Marsden Park Developments Sydney Business Park - Industrial Developments, Stage 3 SSDA

Traffic Impact Assessment

Issue 02 | 3 August 2020

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 253779

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1 Introduction

Marsden Park Developments commissioned Arup to carry out a traffic and transport assessment for the proposed Stage 3 Industrial Developments (Warehouses 1 to 4) in the Marsden Park Industrial Precinct.

The proposal is considered to be classified as State Significant Development under Part 4, Division 4.7 of the Environmental Planning and Assessment Act 1979 (EP&A Act), as it involves development with a capital investment value of more than \$50 million for the purposes of warehousing and distribution, and therefore triggers the criteria in Clause 12 of Schedule 1 of State Environmental Planning Policy (State and Regional Development) 2011.

This report will assess the traffic and transport impacts of the proposed developments and supports the State Significant Development Application (SSDA) submission.

1.1 Planning context

Marsden Park Developments lodged a request for Secretary's Environmental Assessment Requirements (SEARs) early June 2020 with the state government and SEARs were issued in 24/07/2020 (SSD-10477).

This version of the report incorporates the SEARs and provides a response to each requirement in Table 1.

The TfNSW recommended input into the SEARs and a response to each requirement is also included in Table 2.

SEARs	Arup response
a Traffic Impact Assessment detailing all daily and peak traffic and transport movements likely to be generated	Details of the likely daily and peak hour vehicle, public transport and active transport for the proposed development are discussed in Section 4.5 .
(vehicle, public transport, pedestrian and cycle trips) during construction and operation of the development, including	The construction traffic and the road network impact of construction vehicles are included in Sections 5.3 and 5.4 .
a description of vehicle access routes and the impacts on nearby intersections	It is expected that separate detailed Construction Traffic Management(s) would be prepared for each Lot which will discuss the detailed construction traffic volumes and methodologies.
details of access to the site from the road network including intersection location, design and sight distance	Proposed site accesses including private vehicle accesses and loading/unloading vehicle entry and exit points, design and sight distances are described in Section 3.1 and assessed in Section 4.3 .
	Swept path analysis of entry and exit movements from/to each site accesses are included in Appendix A .
an assessment of predicted impacts (including cumulative impacts from nearby surrounding development) on road safety and the capacity of the road network to accommodate the	The surrounding intersections of Hollinsworth Road/ North-South Collector Road and Astoria Street/ North- South Collector Road have been assessed using the SIDRA 8 Network Model, with the detailed results included in Appendix B.

Table 1 SEARs and Arup response

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SEARs	Arup response
development including existing and future performance of nearby key intersections	The performance of these two intersections is discussed in Section 4.8 and the traffic impacts are included in Section 4.9 .
	Future background growth has been included in the scenario testing which is assumed to account for the cumulative impacts from the nearby surrounding developments throughout the precinct.
details of any road upgrades or new roads, roundabouts or intersections required for the development, including demonstration of consultation with the relevant roads' authority on the proposed design	The forecast in peak hour traffic for each lot is considered minor when distributed onto the wider network as shown in Sections 4.5.3 and 4.6 . Modelling results in Section 4.8 show that the surrounding two intersections are generally operating with good Levels of Service during both AM and PM peak periods. This has
	been assessed with assumed background growth from the surrounding precinct through these sites.
details of vehicle circulation of the largest light and heavy vehicles anticipated to access the site, including swept path analysis, loading dock	Loading provision has been designed for 19m Articulated Vehicles (AVs) and 8.8m Medium Rigid Vehicles (MRVs) with occasional 25m B-double access for warehouse 1, 2 and 4 as well as occasional 30m Super B-double for Site 1.
servicing and provisions	Entry/exit will be via Astoria Street, Hollinsworth Road and the proposed north-south collector road access driveways as discussed in Section 4.3 .
	A swept path analysis was undertaken for the relevant manoeuvres and is shown in Appendix A
detailed plans of the proposed site access and parking provision on site in accordance with the relevant Australian Standards	The proposed site accesses and parking provision for each lot are discussed in Sections 3.1 and 4.2 respectively.
identification of any dangerous goods likely to be transported on arterial and local roads to/ from the site and, if necessary, the preparation of an incident management strategy	Reference should be made to EIS and separate SEPP 33 Analysis.
an assessment of the potential impacts of the proposed Castlereagh Freeway road reserve along the southern boundary of the site	The development site is clear of the Castlereagh Freeway road reserve and contained wholly within private land. The current freeway reserve is over 100m in width passing the south of site and has potential to connect to South Street 400m further west of the development site.
details of bicycle parking and end of trip facilities	The DCP bicycle parking requirements for each lot and the proposed spaces are included in Section 4.2.2 . Details of bicycle parking spaces and end-of-trip facilities are shown on the architectural plans.
details of impact mitigation, management and monitoring measures	The volumes generated from the proposed developments are moderate in nature and will have negligible impacts on the operation of key intersections in the vicinity of the site.
	Existing modelling results also show that the surrounding intersections are generally operating satisfactorily at a Level of Service A during both AM and PM peak periods. This is included in Section 4.9 .

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SEARs	Arup response
	In terms of management, no reverse movements are permitted on the public roads and all vehicles including the loading trucks will access the site in a forward manoeuvre. This is also discussed in Section 5.3 . The road authorities will monitor the vehicles and truck
	movements. Mitigation measures for the construction stage are included in Section 5.5 .

TfNSW recommended input into the SEARs	Arup response		
a) Details of current peak hour and daily traffic volume along the road network located adjacent to the site, public transport service and active transport facilities to the site; Details of peak hour and daily traffic volumes (light and heavy) likely to be generated by the proposed development during construction and operation, including a description of haul route origins and destinations, daily inbound and outbound vehicle traffic profile by time of day and day of week (if travel patterns differ across the week)	Details of the likely daily and peak hour vehicle, public transport and active transport for the proposed development are discussed in Section 4.5 . The construction traffic and the road network impact of construction vehicles are included in Sections 5.3 and 5.4 . It is expected that separate detailed Construction Traffic Management(s) would be prepared for each Lot which will discuss the detailed construction traffic volumes and methodologies.		
b) Site and traffic management plan on how to manage number of vehicles likely to be generated during construction and operation and awaiting loading, unloading or servicing can be accommodated on the site to avoid queuing in the surrounding road network	The number of truck movements will vary dependent on the stage of construction; generally, the movements could be estimated as up to 25-50 movements a day, equating to peak flows of up to five vehicles an hour based on 10-hour workdays. Workers may generate additional traffic to the site in the form of vans, utes and SRVs. Up to approximately 130 workers would be expected on site at any one time. Construction workers generally start earlier and finish earlier than the commuter peak periods and would likely not coincide with the commuter peak periods. The volumes of traffic are considered negligible and therefore the impact on the performance of key intersections in the vicinity of the site will be negligible. This is discussed in Sections 5.3 to 5.5 .		
c) Detailed plan of proposed layout of internal road network to demonstrate that the site will be able to accommodate the most productive vehicle types (noting that the surrounding road network accommodates 25/26 metre B-doubles at HML) and parking on site in accordance with the relevant Australian Standard and Council's Development Control Plan	The SSDA includes extension of Hollinsworth Avenue and a new North-South Collector. Reference should be made to civil design plans for road design drawings, but the general concept is to provide a roundabout at the intersection of the two proposed roads as per the DCP. All roads will have on-street parking, a single lane in each direction and comply with the relevant Austroads Guide to Road Design and Australian Standards (AS2890). The roads will be designed to cater for 25m long B-Doubles.		

Table 2 TfNSW recommended input into the SEARs and Arup response

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TfNSW recommended input into the SEARs	Arup response
	Swept path analysis of entry and exit movements from/to each site from these roads as wells as the circulation of the largest vehicle being a 25m B- Double and a 30m Super B- Double on the internal roads are also undertaken and included in Appendix A.
d) Demonstrate continued consultation with TfNSW in relation to protected corridors that traverse the site.	Noted. Sydney Business Park will continue to liaise with TfNSW regarding the corridors.
e) Swept path diagrams to demonstrate vehicles entering, exiting and manoeuvring throughout the site	Swept path analysis of entry and exit movements from/to each site accesses and manoeuvring throughout the sites are included in Appendix A .
f) Details of access to the site from the road network including intersection location, design and sight distance (i.e. turning lanes, swept paths, sight distance requirements);	 Proposed site accesses including private vehicle accesses and loading/unloading vehicle entry and exit points, design and sight distances are described in Section 3.1 and assessed in Section 4.3. Swept path analysis of entry and exit movements from/to each site accesses are included in Appendix A.
 g) An assessment of the forecast impacts on traffic volume generated on road safety and capacity of road network including consideration of cumulative traffic impacts at key intersections using SIDRA or similar traffic model as prescribed by TfNSW. The traffic modelling methodology, scenarios and modelling years need to be agreed prior to the preparation of the traffic impact assessment report. Traffic modelling should include, but not be limited to, the following intersections: Richmond Road / South Street; Richmond Road / Townson Road / Hollinsworth Road; Richmond Road / Langford Dr / Alderton Dr; and Hollinsworth Road / Chifley Glade. 	The surrounding intersections of Hollinsworth Road/ North-South Collector Road and Astoria Street/ North-South Collector Road have been assessed using the SIDRA 8 Network Model, with the detailed results included in Appendix B . The performance of these two intersections is discussed in Section 4.8 and the traffic impacts are included in Section 4.9 . Future background growth has been included in the scenario testing which is assumed to account for the cumulative impacts from the nearby surrounding developments throughout the precinct. The modelling scope will be confirmed based on the outcome of meeting with TfNSW.
h) Details of mitigation measures including any proposed road upgrades, infrastructure works, or new road required for the development and an assessment of potential impact on load road pavement lifespan.	The forecast in peak hour traffic for each lot is considered minor when distributed onto the wider network as shown in Sections 4.5.3 and 4.6 . Modelling results in Section 4.8 show that the surrounding two intersections are generally operating with good Levels of Service during both AM and PM peak periods. This has been assessed with assumed background growth from the surrounding precinct through these sites.
i) Details of the proposed number of car parking spaces and compliance with appropriate parking	The proposed number of car parking spaces and compliance with AS2890 are discussed in Sections 4.2 and 4.4 .

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TfNSW recommended input into the SEARs	Arup response
codes and justify the level of car parking provided on the site.	
j) Demonstrate how future uses of the development will be able to make travel choices that support the achievement of State Plan targets and develop specific sustainable travel plan and list the provision of facilities that will be provided to increase the non-car mode share for travel to and from the site. Detail the measures to be implemented to promote sustainable means of transport including public transport usage and pedestrian and bicycle linkages.	Public transport and sustainable travel for Sydney Business Park are being addressed at an estate- wide level, with provision of bus services and bus stops, a network of pedestrian and bike paths, bike facilities for individual facilities, etc. Refer to Sections 2.2 and 2.5 .
k) To ensure that the above requirements are fully addressed, the traffic impact assessment must properly ascertain the cumulative study area traffic impacts associated with the development (and any other known proposed developments in the area); including:	Future background growth has been included in the scenario testing which is assumed to account for the cumulative impacts from the nearby surrounding developments throughout the precinct.
 IKEA Distribution Facility to the north (SSD 6954) – operating; Lot 3 Warehouse Facilities to the north (DA 17-02162) – under pre-construction; 	
• TigerPak Warehouse Facility to the north-east (DA 19-00984) – under construction;	
• Bucher Municipal Industrial and Warehouse Facility to the north-east (DA 18-02532) – under construction; and	
• Cameron Interstate Warehouse Facility to the east (DA 20-00792).	
1) An assessment of existing and future public transport service and active transport facilities to the site.	The existing and future public transport service and active transport facilities are discussed in Sections 2.2, 2.5, 4.5.2 and 4.10 .
m) An assessment of construction traffic impacts on the adjacent road network.	The construction traffic and the road network impact of construction vehicles are included in Sections 5.3 and 5.4 .
	It is expected that separate detailed Construction Traffic Management(s) would be prepared for each Lot which will discuss the detailed construction traffic volumes and methodologies.

1.2 Scope

This report will cover the following:

- Existing transport conditions including public transport availability, pedestrian and cycle linkages
- Proposed development including access provisions
- Transport and parking assessment including forecast traffic generation and traffic impacts
- Outline construction traffic management plan

1.3 Background

The vision for the Marsden Park Industrial Precinct is to create an attractive employment precinct that provides for a diverse range of job opportunities to support the growing residential areas in Sydney's North West. The precinct will be characterised by a mix of employment generating uses such as general and light industrial, business parks, and commercial uses. It will also consist of some smaller medium and low-density residential areas near the future Marsden Park Town Centre to the north.

The industrial land will form the majority of the precinct. It is intended to support a range of light and general industrial uses from large floor-plate warehousing and storage facilities which capitalise on the precinct's location near Richmond Road, to smaller factory unit style developments for more intensive trade-based activities.

Industrial uses are to operate with best practice industry standards and not impose any adverse impacts on the nearby residential lands. Buildings are to be appropriately designed to address the street and other public domain areas, and all street frontages will contain quality landscaping that establishes a high standard of character and design.

The precinct will accommodate up to six storey buildings set in a campus environment. The business parks are to complement Marsden Park Town Centre by providing a commercial focus of high-value employment within a short distance of the retail activity provided in the Town Centre.

The site location in the context of the Marsden Park Industrial Precinct is highlighted below in Figure 1.



Figure 1: Site location

1.4 Previous studies

A Master Plan transport impact assessment was prepared and submitted to Council in 2010, by AECOM for the Statement of Environmental Effects of the Marsden Park Employment Area.

Stage 2a and 2b transport impact assessment were then developed in 2012 and 2014 respectively to support development for a 10-year horizon and the full development of the Marsden Park Industrial Precinct. This was supported by a detailed Traffic Modelling Assessment and the scenario tested for the site included:

- 568,519m² Business parks and industrial estates,
- 131 residential dwellings,
- 211,480m² SBP

This generated a total of 4,021 to 5,227 peak hour trips during the AM and weekend peaks respectively for the whole precinct.

The report assumed South Street extension to Bidwill and surrounding suburbs will provide an alternate access and egress point for the Precinct and spread traffic around the network in a future year 2036.

It should be also noted that the Marsden Park generated traffic assumed multi-trip discount rates adopted by AECOM's report¹.

1.5 Previously identified intersection upgrades

The previous reports identified the need to provide additional accesses to Richmond Road between Bells Creek and South Street. It was recommended that a new central collector road and intersection along Richmond Road be built, now known as Hawthorne Avenue.

Part of the 2036 final built form of Marsden Park Industrial Precinct includes the signalisation of intersections at Richmond Road and Hollinsworth Road, which was planned and designed to accommodate anticipated traffic growth.

To accommodate the predicted demands of the Marsden Park Industrial Precinct at its completion, the assessment identified the need for Richmond Road to be upgraded to its ultimate configuration of a six lane, divided carriageway by 2036. It also identified that the western leg of Quarry Road (Quarry Road was the previous name for the Hawthorne Avenue) should contain:

- A 60m short left turn bay (excluding tapers).
- A full length shared through/right lane

¹ AECOM - Quarry Road Intersection Development Application, 10 July 2014. | Issue 02 | 3 August 2020 | Arup

2 Existing Conditions

2.1 Location

The site is located in Marsden Park Industrial Zone in the Blacktown City Council Local Government Area (LGA). The relative location of Marsden Park is shown in Figure 2. The Stage 3 site is shown in Figure 3.



Figure 2: Marsden Park, Sydney Business Park - Stage 3 Site Location



Figure 3: Proposed industrial development, Sydney Business Park - Stage 3 Site

2.2 Public transport

Bus 757 provides access from the site to Riverstone Station and to Mt Druitt Station while bus 751 provides access to Blacktown Station. Bus 742 also provides access to Rouse Hill via Riverstone Station. Bus 749 has been recently added to the area and it provides access from the site to Blacktown Station. All services typically operate with one bus every hour. The bus stops on Hollinsworth Road and Richmond Road are within an acceptable walking distance of the site (i.e. within 400m or 5 minutes' walk).



Table 3: Existing public transport accessibility to the site

A bus route is also being provided within the Marsden Park Precinct as per Figure 4. This will entail a bus stop along the future Hollingsworth Road near the site.



Figure 4: Future bus network, Marsden Park Industrial Precinct, Schedule 3 DCP

It should be noted that there are numerous bus services on Hollinsworth Road and Richmond Road with bus stops in a desirable distance from the development for most people as part of their journey to work. Bus priority facilities are provided at intersections along Richmond Road to help facilitate more reliable travel times for bus services compared to the general traffic.

The general schematic of the bus routes and stops planned, show a potential to connect the southern residential precinct in the south. This is subject to discussion with bus operators and Blacktown City Council.

2.3 Road network

Warehouse 1 is accessed from Astoria Street, while Warehouse 2 and 4 are accessed from the proposed north-south collector road, and Warehouse 3 is accessed from the existing Hollinsworth Road; all of which are classified as local roads.

Both Astoria Street and Hollinsworth Road connect to Richmond Road which is classified as a state road. Rooty Hill Road North and the Westlink M7 Motorway meet at an intersection with Richmond Road, south of the site. Other lower order roads around the site are local or unclassified.

The internal road network consisting of Hawthorne Avenue and Hollinsworth Road, both connect to Richmond Road as signalised intersections, connecting through to Harris Avenue. Internal intersections are priority controlled by roundabouts and give-way intersections.

The classified road network is illustrated in Figure 5.



Figure 5: Current road network and classification

The proposed road hierarchy as per the DCP is shown in Figure 6. This includes South Street and Hollinsworth Road as collector roads in the vicinity of the site.



Figure 6: Future road hierarchy, Marsden Park Industrial Precinct, Schedule 3 DCP

2.4 Travel Behaviour

Travel to work data from the 2016 Census for the site is shown in Figure 7. The data indicates that approximately 15.4% of the residents living in the area take the train and bus to work.

It is expected that the percentage of residents using trains will have increased with the introduction of Metro Trains due to the higher frequencies and reliability of service. This will be further enhanced by the expansion of the Metro service to Marsden Park as identified in the Future Transport 2056 strategy.

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	Median wookly rent	\$420						
	Average motor vehicles per dwelling	2						
Travel to N Employed peo	vork, top responses ple aged 15 years and over		Riverstone - Marsden Park	%	New South Wales	%	Australia	%
Car, as driv	rer		5,300	63.1	1,953,399	57.8	6,574,571	61.5
Train			707	8.4	252,786	7.5	488,012	4.6
Worked at	home		362	4.3	163,026	4.8	503,582	4.7
Car, as pas	senger		347	4.1	144,820	4.3	489,922	4.6
Truck			184	2.2	32,908	1.0	85,892	0.8
People who	travelled to work by public transport		1,291	15.4	540,215	16.0	1,225,668	11.5
People who	travelled to work by car as driver or passenger		6,017	71.5	2,182,854	64.6	7,305,271	68.4

Figure 7: Existing travel patterns

Source: ABS Census Quickstats

https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/116021 312?opendocument

2.5 Pedestrians and cyclists

Pedestrian access to the site is good with a comprehensive network of footpaths and signalised crossing locations connecting to Richmond Road. Richmond Road has a shared pedestrian and bicycle path, and crossings which provide access to the site shown in Figure 8.



Figure 8: Pedestrian and bicycle shared a path along Richmond Road

The pedestrian and cycle plan for Marsden Park is shown in Figure 9. Richmond Road forms the main pedestrian and bicycle access spine throughout the industrial precinct, with a shared pedestrian and cycle road planned along Hollinsworth Avenue and South Street.



Figure 9: Future pedestrian and bicycle network, Marsden Park Industrial Precinct, Schedule 3 DCP

3 Proposed Development

The proposed developments predominantly consist of a warehouse / industrial area and office blocks. The breakdown of the floor area for each component is shown in Table 4.

Site Parcels	Building Use	Area (m ²)
Warehouse 1	Warehouse / Industrial	41,900 m ²
	Office (2 levels)	1,760 m ²
	Dock Office (2 levels)	240 m ²
	Ancillary services	595 m ²
Warehouse 1 Total Building Area		44,495 m ²
Warehouse 1 GFA		43,900 m ²
Warehouse 2	Warehouse / Industrial	16,000 m ²
	Office (2 levels)	1,000 m ²
	Dock Office	100 m ²
	Pump Room	35 m ²
Warehouse 2 Total Building A	rea	17,135 m ²
Warehouse 2 GFA		17,100 m ²
Warehouse 3	Warehouse / Industrial	3,475 m ²
	Office (2 levels)	350 m ²
	Pump Room	35 m ²
Warehouse 3 Total Building A	rea	3,860 m ²
Warehouse 3 GFA		3,825 m ²
Warehouse 4	Warehouse / Industrial (Ground, basement and mezzanine)	32,725 m ²
	Ancillary Office	690 m ²
	Ancillary services	606 m ²
Warehouse 4 Total Building A	rea	34, 201 m ²
Warehouse 4 Total Building A	26, 175 m ²	

Table 4: Breakdown of the proposed development

The application also includes the external roads associated with accessing the development, which include a new north-south collector and extension of the Hollinsworth Avenue. Hollinsworth Avenue will be extended to the north-south collector where it will then meet with the existing Astoria Street closing the loop.

The site area and road extents are shown in Figure 10.



Figure 10: Proposed road works and site area

The proposed roads will need to consider the DCP improvements, specifically the shared path along Hollinsworth Road. It is expected that a bus stop will be provided in the section of Hollinsworth Road under construction.

3.1 Proposed site accesses

3.1.1 Private vehicles

For Warehouse 1, the car parking designated for staff and occasional visitors is located along Astoria Street and the proposed north-south collector road. Potential parking spaces are also proposed inside of the warehouse areas with access points shown in Figure 11. All turn manoeuvres into and out of the proposed road to both Astoria Street and the proposed collector road will be permitted.



Figure 11: Sydney Business Park - Stage 3 (Warehouse 1) indicative car park layout

The car parking for Warehouses 2 to 4 is located along Hollinsworth Road as shown in Figure 12. All turn manoeuvres into and out of this road will be permitted.



Figure 12: Sydney Business Park – Stage 3 (Warehouse 2, 3 and 4) indicative car park layout

3.1.2 Loading/service vehicles

Loading/service vehicles for Warehouse 1 are proposed to access and egress the site off Astoria Street, as shown in Figure 13. It should be noted that Astoria Street currently has a sign posted speed limit of 50 km/hr in the vicinity of the site.



Figure 13: Warehouse 1 Loading vehicle access

Loading /service vehicles for Warehouses 2 will enter the warehouse via the North South Collector and egress on the existing Hollinsworth Road. Warehouse 3 and 4 loading/service vehicles will enter and exit the warehouse from the existing Hollinsworth Road. Loading/service vehicle entry and egress for Warehouse 4 will be via the southern leg of the proposed roundabout. These are shown in Figure 14 and Figure 15.



Figure 14 Warehouse 2 Loading vehicle access



Figure 15 Warehouses 3 & 4 Loading vehicle access

3.1.3 Emergency vehicles

Emergency vehicles are proposed to access Warehouse 1 via Astoria Street similar to the private and loading/service vehicles. For Warehouses 2, 3, and 4 emergency vehicles will continue onto the North South Collector Road and following the respective loading/service vehicle access routes. The emergency vehicle (up to 10.5m fire general appliance) is smaller in size than the 19m Articulated Vehicles (AVs). Therefore, it can comfortably be accommodated on-site.

4 Transport and Parking Assessment

The Blacktown City Council Growth Centre Precincts Development Control Plan (DCP) was adopted by the Deputy Director General Strategies and Land Release (or delegate) of the Department of Planning on 14 May 2010 and came into force on 19 May 2010. This DCP applies to the Marsden Park Industrial Precinct.

4.1 Road assessment

The SSDA includes extension of Hollinsworth Avenue and a new North-South Collector. Reference should be made to the civil design plans for road design drawings, but the general concept is to provide a roundabout at the intersection of the two proposed roads as per the DCP (see Figure 16). All roads will have onstreet parking, a single lane in each direction and comply with the relevant Austroads Guide to Road Design and Australian Standards (AS2890). The roads will be designed to cater for 25m long B-Doubles.



Figure 16: Industrial road cross section as per the DCP

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4.2 Parking Assessment

4.2.1 Car parking

The minimum parking rates recommended by the DCP is shown in Table 5. Based on the DCP, the site is required to provide a minimum of 755 parking spaces, with the breakdown shown in Table 5.

Site Parcel	Use	Area GFA	DCP Rate	Car parking required	Car parking provided
Warehouse 1	Warehouse / Industrial	41,900 m ²	1 space per 75m ² (7,500m ² or less)	272	344 (22 additional
			1 space per 200m ² for areas more than 7,500m ²		parking spaces)
	Office / Dock Office	2,000 m ²	1 space per 40m ²	50	
Warehouse 2	Warehouse / Industrial	16,000 m ²	1 space per $75m^2$ (7,500m ² or less)	143	157 (carpark shortfall by 14
			1 space per 200m ² for areas more than 7,500m ²		spaces)
	Office	1,100 m ²	1 space per 40m ²	28	
Warehouse 3	Warehouse / Industrial	3,475 m ²	1 space per $75m^2$ (7,500m ² or less)	46	54 (car park shortfall by 1
			1 space per 200m ² for areas more than 7,500m ²		space)
	Office	350 m ²	1 space per 40m ²	9	
Warehouse 4	Warehouse / Industrial	25,485 m ²	1 space per $75m^2$ (7,500m ² or less)	190	224 (17 additional
			1 space per $200m^2$ for areas more than 7,500m ²		parking spaces)
	Office	690 m ²	1 space per 40m ²	17	
Total DCP	requirement		755	779	

Table 5: DCP guideline requirements

Based on the Transport for NSW (TfNSW), formerly Roads and Traffic Authority, Guide to Traffic Generating Developments for a warehouse and office facility, the site should provide a minimum of 394 car parking spaces, with the breakdown shown in Table 6.

Site Parcel	Use	Area	Recommended Rate	Car parking required
Warehouse 1	Warehouse Industrial	41,900 m ²	1 space per 300m ²	140
	Office / Dock Office	2,000 m ²	1 space per 40m ²	50
Warehouse 2	Warehouse / Industrial	16,000 m ²	1 space per 300m ²	53
	Office	1,100 m ²	1 space per 40m2	28
Warehouse 3	Warehouse / Industrial	3,475 m ²	1 space per 300m ²	12

Table 6: TfNSW guideline requirements

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Site Parcel	Use	Area	Recommended Rate	Car parking required
	Office	350 m^2	1 space per 40m ²	9
Warehouse 4	Warehouse / Industrial	25,485 m ²	1 space per 300m ²	85
	Office	690 m ²	1 space per 40m ²	17
Total DCP re	394			

The DCP guidelines provided are based on the assumption that the size of each component of a mixed-use building is directly proportional to the number of employees by use, and hence car spaces. These guidelines are useful when the number of employees or tenant within a future development is unknown, and as such an estimate for the number of parking spaces required can be provided using the guidelines.

Based on conservative estimates, the site will provide a total of 779 car spaces, with the breakdown shown in Table 5 above. This number is generally compliant with the DCP and exceeds TfNSW recommended parking rates.

4.2.2 Bicycle parking

A total of 456 bicycle parking spaces are required by the DCP. It is estimated that the total number of staff across the site is approximately 600 people, making this requirement is highly excessive for this location as staff will travel to work using a variety of transport modes and this would create a mode share of 77%.

Site Parcel	Area (m ²)	DCP Rate	Bicycle Parking Required
Warehouse 1	43,900	1 bicycle locker or another	220
Warehouse 2	17,100	suitable form of secure bicycle accommodation is to be	86
Warehouse 3	3,825	provided per 200m ² GFA	19
Warehouse 4	26,175		131
Total Bicycle Parking			456

Table 7: DCP Bicycle parking requirements

In response, 5% cycle mode share has been allocated, resulting in approximately 30 bicycle parking spaces which will be provided to better allocate resources of the development. The design does not preclude provision of additional parking if required.

The provision of appropriate cycle facilities will further encourage the use of the existing networks and will assist in the reduction of private vehicle travel for the journey to work for staff.

4.2.3 Truck loading and parking

The DCP does not stipulate any requirements for the number of truck loading bays at industrial areas. However, the TfNSW Guide to Traffic Generating Development (Section 5.2.3) stipulates that industrial developments less than

 8000 m^2 ground floor area require 1 space per 800 m^2 service bay. Industrial developments more than 8000 m^2 ground floor area require 10 + 1 space per 1000 m^2 over 8000 m^2 . Based on this calculation, the total number of loading bays recommended are 107 loading bays. These rates are based on a historic rate when docks were unmanaged unlike today.

Given that the loading bays were calculated based on the total GFA, including warehouse, office and other amenities the number of provided loading bays is likely to be plentiful. Loading provided will be in accordance with user specifications and/or consistent with contemporary warehouse facilities.

4.3 Access

Loading provision has been designed for 19m Articulated Vehicles (AVs) and 8.8m Medium Rigid Vehicles (MRVs). Occasional use for 25m B-doubles has been allowed as well.

Entry/exit will be via the Astoria Street, Hollinsworth Road and the proposed north-south collector road access driveways to be designed in accordance with AS2890.2 for the largest vehicle being the Austroads 25m B-double vehicle.

All vehicles smaller than the 25m B-double will reverse into the loading docks and will exit in a forward manoeuvre. The B-doubles are expected to travel in a forward's direction around the sites. A swept path analysis was undertaken for the relevant manoeuvres and is shown in **Appendix A**.

All entry/exit movements to/from each lot will be in a forward direction. Combined entry/exit accesses have been designed so that two cars will be able to pass at the site driveway. Sight triangles have been provided as per AS2890 to permit safe access into and out of the loading areas / car parks.

4.4 Internal Design

The internal parking and arrangements associated with the proposed SSDA have been assessed in accordance with AS/NZS 2890.1 (2004) and AS/NZS 2890.6: (2009) with the following characteristics noteworthy:

- 90° angle car parking spaces are provided with a dimension of minimum 2.4m × 5.4m within a minimum 5.8m wide aisle, which accords with the requirements for user class 1 & 1A for long term parking.
- 90° angle accessible car parking space(s) are provided with a dimension of 2.4m × 5.4m with an adjoining shared space of the same dimension set within a minimum 5.8m wide aisle.
- An additional 300mm width are provided clear of all obstructions greater than 150mm in height.
- Dead-end aisles are provided a 1.0m aisle extension beyond the last parking space.
- A minimum clear head height of 2.2m are provided throughout all trafficable areas by light vehicles.

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- A minimum clear head height of 2.5m are provided directly above all accessible car parking spaces.
- All columns (if any) are located outside of the parking space design envelope shown in Figure 5.2 of AS/NZS 2890.1: 2004.

In summary, the internal configuration of the car park is designed in accordance with AS 2890.1 (2004) and AS2890.6 (2009).

4.5 Traffic generation

4.5.1 **Person trip generation**

The person trips generated by a development of the scale shown in the design are 0.7 per 100m² of GFA during the AM peak and PM peak hour based on the Roads and Maritime (TfNSW) Guides (average peak person trip rate of 4 warehouse sites in Sydney areas has been considered). This equates to a development person trip generation of 637 person trips during both AM peak and PM peak hour. The mode split for the development is estimated to be as presented in Table 8.

Mode Share		AM Peak Trips	PM Peak Trips	Daily Trips
Public Transport	8.4%	53	53	530
Car as driver	63.1%	402	402	4020
Car as passenger	4.1%	26	26	260
Other	24.4%	155	155	1550
TOTAL	100%	637	637	6370

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4.5.2 Public transport

Development is forecast to generate demand for around 530 daily trips and 53 peak trips by public transport during both AM and PM peaks. The distance to the bus stops on Hollinsworth Road and Richmond Road is within a 5-minute walk which is a desirable distance. Buses provide direct access from the site to nearby train stations.

4.5.3 Vehicle trip generation

Traffic generated from the Sydney Business Park within the Marsden Park Industrial Precinct was based on the land use assumptions identified in AECOM's Sydney Business Park – Road Network Staging Modelling Report (June 2014). The Sydney Business Park ultimate development form is assumed in 2036.

Traffic generated by each site is based on the TfNSW Technical Direction: Guide to Traffic Generating Developments – Updated Surveys (May 2013), the generation of traffic from "business parks" and "industrial estates"

The proposed yield for each site is consistent with the Floor Space Ratio and DCP controls for the site and the permitted land use. On this basis, the site will generate the following trips during the peak hours, shown in Table 9.

Site Parcel	Peak	Area	Trip rate (GFA)	Site trips (peak hour)	Daily trips	Marsden Park total ²
Warehouse 1	AM	43,900 m ²	AM: 0.52	228 trips / hour	2460	AM: 4,021 trips /
	PM	(GFA) $\frac{\text{trips }/}{100\text{m}^2}$		246 trips / hour		hour
	Weekend			154 trips / hour		
Warehouse 2	AM	17,100 m ² (GFA) PM: 0.56 trips / 100m ²	89 trips / hour	960	PM: 4,487 trips /	
	PM		$\frac{\text{trips}}{100\text{m}^2}$	96 trips / hour		hour
	Weekend		60 trips / hour			
Warehouse 3	AM	3,825 m ² (GFA) Weekend: 0.35 trips / 100m ²	20 trips / hour	210	Weekend: 5,227 trips / hour	
	РМ		21 trips / hour			
	Weekend	13 trips / hour				
Warehouse 4	AM	26,175 m ²		136 trips / hour	1470	
	PM	(GFA)		147 trips / hour		
	Weekend			92 trips / hour		

Table 9: Peak hour traffic generation from the site

The Masterplan report indicates a total traffic development for the entire Marsden Park Industrial precinct of 4,021 trips in the AM, 4,487 trips in the PM and 5,227 trips in the weekend peaks. The trip rates for the development are consistent with those used for the wider estate traffic planning which were accounted for in the previous AECOM traffic assessments.

4.6 Traffic distribution

The trips have been estimated consistent with previous studies by AECOM. During the AM peak, 60% of trips will access lots within the site and 40% will egress lots with the reverse occurring in the PM peak. The estimated trips in and out are described below in Table 10.

Development site	AM peak hour		PM peak hour	
	In	Out	In	Out
W1	137	91	98	148
W2	53	36	38	57
W3	12	8	9	13
W4	82	54	59	88

Table 10: Traffic distribution

Taking the directions and proportions from the previous traffic assessments, the expected distribution across the road network is shown in Figure 17.

² AECOM - Quarry Road Intersection Development Application, 10 July 2014 | Issue 02 | 3 August 2020 | Arup



Figure 17: Traffic distribution percentages

Based on this assumed distribution, trips have been assigned to the road network depending on what part of the site they are originating and departing from.

It should be noted that for the purposes of this assessment, the following assumption have been made in line with the assumptions made on the previous studies undertaken by AECOM³ and Arup⁴:

- the west link of Hollinsworth Road between the proposed North South Collector Road and South Street was assumed to be operational in the horizon year 2036;
- the South Street extension to Bidwill and surrounding suburbs will provide an alternate access and egress point for the Precinct (in 2036) and spread traffic around the network. As a result, a discount of 15% was applied to site traffic;
- background traffic growth has been assigned at 1.3% pa.
- heavy vehicle percentage of 10% was assumed for the precinct.

 ^{3 -} Sydney Business Park, Road Network Staging Modelling, AECOM July 2014 and Quarry Road
 Intersection Development Application, AECOM, July 2014

^{4 -} Marsden Park Industrial (Employment) Precinct, Transport and Access Study, Final Report for ILP

Exhibition, August 2009

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4.7 Scenarios modelled

The following scenarios have been modelled using the SIDRA 8 Network model.

- Scenario 1 (opening year: 2021 background growth plus Stage 3 developments traffic flow) It is assumed that the west link of Hollinsworth Road and the South Street extension to Bidwill and surrounding suburbs are not operational. Hence, no traffic is distributed south via future Hollinsworth Road and South Street until time of the horizon year 2036.
- Scenario 2 (horizon year: 2036 background growth plus Stage 3 developments traffic flow)

Both the AM and PM peak hours have been modelled for the opening year (2021) and horizon years 2036.

The 2036 internal precinct intersection traffic volumes were extracted from the Marsden Park Industrial (Employment) Precinct, Transport and Access Study prepared by Arup dated August 2009. It has been assumed that 100% of this traffic will be through traffic using Astoria Street and Hollinsworth Road.

Intersections volume for the modelled scenarios in both AM and PM peak hour are shown in Figure 18 and Figure 21.



Figure 18: AM Peak Hour Development Traffic Distribution - Scenario 1, 2021



Figure 19: AM Peak Hour Development Traffic Distribution - Scenario 1, 2021



Figure 20: AM Peak Hour Development Traffic Distribution - Scenario 2, 2036


Figure 21: PM Peak Hour Development Traffic Distribution - Scenario 2, 2036

4.8 SIDRA Assessment

The intersections of Hollinsworth Road/ North-South Collector Road and Astoria Street/ North-South Collector Road have been assessed using the SIDRA 8 Network Model, with the detailed results appended to this report.

The traffic capacity of the major road network is generally a function of the performance of key intersections. This performance is quantified in terms of Level of Service (LOS), is based on the average delay per vehicle. LOS ranges from A = very good to F = unsatisfactory.

A summary of the traffic modelling results is outlined in Table 11.

Intersection		Control	AM P	AM Peak		PM Peak		
			DoS	Delay	LoS	DoS	Delay	LoS
Sc	Scenario 1 – Opening Year 2021							
1	Hollinsworth Road/ North-South Collector Road	Roundabout	0.089	4.7	А	0.094	5.3	А
2	Astoria Street/ North-South Collector Road	Priority	0.318	7.6	А	0.311	12.4	А
Sc	Scenario 2 – Horizon Year 2036							
1	Hollinsworth Road/ North-South Collector Road	Roundabout	0.506	3.8	А	0.517	4.0	А
2	Astoria Street/ North-South Collector Road	Priority	0.297	8.1	А	0.289	7.8	А

Table 11: Sidra Intersection Assessment

It can be seen from the above that the developments will have minimal impact on the performance of the surrounding road network with all surrounding intersections continuing to operate with acceptable Level of Service A and moderate delays.

4.9 Traffic impacts

The forecast peak hour traffic volumes for each lot is considered minor when distributed onto the wider network, especially when viewed in the context of what have previously been assessed in the Marsden Park Masterplan in the AECOM modelling and assessments to date.

Modelling results also show that the surrounding two intersections are generally operating satisfactorily with good Levels of Service during both AM and PM peak periods. This has been assessed with assumed background growth from the surrounding precinct through these sites.

Traffic modelling for the wider area (Marsden Park precinct) was undertaken through an iterative process previously in order to determine the road improvements needed to accommodate the forecast growth numbers. The external intersections were predicted to operate with the anticipated levels of development traffic from the Marsden Park Industrial Precinct according to the AECOM reports, with the upgrades summarised in Section 1.5 for the wider area.

The forecast traffic generation for the site is consistent with the AECOM modelling inputs and hence no additional impacts above those previously envisaged are expected on the Richmond Road intersections.

4.10 **Public transport and pedestrian cycle network**

The planned DCP networks previously outlined in Sections 2.2 and 2.5 have the objective of encouraging the use of public transport through the provision of integrated bus routes, pedestrian and cycle routes, improving accessibility to the site.

5 Outline Construction Traffic Management Plan (CTMP)

The following proposed traffic management principles would be adopted during the construction period:

- Disruption to all road users during the construction period would be kept to a minimum.
- Traffic control would need to be provided to manage and regulate traffic movements during construction.
- Construction and delivery vehicles entering or leaving the site compound and/or stockpile sites would use arterial roads. These movements would be restricted to non-peak traffic periods.
- In most cases, property access would be maintained throughout the construction period with suitable alternative access arrangements provided otherwise.
- Clear signage and alternate pedestrian routes should be organised if footpaths are affected.
- It is recommended that a detailed CTMP is developed as part of the detailed design stage.

5.1 **Proposed Working Hours**

Depending on the construction stage, the workforce which includes both construction and design personnel will vary. Construction would be undertaken during standard working hours which are assumed to be as follows:

- Monday to Friday: between 7am-6pm.
- Saturday: between 8am-1pm.
- Sunday and public holidays: no work.

In some cases, it may be necessary to undertake night works to minimise disruption to traffic. Further assessments of these requirements would be undertaken once the detailed design stage is undertaken and the requirements are known. All night works would be undertaken in accordance with the TfNSW Environmental Noise Management Manual (2001): Practice Note vii – Roadworks outside normal working hours, as well as the Office of Environment and Heritage Interim Construction Noise Guideline (DECC 2009).

Prior notice would be given to the community if any works are planned to be undertaken outside normal construction hours.

5.2 Truck routes and controls

Construction vehicles would be restricted to the state road network for access to the site and vehicles will likely originate from this network. It is envisaged the main site entrance will be off Richmond Road. It is noted that the main access to the area is via Astoria Street and Hollinsworth Road which are local roads. The proposed construction vehicle routes are shown in Figure 22.



Figure 22: Proposed Construction Vehicle Routes

Trucks will not be permitted to queue along any of the surrounding streets. Vehicles would exit the same way they have entered.

Throughout the construction period, heavy vehicles, concrete mobile pumps and agitator vehicles will be required to drive into the site. The access to the site will only permit manoeuvres from public roads in the forward direction only. No reverse manoeuvres will be permitted to and from the site on any public road.

Vehicles would only be permitted to exit when no vehicles are entering. Pedestrian controls are to be provided via the traffic controllers where footpaths remain open. Pedestrians will have priority at access when construction vehicles are not entering or exiting the access.

5.3 Construction traffic

Heavy vehicle trips generated per day during the various stages are estimated as follows. It should be noted that all numbers are indicative, given no contractors have yet been appointed and could vary widely from those estimated.

The number of truck movements will vary dependent on the stage of construction; generally, the movements could be estimated as up to 25-50 movements a day, equating to peak flows of up to five vehicles an hour based on 10-hour workdays.

Workers may generate additional traffic to the site in the form of vans, utes and SRVs. Up to approximately 130 workers would be expected on site at any one time. Construction workers generally start earlier and finish earlier than the commuter peak periods and would likely not coincide with the commuter peak periods.

5.4 Road network impacts of construction vehicles

Construction vehicles will often need to carefully enter the site and may turn in and out slowly. Suitably qualified traffic controllers will be present to ensure that traffic is safely and adequately managed around the access.

The works will generate a maximum demand for approximately 25-50 trucks per day which is equal to approximately up to five trucks in both morning and evening peak periods. The construction and workforce-related vehicles would arrive at the site spread out throughout the day, or outside of commuter peak periods. The volumes of traffic are considered negligible and therefore the impact on the performance of key intersections in the vicinity of the site will be negligible.

5.5 Mitigation Measures

5.5.1 Measures to Ameliorate Impacts

Mitigation measures will be adopted during the construction, fit-out and finishes works phase to ensure traffic movements have minimal impact on surrounding land uses and the community in general and would include the following:

- Truck loads would be covered during transportation off-site;
- Trucks to enter and exit the site in a forward direction;
- Neighbouring properties would be notified of the alteration works and timing. Any comments would be recorded and taken into consideration when planning alteration activities;
- Pedestrian movements will be managed and controlled by site personnel where required;
- Construction, fit-out and finishes works to be carried out in accordance with the Council's approved hours of work;
- All materials or debris will be contained behind the hoarding until removal. Hoarding will be slab to slab to contain dust;
- Noisy works will be undertaken within the allotted hours.
- Any works in shared areas will whenever possible take place out of hours. A spotter and barriers will be in place before works begin.
- Establishment and enforcement of appropriate on-site vehicle speed limits (20km/h), which would be reviewed depending on weather conditions or safety requirements;
- All Activities including the delivery of materials, demolition and alteration works would not impede traffic flow along local roads;
- Delivery vehicles and trucks not to queue on Portman Street and be wholly accommodated within the site;
- Minimal construction traffic movements to/from the site will be made during peak hours to minimise the impact on the wider road network.

5.5.2 Driver code of conduct

To manage driver conduct, the following measures are to be implemented:

- All deliveries are to be pre-booked;
- All deliveries are to check-in at the site office;
- Drivers are to give way to pedestrians; and
- All loads have traceability point of load and unload.

No queuing or marshalling of trucks is permitted on a public road. Roads and Maritime Services accredited traffic controllers will be used to manage construction traffic on the public street(s) to manage trucks entering or leaving the site.

At all times, vehicles must wait until a suitable gap in traffic allows them to enter or exit the site. The Roads Act does not give any special treatment to trucks leaving a construction site – the vehicles already on the road have the right-ofway. Vehicles entering, exiting and driving around the site will be required to give way to pedestrians at all time.

5.5.3 TfNSW discussions

A detailed Construction Traffic Management Plan will be submitted to Council who may wish to consult Transport for NSW for feedback prior to the Local Traffic Committee meeting when the detailed plans are produced. Any comments will be incorporated into a finalised plan.

6 Conclusion

A traffic and transport assessment for the proposed industrial development in the Marsden Park Industrial Precinct, Sydney Business Park - Stage 3 has been prepared. The report assesses the traffic and transport impacts of the proposed development (the site) and supports the State Significant Development Application (SSDA) submission.

- The total site will consist of a 86,860m² warehouse/ industrial GFA and a 4,140m² office.
- Access, internal circulation and parking arrangements have been designed in accordance with relevant standards including Australian Standards for Parking Facilities (AS 2890.1:2004 and AS 2890.2:2002).
- The SSDA includes extension of Hollinsworth Avenue and a new North-South Collector. Reference should be made to the civil design plans for road design drawings, but the general concept is to provide a roundabout at the intersection of the two proposed roads as per the DCP. All roads will have on-street parking, a single lane in each direction and comply with the relevant Austroads Guide to Road Design and Australian Standards (AS2890). The roads will be designed to cater for 25m long B-Doubles.
- Bus 757 provides access from the site to Riverstone Station and Mt Druitt Station, while bus 751 provides access to Blacktown Station. Bus 742 also provides access to Rouse Hill. Bus 749 has been recently added to the area and provides access from the site to Blacktown Station.
- The whole site has provided 779 car spaces and will provide at least 30 bicycle parking spaces which will be provided to better allocate resources of the development.
- For each site, the hourly traffic generation is able to be accommodated by each of the driveways to access the business park road system.
- The Masterplan report indicates a total traffic development for the entire Marsden Park Industrial precinct of 4,021 trips in the AM, 4,487 trips in the PM and 5,227 trips in the weekend peaks. The stage 3 industrial developments site traffic generation represents less than 12% of the approved trips for the Marsden Park Industrial Precinct. The trip rates for the development are consistent with those used for the wider estate traffic planning which were accounted for in the previous AECOM traffic assessments.
- Prior traffic and transport reports have been reviewed. Traffic modelling has been undertaken through an iterative process in order to determine the road improvements needed to accommodate the forecast 2021 interim and 2036 final growth numbers. The intersections are predicted to operate with the required upgrades according to the AECOM reports.
- The site is consistent with the original traffic modelling forecasts and will have moderate impacts on the surrounding road network performance, subject to the intersection upgrades being implemented at the appropriate time and before all the developments in the precinct are operational.
- The Marsden Park Industrial Precinct Development Control Plan has the objective of encouraging the use of public transport through the provision of Issue 02 | 3 August 2020 | Arup
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integrated bus routes, pedestrian and cycle routes, improving accessibility to the site which has been accommodated.

Appendix A

Swept Paths



19.000m 2.500m 4.301m 0.418m 2.500m 6.00 sec 12.500m Lock to Lock Time Curb to Curb Turning Radius 5.200m 1.940m 1.878m 0.272m 1.840m 4.00s 6.250m verall Length verall Width verall Body Height in Body Ground Clearance ack Width ick-to-lock time inh to Curb Turning Radius F 03/08/20 LK JT

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Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

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С	20/07/20	LK	JT	JT	
В	14/07/20	LK	JT	JT	
А	07/07/20	LK	JT	JT	
For Information					
Issue	Date	Ву	Chkd	Appd	

JT

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Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths 19.0 m Articulated Vehicle and B99 Entry and exit and Circulation Warehouse 1

Scale at A3

Discipline Transport

Drawing Status

Job No 253779

Drawing No **SKT001** Issue



Issue

F

JT

JT

JT

JT

JT

JT

Bo 30 60 W

Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

Design Vehicle(s)

B99 Vehicle (Realistic min radius) (2004) Overall Length Overall Width dividth (2004) (2004) Min Body Ground Clearance Track Width Lock-to-lock time Curb to Curb Turning Radius

5	200m
ĭ	.940m
1	.878m
ĭ	.840m
4	.00s
6	.250m

03/08/20	LK	JT	JT		
31/07/20	LK	JT	JT		
30/07/20	LK	JT	JT		
20/07/20	LK	JT	JT		
14/07/20	LK	JT	JT		
07/07/20	LK	JT	JT		
For Information					
Date	Ву	Chkd	Appd		
	03/08/20 31/07/20 30/07/20 20/07/20 14/07/20 07/07/20 For Inform Date	03/08/20 LK 31/07/20 LK 30/07/20 LK 20/07/20 LK 14/07/20 LK 07/07/20 LK 07/07/20 LK Date By	03/08/20 LK JT 31/07/20 LK JT 30/07/20 LK JT 20/07/20 LK JT 14/07/20 LK JT 07/07/20 LK JT 07/07/20 LK JT Date By Chkd		

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Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths B99 Vehicle Entry and exit and Circulation Warehouse 1 - North

Scale at A3 1:250

Discipline Transport

Drawing Status

Job No 253779 Drawing No

© Arup

Issue

Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

Design Vehicle(s)

ock to Lock Tin

Overall Length Overall Width Overall Body Height Min Body Ground Cle Track Width

5 200m	
1.940m	
1.878m	
0.272m	
1.840m	
4.00s	

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For Information					
Issue	Date	Ву	Chkd	Appd	

ARUP

Arup, Level 5 Barrack Place, 151 Clarence Street Sydney, NSW, 2000 Tel +61(02)9320 9320 Fax +61(02)9320 9321 www.arup.com.au

Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths 19.0 m Articulated Vehicle Exit Movement and Circulation Warehouse 1 - North west

Scale at A3 1:500

Discipline Transport

Drawing Status

Job No 253779

Drawing No **SKT004**

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Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

Design Vehicle(s)

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Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths 19.0 m Articulated Vehicle and Fire Truck Circulation Warehouse 1 - South west

Scale at A3 1:500

Discipline Transport

Drawing Status

Job No 253779

Drawing No SKT006

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Issue

Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

Design Vehicle(s)

Overall Body Height Min Body Ground Clearance Track Width Lock to Lock Time Curb to Curb Turning Radius

19.000n 2.500m 4.301m 0.418m 2.500m 6.00 sec 12.500n		1.4
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Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths 19m Articulate Vehicle (AV) Entry Movement Warehouse 2 - North west

Scale at A3 1:500

Discipline Transport

Drawing Status

Job No 253779 Drawing No

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Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

Design Vehicle(s)

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Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths 19m Articulate Vehicle (AV) Entry Movement and Circulation Warehouse 2 - North east

Scale at A3 1:500

Discipline Transport

Drawing Status

Job No 253779

Drawing No SKT009

© Arup

Issue

Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope

Design Vehicle(s)

Lock to Lock Time Curb to Curb Turning

J Vehicle (Realistic new verall Length verall Body Height Min Body Ground Clee Track Width Lock-to-lock time Curb to Curb Turnin

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Client

Sydney Business Park Marsden Park

Job Title Business Park - Stage 3

Drawing Title Turning Paths 19m Articulate Vehicle (AV) and B99 Entry Movement and Circulation Warehouse 2 - South west

Scale at A3 1:500

Discipline Transport

Drawing Status

Job No 253779

Drawing No **SKT011**

© Arup

Issue

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	Fire Truck General Appliance	10 100m		
	Overall Width Overall Body Height Min Body Ground Clearance Track Width Lock-to-lock time Wall to Wall Turning Radius	2.500m 4.000m 0.409m 2.450m 5.00s 11.300m		
	B99 Vehicle (Realistic min radius) (2 Overall Length Overall Width Overall Body Height Min Body Charged Clearance	004) 5.200m 1.940m 1.878m 0.2722m		
	Track Width Lock-to-lock time Curb to Curb Turning Radius	0.272m 1.840m 4.00s 6.250m		
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A1 Occasional use for 25m B-doubles and Super B-doubles

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Design Vehicle(s) Image: Contract of the second street system, New 2000 Image: Contract of the seco					Body Ei 300mm 600mm Wheel I	nvelope Envelope Envelope Envelope	
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E 31/07/20 LK JT JT D 30/07/20 LK JT JT C 20/07/20 LK JT JT B 14/07/20 LK JT JT A 07/07/20 LK JT JT For Information			F	03/08/20	LK	JT	JT
D 30/07/20 LK JT JT C 20/07/20 LK JT JT B 14/07/20 LK JT JT A 07/07/20 LK JT JT A 07/07/20 LK JT JT A 07/07/20 LK JT JT For Information Issue Date By Chkd Appd Arup, Level 5 Barrack Place, 151 Clarence Street Sydney, NSW, 2000 Tel +61(02)9320 9321 Www.arup.com.au Client Sydney Business Park Marsden Park Marsden Park Job Title Business Park - Stage 3 Drawing Title Turning Paths Super B-Double Entry Movement Warehouse 1 Scale at A3 1/450 Discipline Transport Drawing Status	9		E	31/07/20	LK	JT	JT
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B 14/07/20 LK JT JT A 07/07/20 LK JT JT For Information Issue Date By Chkd Appd Arup, Level 5 Barrack Place, 151 Clarence Street Sydney, NSW, 2000 Tel +61 (02)9320 9320 Fax +61 (02)9320 9321 Www.arup.com.au Client Sydney Business Park Marsden Park Job Title Business Park - Stage 3 Drawing Title Turning Paths Super B-Double Entry Movement Warehouse 1 Scale at A3 Scale at A3 1/450 Discipline Transport Drawing Status	P		C	20/07/20	LK	JT	JT
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			Issue Arup, Ler Sydney, Tel +8f(U Www.aru Client Sydr Mars Job Title Busi Drawing Turn Supe Entry Ward Scale at J. Discipline	For Inform Date Pate RU Vel 5 Barrack Pla NSW, 2000 209320 9320 Fa p.com.au ney Busin Sden Par ness Pan ness Pan ness Pan ness Pan ness Pan ness Pan ness Pan ness Pan ness Pan ness Pan	ation By P Ce, 151 Clarence tx +61(02)9320 ness Pa k rk - Stag sble nent	e Street 9321 rk je 3	Appd
			Issue Arup, Lete Sydney, Tel +61(0 www.aru Client Syder Mars Job Title Busi Drawing Turn Supe Entry Ward Scale at a Disciplint Drawing Job No	For Inform Date Pate RU Vel 5 Barrack Pla NSW, 2000 12/9320 9320 Fe p.com.au ney Busin sden Par ness Pan ness Pan ness Pan ritle ing Path er B-Dou y Movem ehouse 1 A3 1/450 3 Transpo	ation By P Ce, 151 Clarenc ix +61(02)9320 ness Pa k rk - Stag sble nent l ort	e Street 9321 rk	Appd

		Body Ei 300mm	nvelope Envelope	
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F	03/08/20	LK	JT	JT
E	31/07/20	LK	JT	JT
D	30/07/20	LK	JT	JT
С	20/07/20	LK	JT	JT
B	14/07/20	LK	JT	JT
A	07/07/20	LK	JT	JT
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Arup, Level 5 Barrack Place, 151 Clarence Street Sydney, NSW, 2000 Tel +61(02)9320 9320 Fax +61(02)9320 9321 www.arup.com.au

Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths Super B-Double Circulation Warehouse 1

Scale at A3 1/450

Discipline Transport

Drawing Status

Job No 253779 Drawing No

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Issue

F	03/08/20	LK	JT	JT
Е	31/07/20	LK	JT	JT
D	30/07/20	LK	JT	JT
С	20/07/20	LK	JT	JT
В	14/07/20	LK	JT	JT
А	07/07/20	LK	JT	JT
	For Inform	ation		
Issue	Date	Ву	Chkd	Appd

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Client

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title

Turning Paths Super B-Double Exit Movement Warehouse 1

Scale at A3 1/450

Discipline Transport

Drawing Status

Job No 253779 Drawing No SKT005

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Body Envelope 300mm Envelope 600mm Envelope Wheel Envelope Design Vehicle(s) 000 4.6 Max 72 Max 6* Overall Length Overall Width Overall Body Height Min Body Ground Cl Track Width 25.000m 2.500m 4.300m 0.540m 2.500m 6.00s 15.000m Lock-to-lock time Curb to Curb Turning Ra

F	03/08/20	LK	JT	JT
Е	31/07/20	LK	JT	JT
D	30/07/20 LK		JT	JT
С	20/07/20	LK	JT	JT
В	14/07/20	LK	JT	JT
А	07/07/20	LK	JT	JT
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Arup, Level 5 Barrack Place, 151 Clarence Street Sydney, NSW, 2000 Tel +61(02)9320 9320 Fax +61(02)9320 9321 www.arup.com.au

Sydney Business Park Marsden Park

Job Title

Business Park - Stage 3

Drawing Title Turning Paths 25m B-Double **Roundabout Circulation** Warehouse 2

Scale at A3 1/450

Discipline Transport

Drawing Status

253779

Drawing No SKT010

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Issue

Legend Design Vehi Legend Design Vehi Legend L	- Body E - 300mm - 600mm - Wheel I cle(s) 	25000m 25000m 2500m 2500m 2500m 2500m 2500m 2500m 2500m 2500	
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Job Title Business Pa Drawing Title Turning Patt 25m B-Douts Entry and ex Warehouse Scale at A3 Discipline Transp Drawing Status	ark - Stag ole kit and C 4 port Drawing No SKT01	je 3 irculation	1 ssue F



3				
TOTES	Legend	Body Er 300mm 600mm Wheel E Cle(s)	25.000m 2.500m 6.00s 15.000m	
N	F 03/08/20 E 31/07/20 D 30/07/20 C 20/07/20 B 14/07/20 A 07/07/20 For Inform Issue Date	LK LK LK LK LK LK ation By	JT JT JT JT JT JT Chkd	JT JT JT JT JT JT Appd
	Arup, Level 5 Barrack Plac Sydney, NSW, 2000 Tel +61(02)9320 9320 Fa www.arup.com.au Client Sydney Busin Marsden Par	rk - Stag	e Street 9321 rk je 3	
	Drawing Title Turning Path 25m B-Doubl Turning Point Warehouse 4 Scale at A3 1/450 Discipline Transpo Drawing Status	S le t J ort Drawing No SKT01	3	Issue

Appendix B

Sidra Outputs

NETWORK LAYOUT

中中Network: N101 [AM North-South Collector Road / Hollinsworth Road / Astoria Street - 2021]



SIDRA INTERSECTION 8.0 | Copyright © 2000-2018 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: ARUP PTY LTD | Created: Monday, 3 August 2020 8:38:41 PM

Site: 101 [AM North-South Collector Road / Hollinsworth Road - 2021]

^{申申}Network: N101 [AM North-South Collector Road / Hollinsworth Road / Astoria Street - 2021]

AM North-South Collector Road / Hollinsworth Road Site Category: (None) Roundabout

Movement Performance - Vehicles Aver. Average Aver. Back of Demand Effective Level Deg. Average Prop. Flows Queue Flows of Stop Satn Delay Speed ID Queued Service Rate HV Total Vehicles Distance Cycles Total veh/h % veh/h % sec veh m km/h South: W4 Access 2 T1 9 10.0 9 10.0 0.009 3.3 LOS A 0.0 0.1 0.24 0.38 0.24 44.4 R2 2 10.0 7.8 LOS A 0.0 0.38 0.24 48.2 3 2 10.0 0.009 0.1 0.24 4.1 LOS A 0.24 Approach 12 10.0 12 10.00.009 0.0 0.1 0.24 0.38 45.5 East: Existing Hollinsworth Road 0.08 2 10.0 0.070 2.9 LOS A 0.1 1.0 0.08 0.58 45.5 L2 2 10.0 4 R2 6 100 10.0 100 10.0 0.070 7.5 LOS A 0.58 0.08 42.0 0.1 1.0 0.08 102 10.0 102 10.00.070 7.4 LOS A 1.0 0.08 42.1 Approach 0.1 0.08 0.58 North: North-South Collector Road 7 L2 132 10.0 132 10.0 0.089 2.9 LOS A 0.2 1.4 0.03 0.38 0.03 47.8 8 T1 15 10.0 15 10.0 0.089 2.9 LOS A 0.2 1.4 0.03 0.38 0.03 49.3 Approach 146 10.0 146 10.00.089 2.9 LOS A 0.2 1.4 0.03 0.38 0.03 47.9 All 260 10.0 260 10.00.089 4.7 LOS A 0.2 1.4 0.06 0.46 0.06 45.9 Vehicles

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: ARUP PTY LTD | Processed: Monday, 3 August 2020 6:12:28 PM

Site: 102 [AM North-South Collector Road / Astoria Street - 2021]

AM North-South Collector Road / Astoria Street Site Category: (None) Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Dei F Total	mand Flows HV	A F Total	arrival Flows HV	Deg. Satn	Average Delay	Level of Service	Aver. E Qui Vehicles	Back of eue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South	h: North	n-South	Collec	ctor Ro	ad									
1	L2	86	10.0	86	10.0	0.206	6.4	LOS A	0.3	2.3	0.52	0.72	0.52	43.5
3	R2	53	10.0	53	10.0	0.206	12.0	LOS A	0.3	2.3	0.52	0.72	0.52	43.0
Appro	bach	139	10.0	139	10.0	0.206	8.5	LOS A	0.3	2.3	0.52	0.72	0.52	43.3
East:	Astoria	a Street	East											
4	L2	79	10.0	79	10.0	0.249	4.7	LOS A	0.0	0.0	0.00	0.09	0.00	48.9
5	T1	373	10.0	373	10.0	0.249	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	49.4
Appro	bach	452	10.0	452	10.0	0.249	0.8	NA	0.0	0.0	0.00	0.09	0.00	49.4
West	: Astori	a Stree	t West	t										
11	T1	364	10.0	364	10.0	0.318	1.3	LOS A	0.6	4.8	0.36	0.18	0.39	48.1
12	R2	121	10.0	121	10.0	0.318	7.6	LOS A	0.6	4.8	0.36	0.18	0.39	46.4
Appro	bach	485	10.0	485	10.0	0.318	2.9	NA	0.6	4.8	0.36	0.18	0.39	47.8
All Vehic	les	1076	10.0	1076	10.0	0.318	2.8	NA	0.6	4.8	0.23	0.21	0.25	47.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the

average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: ARUP PTY LTD | Processed: Monday, 3 August 2020 6:12:28 PM

NETWORK LAYOUT

中中Network: N101 [PM North-South Collector Road / Hollinsworth Road / Astoria Street - 2021]



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Organisation: ARUP PTY LTD | Created: Monday, 3 August 2020 8:40:01 PM

Site: 101 [PM North-South Collector Road / Hollinsworth Road - 2021]

^{申申}Network: N101 [PM North-South Collector Road / Hollinsworth Road / Astoria Street - 2021]

AM North-South Collector Road / Hollinsworth Road Site Category: (None) Roundabout

Movement Performance - Vehicles Aver. Average Aver. Back of Demand Effective Level Deg. Average Prop. Flows Queue Flows of Stop Speed ID Satn Queued Delay Service Rate HV Total Vehicles Distance Cycles Total veh/h % veh/h % sec veh km/h South: W4 Access 2 T1 16 10.0 16 10.0 0.016 3.5 LOS A 0.0 0.2 0.29 0.40 0.29 44.2 R2 8.0 LOS A 0.0 0.40 0.29 48.1 3 3 10.0 3 10.0 0.016 0.2 0.29 4.3 LOS A 0.29 Approach 19 10.0 19 10.00.016 0.0 0.2 0.29 0.40 45.2 East: Existing Hollinsworth Road 0.06 2 10.0 0.094 2.9 LOS A 0.2 1.4 0.06 0.58 45.5 4 L2 2 10.0 R2 6 10.0 141 10.0 0.094 7.4 LOS A 0.2 0.06 0.58 0.06 42.1 141 1.4 10.0 143 10.00.094 7.4 LOS A 0.2 1.4 0.06 42.1 Approach 143 0.06 0.58 North: North-South Collector Road 7 L2 107 10.0 107 10.0 0.074 2.9 LOS A 0.2 1.2 0.03 0.38 0.03 47.8 8 T1 10.0 11 10.0 0.074 2.9 LOS A 0.2 1.2 0.03 0.38 0.03 49.2 11 Approach 118 10.0 118 10.00.074 2.9 LOS A 0.2 1.2 0.03 0.38 0.03 47.9 All 280 10.0 280 10.00.094 5.3 LOS A 0.2 1.4 0.07 0.48 0.07 45.2 Vehicles

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: ARUP PTY LTD | Processed: Monday, 3 August 2020 6:20:45 PM

Site: 102 [PM North-South Collector Road / Astoria Street - 2021] ^{申申}Network: N101 [PM North-South Collector Road / Hollinsworth Road / Astoria Street - 2021]

AM North-South Collector Road / Astoria Street Site Category: (None) Giveway / Yield (Two-Way)

Move	ement	Perfor	manc	e - Ve	hicles									
Mov ID	Turn	Dei F Total	mand Flows HV	A F Total	rrival Iows HV	Deg. Satn	Average Delay	Level of Service	Aver. E Qu Vehicles	Back of eue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cvcles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South	: Nort	h-South	Colle	ctor Ro	ad									
1	L2	129	10.0	129	10.00	.311	6.8	LOS A	0.5	4.1	0.55	0.78	0.64	43.1
3	R2	85	10.0	85	10.00	.311	12.4	LOS A	0.5	4.1	0.55	0.78	0.64	42.7
Appro	ach	215	10.0	215	10.00	.311	9.0	LOS A	0.5	4.1	0.55	0.78	0.64	42.9
East:	Astori	a Street	East											
4	L2	57	10.0	57	10.00	.232	4.7	LOS A	0.0	0.0	0.00	0.07	0.00	49.1
5	T1	365	10.0	365	10.00	.232	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	49.5
Appro	ach	422	10.0	422	10.00	.232	0.7	NA	0.0	0.0	0.00	0.07	0.00	49.5
West:	Astor	ia Stree	t West	t										
11	T1	374	10.0	374	10.00	.292	0.9	LOS A	0.4	3.3	0.28	0.13	0.29	48.6
12	R2	93	10.0	93	10.00	.292	7.2	LOS A	0.4	3.3	0.28	0.13	0.29	47.3
Appro	ach	466	10.0	466	10.00	.292	2.1	NA	0.4	3.3	0.28	0.13	0.29	48.4
All Vehic	les	1103	10.0	1103	10.00	.311	2.9	NA	0.5	4.1	0.23	0.23	0.24	47.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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NETWORK LAYOUT

中中Network: N101 [AM North-South Collector Road / Hollinsworth Road / Astoria Street - 2036]



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Organisation: ARUP PTY LTD | Created: Friday, 31 July 2020 5:53:32 PM

Site: 101 [AM North-South Collector Road / Hollinsworth Road - 2036] ♦ Network: N101 [AM North-South Collector Road / Hollinsworth Road / Astoria Street - 2036]

AM North-South Collector Road / Hollinsworth Road Site Category: (None) Roundabout

Mov	Movement Performance - Vehicles													
Mov ID	Turn	Dei F	mand Flows	A I Totol	Arrival Flows	Deg. Satn	Average Delay	Level of	Aver. E Qu	Back of eue	Prop. Queued	Effective Stop	Aver. No.	Average Speed
		TOIAI		TO(a)	۳v 0/			Service	venicies	Distance		Nale	Cycles	km/b
Sout	b: \\//		70	ven/n	70	V/C	Sec	_	ven		_	_	_	KIII/II
1	1. 12	100000	10.0	4	10.00	016	74		0.0	03	0.70	0.60	0.70	45.1
2		4	10.0	4	10.00	2.010	7.4		0.0	0.5	0.70	0.00	0.70	40.1
2	11 D2	1	10.0	1	10.00	2.010	12.0		0.0	0.3	0.70	0.00	0.70	41.5
Appr		12	10.0	12	10.00	0.010	7.0		0.0	0.3	0.70	0.00	0.70	40.5
Appro	Jach	12	10.0	12	10.00	5.010	1.0	L03 A	0.0	0.5	0.70	0.00	0.70	43.0
East:	Existir	ng Hollir	nswort	h Road	ł									
4	L2	2	10.0	2	10.00).483	3.1	LOS A	1.8	13.5	0.23	0.35	0.23	47.2
5	T1	665	10.0	665	10.00).483	3.1	LOS A	1.8	13.5	0.23	0.35	0.23	48.3
6	R2	65	10.0	65	10.00).483	7.6	LOS A	1.8	13.5	0.23	0.35	0.23	44.8
Appro	oach	733	10.0	733	10.00).483	3.5	LOS A	1.8	13.5	0.23	0.35	0.23	48.1
North	n: North	n-South	Collec	ctor Ro	ad									
7	L2	82	10.0	82	10.00).147	7.4	LOS A	0.4	2.7	0.72	0.73	0.72	44.3
8	T1	8	10.0	8	10.00).147	7.3	LOS A	0.4	2.7	0.72	0.73	0.72	45.6
9	R2	18	10.0	18	10.00).147	11.9	LOS A	0.4	2.7	0.72	0.73	0.72	45.5
Appro	oach	108	10.0	108	10.00).147	8.1	LOS A	0.4	2.7	0.72	0.73	0.72	44.6
West	: Futur	e Hollins	sworth	n Road										
10	L2	26	10.0	26	10.00	0.506	3.4	LOS A	1.7	12.6	0.33	0.37	0.33	44.1
11	T1	681	10.0	681	10.00	0.506	3.4	LOS A	1.7	12.6	0.33	0.37	0.33	48.1
12	R2	6	10.0	6	10.00	0.506	8.0	LOS A	1.7	12.6	0.33	0.37	0.33	48.2
Appro	oach	714	10.0	714	10.00	0.506	3.5	LOS A	1.7	12.6	0.33	0.37	0.33	48.0
All Vehic	cles	1566	10.0	1566	10.00	0.506	3.8	LOS A	1.8	13.5	0.31	0.39	0.31	47.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Site: 102 [AM North-South Collector Road / Astoria Street - 2036] ♦ Network: N101 [AM North-South Collector Road / Hollinsworth Road / Astoria Street - 2036]

AM North-South Collector Road / Astoria Street Site Category: (None) Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Dei F Total	mand Flows HV	A F Total	rrival lows HV	Deg. Satn	Average Delay	Level of Service	Aver. E Qui Vehicles	Back of eue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South	n: North	n-South	Collec	ctor Ro	ad									
1	L2	41	10.0	41	10.0	0.160	6.7	LOS A	0.2	1.6	0.59	0.77	0.59	42.7
3	R2	45	10.0	45	10.0	0.160	12.6	LOS A	0.2	1.6	0.59	0.77	0.59	42.2
Appro	bach	86	10.0	86	10.0	0.160	9.8	LOS A	0.2	1.6	0.59	0.77	0.59	42.4
East:	Astoria	a Street	East											
4	L2	67	10.0	67	10.0	0.280	4.7	LOS A	0.0	0.0	0.00	0.07	0.00	49.1
5	T1	442	10.0	442	10.0	0.280	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	49.5
Appro	bach	509	10.0	509	10.0	0.280	0.6	NA	0.0	0.0	0.00	0.07	0.00	49.5
West	: Astori	a Stree	t West	t										
11	T1	436	10.0	436	10.0	0.297	0.7	LOS A	0.3	2.6	0.19	0.07	0.21	49.0
12	R2	55	10.0	55	10.0	0.297	8.1	LOS A	0.3	2.6	0.19	0.07	0.21	48.0
Appro	bach	491	10.0	491	10.0	0.297	1.6	NA	0.3	2.6	0.19	0.07	0.21	48.9
All Vehic	les	1086	10.0	1086	10.0	0.297	1.8	NA	0.3	2.6	0.13	0.13	0.14	48.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the

average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Site: 101 [PM North-South Collector Road / Hollinsworth Road- 2036] ♦ ♦ Network: N101 [PM North-South Collector Road / Hollinsworth Road / Astoria Street - 2036]

AM North-South Collector Road / Hollinsworth Road Site Category: (None) Roundabout

Mov	Movement Performance - Vehicles													
Mov ID	Turn	Dei F	mand Flows	A F	rrival Flows	Deg. Satn	Average Delay	Level of	Aver. I Qu	Back of eue	Prop. Queued	Effective Stop	Aver. No.	Average Speed
		TOIAI		TOLAI				Service	venicies	Distance		Nale	Cycles	luna /h
South		ven/n	%	ven/n	%	V/C	sec		ven	m				KM/N
30uu 1	1. 19	400855	10.0	6	10.00	0 0 2 7	0.1		0.1	0.5	0.72	0.64	0.72	44.7
1 2	L2 T4	0	10.0	0	10.00	J.UZ1	0.1		0.1	0.5	0.73	0.04	0.73	44.7
2		9	10.0	9	10.00	J.UZ7	0.1	LOSA	0.1	0.5	0.73	0.64	0.73	40.9
3	KZ	2	10.0	2	10.00	J.027	12.6	LOSA	0.1	0.5	0.73	0.64	0.73	46.0
Appro	bach	18	10.0	18	10.0	0.027	8.6	LOSA	0.1	0.5	0.73	0.64	0.73	43.4
East:	Existir	ng Hollir	swort	h Road	ł									
4	L2	1	10.0	1	10.00	0.517	3.2	LOS A	2.0	15.4	0.27	0.36	0.27	47.0
5	T1	685	10.0	685	10.00	0.517	3.1	LOS A	2.0	15.4	0.27	0.36	0.27	48.1
6	R2	88	10.0	88	10.00	0.517	7.7	LOS A	2.0	15.4	0.27	0.36	0.27	44.4
Appro	bach	775	10.0	775	10.0	0.517	3.7	LOS A	2.0	15.4	0.27	0.36	0.27	47.8
North	: North	n-South	Collec	ctor Ro	ad									
7	L2	71	10.0	71	10.00	0.143	7.2	LOS A	0.3	2.7	0.72	0.74	0.72	44.2
8	T1	6	10.0	6	10.00	0.143	7.2	LOS A	0.3	2.7	0.72	0.74	0.72	45.4
9	R2	28	10.0	28	10.00	0.143	11.7	LOS A	0.3	2.7	0.72	0.74	0.72	45.3
Appro	bach	105	10.0	105	10.0	0.143	8.4	LOS A	0.3	2.7	0.72	0.74	0.72	44.5
West	: Futur	e Hollins	sworth	n Road										
10	L2	19	10.0	19	10.0	0.511	3.7	LOS A	1.7	12.7	0.40	0.41	0.40	43.6
11	T1	667	10.0	667	10.00	0.511	3.6	LOS A	1.7	12.7	0.40	0.41	0.40	47.9
12	R2	4	10.0	4	10.00	0.511	8.2	LOS A	1.7	12.7	0.40	0.41	0.40	48.0
Appro	bach	691	10.0	691	10.0	0.511	3.7	LOS A	1.7	12.7	0.40	0.41	0.40	47.8
All Vehic	les	1588	10.0	1588	10.0	0.517	4.0	LOS A	2.0	15.4	0.36	0.41	0.36	47.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: ARUP PTY LTD | Processed: Tuesday, 28 July 2020 11:00:53 PM

Site: 102 [PM North-South Collector Road / Astoria Street - 2036]

^{申申}Network: N101 [PM North-South Collector Road / Hollinsworth Road / Astoria Street - 2036]

AM North-South Collector Road / Astoria Street Site Category: (None) Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Dei F Total	mand Flows HV	A F Total	arrival Flows HV	Deg. Satn	Average Delay	Level of Service	Aver. E Qu Vehicles	Back of eue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South	h: North	n-South	Collec	ctor Ro	ad									
1	L2	59	10.0	59	10.0	0.244	7.0	LOS A	0.4	2.7	0.61	0.81	0.66	42.4
3	R2	73	10.0	73	10.0	0.244	13.0	LOS A	0.4	2.7	0.61	0.81	0.66	41.9
Appro	bach	132	10.0	132	10.0	0.244	10.3	LOS A	0.4	2.7	0.61	0.81	0.66	42.1
East:	Astoria	a Street	East											
4	L2	48	10.0	48	10.0	0.267	4.7	LOS A	0.0	0.0	0.00	0.05	0.00	49.3
5	T1	437	10.0	437	10.0	0.267	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	49.6
Appro	bach	485	10.0	485	10.0	0.267	0.5	NA	0.0	0.0	0.00	0.05	0.00	49.6
West	: Astori	a Stree	t West	t										
11	T1	444	10.0	444	10.0	0.289	0.5	LOS A	0.3	2.0	0.15	0.06	0.16	49.2
12	R2	44	10.0	44	10.0	0.289	7.8	LOS A	0.3	2.0	0.15	0.06	0.16	48.4
Appro	bach	488	10.0	488	10.0	0.289	1.2	NA	0.3	2.0	0.15	0.06	0.16	49.2
All Vehic	les	1105	10.0	1105	10.0	0.289	2.0	NA	0.4	2.7	0.14	0.15	0.15	48.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the

average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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