

4.1 Car Parking Layout

4.1.1 Basement Parking Levels

Car parking spaces within the basement levels have generally been designed in accordance with the Australian Standard for Off-Street Car Parking (AS2890.1:2004)

The parking spaces towards the north of each level are 2.4m wide by 5.4 m long and aligned at 90-degrees to a parking aisle of minimum 6.0 metres width. Spaces located against walls have been provided with an additional 300 mm width to assist with door opening, and aisle extensions of 1 metre are provided at the end of blind aisles to assist with manoeuvring. In addition to the above, blade columns that are located adjacent to spaces have been located so as to avoid breaching the vehicle clearance envelope.

These spaces exceed the minimum design criteria outlined for residential, domestic and employee parking (User Class 1A) at Clause 2.4.1 of the Australian Standard.

Parking spaces towards the south of each basement level comprise a mix of 90-degree and parallel parking spaces. Both of these arrangements provide parking bay dimensions that are compliant with the Australian Standard; however the structural elements required to support the tower levels above impede on the parking aisles in some locations.

Swept path diagrams have been prepared for the parking spaces that are not fully compliant with Australian Standard dimensions to determine if adequate manoeuvring space is provided for vehicular ingress and egress.

The diagrams are attached in the Appendix and demonstrate that each of the parking spaces is accessible in an acceptable number of manoeuvres, confirming that the basement car parking layouts can function appropriately.

Whilst it is preferable for all car parking spaces to be provided with uniform dimensions, the car parking spaces at the south of the building will be allocated to a particular resident who will become familiar with the operation of the car park and opt to enter/exit their car parking space in the manner which is most convenient to them.

It should also be noted that parking spaces that are accessed from blind aisles that are longer than recommended by the Australian Standard will also be allocated to residents, therefore the need for vehicle turn-around areas in these aisles is not necessary.

Basement levels are provided with a floor to floor height of 3.0 metres. Overhead structure will be located so as to provide an overhead height clearance of at least 2.2 metres above conventional parking spaces, ramps and circulation areas, and at least 2.5 metres above accessible spaces.

Forty-three (43) accessible parking spaces are proposed throughout the basement levels which are typically 3.2 metres wide by 5.4 metres long. These parking spaces are not fully compliant with the most recent Australian Standard for Off-Street Parking for People with Disabilities (AS2890.6:2009) and are generally designed as such to accommodate structural elements associated with the residential tower.

The Australian Standard requires accessible spaces be 2.4m wide by 5.4m long and located adjacent to a shared area of the same dimensions. It is noted however that a bollard is located in the centre of the adjacent shared area 800mm from the open end of the parking space, which reduces the effective width of the parking space to 3.2 metres.

The use of 3.2 metre wide spaces, which is compliant with the pre 2009 Australian Standard, is considered an acceptable alternative design to accommodate the structure above.

4.1.2 At-Grade Parking Spaces

The 10 parking spaces provided along the northern boundary at the west of the site are each 2.6 metres wide by 5.4 metres long.

These spaces are provided in an indented arrangement along the southern side of the new roadway along the northern site boundary, and satisfy the design criteria outlined by the Australian Standard for short-term city and town centre parking.

4.2 Site Access

A new roadway will be constructed along the northern boundary of the site as per the Sydney Olympic Park Master Plan 2030. The roadway will intersect Bennelong Parkway to the east of the site at an unsignalised T-intersection where left-in and left-out vehicle movements will be permitted.

The new roadway will provide vehicular access to the subject site and abut two parcels of land to the north. A new north-south road to be constructed by the Sydney Olympic Park Authority will extend north from the roadway providing connectivity to the rest of the Parkview Precinct and the commercial facilities of the Central Precinct.

Vehicular access from the roadway to the subject site is proposed via the construction of an 8 metre wide two-way crossover located 30 metres from the Bennelong Parkway intersection. At 8 metres wide, the crossover will be of adequate width to accommodate the swept paths of opposing vehicles should concurrent opposing movements occur at the site access.

The location of the site access point is generally in line with the preferred location outlined in the Sydney Olympic Park Master Plan 2030. The traffic analysis presented in Section 7 of this report indicates that under post-development peak-hour operating conditions, vehicles queued at the Bennelong Parkway intersection will not queue beyond the access point to the development. The siting of the crossover is therefore considered appropriate.

Internally, the crossover provides vehicular access to the site just east of the loading docks on Basement Level 2. This area is at-grade with the property boundary and therefore satisfies the property line gradient requirements of the Australian Standard.

4.3 Sight triangles

Figure 3.3 of the Australian Standard indicates clear sight lines should be provided at a car park exit point for pedestrian safety.

The figure suggests that sight triangles clear of visual obstruction be provided on either side of an exit point which measure 2.0 metres along the frontage road and 2.5m along the exit lane. It is noted that where a driveway provides two-lane, two-way flow, there is no requirement to provide a sight triangle on the inbound side of the site access.

A review of the development plan indicates that there is no sight triangle provided on the required (western) side of the driveway. In the absence of providing this triangle, a visually permeable wall treatment such as louvres could be used west of the access, or a convex mirror could be mounted on the eastern side of the accessway to alert pedestrians to the presence of cars.

4.4 Vehicular Ramps and Circulation Arrangements

Three (3) vehicular ramps are proposed within the basement car parking levels.

> A 6.3 metre wide ramp near the site access provides a drop of 1.0 metre between the loading bays and childcare parking area. The ramp has a maximum grade of 1:5 and provides transitions of 1:8 over 2 metres at both the top and base of the ramp.

> Two (2) larger ramps are proposed to interconnect the 3 parking levels. These ramps provide a trafficable width of 6.9 metres between kerbs, have a maximum grade of 1:7, and provide 1:10 transitions over 2 metres at both the top and base of the ramp.

These ramps are of sufficient width to allow two-way vehicle movement and provide adequate grade transitions to avoid vehicle scraping.

The design of the ramps is therefore in accordance with the requirements of the Australian Standard for Off-Street Car Parking (AS/NZS 2890.1:2004)

Circulation throughout the north of each basement level is typically provided by parking aisles that are 6.0 metres in width and allow two-way vehicular flow.

Circulation throughout the south of each level is provided by a one-way circulation arrangement due to the location of structural elements that impede on the parking aisles. The minimum width provided in this section is 3.3 metres which is appropriate to accommodate a single lane of traffic.

All spaces accessed from the one-way circulation aisle will be allocated to residents of the development who will become familiar with the orientation of the car park.

4.5 Bicycle Parking and Access

The development plan indicates provision of 246 dedicated bicycle spaces, comprising 156 spaces on Basement Level 1 and 90 spaces located at ground level. It is proposed that these spaces be provided via the installation of vertically hung bicycle racks such as the 'Ned Kelly' system.

The Sydney Olympic Park Master Plan 2030 states that all on-site bicycle parking facilities are to comply with the Australian Standard for Bicycle Parking Facilities (AS2890.3:1993), however it is noted that this standard predates the use of vertically hung bicycle racks like those which are proposed.

According to the Standard, vertically stored bicycles should be provided with 600mm clear width to avoid interfering with adjacent bicycles. This is based on the assumption that bicycles are stored at 90-degrees to the wall with their rear wheel on the ground.

Vertically hung bicycle racks like those proposed for installation at the subject site provide hooks for a user to hang their bicycle upon. Racks are spaced at 450mm centres but are staggered in height, to avoid the handlebars and pedals of adjacent bicycles from impeding on adjacent bicycles.

Effectively, bicycles stored at the same height are separated by 900mm which exceeds the requirements of the Australian Standard.

A review of the product sheet for vertically hung bicycles racks indicates a depth of 1.2 metres is required from the wall mount for bicycle storage, with a corridor width of 1.5 metres provided for access.

The development plans indicate that these spatial requirements will be provided.

The use of vertically hung bicycle racks is an efficient use of space that is becoming commonplace in multi-unit developments and their use at the subject site is considered acceptable.

4.6 Loading Considerations

A loading dock is to be provided inside the main building near the car park entrance on Basement Level 2, which has been designed to accommodate 2 rigid vehicles.

Swept path diagrams have been prepared to demonstrate vehicular access and egress from the loading bays. The 8.8 metre long rigid vehicle from the AustRoads guidelines has been used as the design vehicle, the dimensions of which are shown on the attached diagrams in the Appendix.

The diagrams indicate that adequate manoeuvring space is provided for each loading bay to be accessed independently of one another, confirming the plan layout is appropriate.

It is noted that a height clearance of 4.0 metres will be provided above the loading bays, which is less than the 4.5 metres recommended by the Australian Standard for Off-Street Commercial Vehicle Facilities (AS289.2:2002).

Height limits for the loading bays should be clearly advised at the vehicular entry point to the basement levels and service vehicles that require access to the loading area on a regular basis will be chosen on the basis of accessibility.

4.7 Refuse Collection

A large waste and recycling storage room has been located on Basement Level 2 directly adjacent to the loading bay. Smaller areas for the storage of recyclables and capture of waste from the garbage chute system have been located near to the southern lift core of the residential tower.

A waste management plan has been prepared by Elephants Foot Recycling Solutions which details the proposed waste handling arrangements on the site, as well as the collection arrangements for transportation away from the site.

The plan states that residential waste and recycling will be collected from the loading bay on Basement Level 2 by Auburn City Council Contractors, which require a clearance height of 4.0 metres to allow a rear loading 'medium rigid vehicle' gain access to the waste collection area.

The swept path diagrams attached in the Appendix demonstrate that there is adequate manoeuvring space provided for the above design vehicle to access the site and provide a collection service.

The plan also states that the collection of commercial waste and recycling will be undertaken by private contractor and may occur from the loading area on Basement Level 2. The refuse collection vehicle used by the Private Contractor to service the site will need to be selected on the basis of accessibility given the reduced height clearance (4.0m) available.

It is noted that this height clearance will be adequate to accommodate a range of modern refuse collection vehicles.

4.8 Boom Gates

A boom gate is to be located within Basement Level 2 to segregate the parking spaces allocated to residents, resident visitors and café staff from the childcare parking spaces. The boom gate is located approximately 45 metres from the site entrance.

Based on the AustRoads queueing theory calculations (Part 2 : Roadway Capacity) and the likely rate of peak hour resident arrivals to the subject site presented in Section 7 of this report, the 99th percentile back of queue length would be 2 vehicles. This represents the queue length that would only be exceeded 1% of the time during the peak hour and includes the vehicle currently propped at the boom gate.

There is ample storage area within the site for this level of queueing to occur without blocking the site access.

Inbound residents and staff members will have remote access to the boom gate. Resident visitors will require access be provided via resident. An inductive loop installed beneath the pavement on the outbound approach will allow vehicles to exit the site without delay.

5 Car Parking Considerations

5.1 Development Control Parking Requirements

The Sydney Olympic Park Master Plan 2030 has been prepared to guide the long-term development of the area as it evolves into an active, vibrant town within metropolitan Sydney. The area will incorporate residential, commercial, recreational and entertainment land uses, and will benefit from conveniently located public transport services. A high level of pedestrian and bicycle facilities are also proposed to encourage the use of sustainable modes of transport.

Given the above, developments within the defined masterplan boundaries are subject to a car parking limitation policy. This policy differs from normal development control guidelines in that it outlines a maximum number of car parking spaces that can be provided on the site, rather than a minimum provision.

Section 4.7 of the masterplan outlines maximum car parking rates for the proposed uses on the site as outlined in Table 5-1 below.

Table 5-1 Sydney Olympic Park Master Plan 2030 - Maximum Parking Rates

Use	Rate	Car Parking Measure
Residential Dwelling	1 space	to each one bedroom dwelling
	1.2 spaces	to each two bedroom dwelling
	1.5 spaces	to each three bedroom dwelling
	2 spaces	to each four bedroom dwelling
	0.25 spaces	to each dwelling for visitor use
Commercial (Café)	1 space	to every 50m^2 of floor area
Childcare Centre	1 space 1 space	to every 4 children and suitable drop-off facilities to every 2 staff

Based on the above rates, the maximum number of car parking spaces permitted on the site is 545 spaces.

Table 5-2 summarises the maximum number of parking spaces permitted for each component of the proposal against the indicative allocation of parking spaces presented in Table 3-2

Table 5-2 Allocation of On-Site Car Parking Spaces

Use	Maximum No. of Spaces Permitted	No. Spaces Allocated
Resident	424	408
Resident Visitor	92	52
Commercial (Café)	2	2
Childcare Centre	27	20
Total	**545**	**482**

The allowance of on-site car parking spaces to each of the proposed uses on the site is in accordance with the development controls set out by the Sydney Olympic Park Master Plan 2030.

5.2 Assessment against ECOVE Parking Provisions

ECOVE recently received planning approval for a mixed-use development of slightly larger scale on land located at Site 3 of the Sydney Olympic Park Master Plan 2030.

The mixed-use development provided an on-site parking provision within the car parking limitation policy outlined at Section 4.7 of the masterplan and allocated on-site parking spaces to residents and resident visitors at the rates outlined in Table 5-3 below

Table 5-3 ECOVE Residential Parking Allocation Rates

Use	Rate	Car Parking Measure
Residential Dwelling	1 space	to each one bedroom dwelling
	1 spaces	to each two bedroom dwelling
	2 spaces	to each three bedroom dwelling
	2 spaces	to each four bedroom dwelling
	0.14 spaces	to each dwelling for visitor use

Based on adoption of the above car parking measures, the subject proposal would be expected to provide 405 parking spaces to residents and 52 parking spaces to resident visitors.

The subject proposal has allowed for provision of 408 spaces for residents and 52 spaces for resident visitors, which is in line with the above provisions.

5.3 Suitability of Car Parking Provision

The subject proposal will provide an on-site parking provision that is within the maximum number of parking spaces permitted by the car parking limitation policy of the Sydney Olympic Park Master Plan 2030. Furthermore, each component has been allowed an on-site parking provision that is within the maximum number of parking spaces permitted for that use.

It is noted that the car parking limitation policy extends to the short-term parking demands generated by Resident Visitors and Childcare set-down / collection activity. Based on the indicative parking allocation outlined in Table 3-2 of this report:

> An allowance for 20 parking spaces has been set aside for the childcare centre. This allowance is provided via a dedicated set-down and collection area (17 spaces) on 'Basement Level 2' and the shared use of the indented parking spaces at the northern boundary.

  The RMS publication 'Guide to Traffic Generating Developments (October 2002) suggest average peak parking demand for childcare centres is in the order of 0.23 spaces per child. This equates to a likely peak parking demand in the order of 19 spaces if the childcare centre is at capacity which can be accommodated on-site.

> An allowance for 52 on-site parking spaces has been made for resident visitors. This will be provided via a mix of allocated parking spaces across the basement parking levels and the shared use of the indented parking spaces at the northern boundary

  The allowance for resident visitor parking (52 spaces) is equivalent to rate of 0.14 spaces per dwelling, or 1 space to every 7 dwellings. This accords with the resident visitor parking provisions outlined in the RMS Guidelines for high-density residential flat buildings in metropolitan regional (CBD) centres.

  The proximity of public transport services and the ease of pedestrian and cycling access to the site supports the use of the RMS Guidelines to determine an appropriate resident visitor parking provision.

6 Bicycle Parking Considerations

6.1 Development Control Parking Requirements

The subject site is subject to the minimum bicycle parking requirement rates outlined at Section 4.7 of the Sydney Olympic Park Master Plan 2030.

The minimum rates for the proposed uses on the site are outlined in Table 6-1 below.

Table 6-1 Sydney Olympic Park Master Plan 2030 - Minimum Bicycle Parking Rates

Use	Rate	Bicycle Parking Measure
Commercial (Café)	1 space	to every 150m^2 of floor area for staff use
	1 space	to every 75m^2 of floor area for visitor use
Educational (Childcare)	1 space	to every 100 full-time students for staff use
	1 space	to every 10 full-time students for student use
Residential Dwelling	1 space	to each one bedroom dwelling
	1.2 spaces	to each two bedroom dwelling
	1.5 spaces	to each three bedroom dwelling
	2 spaces	to each four bedroom dwelling
	0.25 spaces	to each dwelling for visitor use

Application of the above rates to the subject proposal equates to a minimum bicycle parking requirement of 519 spaces. This comprises the following minimum allocations:

> 424 for resident use,

> 92 spaces for resident visitor use,

> 1 space for café staff use,

> 1 space for café visitor use, &

> 1 space for childcare staff use.

6.2 Suitability of Bicycle Parking Provision

Whilst the Sydney Olympic Park Master Plan 2030 outlines a statutory requirement for 519 bicycle spaces to be provided on the site, it is commonly agreed that the rates used to determine this requirement are inappropriately high.

In particular, the rates used to determine minimum bicycle parking requirements for residential use (between 1 and 2 bicycle spaces per apartment) are the same rates used to determine the maximum number of car parking spaces permitted for residential use under the limitation policy. In effect, the masterplan dictates that more bicycle parking spaces should be provided on the site for residential use than car parking spaces.

When applying the masterplan rates to the subject proposal, there is a requirement to provide 425 resident bicycle parking spaces for the 369 apartments. This is considered an excessive provision as some residents may not own, or be physically able to ride a bicycle. Furthermore, owners of particularly valuable bicycles may not feel comfortable storing their bike in areas of the basement which are accessible to all residents of the development.

The subject proposal will provide an on-site bicycle parking provision of 246 spaces, comprising 156 spaces on basement level 1 for resident use and 90 spaces on the ground level for the use of staff and resident visitors.

Further space for an additional 42 bicycles is provided at ground level to enable the cafe to offer bicycle rental facilities to the general public if desired.

When considering this provision it is noted that:

> The provision of 90 bicycle parking spaces for the use of staff and resident visitors is closely in line with the minimum requirement outlined by the masterplan (95 spaces) and considered adequate for the proposal.

> The provision of 156 bicycle parking spaces for resident use is equivalent to a rate of approximately 1 bicycle space to every 2.4 apartments, or 0.42 spaces per apartment.

  It is noted that this provision exceeds the resident bicycle parking requirements outlined for similar areas of metropolitan Sydney that currently provide, or are planned to provide high density residential development. By way of comparison, the Rhodes West Development Control Plan (April 2011) outlines a minimum resident bicycle parking requirement of 1 space per 3 apartments.

Notwithstanding the above, 290 of the storage areas within the basement parking levels have been designed with adequate dimensions to accommodate a bicycle if the owner/occupier of that unit desires to do so.

If these areas are considered in conjunction with the formal resident bicycle parking spaces, there is potential for the basement levels to accommodate 446 bicycle parking spaces, or around 1.2 bicycles per apartment.

This design solution provides more than adequate storage for bicycles on the site without the need to construct significant on-site parking infrastructure that would likely be underutilised.

7 Traffic Considerations

7.1 Traffic Generation Rates

The RMS publication 'Guide to Traffic Generating Developments' (October 2002) suggests that dwellings within medium density residential flat buildings generate vehicle movements at the daily and peak hourly rates outlined in Table 7-1

Table 7-1 RMS Trip Generation Rates – Medium Density Residential Flat Buildings

Component	24 Hour (vpd)	Peak Hour (vph)
Smaller Units and Flats (Up to 2 bedrooms)	4.0 – 5.0	0.4 - 0.5
Larger Units and Townhouses (3 or more bedrooms)	5.0 – 6.5	0.50 - 0.65

Based on the above, a trip generation rate of 5.0 vehicle movements per dwelling per day (with a peak hour component of 10%) is considered reasonable to determine the traffic volume generated by the residential component of the subject proposal.

It is noted that this will likely provide a conservative estimate of traffic generation as the vast majority of apartments proposed on the site (90%) have 2-bedrooms or less.

The RMS Guide also suggests that Childcare Centres generate peak hour vehicle movements per childcare place provided at the rates outlined in Table 7-2.

Table 7-2 RMS Trip Generation Rates – Childcare Centres

Centre Type	7:00am-9:00am	2:30pm-4:00pm	4:00pm-6:00pm
Pre-School	1.4	0.8	-
Long-day Childcare Centre	0.8	0.3	0.7
Before / After Care	0.5	0.2	0.7

A conventional childcare centre is proposed on the site and the standard rates presented above for a 'long-day' childcare centre are considered appropriate to estimate the traffic generation of this use.

In addition to the above components, the commercial use (café) will be allocated 2 on-site parking spaces for staff use. It is likely that these spaces will both generate an inbound vehicle movement during the morning peak period and an outbound vehicle movement during the evening peak period.

7.2 Estimate of Site-Generated Traffic Volume

Based on the assumptions presented in the preceding section, the subject proposal is likely to generate the peak hourly traffic volumes presented in Table 7-3

Table 7-3 Site-Generated Peak Hour Traffic Volumes

Component	AM Peak		PM Peak	
	Rate	Traffic Volume (vph)	Rate	Traffic Volume (vph)
Residential	0.5 trips per dwelling	185	0.5 trips per dwelling	185
Childcare	0.8 trips per child	64	0.3 trips per child	24
Café	1 movement per space	2	1 movement per space	2
Total		**251**		**211**

The subject proposal is estimated to generate in the order of 251 vehicle movements during the morning peak period and 211 vehicle movements during the afternoon peak period.

7.3 Distribution of Site-Generated Traffic to Road Network

The following assumptions are made regarding the inbound / outbound directional split of site-generated vehicle movements:

> 70% of residential vehicle movements will be in the peak direction, that is outbound during the morning peak and inbound during the afternoon peak.

> Childcare Centre traffic will be split evenly between inbound and outbound vehicle movements.

Given the left-in, left-out turning arrangement at the Bennelong Parkway intersection, the following assumptions are made regarding the distribution of site-generated vehicle movements to the road network:

> The north-south road to the west of the site access will provide the most convenient outbound route from the subject site to the arterial road network and the commercial / community facilities of the other Olympic Park Precincts. It is assumed that at least 60% of outbound vehicle movements will depart via this route and up to 40% of outbound vehicle movements will depart via the Bennelong Parkway intersection.

> The Bennelong Parkway intersection will provide the most direct inbound route from the arterial road network to the subject site and also provide relatively convenient access from the other Olympic Park Precincts. It is assumed that up to 80% of inbound vehicle movements will approach the site via the Bennelong Parkway intersection and the remaining 20% will approach the site via the north-south road to the west of the site access.

Table 7-4 summarises the distribution of peak hour site-generated vehicle movements to and from the Bennelong Parkway intersection in light of the above assumptions.

Table 7-4 Site-Generated Peak Hour Traffic Distribution

Component	AM Peak		PM Peak	
	Inbound	Outbound	Inbound	Outbound
Residential	45	52	104	22
Childcare	26	13	10	5
Café	2	0	0	1
Total	**73**	**65**	**114**	**28**

7.4 Consideration of Adjacent Developments

The land parcels to the immediate north (Site 67A and Site 67B) have frontages to the new roadway to be constructed along the northern site boundary.

Cardno has been advised of the following approximate development yields for these sites:

> Site 67A – 296 Dwellings

> Site 67B – 312 Dwellings

It would be reasonable to assume that around 20% of outbound vehicle movements and 50% of inbound vehicle movements generated by these sites will utlise the new roadway along the subject site boundary and the Bennelong Parkway intersection. The remaining vehicle movements would use other roads constructed as per the masterplan to access these sites.

Table 7-5 summarises the distribution of peak hour vehicle movements of these sites to and from the Bennelong Parkway intersection based on the trip generation and directional split assumptions made in the preceding sections.

Table 7-5 Peak Hour Traffic Volumes Generated by Adjacent Developments

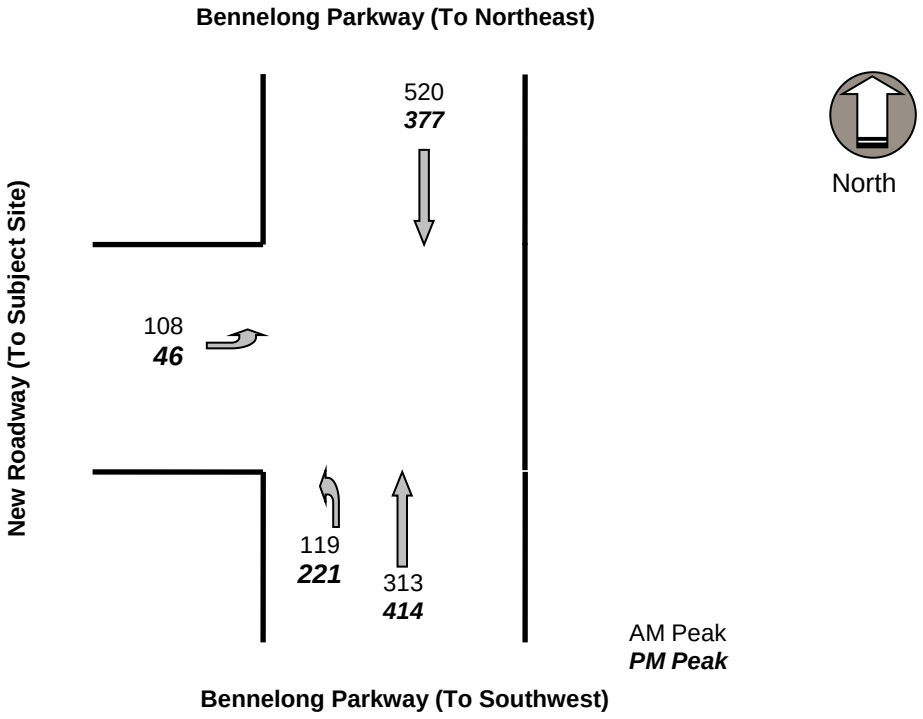
Site	AM Peak		PM Peak	
	Inbound	Outbound	Inbound	Outbound
Site 67A	22	21	52	9
Site 67B	24	22	55	9
Total	**46**	**43**	**107**	**18**

7.5 Likely Post-Development Peak Hour Traffic Volumes

The preceding sections have estimated the traffic volumes likely to be generated by the subject proposal and adjacent developments that will pass through the Bennelong Parkway intersection during each peak period.

These vehicle movements have been added to the Bennelong Parkway traffic volumes at Figure 2-7 to represent the likely post-development traffic conditions at the intersection, which are presented in Figure 7-1 below.

Figure 7-1 Likely Post-Development Peak Hour Traffic Volumes



7.6 Intersection Analysis

The operation of the intersection where the new roadway intersects Bennelong Parkway has been analysed using the SIDRA Intersection software. This computer package, originally developed by the Australian Road Research Board, provides information about the capacity of an intersection in terms of a range of parameters, as described below:

Degree of Saturation (D.O.S.) is the ratio of the volume of traffic observed making a particular movement compared to the maximum capacity for that movement. Various values of degree of saturation and their rating are shown in Table 7-6.

Table 7-6 Rating of Degrees of Saturation

D.O.S.	Rating
Up to 0.6	Excellent
0.6 to 0.7	Very Good
0.7 to 0.8	Good
0.8 to 0.9	Fair
0.9 to 1.0	Poor
Above 1.0	Very Poor

It is considered acceptable for some critical movements in an intersection to operate in the range of 0.9 to 1.0 during the high peak periods, reflecting actual conditions in a significant proportion of suburban signalised intersections.

Level of Service (L.O.S.) is a qualitative measure of traffic factors such as speed, volume of traffic, delays and freedom to manoeuvre. The best indicator of level of service at GIVE WAY intersections is the highest average delay per vehicle movement. These levels of service and their rating are described in Table 7-7 below.

Table 7-7 Rating of Level of Service at GIVE WAY Intersections

L.O.S.	Average Delay per Vehicle (secs/veh)	Description
A	Less than14	Good operation
B	15-28	Acceptable delays and spare capacity
C	29-42	Satisfactory, but accident study required
D	43-56	Near capacity and accident study required
E	57-70	At capacity, requires other control mode
F	Over 70	Unsatisfactory and requires other control mode.

Based on the above ratings, a level of service 'C' or greater is considered satisfactory.

The ***95th Percentile (95%ile) Queue*** represents the maximum queue length, in metres, that can be expected in 95% of observed queue lengths in the peak hour; and

Average Delay is the delay time, in seconds, which can be expected over all vehicles making a particular movement in the peak hour.

The results of the SIDRA Intersection analysis are summarised in Table 7-8. The left-in, left-out arrangement at the Bennelong Parkway intersection will ensure that the southbound traffic flow along Bennelong Parkway will remain uninterrupted.

Table 7-8 SIDRA Intersection Analysis Summary

	Approach	Movement	Degree of Saturation	95th%ile Queue Length (m)	Average Delay (s)	Level of Service
AM Peak	New Roadway	Left	0.10	2.9	5.9	A
	Bennelong Parkway (Northbound)	North	0.24	0.0	1.1	A
		Left	0.24	0.0	5.6	A
PM Peak	New Roadway	Left	0.05	1.3	6.3	A
	Bennelong Parkway (Northbound)	North	0.36	0.0	1.1	A
		Left	0.36	0.0	5.6	A

The SIDRA analysis indicates that the intersection will operate with a good level of service (Level A) under post-development traffic loadings. Furthermore, the degrees of saturation indicate that each leg of the intersection will operate well below capacity.

Importantly, the analysis indicates that vehicles queued on the minor road approach to the intersection will not queue beyond the proposed access point to the basement levels, confirming that the location of the access point shown on the development plan and preferred by the Sydney Olympic Park Master Plan 2030 is appropriate.

Accordingly, the traffic generated by the site will have no detrimental impacts on capacity, road safety or amenity at the intersection.

On a wider scale, the surrounding roads and intersections have been designed to accommodate the anticipated traffic volumes generated by development of the Sydney Olympic Park area as proposed under the masterplan.

7.7 Construction Traffic

Construction of the mixed-use development as proposed will require larger vehicles enter and exit the site from the abutting road network during several stages of the project.

During the excavation stage, vehicles will be required to access the site to be loaded with cut earth and materials for transportation away from the area. During the construction stage, areas will be need to be set aside for the storage of plant and machinery and an area nominated for vehicles to deliver materials to the site.

Vehicles which are required to access the site during all stages of the development should be chosen on the basis of accessibility, and the areas nominated to accommodate these vehicles should be chosen in consideration of the potential impacts caused to surrounding land uses.

Vehicular access to the site will be provided via the new roadway constructed along the northern boundary as per the masterplan. The roadway will intersect Bennelong Parkway at an unsignalised T-intersection to the east of the site where left-in, left-out turning movements are permitted.

This arrangement will provide inbound construction vehicles with a convenient and direct access route from the arterial road network south of the site, which avoids sensitive land uses and is not impeded by any low structures such as bridges.

Some outbound construction vehicles may utilise the north-south road to the west of the site access to return to the arterial road network, however some larger construction vehicles may need to turn left onto Bennelong Parkway and circulate around the Olympic park area.

Vehicular access from the new roadway to the site may require several access points depending on the stage of the project. Any damage to the kerb and channel caused during these works will be reinstated at the completion of the project.

Parking demands generated by tradesman vehicles and utes should be accommodated on-site where possible. It is noted that these parking demands could be accommodated within the basement parking levels once constructed.

Signage and traffic control procedures throughout the duration of the project should be documented within Construction traffic Management Plan prior to the commencement of works on the site.

8 Summary & Conclusions

Based on the foregoing analysis it is concluded that;

> A mixed-use development comprising a residential tower of 369 apartments with commercial use at ground floor and 3 basement parking levels is proposed on the site.

> Vehicular access to the site is proposed via a new roadway to be constructed from Bennelong Parkway along the northern boundary of the site as per the Sydney Olympic Park Master Plan 2030.

> An on-site parking provision of 482 spaces is proposed, comprising 472 spaces within the basement parking levels and 10 spaces indented along the carriageway of the new roadway.

> The proposed on-site parking provision is within the maximum number of car parking spaces permitted on the site under the car parking limitation policy outlined at Section 4.7 of the Sydney Olympic Park Master Plan 2030.

> The allowance of parking spaces to each of the proposed uses on the site is within the maximum number spaces permitted for that use under the ca parking limitation policy.

> An appropriate number of bicycle parking spaces has been provided on the site to accommodate the anticipated bicycle parking demands of residents, staff and resident visitors.

> The on-site parking areas and vehicular circulation arrangements have generally been designed in accordance with the Australian Standard for Off-Street Car Parking (AS28901:2004) and can function appropriately.

> The siting of the vehicular access point to the basement parking levels accords with the preferred location for site access outlined within the Sydney Olympic Park Master Plan 2030.

> The SIDRA analysis indicates that queueing along the new roadway at the Bennelong Parkway intersection will not impede on vehicular access to and from the basement parking levels.

> The SIDRA analysis indicates that traffic generated by the subject proposal, in consideration of the traffic generated by development of the land in the immediate vicinity of the site, will have no detrimental impacts on capacity, road safety or amenity at the intersection.

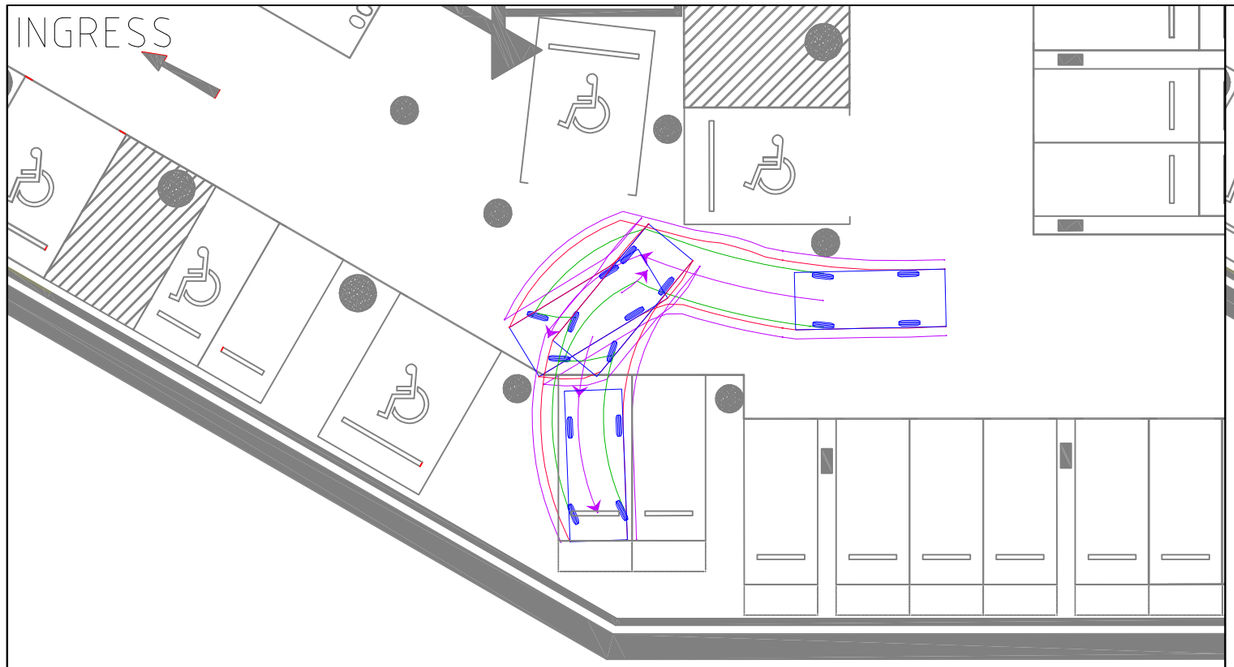
> The surrounding roads and intersections have been designed to accommodate the anticipated traffic volumes generated by development of the subject site and wider Sydney Olympic Park area as proposed under the Master Plan 2030.

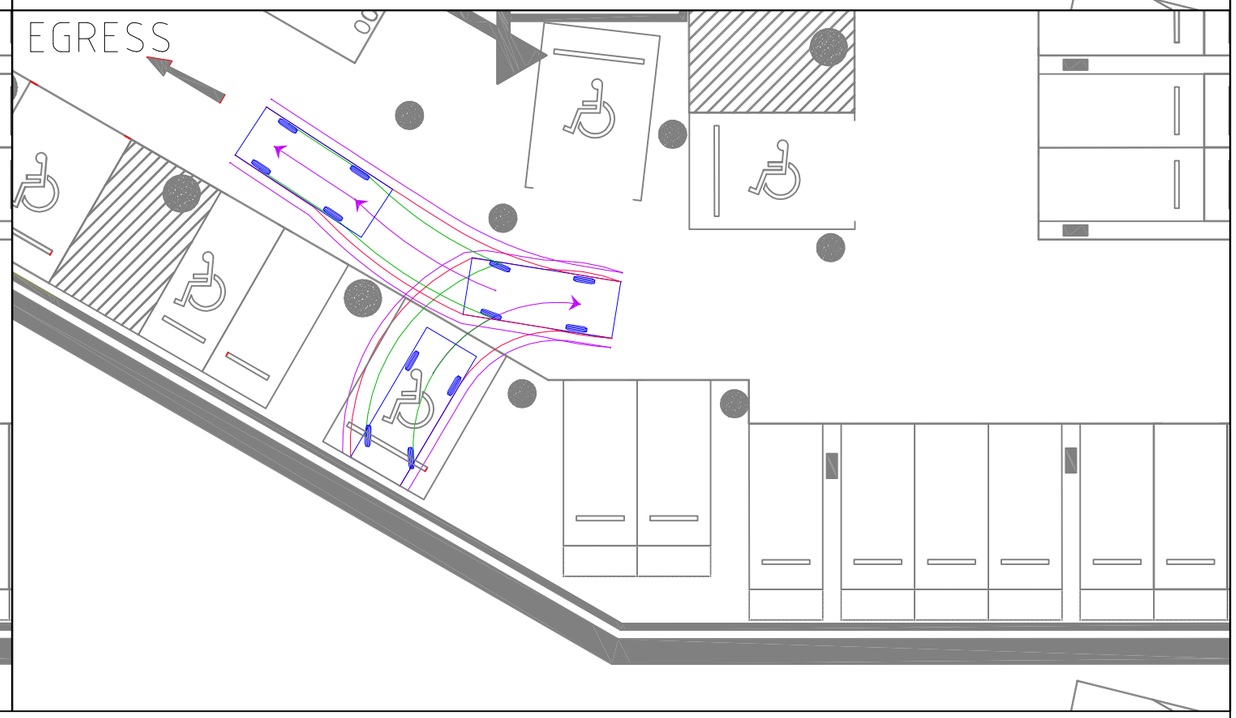
Site 68 - Sydney Olympic Park

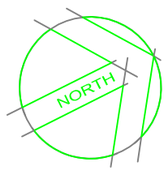
APPENDIX A

SWEPT PATH DIAGRAMS

Cardno
Shaping the Future







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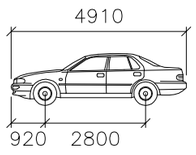


B85	mm
Width	: 1870
Track	: 1770
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

VEHICLE LEGEND

B85CAR 300mm CLEARANCE

B85CAR OVERHANG

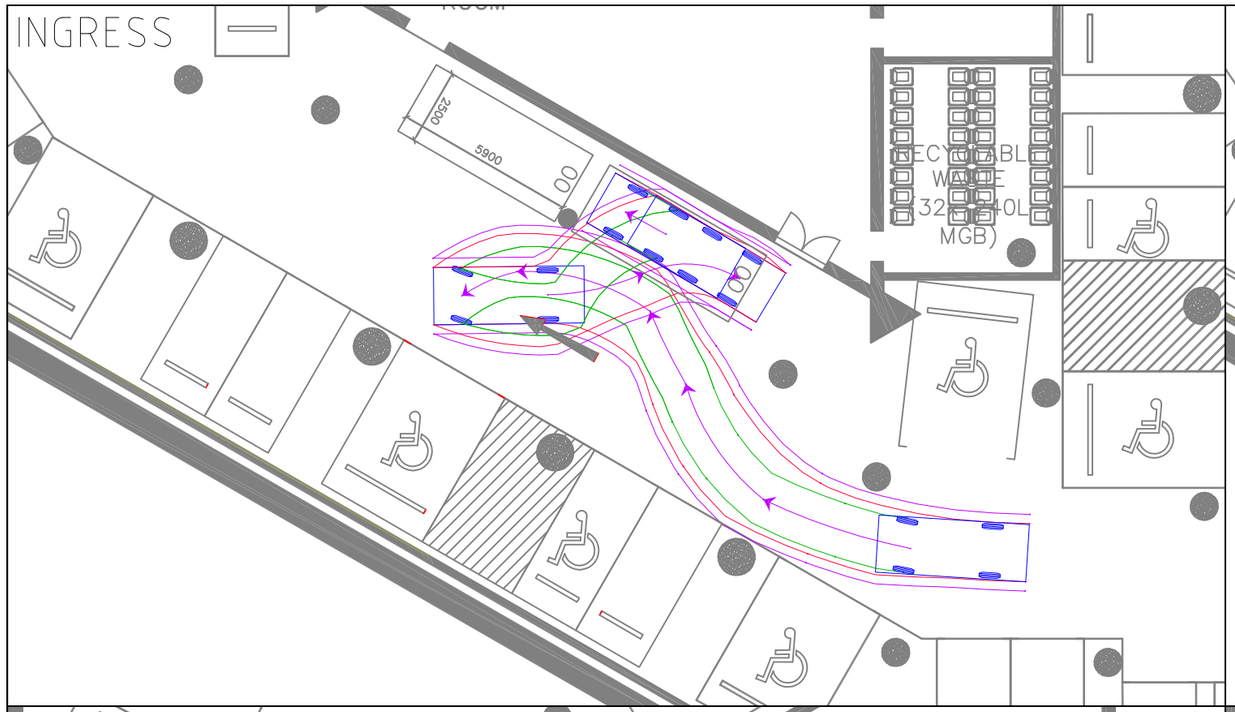
B85CAR CENTRELINE

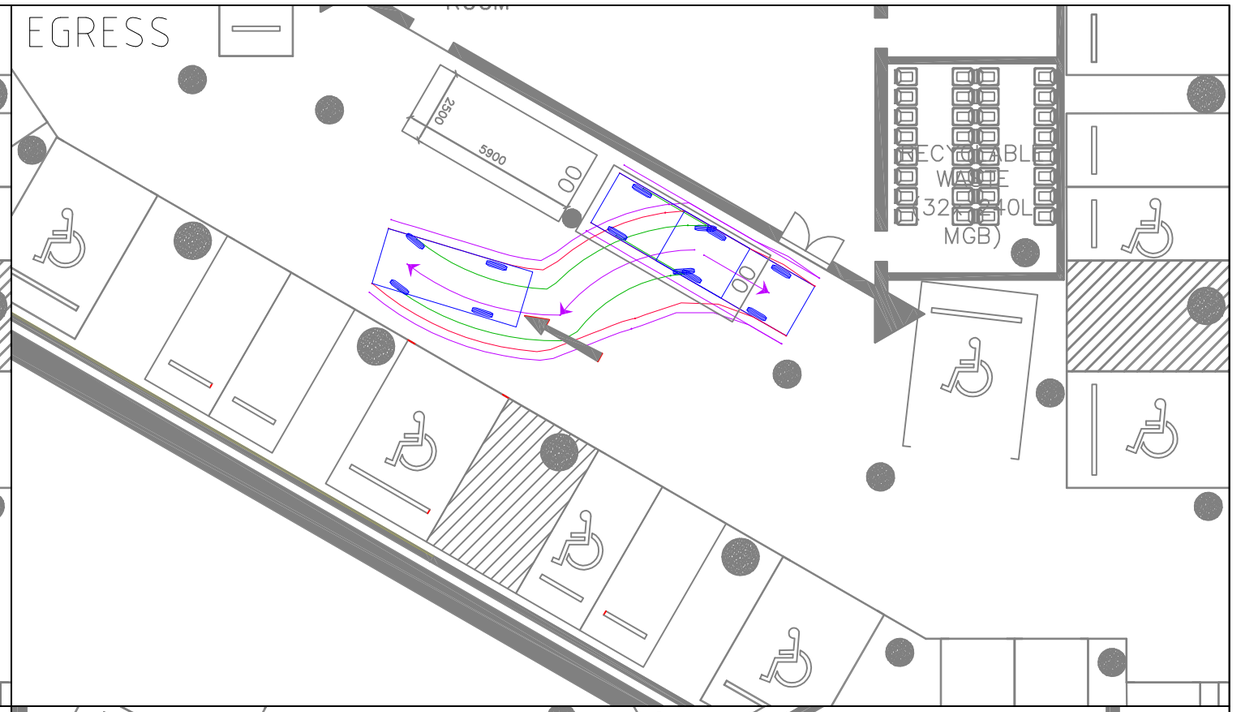
AUSTROADS B85CAR

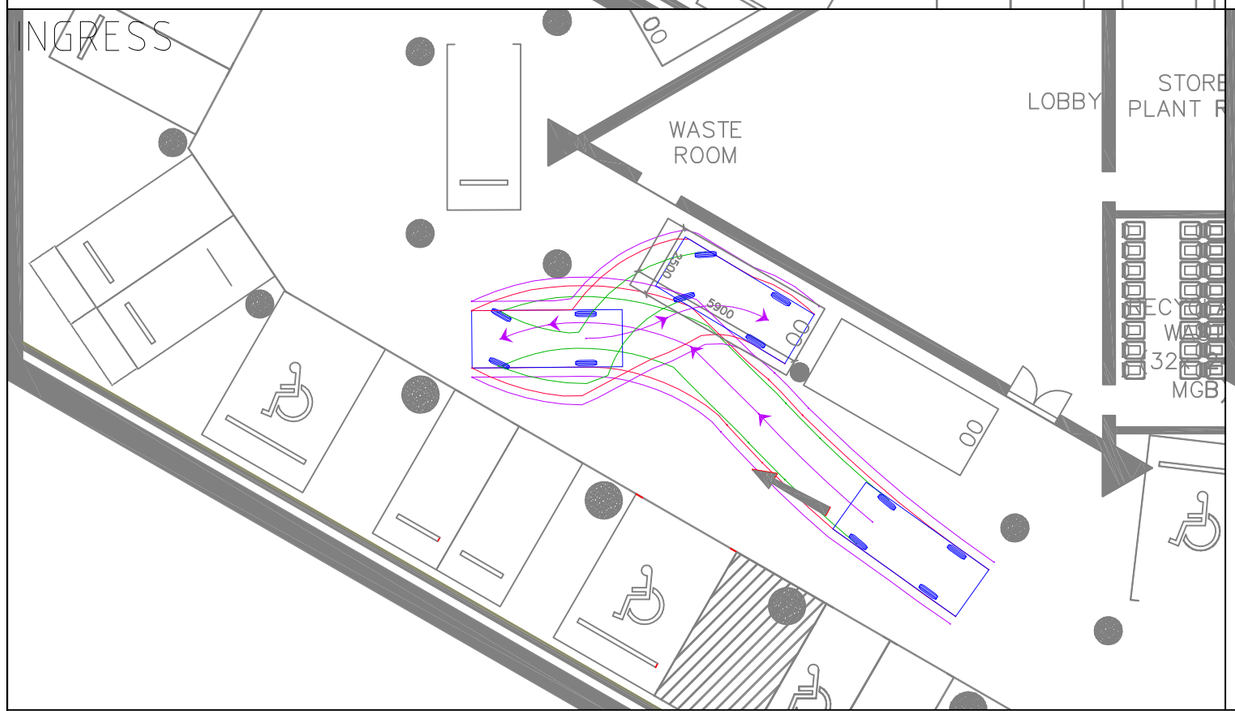
80014010 SK001

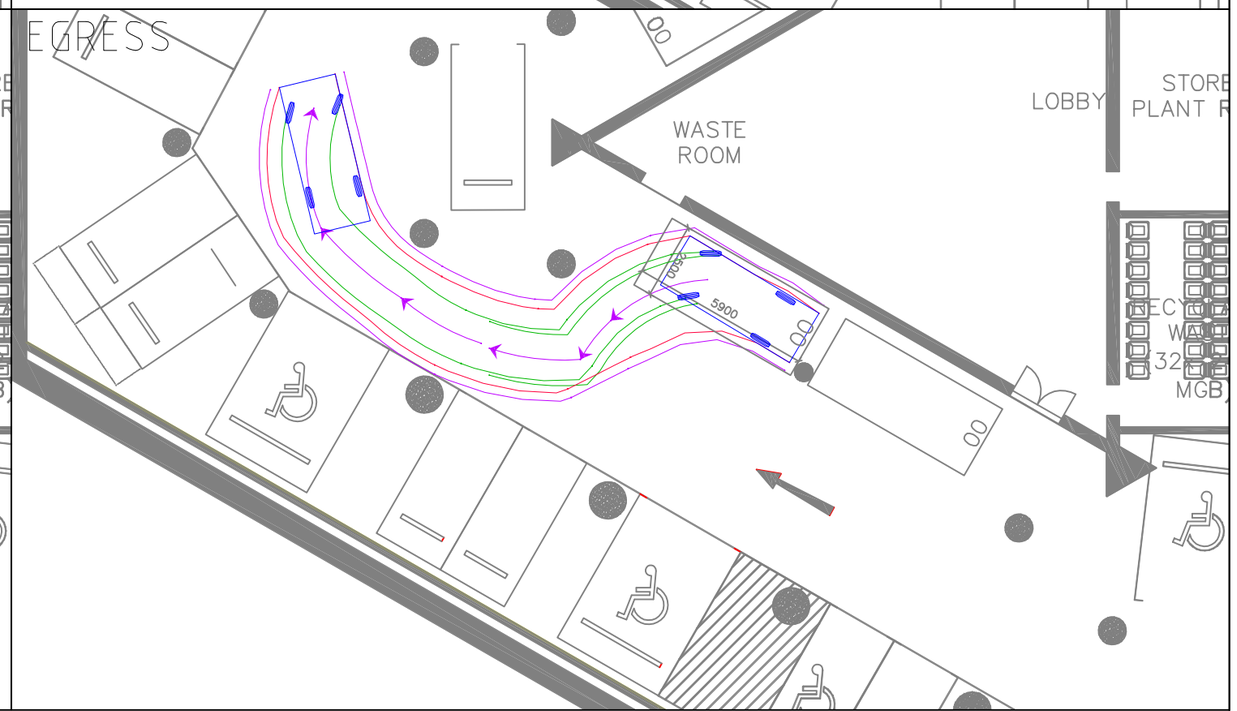
PROPOSED MIXED-USE DEVELOPMENT
SITE 68, SYDNEY OLYMPIC PARK
VEHICULAR ACCESS TO
BASEMENT PARKING SPACES
M.D. 15.09.2014

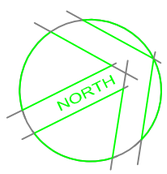
Cardno











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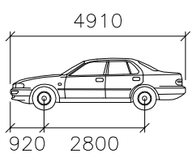


B85 mm

Width	: 1870
Track	: 1770
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

VEHICLE LEGEND

B85CAR 300mm CLEARANCE

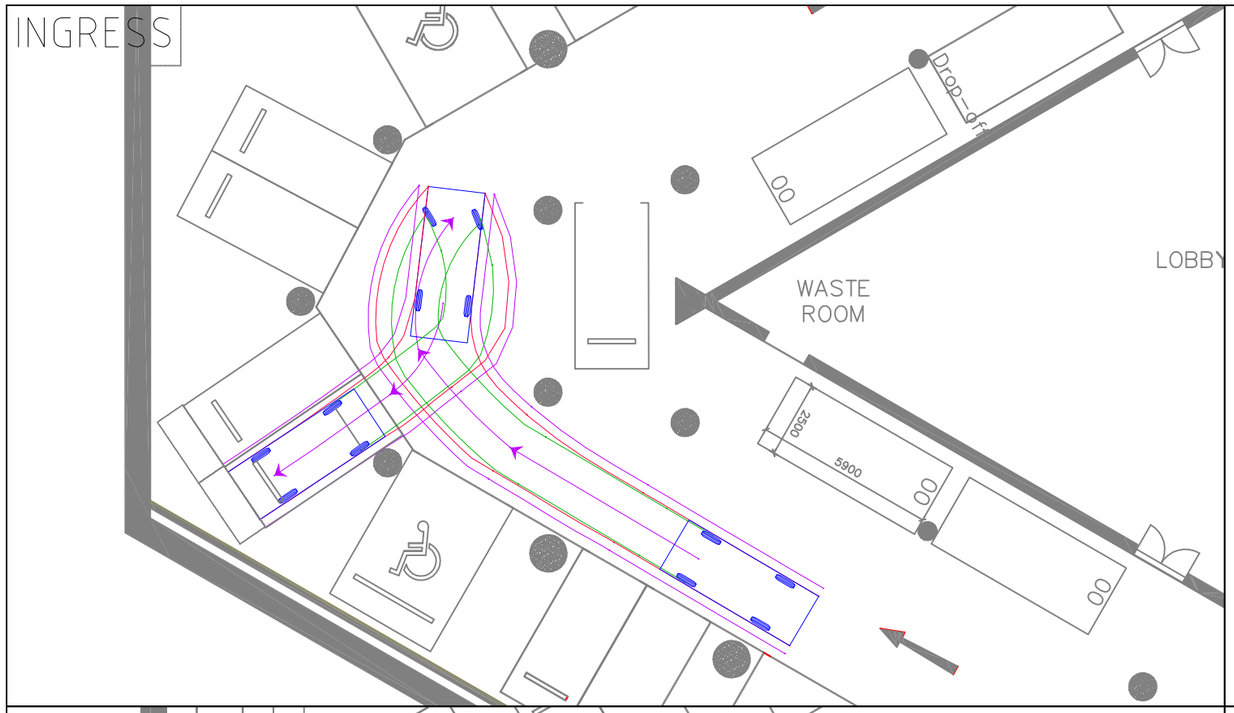
B85CAR OVERHANG

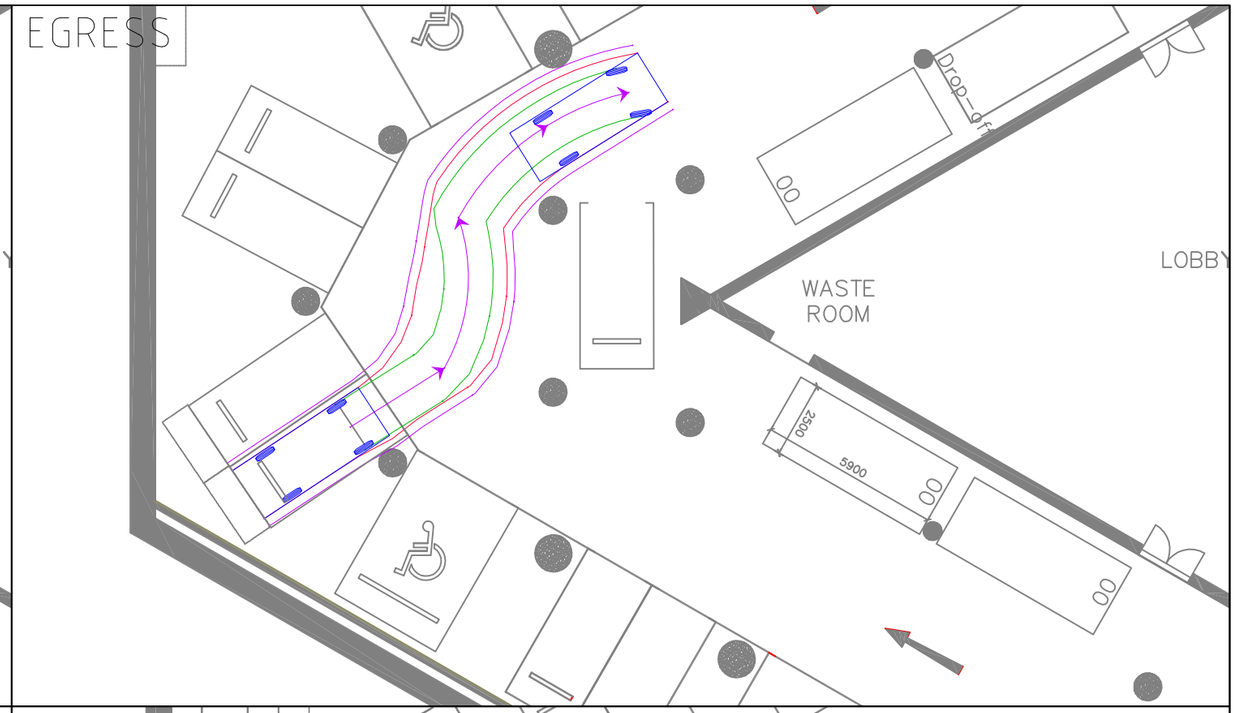
B85CAR CENTRELINE

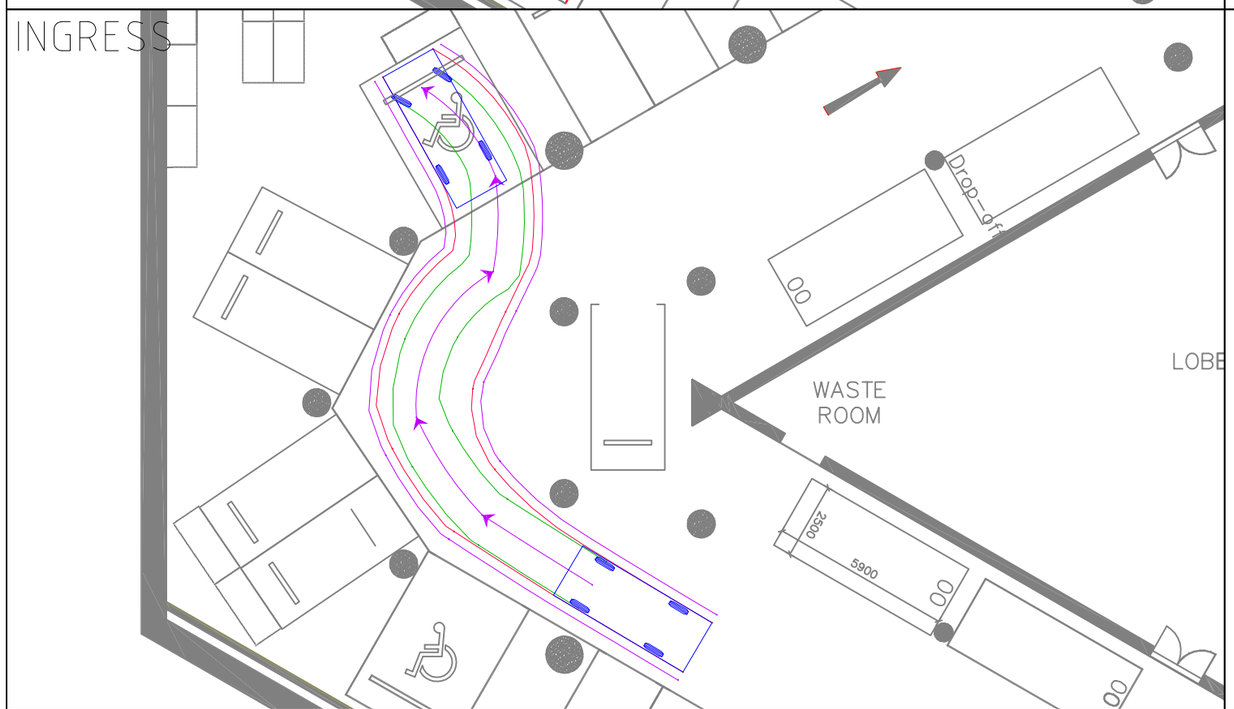
80014010 SK002

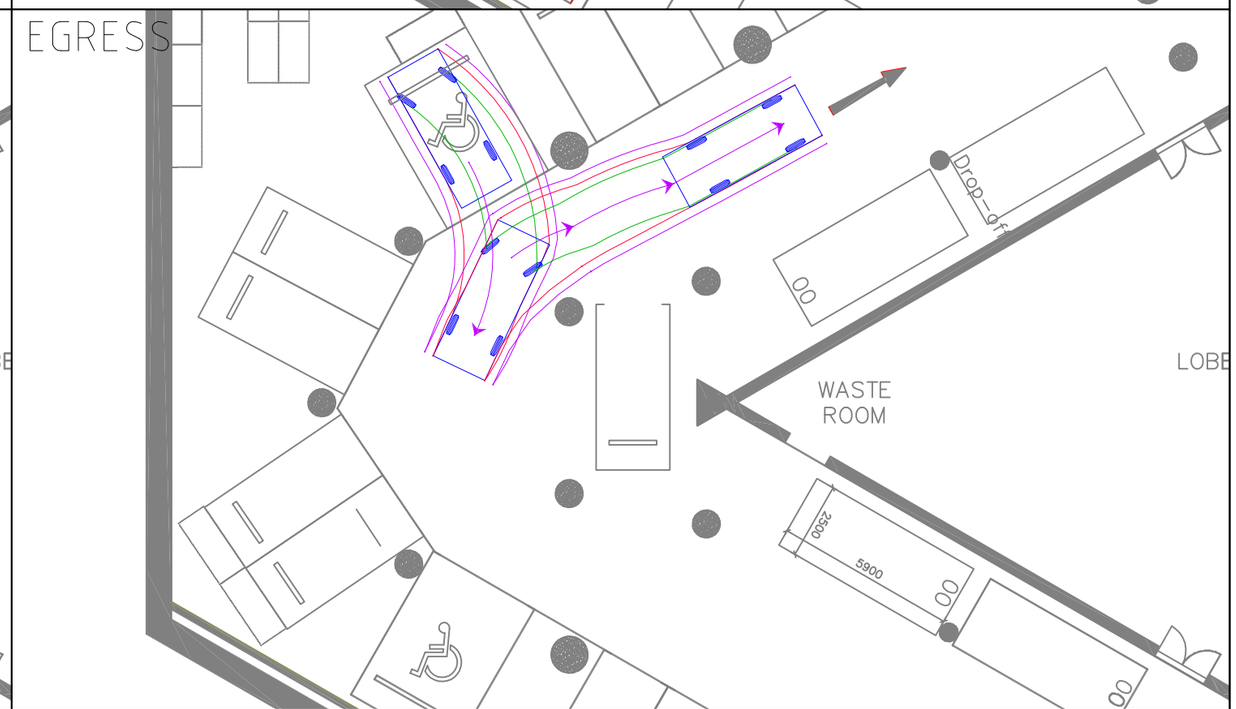
PROPOSED MIXED-USE DEVELOPMENT
SITE 68, SYDNEY OLYMPIC PARK
VEHICULAR ACCESS TO
BASEMENT PARKING SPACES
M.D. 15.09.2014

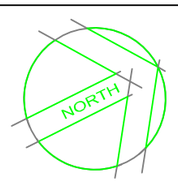
Cardno











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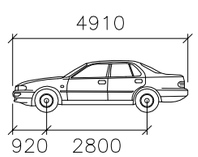


B85 mm

Width	: 1870
Track	: 1770
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

VEHICLE LEGEND

B85CAR 300mm CLEARANCE

B85CAR OVERHANG

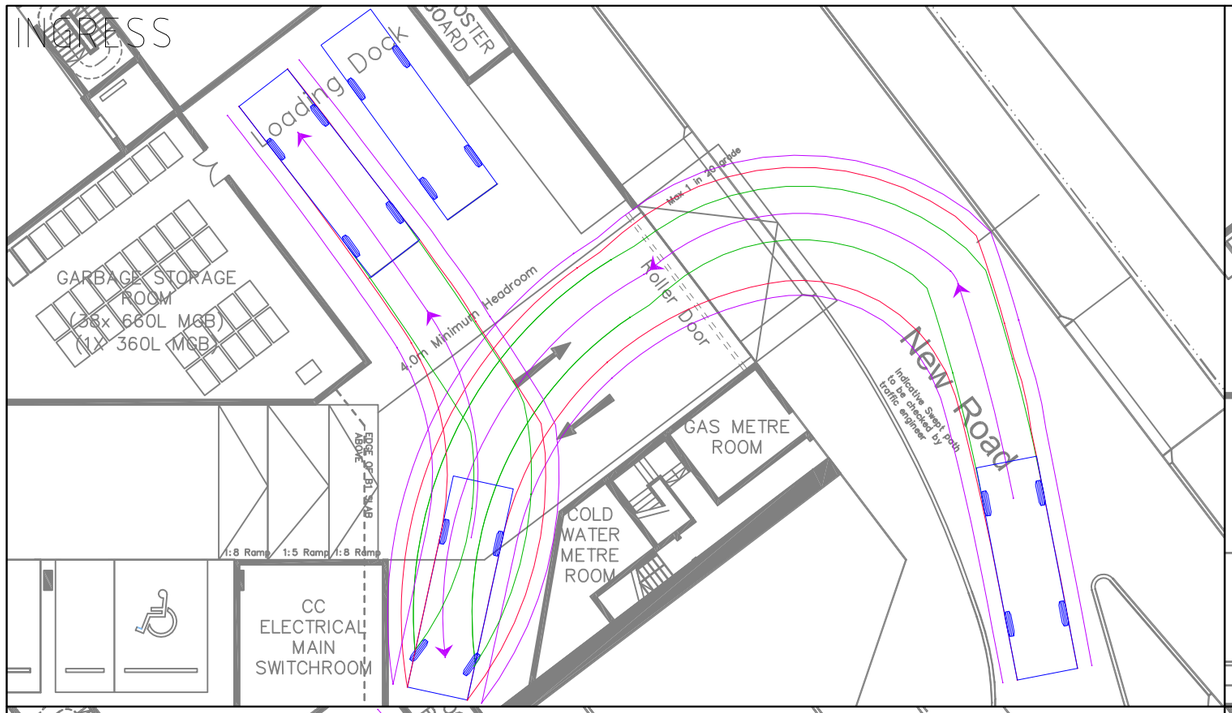
B85CAR CENTRELINE

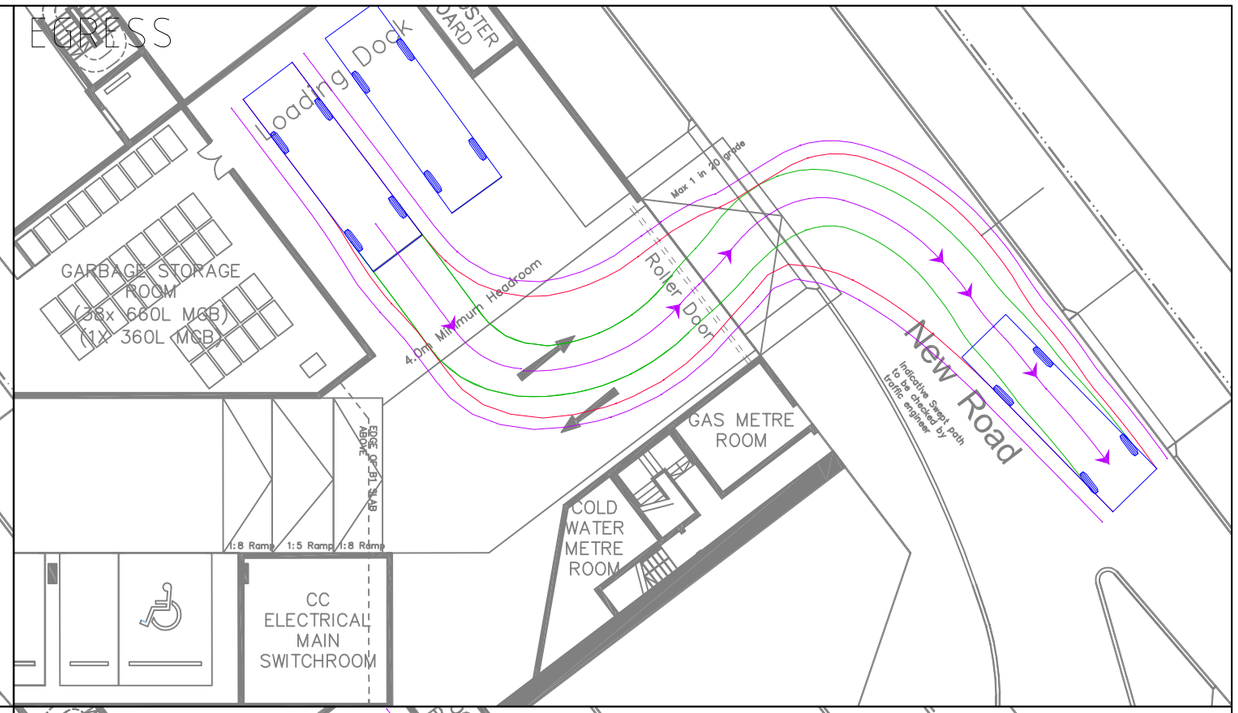
AUSTROADS B85CAR

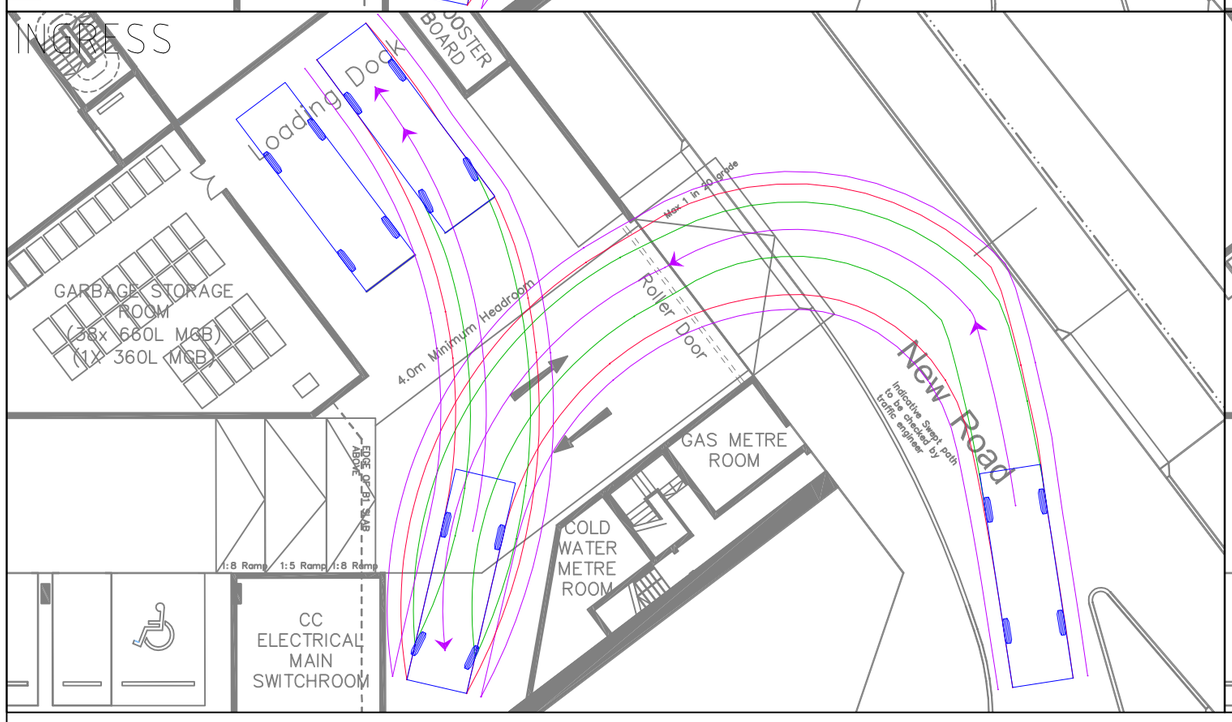
80014010 SK003

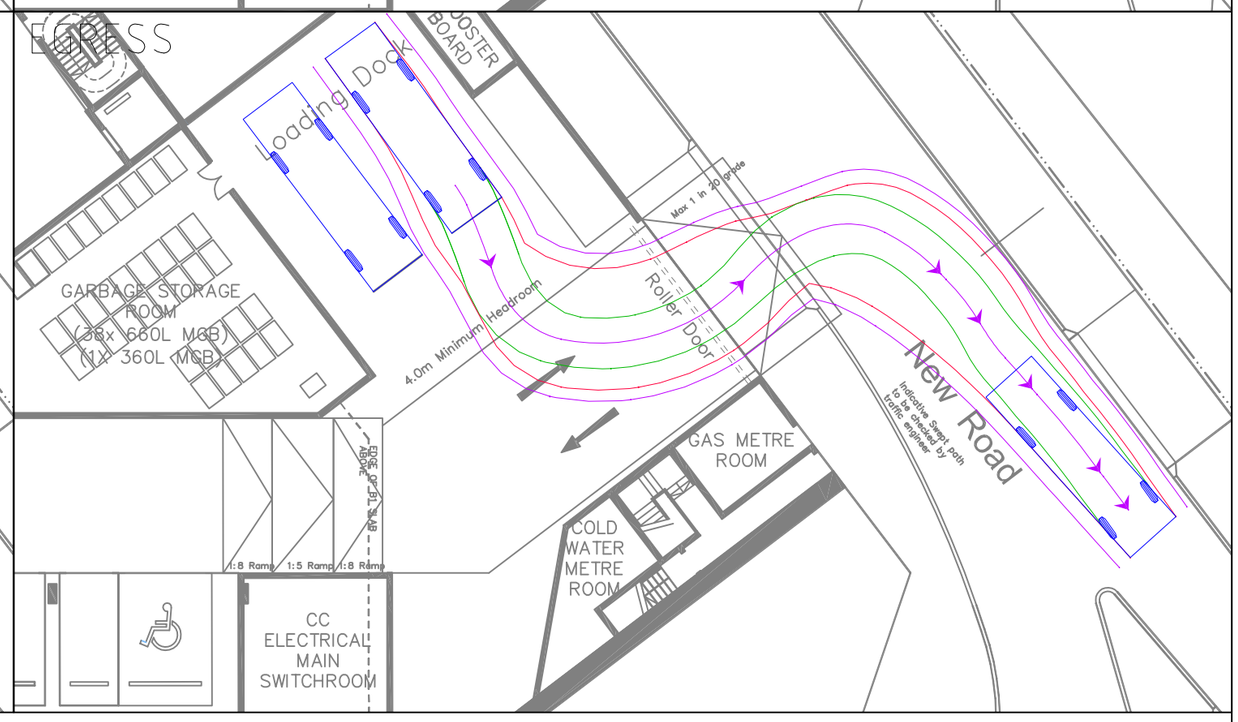
PROPOSED MIXED-USE DEVELOPMENT
SITE 68, SYDNEY OLYMPIC PARK
VEHICULAR ACCESS TO
BASEMENT PARKING SPACES
M.D. 15.09.2014

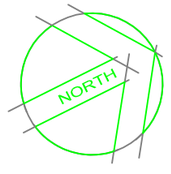
Cardno











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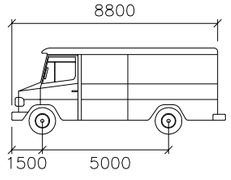

SERVICE VEHICLE

Width	: 2500
Track	: 2500
Lock to Lock Time	: 6.0
Steering Angle	: 38.7

VEHICLE LEGEND

- 8.8m RIGID VEHICLE 600mm CLEARANCE
- 8.8m RIGID VEHICLE OVERHANG
- 8.8m RIGID VEHICLE CENTRELINE

AUSTROADS
8.8m RIGID VEHICLE

80014010 SK004

PROPOSED MIXED-USE DEVELOPMENT
SITE 68, SYDNEY OLYMPIC PARK
8.8m RIGID VEHICLE ACCESS
TO LOADING BAY
M.D. 15.09.2014

Cardno