IKEA Multi Function Logistics Unit Traffic Impact Assessment

Marsden Park Development

80515055

Prepared for
FDC Construction & Fitout Pty Ltd

2 July 2015

Cardno
Shaping the Future

Document Information

Prepared for	FDC Construction & Fitout Pty Ltd
Project Name	Marsden Park Development
File Reference	R001 VerC IKEA Marsden Park TIA.docx
Job Reference	80515055
Date	2 July 2015

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
A	24/04/15	Draft	Nigel Chan	Tim Sullivan
B	01/05/15	Draft	Nigel Chan	Tim Sullivan
C	02/07/15	Draft	Nigel Chan	Tim Sullivan

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1 Introduction

1.1 Background

Cardno has been engaged by FDC Construction & Fitout Pty Ltd to prepare a Traffic Impact and Parking Assessment for the proposed development associated with the IKEA Multi Function Logistics Unit (MFLU) project located in Marsden Park.

The plan for the proposed development, which was assessed for this Traffic Impact Assessment report, is as follows:

> 14101_DA02_SITE PLAN.dwg

The proposed development consists of:

> Warehouse: 69,033 m²; and
> Office: 1,358 m².

1.2 Scope of Work

The following works have been undertaken as part of this study:

> Obtain traffic flow data from previous traffic studies for the Townson Road / Richmond Road intersection;

> Undertake capacity analysis of the above intersection using SIDRA 6.1 modelling software for the scenarios below:

  - Future baseline scenario (opening year plus 10 years without development);
  - Future baseline scenario (opening year plus 10 years with development);

  Additional scenarios if required:

  - Future baseline scenario (opening year without development); and
  - Future baseline scenario (opening year with development).

> Assess on-site statutory car parking requirements of the proposed development based on parking rates stipulated in the Blacktown City Council DCP and the RMS Guide to Traffic Generation Developments (2002) document and provide justification on the number of parking spaces proposed;

> Assess pedestrian and cyclist facilities and public transport connections applicable to the subject site;

> Provide advice to the design team on the parking supply, site access and general layout for both light and heavy vehicles; and

> Propose site access / egress arrangements with commentary on suitability and visibility requirements in line with Australian Standards.

1.3 Reference Documents

The following documents have been reviewed and referenced in this report:

> Blacktown City Council Growth Centre Precincts Development Control Plan 2010 Schedule 3 – Marsden Park Industrial Precinct;

> Blacktown Development Control Plan 2006 Part E – Development in the Industrial Zones;

> Blacktown Council Integrated Transport Plan 2013;

> Guide to Traffic Generating Developments (RTA, 2002);

> Guide to Traffic Generating Developments – Updated traffic surveys (RMS, TDT 2013/04a); and

> Australian Standards 2890.

2 Existing Conditions

2.1 Site Location

The proposed development site will be located in the Sydney Business Park as shown in **Figure 2-1**. Sydney Business Park is enclosed by South Street to the North and West, Richmond Road to the East and the proposed Castlereagh Freeway to the South. The IKEA development is one of many to be located in the Sydney Business Park.

As this is a Greenfield development, there are no developments that existed previously at the study site. Many developments in the area including the IKEA development are currently under construction.

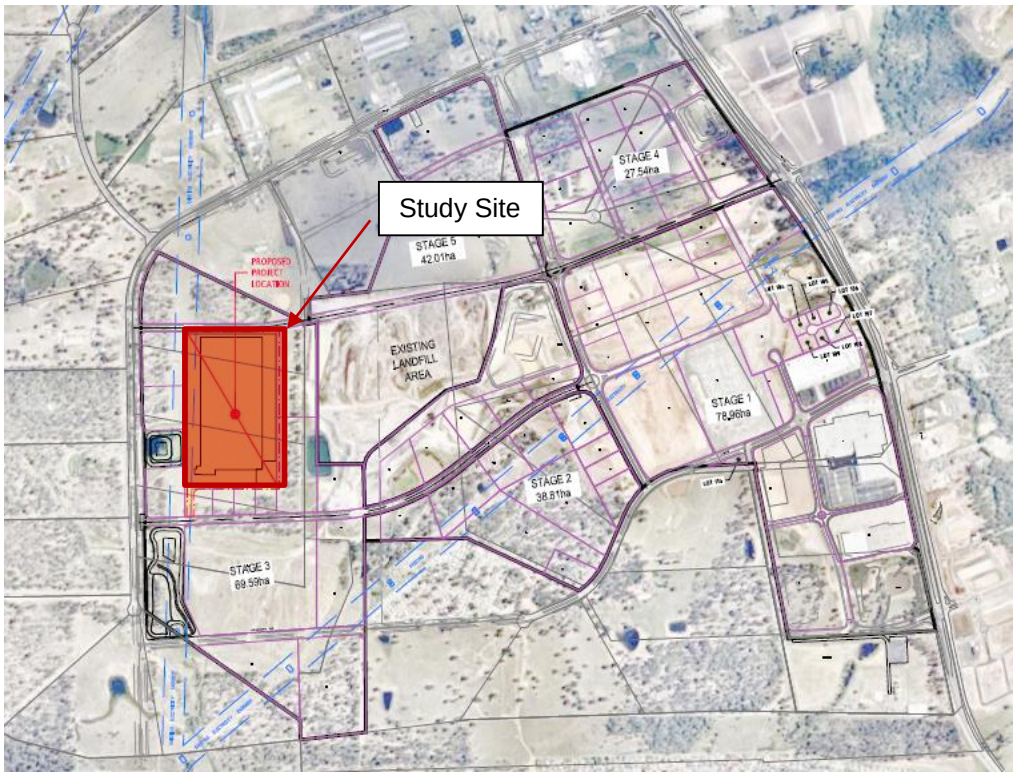


Figure 2-1 Subject Site Area

Source: FDC Construction & Fitout Pty Ltd

2.2 Existing Road Network

As many of the developments in Sydney Business Park are currently under construction, most of the proposed internal roads do not yet exist. However, the external roads surrounding the development consists of:

> South Street (Local Road);

> Hollinsworth Road (Local Road); and

> Richmond Road (State Road).

2.2.1 South Street

South Street is a Local Road under the authority of Blacktown City Council, which starts at Carnarvon Road, intersects with Richmond Road and continues to a dead end. There are no speed limit signs posted along the road so the speed limit on South Street is the default 50 km/hr (roads with buildings adjacent). There is a truck curfew between 7pm and 3am on South Street west of Richmond Road. The road is primarily two-way with one lane in each direction with no lane markings and no on-street parking permitted on either side.

2.2.2 Hollinsworth Road

Hollinsworth Road is a two way road with one lane in each direction that connects Main Street to Richmond Road. As it is a local road, it is also under the authority of Blacktown City Council. The speed limit is 60 km/hr in each direction. Currently the existing road bends around the IKEA store, however, constructions works are underway to remove the bend on Hollinsworth Road. There is no parking permitted on either side of the road.

2.2.3 Townson Road

Townson Road is opposite Hollinsworth Road across Richmond Road which has one lane in each direction. As a local road, it is also under the authority of Blacktown City Council. The speed limit is 80 km/hr in each direction. Townson Road has been connected to Hollinsworth Road based on the recommendations made by ARUP in 2009. There is no parking permitted on either side of the road.

2.2.4 Richmond Road

The main traffic corridor in the vicinity of the subject site is Richmond Road which is classified as a State Road under the authority of NSW Roads and Maritime Services (RMS) connecting Blacktown in the south and Richmond to the north where it changes name to Blacktown Road. The speed limit varies from 70 to 80 km/hr but slows to 60 km/hr near intersections. The road has a length of approximately 23.5 km. In the study area, Richmond Road is a two-way road with two lanes in each direction with no parking on either side.

2.3 Existing Public Transport Services

The Sydney Business Park in Marsden Park currently has limited public transport service provisions, mainly due to the undeveloped nature of the area. However, there are two bus routes that operate along Richmond Road and Stoney Creek Road. The Richmond train line is also accessible from the Riverstone and Schofields stations, which are located approximately 4km to the east.

The following sub sections outline the bus and train service operation details.

2.3.1 Bus Services

The subject site is serviced by two Busway routes. **Table 2-1** outlines the service details of these two bus services and **Figure 2.3** shows an extract of the bus network map in the area.

Table 2-1 Bus Service Details

Bus Route	Service	Weekday Frequency		
		AM Peak (7AM – 9AM)	PM Peak (4PM – 6PM)	Off Peak (10AM – 3PM)
757	Riverstone to Mt Druitt via Plumpton & Rooty Hill	40 minutes	30 minutes	2 hours
	Mt Druitt to Riverstone via Rooty Hill & Plumpton	30 minutes	60 minutes	2 hours
674	Mt Druitt to Windsor via Whalan, Shanes Park and South Windsor	40-60 minutes	60 minutes	2.5 hours
	Windsor to Mt Druitt via South Windsor and Shanes Park	45 minutes	60 minutes	3 hours

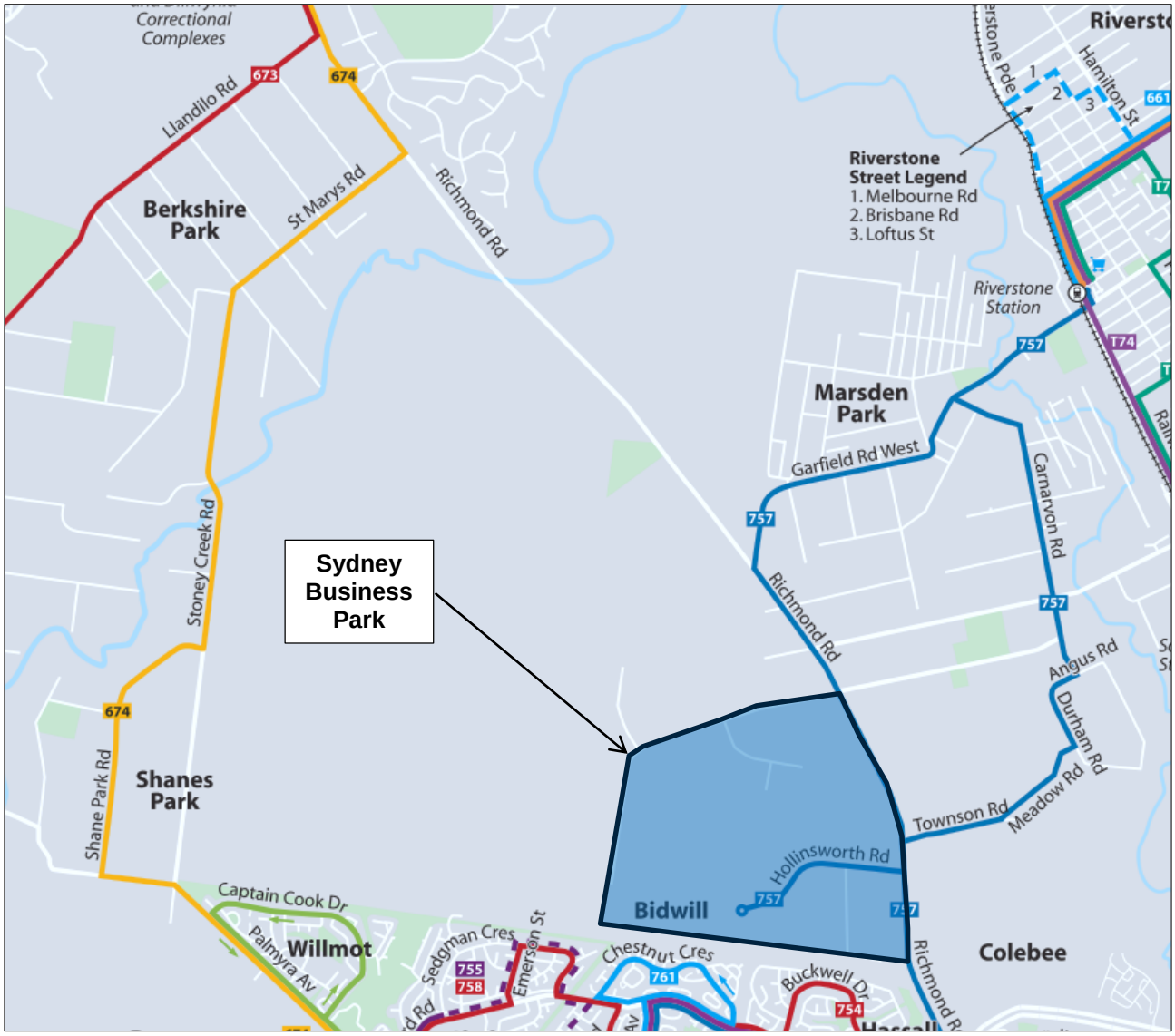


Figure 2-2 Existing Bus Services in the Vicinity of the Sydney Business Park

Source: Busways

2.3.2 Train Services

The Sydney Business Park is located approximately 5km and 4km west of Schofields and Riverstone stations, respectively. Both these stations are located on the Richmond branch of the Western Line. The train service details are outlined in **Table 2-2**. The train service map is shown in **Figure 2-4**.

Table 2-2 Train Service Details (Schofields and Riverstone Stations)

Train Service	Period	Number of Services	
		Riverstone Station	Schofields Station
Richmond to Chatswood	Mon – Fri AM (between 7-9AM)	4	8
	Mon – Fri PM (between 4-6PM)	4	5
	Saturday, Sunday and Public Holidays (whole day)	36	36
Chatswood to Richmond	Mon – Fri AM (between 7-9AM)	4	4
	Mon – Fri PM (between 4-6PM)	4	5
	Saturday, Sunday and Public Holidays (whole day)	34	34

It should be noted that the 'Richmond Line Duplication' project (completed in December 2011) involved the duplication of the Richmond Line between Quakers Hill and Schofields. The project caters for future population growth, improves rail operational reliability and flexibility and provides a modern, easy access station and interchange for Sydney's North West Growth Centres. The duplication has resulted in the provision of an increased number of services from Schofields station during AM and PM peak hours (current services shown in **Table 2.2**).

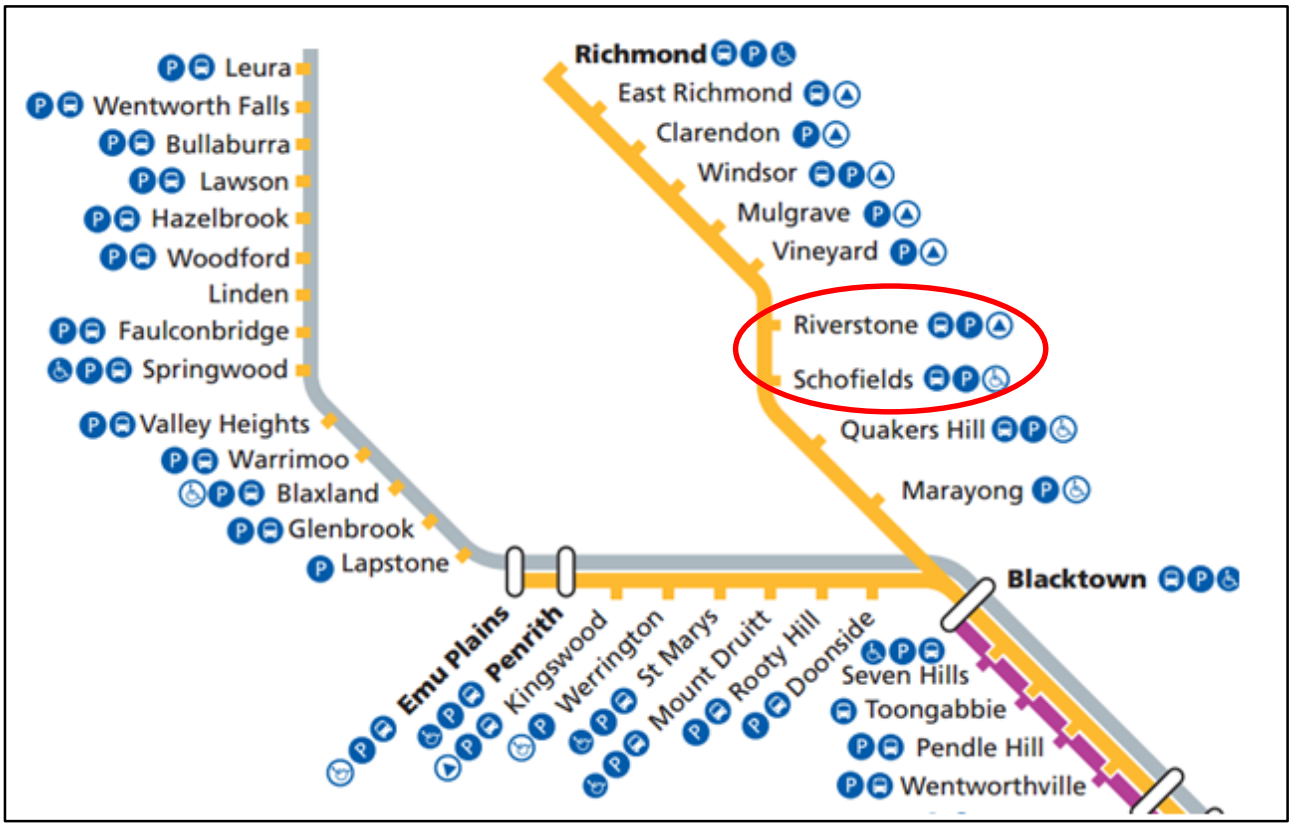


Figure 2-3 Suburban Train Service Map

Source: Cityrail

2.3.3 Pedestrian and Cycling Facilities

Currently, pedestrian and cycling facilities within the vicinity of the Sydney Business Park are limited due to the rural and undeveloped nature of this area. The current configuration of Richmond Road includes cycle ways on both sides of the carriageway throughout the entire length of the road. Pedestrian crossing facilities are also currently in place at the signalised intersection of Richmond Road and Garfield Road West.

The existing and proposed on and off road cycle ways in the vicinity of the Sydney Business Park are shown in **Figure 2-4**. There are also regional cycling links provided on the surrounding network, which includes cycle lanes on the M7 Motorway and on-road cycle lanes on Quakers Hill Parkway.

Visitors or workers commuting to Sydney Business Park are able to travel to Riverstone train station by bicycle in roughly 20 minutes, walk to the bus stop to Riverstone station in roughly 10 minutes or walk to the southbound bus stop in roughly 20 minutes.

Figure 2-4 Existing and Proposed Cycle-ways in the Vicinity of Sydney Business Park

Source: Blacktown City Council

3 Proposed Development

3.1 Development Proposal

The total area of the subject site is 125,000m² and the Gross Floor Area is 70,520 m². The subject site will be bordered by South Street to the west, Road No. 4 to the north, Road No. 5 to the south, and adjacent lots to the east.

The land use components comprising the development is summarised in **Table 3-1**.

Table 3-1 Development Components

Land Use	GFA (m²)
Warehouse	69,130
Office	1,390

3.2 Proposed Road Network

Multiple internal roads have been proposed as part of the Sydney Business Park and are currently in the construction phase. Only Road No. 5 to the north and Road No. 4 to the south are within the vicinity of the study site.

With two lanes in each direction, Richmond Road has also been proposed to be upgraded (Blacktown Integrated Transport Management Plan 2013) in the long term to three lanes in each direction.

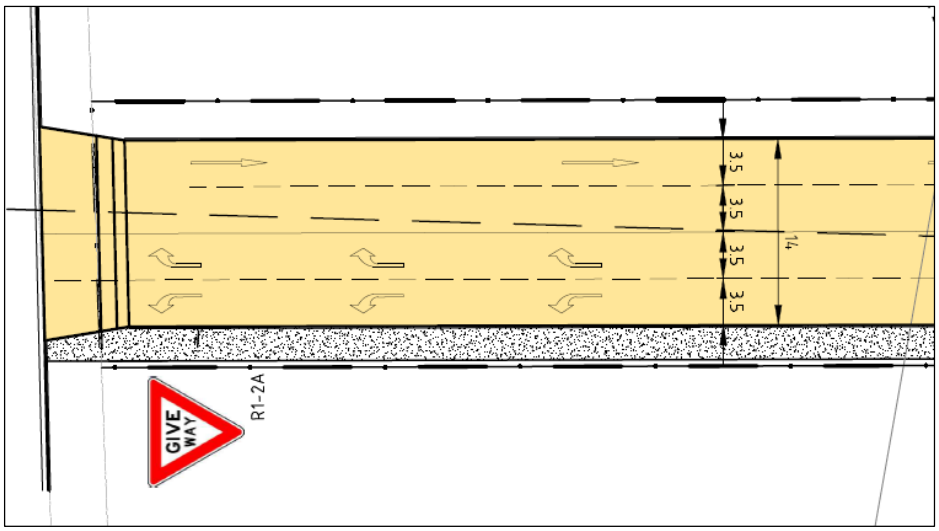
Richmond Road / South Street will be upgraded to a signalised intersection in the near future and in the longer term into a grade separated intersection.

3.3 Proposed Site Access

The proposed site access to the development is located off Road No. 5. One entry lane is provided for the staff/visitor vehicles and one entry lane is provided for commercial/service vehicles. Both lanes lead to boomgates and are connected to the external Road No. 5 via a four-lane two-way internal road as seen in **Figure 3-1**. The site access point at the intersection of the internal road and the external Road No. 5 is located approximately 150 m east of the South Street / Road No. 5 intersection.

As the study site is primarily a warehouse without a customer front end, there is expected to be a negligible amount of foot traffic generated by the proposed development. As such, footpaths and pedestrian crossings at the frontage of the study site are not considered to be a necessity.

Figure 3-1 Proposed Site Access lane configuration



3.4 Proposed Public Transport

McCormick Rankin Cagney prepared the North West Sector Bus Servicing Plan for Transport for NSW which details a proposed bus network servicing North West Sydney. This proposed network can be seen in **Figure 3-2**. As shown, some proposed bus routes travel adjacent to the Sydney Business. Alternatively a short walk to the nearest bus stop on Richmond Road would allow passengers access to Riverstone train station.

Although there may be certain upgrades required for these bus routes such as road widening (such as Richmond Road) and possible introduction of bus only lanes, these all day bus routes would potentially alleviate a significant amount of traffic impact caused by the proposed development.

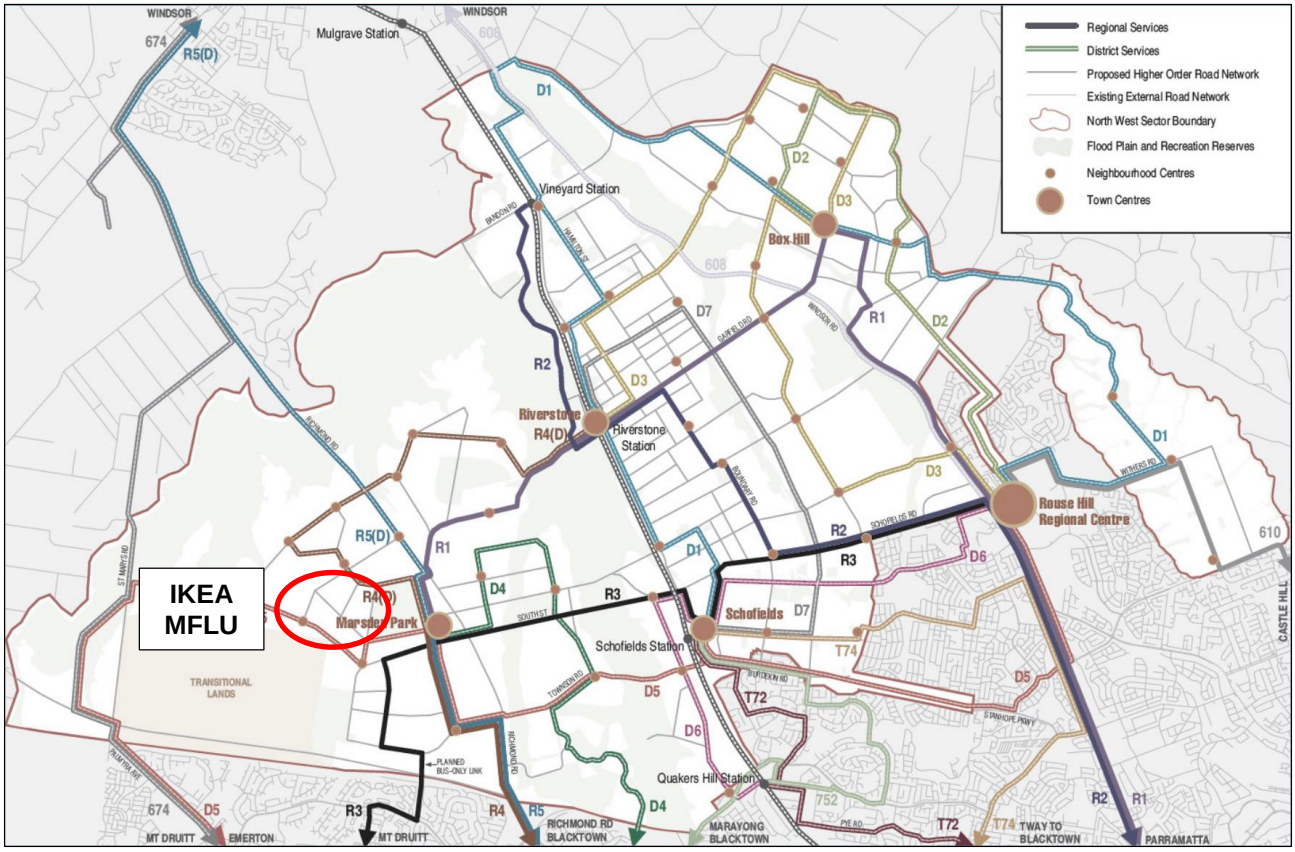


Figure 3-2 Proposed Bus Network for the North West Sector

Source: McCormick Rankin Cagney 2009

3.5 Proposed Walking and Cycling

Blacktown Council has plans to implement additional bike routes in the study area as shown in **Figure 2-5**. As shown, bicycle routes are planned on most of the proposed internal roads which will lead the cyclists to the existing bicycle route on Richmond Road. Although cycle trips to the proposed development are likely to be low, the cycle network helps to mitigate the overall traffic generating potential of the Business Park.

3.6 Development Vehicle Traffic Generation

The proposed development traffic generation was calculated using the expected heavy vehicle flows provided by IKEA. These heavy vehicle values are then converted into PCUs using PCU conversion factors. The factors and vehicle traffic generation for the proposed development is shown in **Table 3-2** and **Table 3-3**.

The daily flow numbers in the tables below have been converted to peak hour flows based on discussions with FDC Construction & Fitout. These are conservative estimates as it has been assumed that the peak of staff vehicles will align with the peak of heavy vehicles as the temporal distribution of staff vehicles and heavy vehicles is not known and may vary in reality.

Table 3-2 Inbound Development Traffic Generation Over a Typical Day

Land Use	Daily Flow (Veh/Day)	Peak Flow (Veh/Hour)	PCU Conversion Factor	Peak Flow (PCUs/hour)
Inbound 40' Containers	25	14	4	56
Inbound Trucks/Vans	30	5	3	15
Inbound Office Workers	200	100	1	100
Inbound Trips Generated				**171**

Table 3-3 Outbound Development Traffic Generation Over a Typical Day

Land Use	Daily Flow (Veh/Day)	Peak Flow (Veh/Hour)	PCU Conversion Factor	Peak Flow (PCUs/hour)
Outbound 40' Containers	35	14	4	56
Outbound Trucks/Vans	30	5	3	15
Outbound Office Workers	200	100	1	100
Outbound Trips Generated				**171**

4 Traffic Assessment

4.1 Key Intersections

The performance of the following key intersections/access points for the proposed development has been assessed as part of this TIA:

> Richmond Road / Townson Road (signalised)

Based on correspondence with FDC Construction & Fitout, traffic generated by the proposed development including staff and heavy vehicles will not travel through Richmond Road / South Street but will instead travel through Richmond Road / Townson Road and hence, the Richmond Road / South Street intersection was not assessed as part of this TIA. As it is not part of the scope of these works, Cardno assumes that the heavy vehicles will be able to traverse through the internal intersections in the Sydney Business Park. The Richmond Road / Townson Road intersection layout has been taken from the Richmond Road Upgrade REF Submissions Report (AECOM, 2011).

4.2 Previous Studies

In 2009, Road Delay Solutions undertook strategic modelling for key intersections along Richmond Road including South Street and Townson Road to provide future traffic volumes for Transport and Urban Planning. Roads Delay Solutions had used the NETANAL model and turning counts in 2009 to predict volumes for years 2011, 2016, 2021, and 2036, and had included anticipated traffic generation from proposed developments in the surrounding area. Transport and Urban Planning then used SIDRA and SCATES to analyse performance of those key intersections. Both SIDRA and SCATES had revealed that the Richmond Road / South Street intersection would fail with a LoS of F by 2021, however, the Richmond Road / Townson Road intersection would still have an acceptable LoS in 2021.

In 2011, ARUP had performed a strategic transport study for the Marsden Park Industrial Precinct based on the results presented by Road Delay Solutions. In their findings, ARUP had recommended that South Street would need to be upgraded to a grade separated intersection or restrict traffic to left turn movements only.

In 2011, AECOM reviewed the previous assessments undertaken and analysed the performance of Richmond Road / South Street and Richmond Road / Townson Road intersections using revised traffic data. Their analysis also showed Richmond Road / South Street failing in 2021 without opening additional intersections to relieve traffic demand at that intersection.

The previous assessments briefly outlined above reveal that Richmond Road / South Street intersection is likely to fail in years past 2021 (or even earlier). However, FDC Construction & Fitout has informed Cardno that the development traffic will only travel through the Richmond Road / Townson Road intersection to reach Richmond Road. The development generated through traffic travelling North-South through the Richmond Road / South Street intersection has already been accounted for by the background growth rates in previous assessments such as the AECOM Traffic and Transport Assessment, 2012. As such, the IKEA MFLU development is not expected to cause the premature failure of the Richmond Road / South Street intersection.

The Costco - Marsden Park Traffic Impact Assessment undertaken by GTA Consultants in April 2013 had estimated the trip generation from the bulky goods precinct including the IKEA store (not to be confused with the MFLU), Masters, Costco, and another store yet to be confirmed. By growing these numbers up to year 2025 and adding the development traffic, the performance of the Richmond Road / Townson Road intersection was analysed. The intersection was found to be performing at LoS B on Weekday PM peak hour and LoS C on a Saturday peak hour.

4.3 Baseline Traffic Assessment

4.3.1 Baseline Traffic Flows (2025)

The majority of the traffic at the Townson Road intersection will come from the bulky goods precinct comprising IKEA, Costco, Masters and another store. According to RMS, the peak time for bulky good retail stores would be on a weekday evening period (on a Thursday, most likely due to late night shopping).

However, the analysis undertaken by GTA specific to Marsden Park has shown that Saturday caused more stress to the network compared to Thursday. Hence, for this analysis, only the Saturday peak hour will be modelled.

The baseline traffic flows for the year 2025 were extracted from the TIA undertaken by GTA in 2013 (based on the RDS assessment in 2009 and the AECOM assessment in 2012). **Figure 4-1** shows the Saturday 2025 baseline traffic flows for the subject intersection.

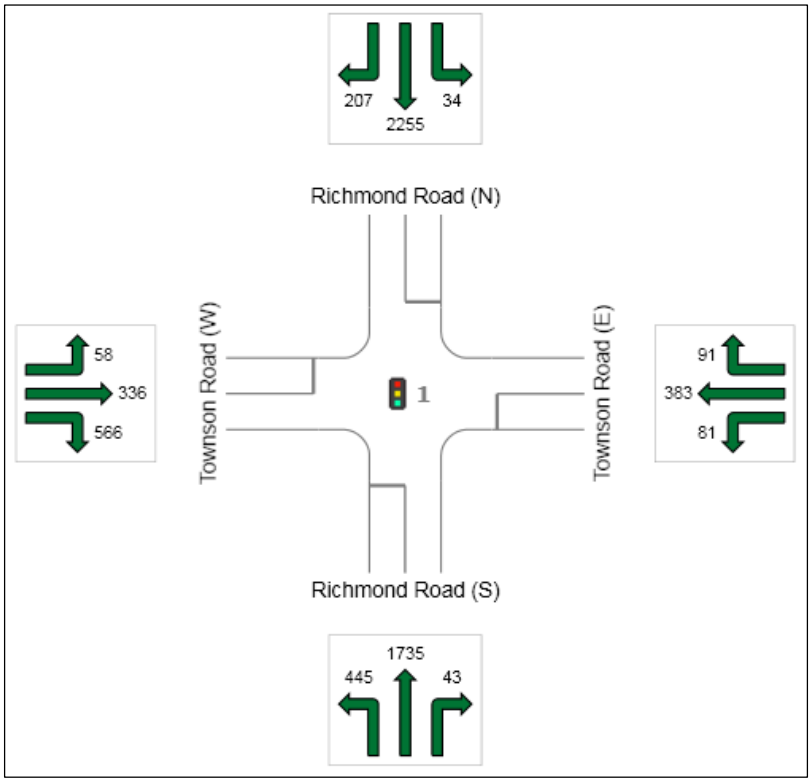


Figure 4-1 2025 Saturday Baseline Traffic Flows (GTA, 2013)

4.3.2 Baseline Traffic Flows (2027)

To increase the flows in the above figure to 2027, growth rates were calculated using the predicted 2021 and 2036 flows from the 2012 AECOM report as shown in **Table 4-1**. This approach is considered to be appropriate since the growth rates will only be used to upscale traffic flows from 2025 to 2027 and is between 2021 and 2036.

Table 4-1 Predicted Traffic Flows along Richmond Road Adjacent to the Townson Road (Source: AECOM, 2013)

	Weekday AM Peak			Weekday PM Peak		
	2021	2036	Growth Rate	2021	2036	Growth Rate
Northbound	2419	2413	-0.02%	2668	4344	4.19%
Southbound	2517	3973	3.86%	2551	3108	1.46%

Based on the data above, the growth rate for this analysis has been assumed to be 4.2% as it is consistent with rates Cardno have calculated using historical traffic data from 2005 to 2012.

SIDRA Intersections 6.1 was used to analyse the performance for the Richmond Road / Townson Road intersection. **Figure 4-2** shows the estimated Saturday 2027 baseline traffic flows for the subject intersection.

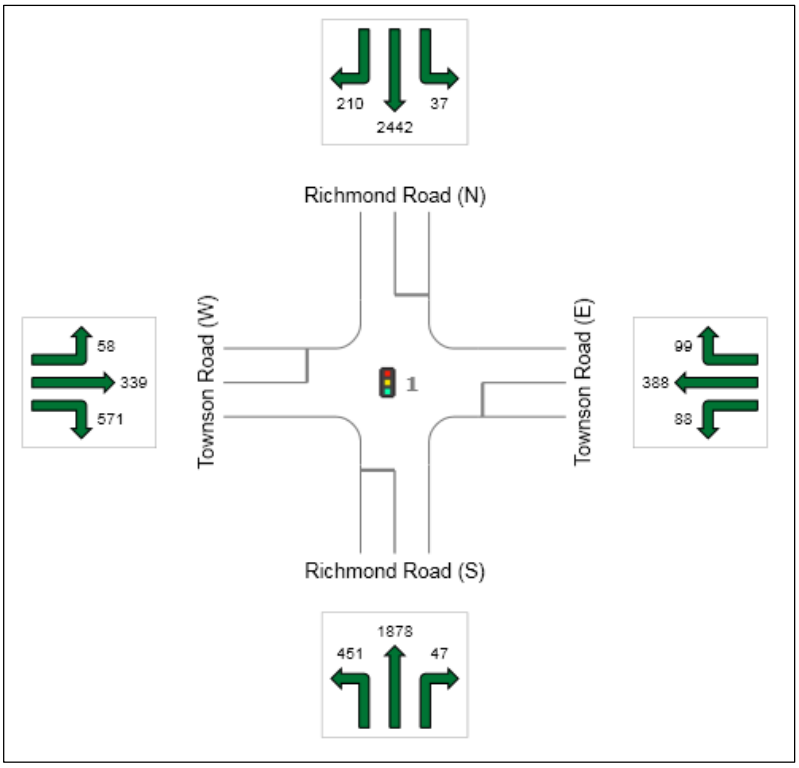


Figure 4-2 2027 Saturday Baseline Plus Bulky Goods Precinct Development Traffic Flows

4.4 Development Traffic Assessment

4.4.1 Development Traffic Flows (2027)

The traffic flows, including staff/visitor vehicles, provided by FDC Construction & Fitout Pty Ltd (**Section 3.3**) were utilised to obtain the development flows for the traffic movements generated by the proposed development. This was then added to the baseline traffic flows at the year of 2027 base to obtain the 2027 base plus development flows as shown in **Figure 4-3**.

Based on correspondence with FDC Construction & Fitout, all development traffic, including heavy vehicles, will travel through Richmond Road / Townson Road to reach Richmond Road.

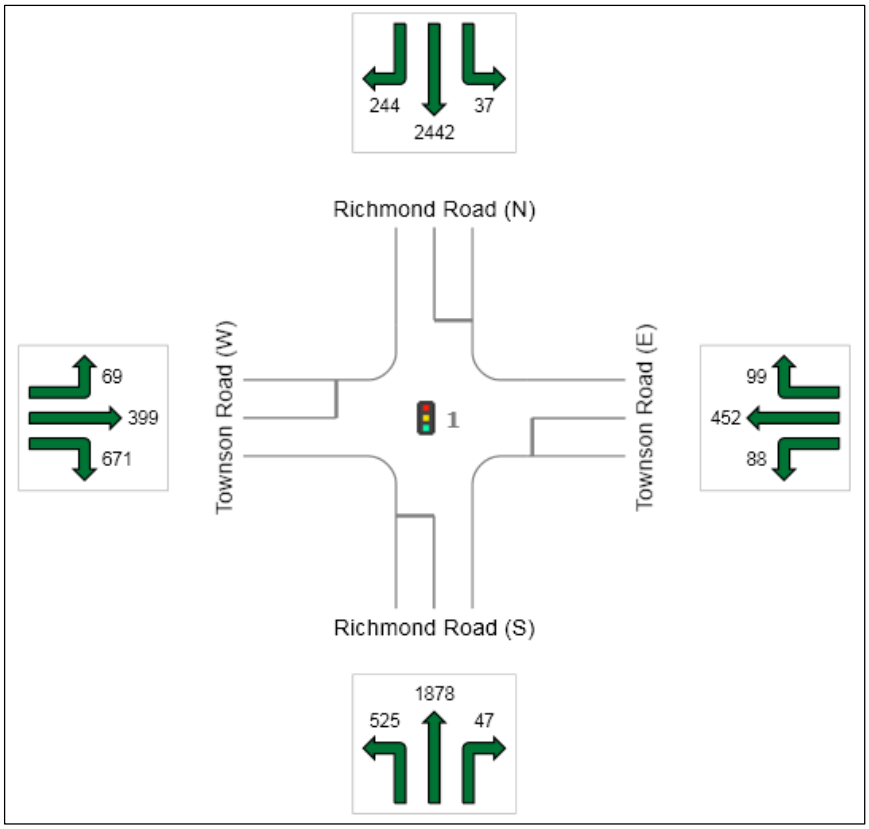


Figure 4-3 2027 Saturday Base Plus Bulky Goods Precinct and Industrial Precinct Developments Traffic Flows

4.5 Intersection Performance

The capacity of a road network is largely determined by the capacity of the controlling intersections. The intersection operating performance was assessed using the SIDRA software package to determine the Degree of Saturation (DoS), Average Delay (AVD in seconds) and Level of Service (LoS) at each intersection. The key indicator of intersection performance is Level of Service, where results are placed on a continuum from 'A' to 'F', as shown in **Table 4-2**.

Table 4-2 Intersection Level of Service

LoS	Traffic Signal/Roundabout	Giveway / Stop Sign / T-Junction
A	Good Operation	Good Operation
B	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but accident study required
D	Operating near capacity	Near Capacity & accident study required
E	At Capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Unsatisfactory and requires additional capacity. Roundabouts require other control mode	Unsatisfactory and requires additional capacity.

The Average Vehicle Delay provides a measure of the operational performance of an intersection as indicated in **Table 4-3** which relates AVD to LoS. The AVDs should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route). For traffic signals, the average delay over all movements should be taken. For roundabouts and priority control intersections (sign control) the critical movement for level of service assessment should be that movement with the highest average delay.

Table 4-3 Intersection Average Delay (AVD)

LoS	Average Delay per Vehicle (seconds/vehicle)
A	Less than 14
B	15 to 28
C	29 to 42
D	43 to 56
E	57 to 70
F	>70

The Degree of Saturation is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals both queue length and delay increase rapidly as DoS approaches 1. DoS in the order of 0.7 generally represents satisfactory intersection operation and when DoS exceeds 0.9, queues can be expected hence it is usually beneficial to have a DoS less than 0.9.

4.5.2 Townson Road / Richmond Road Intersection

The Townson Road / Richmond Road signalised intersection was analysed using SIDRA intersection 6.1 software as part of this TIA. This analysis was based on Saturday peak network volumes and development traffic volumes. The following table represents key performance indicators for each of the scenarios assessed in SIDRA. Detailed SIDRA outputs are presented in **Appendix A**.

Table 4-4 Townson Road/Richmond Road Intersection Performance during Saturday Peak

Scenario	DoS	Delay (Sec)	LoS	95th%ile Queue (m)
2027 Base + Bulky Goods Precinct	0.911	33.0	C	195.5
2027 Base + Bulky Goods Precinct + Industrial	1.032	48.8	D	268.7

The results in **Table 4-4** show that the performance of the intersection is excellent for the modelled subject intersections. The Townson Road / Richmond Road intersection achieves an acceptable LoS of D even in the worst case scenario, 2027 Base plus Development in the Saturday peak.

As even the worst case scenario resulted in an acceptable LoS, Cardno does not consider the IKEA MFLU development opening year (2017) scenario to be critical, especially since the heavy vehicle flows generated by the development are relatively low (71 PCUs/hour) and the background traffic flows are significantly lower in 2017 compared to the year 2027 scenario analysed.

5 Parking Assessment

This section investigates the proposed parking provisions against the statutory requirements applicable for the subject development. A car park design review has also been undertaken to ensure compliance of the proposed design against the minimum standards stipulated in the Blacktown Council DCP 2006, RMS/RTA Guidelines and the Australian Standards.

5.1 Parking Generation

5.1.1 Parking Supply

The parking rates were obtained from Part A of the Blacktown City Council Development Control Plan (2006). The car parking rates adopted to calculate the amount of car parking spaces required are tabulated in **Table 5-1**.

Table 5-1 Proposed Car Parking Supply

Type	GFA (m²)	DCP Requirement	DCP Spaces	RMS Requirement	RMS Spaces
Warehouse	69,033	1 per 75 m² GFA (7,500 m² or less) 1 per 200 m² GFA (in excess of 7,500 m²)	408	1 per 300 m² GFA (including office)	235
Office	1,358	1 per 40 m² GFA	34		
Total Spaces Required		442		235	
Spaces Provided		262			

The development has proposed to provide 262 parking spaces including 4 disabled parking spaces. Blacktown Council DCP 2006 Part E Clause 4.7 Car Parking sets out the requirements for warehouse use (**Table 5-1**) equating to 442 car parking spaces required. However, RMS Guide to Traffic Generating Developments 2002 requires only 235 spaces for the warehouse development (including the office) in total. The current proposal in terms of off-street parking provision satisfies RMS requirements but it is acknowledged that there is a shortfall of parking spaces when assessed against Council DCP 2006.

However, correspondence with FDC Construction & Fitout Pty Ltd has indicated that since the warehouse will be operating 24/7, the 200 employees will be working in shifts resulting in 100 staff members being on-site at any one time. Hence, the 262 parking spaces provided are considered to be sufficient as it is reasonable to assume that parking demand will not exceed the total number of staff members of 200.

5.1.2 Service Vehicle Parking

The RMS Guide to Traffic Generating Developments 2002 sets out a provision for delivery and service vehicles; for industrial developments over 20,000 m² GFA, 10 spaces plus 1 space per every 1,000 m² over 8,000 m² are required. With a warehouse area of 69,033 m², 72 spaces for delivery and service vehicles are required. This requirement is satisfied by the proposed 73 loading docks. It should also be noted since there are only 55 inbound and 65 outbound service vehicles/trucks per day, from a first principles perspective, the 73 provided docks are much more than sufficient.

5.1.3 Parking for People with Disabilities

The National Construction Code Series 2013 Building Code of Australia states that 1 out of every 100 car parking spaces is required to be a disabled parking space for a class 7 building in Clause D3.5 Accessible car parking. With 262 total car parking spaces, this equates to 3 disabled parking spaces hence the 6 provided are more than sufficient.

5.1.4 Motorcycle and Bicycle Parking

Neither the Blacktown DCP nor the RMS guidelines specify any requirement for motorcycle and bicycle parking for warehouses or offices. Considering the type and location of development, a warehouse with limited public transport, it is anticipated that few, if any, employees will commute via motorcycles or bicycles. However, 12 bicycle parking bays and 6 motorcycle parking spaces have been provided in addition to the car spaces above which may have the effect of encouraging active transport and more sustainable private transport.

5.2 Car Park Design

5.2.1 Access Driveway and Circulation

There are two lanes inbound to the carpark and two lanes outbound. Of the two inbound lanes, the left is restricted to trucks and service vehicles while the right is restricted to staff/visitor vehicles. Each lane then leads to a separate boomgate before reaching their respective parking lots. Neither of the two outbound lanes are restricted to a certain vehicle. The site access point at the intersection of the internal road and the external Road No. 5 is located approximately 150 m east of the proposed intersection of South Street and Road No. 5. All access points are connected to external Road No. 5 via a four-lane two-way internal road.

Widths for proposed driveways off Ironbark Avenue have been designed to accommodate the largest vehicle for both entry and exit, the 25m B-Double Truck, in accordance with AS 2890.1-2004. The swept path analysis also confirmed that the internal carpark circulation is compliant as seen in **Appendix B**.

5.2.2 Car Park Dimensions

The minimum dimensions required for the car park are shown in **Table 5-2**:

Table 5-2 Car Parking Dimensions

Type	Parking Space Width	Parking Space Length	Parking Aisle Width (two-way)
Car Spaces	2.4m	5.4m	5.8m
Small Car Spaces	2.3m	5.0m	5.8m
Accessible Car Spaces and Shared Spaces	2.4m	5.4m	5.8m
Service Bays	3.5m	19m	NA

The car park dimensions in the design plans provided to Cardno have been confirmed to be in accordance with the AS 2890 series including the loading docks to the east and the west. The shared space between each pair of accessibility parking spaces shall be marked (hatching) appropriately and have a bollard 0.8m from the aisle.

5.2.3 Grade

The grades in the designs provided to Cardno have been confirmed to be compliant to the AS 2890 series as tabulated in **Table 5-3**.

Table 5-3 Requirements for Grade and Grade Change

Type	Min Grade	Max Grade	Max Grade Change
Circulation Roadway	NA	16.7%	15% for summit 12.5% for sag
Car Parking	1.0%	6.25%	NA
Accessible Parking	1.0%	3.03%	NA
Service Bays	NA	15.4%	6.25%

5.3 Sight Distance

The minimum sight distance requirement for the driveway in the study site is 65m and the desirable distance is 83m as the frontage road, Road No. 5, has a speed limit of 60km/h. As the proposed development is a Greenfield site, no obstructions currently exist. However, the design shall account for sufficient stopping sight distances from the exit driveway in accordance to AS 2890.1-2004 for both vehicles and pedestrians.

5.4 Service Bay Design

The design of the 73 service bays as per the designs provided to Cardno are confirmed to comply with the Australian Standards AS 2890.2-2009 and swept path analyses have confirmed B-double trucks are able to reverse into position..

6 Summary and Conclusions

Cardno was engaged by FDC Construction & Fitout Pty Ltd to perform a traffic impact and parking assessment in support of a development application for a proposed IKEA MFLU development in Sydney Business Park, Blacktown NSW. The proposed development was assessed in accordance with the Blacktown City Council DCP 2006 and the AS 2890 Series. The assessment outcomes are as follows:

> An investigation of the public transport available revealed several bus routes frequently passing through the subject site. However, the nearest train station require a lengthy bus ride (45 minutes) to reach, indicating a possible accessibility issue for those not travelling in a private vehicle. Bicycle routes have been proposed throughout the Sydney Business Park leading towards the existing bicycle routes on Richmond Road.

> A background review of previous traffic studies undertaken for the Marsden Park area revealed that the Richmond Road / South Street intersection is close to failure, with likely failure at or before year 2021. Subsequently, it was not modelled in this assessment as this intersection will be upgraded in the short to medium term. However, the development traffic will only travel through the Richmond Road / Townson Road Intersection and is therefore unlikely to cause the Richmond Road / South Street intersection to fail prematurely.

> The traffic analysis undertaken by GTA was used in estimating traffic flows for year 2027 (opening year + 10 years) by separating the development and base flows then scaling the flows up by the growth rate derived from RDS and AECOM data.

> Trip distribution was calculated using the AECOM Traffic and Transport Assessment. The number of trips generated by the development was obtained from discussions with FDC Construction & Fitout. Approximately 171 PCUs/hour for both inbound and outbound are expected to be generated from the proposed development during the Saturday peak hour period including the trips generated from both the office and warehouse components.

> Using the adjusted traffic flows, Richmond Road / Townson Road intersection was analysed using SIDRA Intersection 6.1. The performance assessment revealed that even in the worst case scenario of 2027 base plus development, the intersection performed at an acceptable LoS D.

> Employees at the proposed development will work in shifts and hence only 100 of the 200 employees will be on site at any one time. The proposed development provides a total of 262 car parking spaces on the provided design plans which, although is lower than the car parking rates required by the Blacktown DCP 2006, is more than sufficient to cater for all staff. Although bicycle and motorcycle parking is not required by the DCP or RMS, bicycle racks and motorcycle parking has been provided. This has the potential to promote active transport and more sustainable private transport.

> The number of provided service vehicle parking spaces has been confirmed to comply with the RMS Guidelines. An assessment of the car park designs shows that it has been designed to Australian Standard 2890 for both staff/visitor vehicles and service vehicles.

Although this traffic impact assessment has been exceptionally conservative, it has demonstrated that the subject intersection of Richmond Road / Townson Road will perform acceptably well up to and beyond the future year horizon of 2027, 10 years after the opening year.

The investigation of the public transport options also revealed a reasonable level of bus accessibility to the site. The site also consists of multiple proposed cycleways. Given these factors, and the results of the intersection analysis, it is clear that this development is sustainable in transport terms, with acceptable impacts on the local transport network.

Marsden Park Development

APPENDIX A

SIDRA OUTPUTS

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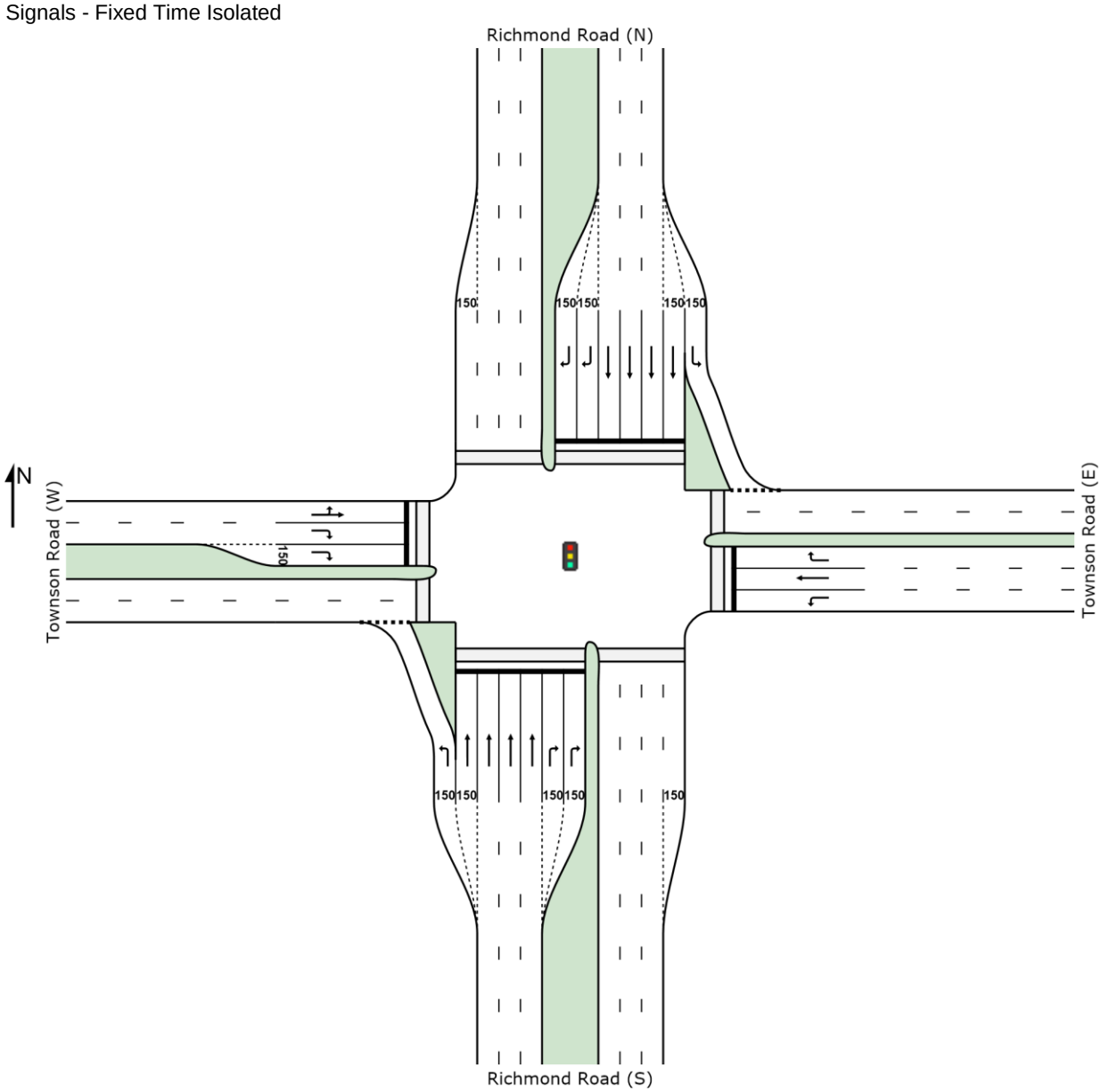
SITE LAYOUT

Site: Richmond Road / Townson Road

RichmondRoad/TownsonRoad
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 2027 SAT Base + Dev_Bulky Richmond Road / Townson Road

RichmondRoad/TownsonRoad
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Richmond Road (S)											
1	L2	451	0.0	0.497	14.5	LOS A	6.6	46.1	0.70	0.79	58.3
2	T1	1878	0.0	0.670	22.4	LOS B	16.1	112.8	0.88	0.77	53.8
3	R2	47	0.0	0.234	48.4	LOS D	0.9	6.6	0.97	0.71	37.9
Approach		2376	0.0	0.670	21.4	LOS B	16.1	112.8	0.85	0.77	54.1
East: Townson Road (E)											
4	L2	88	0.0	0.211	34.6	LOS C	2.8	19.9	0.85	0.76	43.8
5	T1	388	0.0	0.884	43.6	LOS D	17.9	125.6	1.00	1.04	41.4
6	R2	99	0.0	0.305	39.5	LOS C	3.5	24.3	0.91	0.77	42.2
Approach		575	0.0	0.884	41.5	LOS C	17.9	125.6	0.96	0.95	41.9
North: Richmond Road (N)											
7	L2	37	0.0	0.031	10.1	LOS A	0.4	2.5	0.35	0.66	62.5
8	T1	2442	0.0	0.871	32.2	LOS C	27.9	195.5	0.98	0.98	47.0
9	R2	210	0.0	0.907	68.5	LOS E	5.8	40.8	1.00	1.09	31.4
Approach		2689	0.0	0.907	34.7	LOS C	27.9	195.5	0.97	0.98	45.4
West: Townson Road (W)											
10	L2	58	0.0	0.911	55.4	LOS D	19.6	137.1	1.00	1.10	37.6
11	T1	339	0.0	0.911	48.4	LOS D	19.6	137.1	1.00	1.10	38.8
12	R2	571	0.0	0.878	53.0	LOS D	13.2	92.1	1.00	1.01	36.6
Approach		968	0.0	0.911	51.5	LOS D	19.6	137.1	1.00	1.05	37.4
All Vehicles		6608	0.0	0.911	33.0	LOS C	27.9	195.5	0.93	0.91	46.3

Level of Service (LOS) Method: Delay (RTA NSW).
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.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	South Full Crossing	50	30.7	LOS D	0.1	0.1	0.88	0.88
P2	East Full Crossing	50	26.5	LOS C	0.1	0.1	0.81	0.81
P3	North Full Crossing	50	30.7	LOS D	0.1	0.1	0.88	0.88
P4	West Full Crossing	50	26.5	LOS C	0.1	0.1	0.81	0.81
All Pedestrians		200	28.6	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

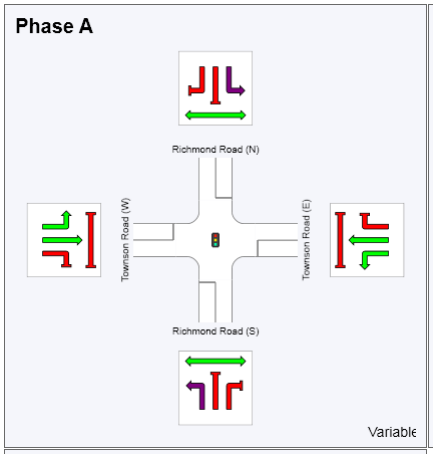
Site: 2027 SAT Base + Dev_Bulky Richmond Road / Townson Road

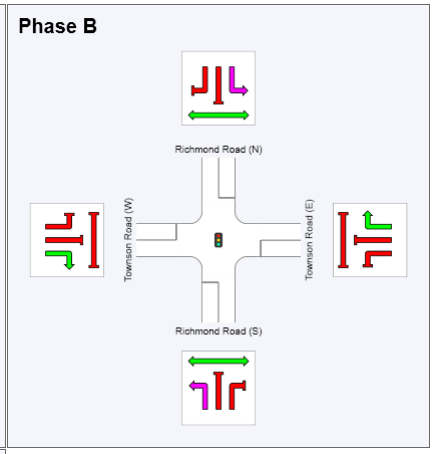
RichmondRoad/TownsonRoad
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)Variable Sequence Analysis applied. The results are given for the selected output sequence.

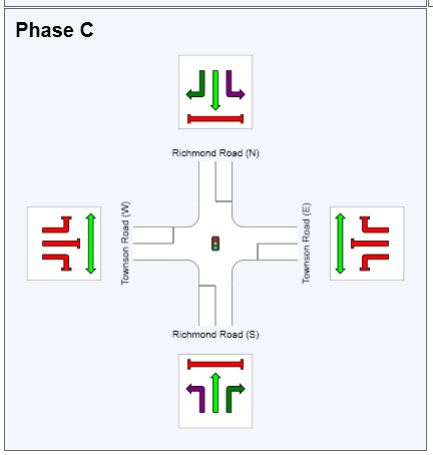
Phase times determined by the program
Sequence: Variable Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Reference Phase	No	Yes	No
Phase Change Time (sec)	56	0	20
Green Time (sec)	18	14	30
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	24	20	36
Phase Split	30 %	25 %	45 %







	Normal Movement		Permitted/Opposed
	Slip/Bypass-Lane Movement		Opposed Slip/Bypass-Lane
	Stopped Movement		Turn On Red
	Other Movement Class Running		Other Movement Class Stopped
	Mixed Running & Stopped Movement Classes		
	Undetected Movement		Phase Transition Applied

MOVEMENT SUMMARY

Site: 2027 SAT Base + Dev_Bulky + Dev_Indus Richmond Road / Townson Road

RichmondRoad/TownsonRoad
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Richmond Road (S)											
1	L2	525	0.0	0.629	16.8	LOS B	8.9	62.2	0.82	0.83	56.2
2	T1	1878	0.0	0.628	20.6	LOS B	15.4	108.0	0.85	0.74	55.2
3	R2	47	0.0	0.230	45.6	LOS D	0.9	6.4	0.94	0.73	39.0
Approach		2450	0.0	0.629	20.3	LOS B	15.4	108.0	0.84	0.76	55.0
East: Townson Road (E)											
4	L2	88	0.0	0.200	33.7	LOS C	2.8	19.6	0.84	0.76	44.3
5	T1	452	0.0	0.976	74.6	LOS F	28.9	202.3	1.00	1.33	30.8
6	R2	99	0.0	0.305	39.5	LOS C	3.5	24.3	0.91	0.77	42.2
Approach		639	0.0	0.976	63.6	LOS E	28.9	202.3	0.96	1.16	33.6
North: Richmond Road (N)											
7	L2	37	0.0	0.032	10.6	LOS A	0.4	2.7	0.36	0.66	61.9
8	T1	2442	0.0	0.817	26.1	LOS B	24.6	172.2	0.94	0.89	51.0
9	R2	244	0.0	1.015	142.5	LOS F	10.9	76.6	1.00	1.40	19.3
Approach		2723	0.0	1.015	36.3	LOS C	24.6	172.2	0.94	0.93	44.5
West: Townson Road (W)											
10	L2	69	0.0	1.018	122.9	LOS F	38.4	268.7	1.00	1.57	22.4
11	T1	399	0.0	1.018	115.9	LOS F	38.4	268.7	1.00	1.57	22.8
12	R2	671	0.0	1.032	142.1	LOS F	29.4	205.6	1.00	1.55	19.5
Approach		1139	0.0	1.032	131.8	LOS F	38.4	268.7	1.00	1.56	20.7
All Vehicles		6951	0.0	1.032	48.8	LOS D	38.4	268.7	0.92	0.99	38.6

Level of Service (LOS) Method: Delay (RTA NSW).
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.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	South Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89
P2	East Full Crossing	50	25.7	LOS C	0.1	0.1	0.80	0.80
P3	North Full Crossing	50	31.6	LOS D	0.1	0.1	0.89	0.89
P4	West Full Crossing	50	25.7	LOS C	0.1	0.1	0.80	0.80
All Pedestrians		200	28.6	LOS C			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

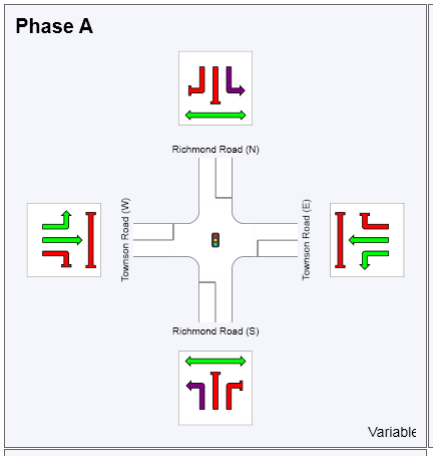
Site: 2027 SAT Base + Dev_Bulky + Dev_Indus Richmond Road / Townson Road

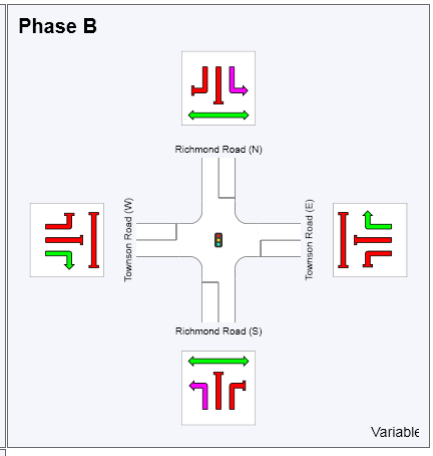
RichmondRoad/TownsonRoad
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)Variable Sequence Analysis applied. The results are given for the selected output sequence.

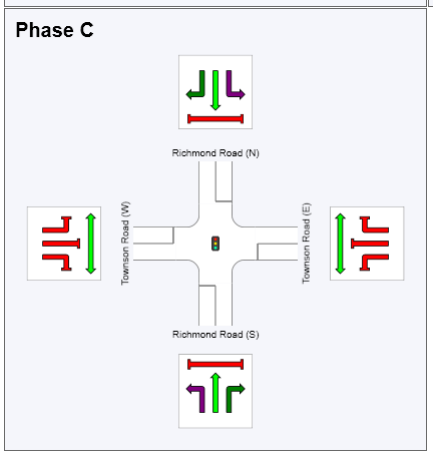
Phase times determined by the program
Sequence: Variable Phasing
Movement Class: All Movement Classes
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Reference Phase	No	No	Yes
Phase Change Time (sec)	37	61	0
Green Time (sec)	18	13	31
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	24	19	37
Phase Split	30 %	24 %	46 %







	Normal Movement		Permitted/Opposed
	Slip/Bypass-Lane Movement		Opposed Slip/Bypass-Lane
	Stopped Movement		Turn On Red
	Other Movement Class Running		Other Movement Class Stopped
	Mixed Running & Stopped Movement Classes		
	Undetected Movement		Phase Transition Applied

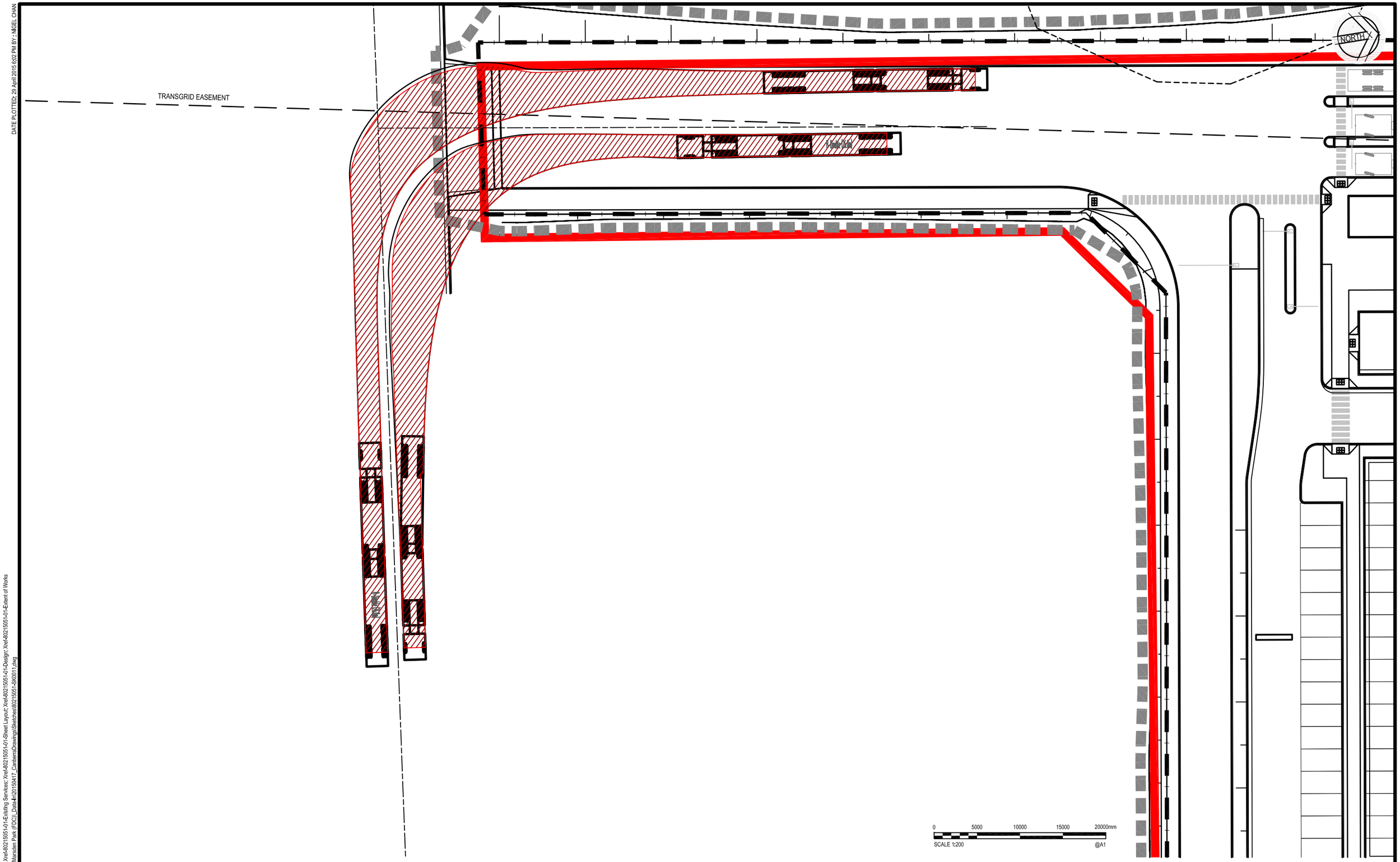
Marsden Park Development

APPENDIX B

SWEPT PATHS

DATE PLOTTED: 29 April 2015 6:02 PM BY: NIGEL CHAN

XREFs: Xref-80215051-01-Site Boundary; Xref-80215051-01-Existing Services; Xref-80215051-01-Sheet Layout; Xref-80215051-01-Design; Xref-80215051-01-Extent of Works
CAD File: N:\Projects\80\0PR\150055_IKEA Marsden Park (FDC)_Data\4-Prj\20150417_Canberra\Drawings\Sketches\80215051-SK0011.dwg



FDC

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St. Leonards, NSW 2065
Tel: 02 9496 7700 Fax: 02 9439 5170
Web: www.cardno.com.au

FDC BUILDING
IKEA MFLU
MARSDEN PARK
B-DOUBLE TURNING PATHS SKETCH PLAN 2/4

Datum	Date	Scale	Size
AHD	MARCH 15	1:200	A1

Drawing Number	Revision
80215051-SK012	1

DATE PLOTTED: 29 April 2015 6:01 PM BY : NIGEL CHAN

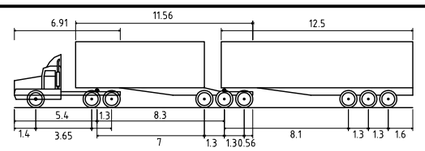
NORTH

TRANSGRID EASEMENT

1.

0 5000 10000 15000 20000mm

SCALE 1:200 @A1



B-Double (26.0m)	
Overall Length	26.000M
Overall Width	2.500M
Overall Body Height	4.300M
Min Body Ground Clearance	0.540M
Track Width	2.500M
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	15.000M

FDC

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FDC BUILDING
IKEA MFLU
MARSDEN PARK
B-DOUBLE TURNING PATHS SKETCH PLAN 1/4

Datum	Date	Scale	Size
AHD	MARCH 15	1:200	A1

Drawing Number	Revision
80215051-SK011	1

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