Prepared for

CADENCE

Development Application - Traffic Impact Assessment

Proposed Warehouse Development
128 Andrews Road, Penrith

Ref: 0670r02v2
1/11/2018

Info@asongroup.com.au | +61 2 9083 6601 | Suite 1202, Level 12, 220 George Street. Sydney, NSW 2000

Document Control

Project No: 0670r02v2

Project: 128 Andrews Road, Penrith

Client: Cadence

File Reference: 0670r02v2 DA TIA_ 128 Andrews Rd, Penrith (final)

Revision History

Revision	Date	Details	Author	Approved by
-	21/09/2018	Draft	A. Rasouli	T. Lewis
1	30/10/2018	Issue I	A. Rasouli	T. Lewis
2	01/11/2018	Issue II	A. Rasouli	A. Rasouli

Table of Contents

Appendices

1 Introduction

1.1 Overview

Ason Group has been commissioned by Cadence to prepare a Traffic Impact Assessment (TIA) for a proposed warehouse development at 128 Andrews Road, Penrith (the Site). The proposal consists of a large format warehouse development with a total Gross Floor Area (GFA) of 50,150 m^2, associated car parking spaces and on-site loading facilities (the Proposal) which will be accessed via an existing Right of Carriageway (RoW) easement to Andrews Road. The Site is located within the Penrith City Council (PCC) local government area (LGA); the Proposal is therefore subject to that council's controls.

A location plan is presented in **Figure 1** to demonstrate the extent of the Site in relation to the existing road network in this immediate vicinity.

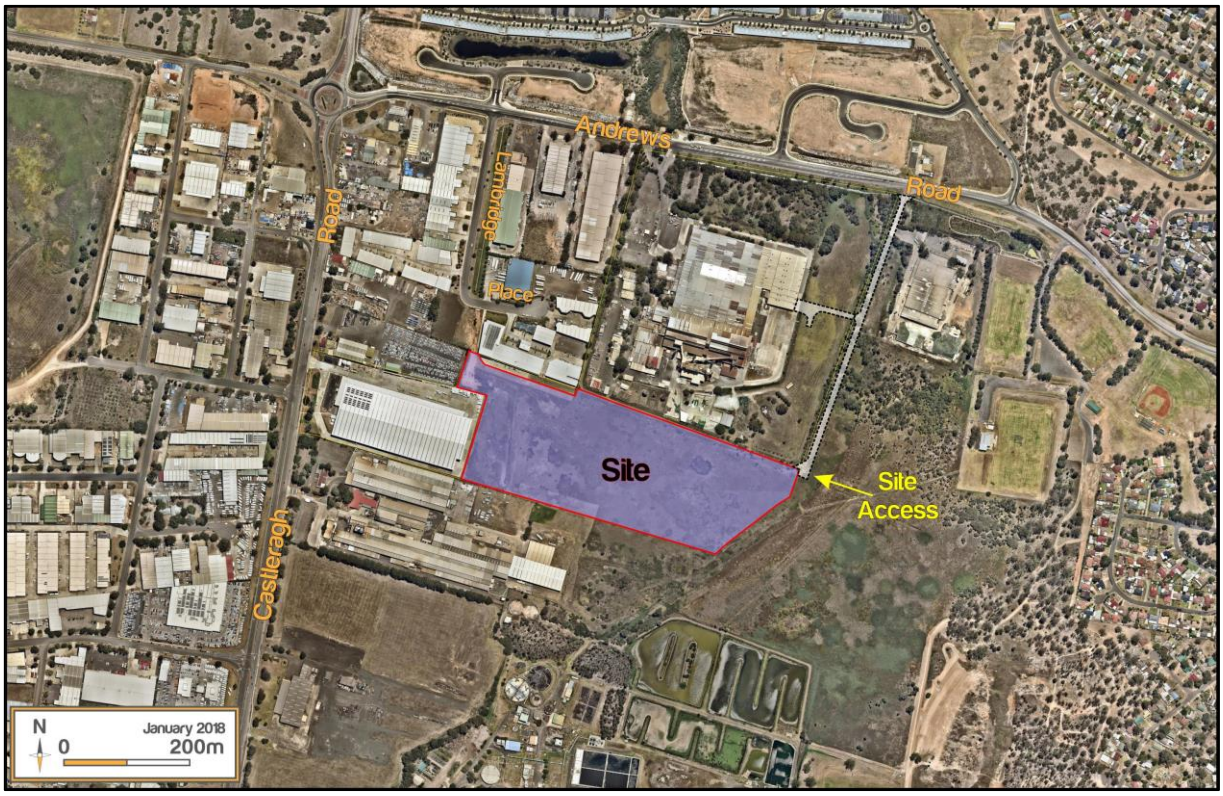


Figure 1: Location Plan

As the site will be accessed via Andrews Road – a Classified Road – as the only feasible site frontage road for the Lot; the development will require formal referral to Roads and Maritime Services (RMS) under the provision of *SEPP (Infrastructure) 2007*.

This TIA report provides an assessment of the relevant traffic, transport and parking implications of the Proposal.

1.2 Consultation with Authorities

A pre-DA meeting was held with Penrith City Council officers on 30 August 2018 in which Council outlined a number of requirements. These are broadly summarised as a requirement for a "*traffic, access and parking assessment*" to be provided which includes assessment of:

- the following intersections to be assessed using SIDRA to ensure any proposed access treatments accommodate traffic growth to at least 10 years in the future:
  - Andrews Road / site access driveway, and
  - Castlereagh Road / new road.

    (NOTE: no access to the Castlereagh Road is proposed as part of this subject Development Application and, accordingly, this assessment is not required)
- An assessment of the Site access and internal circulation arrangements in accordance with AS2890.
- Parking provisions, including both car and bicycle parking provisions. Any departure from the nominal rates is to be supported by assessment of similar existing developments, such as those in Erskine Park Industrial Area.

Subsequently, discussions were held with RMS, noting that formal referral to the RMS is required post-submission under the requirements of *SEPP (Infrastructure) 2007*. In addition to assessment of the Andrews Road / site access driveway – required by Council above – RMS also requested details of increased traffic volumes at other nearby intersection of Andrews Road with The Northern Road and Castlereagh Road.

Separately, RMS has also provided future projected 2026 / 2036 growth factors – from its EMME strategic models - along Andrews Road to assist in future-year assessment of the site access driveway.

1.3 Study Objectives

The key objective of this study is to address Council's traffic and parking requirements above.

- Assess the impact of development traffic on the surrounding road network. In accordance with the above, this is to include the following scenarios:
  - Existing (surveyed 2018),
  - Existing + Development,
  - Future (2028 volumes), and
  - Future + Development.

- Review the internal design of the development, including car parking and on-site loading areas. Plans with regard to the external Andrews Road intersection treatment are being prepared separately by Costin Roe, with input from the above modelling.
- Review and assess the proposed parking demand and supply as part of the Proposal.

1.4 References

In preparing this TIA, Ason Group has referenced key planning documents, these include Penrith City Council Development Control Plan (2014).

This TIA also references general access, traffic and parking guidelines, including:

- Roads and Maritime Services, *Guide to Traffic Generating Developments* (RMS Guide)
- Roads and Maritime Services, *Technical Direction – TDT 2013/04a*, August 2013
- Australian Standard 2890.1: Parking Facilities – Off Street Car Parking (AS 2890.1)
- Australian Standard 2890.2: Parking Facilities – Off-street commercial vehicle facilities (AS 2890.2)

1.5 Report Structure

The report is structured as follows:

- Section 2 provides a summary of the proposed development.
- Section 3 describes the existing site conditions and land-uses.
- Section 4 describes the existing and planned public transport, pedestrian and cycling links.
- Section 5 discusses the potential future regional upgrades in the vicinity of the Site.
- Section 6 assesses the traffic impacts of the development including the Site's projected trip generation and forecasted network performance.
- Section 7 provides summary of the parking requirements based on different Controls.
- Section 8 discusses the site access and internal design of the development.
- Section 9 provides a summary of the key conclusions.

2 Overview of Proposal

2.1 Summary of Proposed Development

A detailed description of the Proposal is provided within the Statement of Environmental Effects prepared separately by Willowtree Planning. The following summarises key aspects of the Proposal as they relate to traffic and parking considerations:

- 50,150m^2 GFA warehouse building, including:
  - 50,000m^2 warehouse area, and
  - 150m^2 ancillary office area.
- Provision of 98 car parking spaces, including 2 accessible bays.
- Provision of a total of 12 loading docks, including 2 recessed docks. Operationally it is expected that roller shutter doors (RSD) along the south side of the building will be used for side-loading.
- Vehicular access from Andrews Road (refer below section for further information).

Reference should be made to the plans prepared by Watson Young which are submitted separately. A reduced copy of the locality plan is reproduced at a reduced scale for context in **Figure 2**.

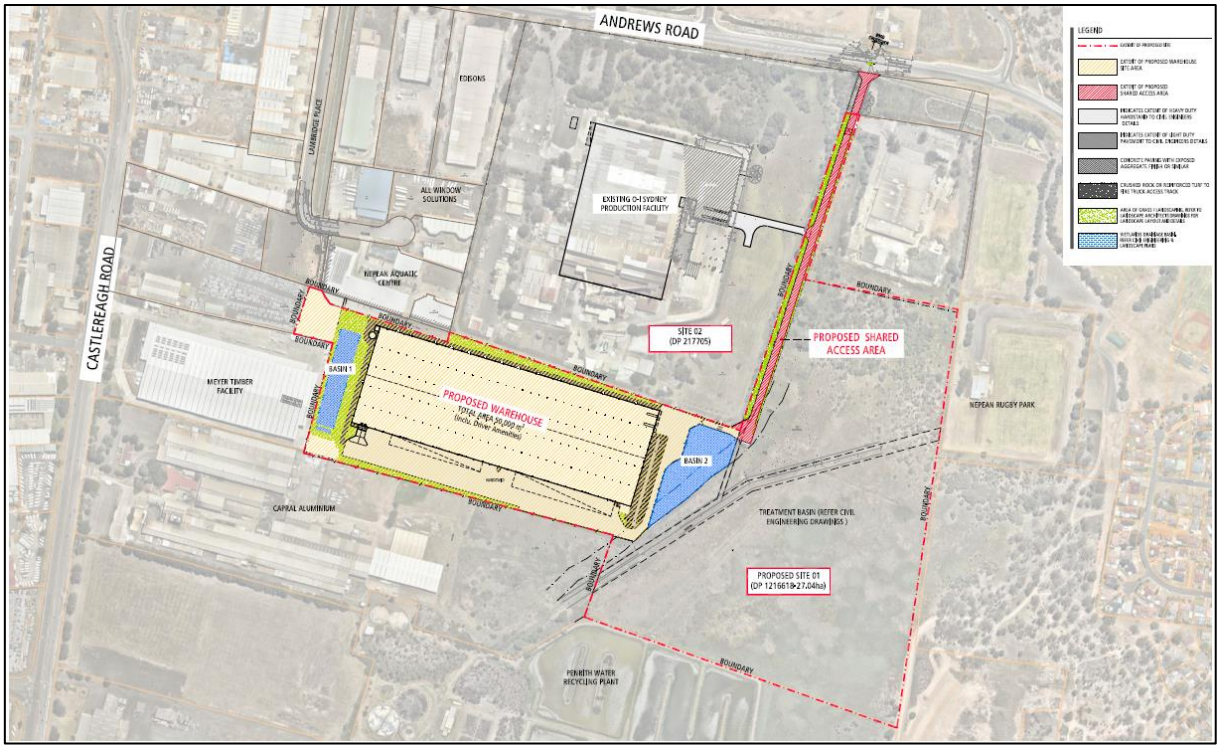


Figure 2: Proposed Locality Plan

2.2 Proposed Access Arrangement

The Proposal will be accessed via the existing full movement access crossover from Andrews Road – via an existing RoW over Lot 3 DP 747153 - with additional design measures to improve the vehicular movements as follows:

- Dedicated right and left turn bay on Andrews Road, and
- Median storage and short acceleration lane on Andrews Road to provide opportunities for 2 stage right turn from the access to Andrews Road eastbound.

Reference should be made to the Functional Layout Plan Andrews Road Intersection prepared by Costin Roe Consulting (the project civil engineer) which is attached in **Appendix A**. It is noteworthy to mention that a similar arrangement is provided at the intersection of Andrews Road / Lambridge Place, to the west of this access.

2.3 Proposed Tenant's Specific Operational Information

According to the advice provided to Ason Group the future tenant for this Site will have the following operational characteristics:

- 24/7 operations,
- A total of up to 30 staff at any one time.
- Anticipated DAILY truck movements are as outlined in **Table 1** below:

Table 1: Anticipated Daily Truck Movements

Description	Current Operation	Vehicle type	Daily Movements
INBOUND MOVEMENT TO NEW WAREHOUSE AT 128 ANDREWS ROAD			
Interstate transfers	24 hrs x 7 days	B-doubles	2
Containers	24 hrs x 7 days	40' shipping container	1 to 3
Packaging loads	na	na	0
Total Inbound	**na**	**na**	**3 to 5**
OUTBOUND MOVEMENT FROM NEW WAREHOUSE AT 128 ANDREWS ROAD			
Transit lane	24 hrs x 7 days	B-doubles	12
		Various	6
Customer orders	24 hrs x 6 days	48' single	30 to 45
Containers	24 hrs x 7 days	40' shipping container	1 to 3
Total Outbound	**na**	**na**	**48 to 63**

According to the above, it noted that:

- **Conservatively**, it is estimated that the total inbound and outbound movements will involve up to 68 trucks per day.
- Assuming no back-loading, again a **conservative** assumption, this equates to total of a total of 136 daily truck movements per day (68 in, 68 out).

3 Existing Conditions

3.1 Site & Location

The Site is located at 128 Andrews Road, Penrith and is legally known as Lot 20 DP1216618. A site location figure is presented in **Figure 3** providing the context of the site in the broader road network.

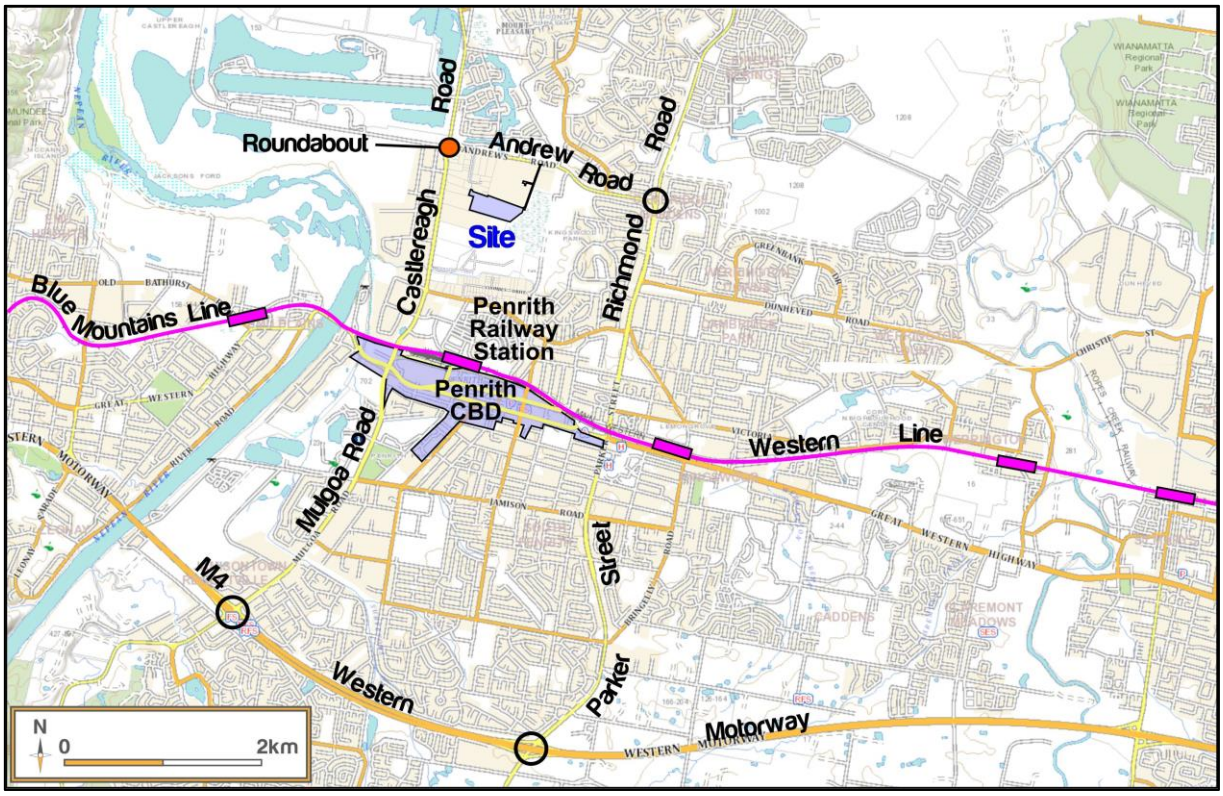


Figure 3: Site Location (in a broader context)

3.1.1 Existing Land Use

The Site zoned IN1 General Industrial under the *Penrith Local Environmental Plan 2010* (LEP).

It is currently vacant and undeveloped land.

3.1.2 Existing Site Generation

Having regard for the above, the Site does not generate any material traffic and, as such, any additional traffic resulting from the development would be considered a net increase of traffic on the surrounding road network.

3.2 Road Hierarchy

The hierarchy of the roads in the vicinity of the Site are shown in **Figure 4.**

- **Andrews Road –** in this general vicinity is a two-way road which operates under a sign posted speed limit of 70 km/hr. Andrews Road runs east-west between Richmond Road and Castlereagh Road in this vicinity and will be the primary major corridor to cater for the proposed development traffic.

  According to traffic surveys undertaken by Ason Group on 6th of September 2018, it is established that the critical (one-hour) morning peak on Andrews Road occurs between 7:45 - 8.45AM with a total (two-way) traffic flow of approximately 1,100 vhe/hr. The evening peak is also recorded to occur between 4:15 to 5:15PM with a total (two-way) traffic flow of about 1,220 veh/hr.

- **Right of Carriageway (RoW)** – the Site is benefited by an existing 18 metre wide easement which is created over DP 747153 and will provide access for the Site and other existing Lots including Lot 3 In DP747153 (Council owned land) and Lot 1 In DP747153. Traffic surveys undertaken at the Andrews Road access during the morning and evening peak hours confirm a total of 12 and 13 veh/hr during AM and PM peak hours, respectively. This can be translated into a daily traffic volume of less than 200 veh/day at this RoW easement.

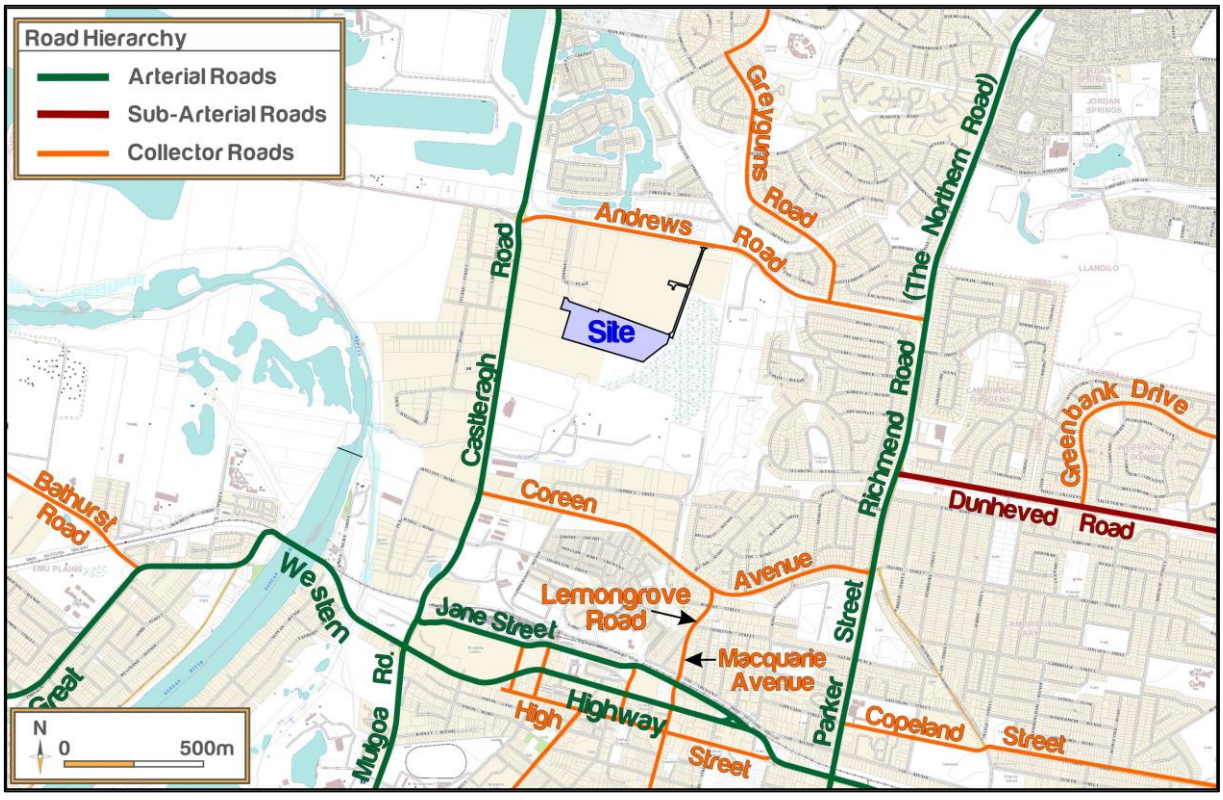


Figure 4: Road Hierarchy

3.3 Restricted Access Vehicle (RAV) Classification

Andrews Road, Castlereagh Road and Richmond Road in this area are designated as approved 25/26 metres B-Double routes, as demonstrated by the relevant RMS Restricted Access Vehicle mapping; an extract of which is included in **Figure 5**.

Figure 5: RAV MAP

3.4 Existing Intersection

The existing access crossover provides full turning movements to Andrews Road. It forms an offset intersection – by approximately 10 metres (centre to centre) – with an existing development access driveway to the electrical substation at 125 Andrews Road. The existing access is currently unpaved and does not provide formal turning facilities from Andrews Road.

This access is located approximately 700 metres to the east of Lambridge Place and 170 metres to the west of Laycock Street intersections and currently services number of other existing developments as shown in **Figure 6**.

Weekday morning and evening peak hourly traffic profiles – based on recent surveys - at this access are shown in **Figure 7** below. It is noted that nil traffic was observed using the substation driveway on the northern side of the intersection during peak periods.

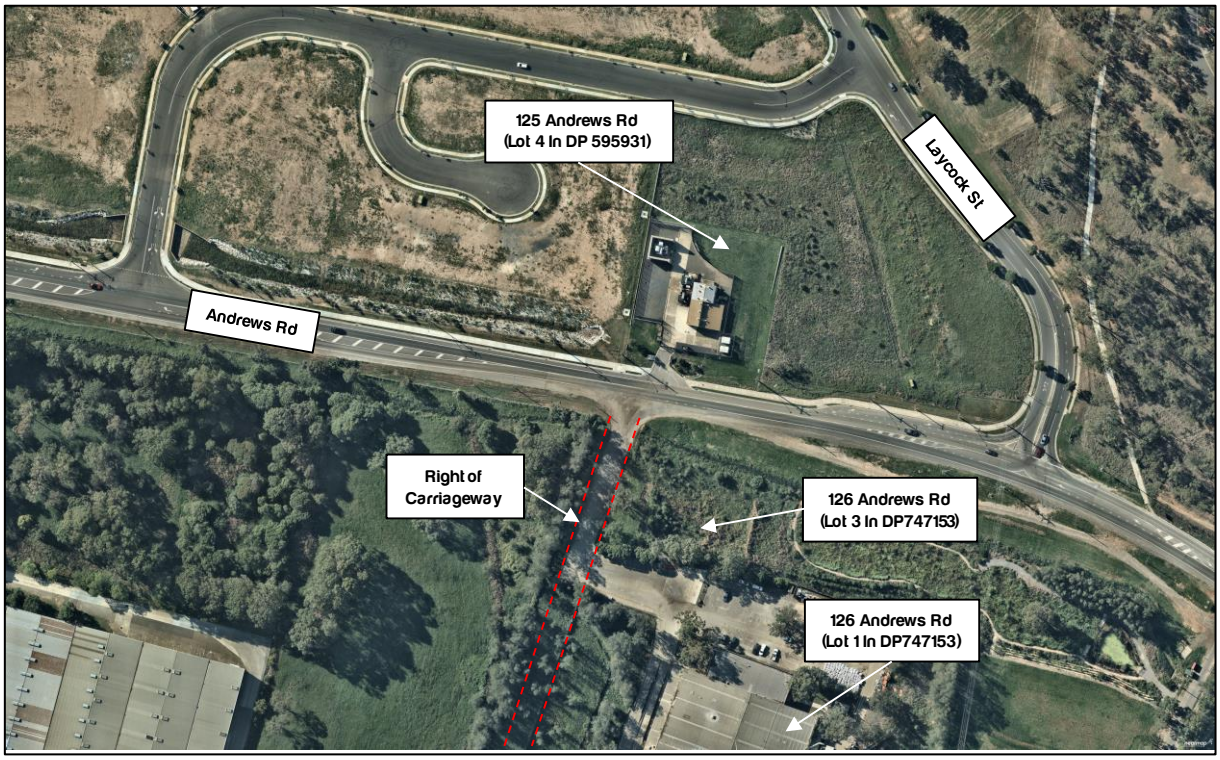


Figure 6: Andrews Road Existing Access Crossover

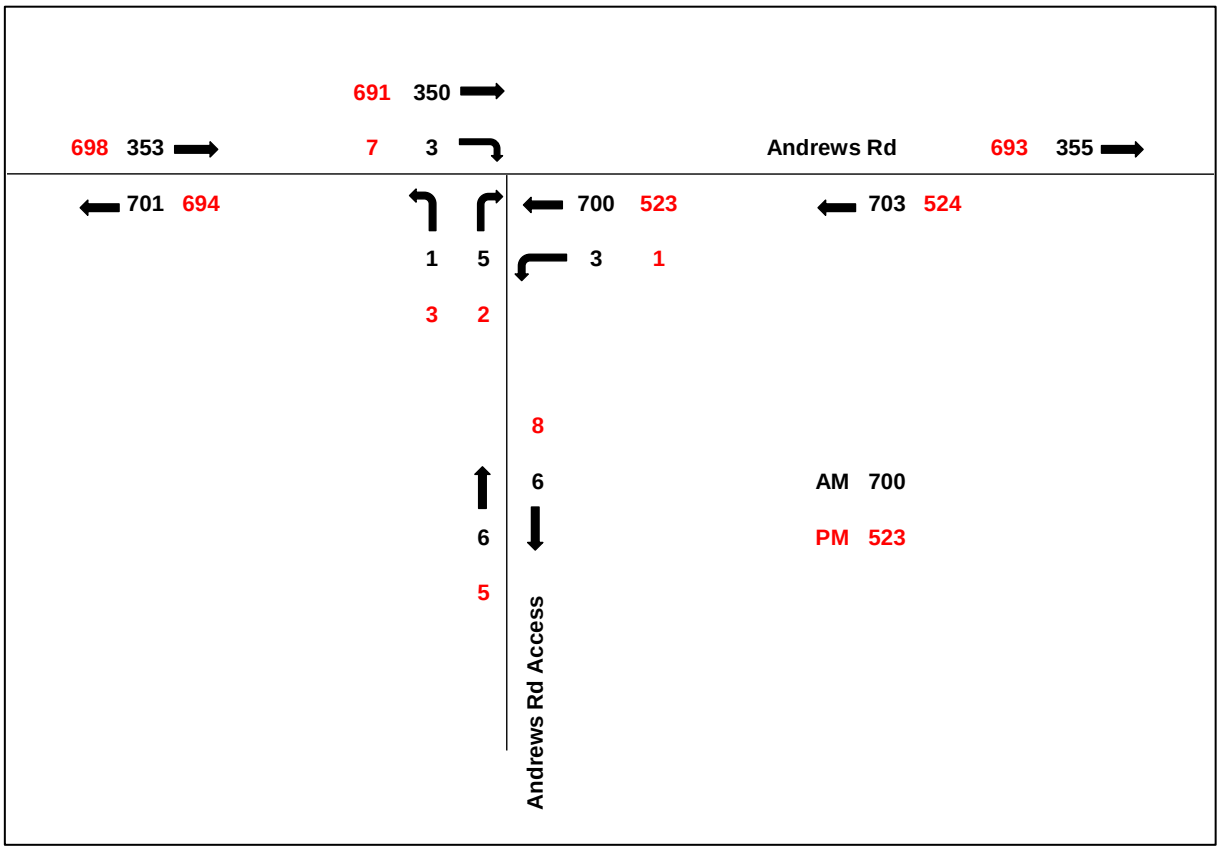


Figure 7: AM and PM Peak Hour Traffic Profile

3.4.1 Baseline SIDRA Performance Testing

The performance of the of the Andrews Road access has been analysed using the SIDRA computer program. SIDRA modelling outputs a range of performance measures, in particular:

- *Average Vehicle Delay (AVD)* – The AVD (or average delay per vehicle in seconds) for intersections also provides a measure of the operational performance of an intersection and is used to determine an intersection's Level of Service (see below). For signalised intersections, the AVD reported relates to the average of all vehicle movements through the intersection. For priority (Give Way, Stop & Roundabout controlled) intersections, the AVD reported is that for the movement with the highest AVD.
- *Level of Service (LOS)* – This is a comparative measure that provides an indication of the operating performance, based on AVD.

The following table provides a recommended baseline for assessment as per the RMS Guide:

Table 2 : RMS Level of Service Summary

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.

The existing Andrews Road access performance under the existing year 2018 "baseline" scenario is provided in below **Table 3**.

Table 3: Local Network Performance – Existing Baseline Scenario

Intersection	Period	Intersection Delay	Level of Service
Andrews Road Access	AM	26.3 (0.4)	B
	PM	15.5 (0.2)	B

Notes: 1) The figures in bracket () presents the overall average intersection delays.

2) Having regard for the absence of traffic using the northern leg of this intersection, the access has been modelled as a full movement T-intersection in SIDRA.

The analysis indicates that Andrews Road access operates satisfactorily under the baseline scenario with a LoS 'B' during both AM and PM peak hour periods with minimal delays and significant spare capacity.

Relevant SIDRA outputs for baseline scenario are included in **Appendix B**.

4 Public Transport, Cycling and Pedestrian Access

4.1 Railway Services

The Site is not located within 800 metres of any train stations. However, bus services – discussed below - provide connectivity for the Site to/from Penrith Train Station, providing access to the rail network serving the wider metropolitan area.

4.2 Bus Services

Three bus routes traversing Andrews Road and Castlereagh Road currently service the subject site. Details of the available bus services are shown in **Figure 8** and briefly discussed in below:

- Bus service 673 traversing along Andrews Road provides connections and accessibility for the Site to/from Penrith and other surrounding suburbs to the south and Windsor to the north.
- Bus Service 783 provides connection to Jordan Springs.
- Bus Service 784 provides connections to wider Cranebrook area.

4.3 Existing Pedestrian Accessibility

Pedestrian footpaths are currently provided along northern verge of Andrews Road in this vicinity. The southern verge (immediately adjacent to the Site) does not currently include concrete pedestrian footpaths, however grass verge is provided at the moment and it is expected that by further development of this area – or potentially as part of future RMS works - the southern verge may also be redeveloped to a same standard as the northern verge with pedestrian footpaths.

4.4 Existing Cycle Routes

With reference to **Figure 8,** off-road shared paths are provided along Andrews Road to the north and Castlereagh Road to the west of the Site. Furthermore, Castlereagh Road to the north of its roundabout intersection with Andrews Road provides on-road cycle routes.

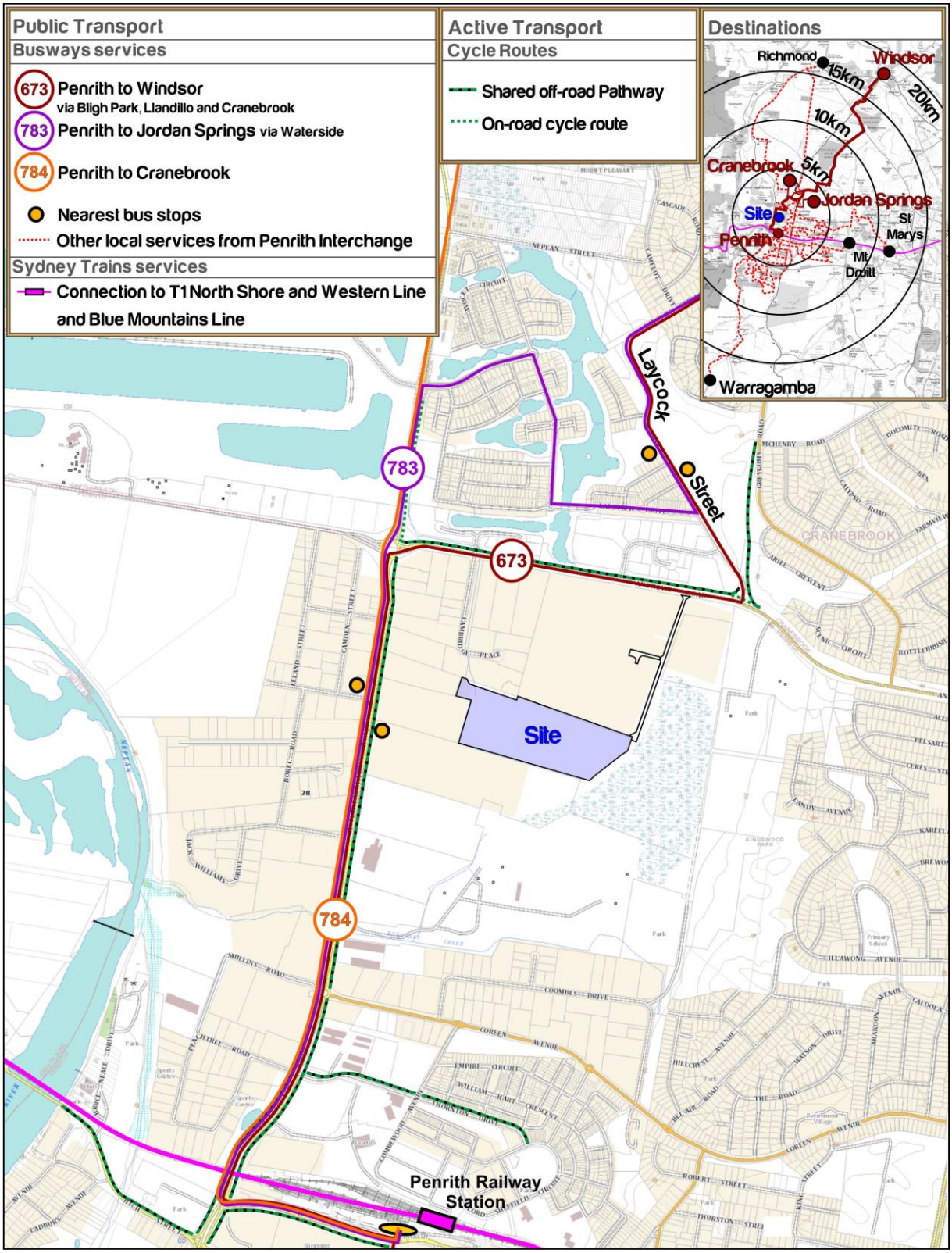


Figure 8: Public Transport Network

5 Future Context (Without Proposal)

The RMS, *Mulgoa Road / Castlereagh Road Corridor Upgrade (Preferred Option Report), revision 4*, dated April 2017, identifies that the government is planning to widen and upgrade 6.5 kilometres of Mulgoa Road / Castlereagh Road between Glenmore Parkway, Glenmore Park and Andrews Road in Penrith LGA to support the current and future traffic demands and expected traffic growth in the area.

The above study has been undertaken in 5 sections as outlined in Figure 9 and summarised as follows:

- Section A – Glenmore Parkway to M4 Interchange,
- Section B – M4 Interchange to Preston Street,
- Section C – Preston Street to Union Road,
- Section D – Museum Drive to Jack William Drive,
- Section E – Jack William Drive to Andrews Road.

It is understood that the Castlereagh Road in this vicinity would be upgraded to three-lanes in each direction; with a signalised intersection to be provided at Andrews Road. A copy of the regional upgrade layout is presented in **Figure 10**.

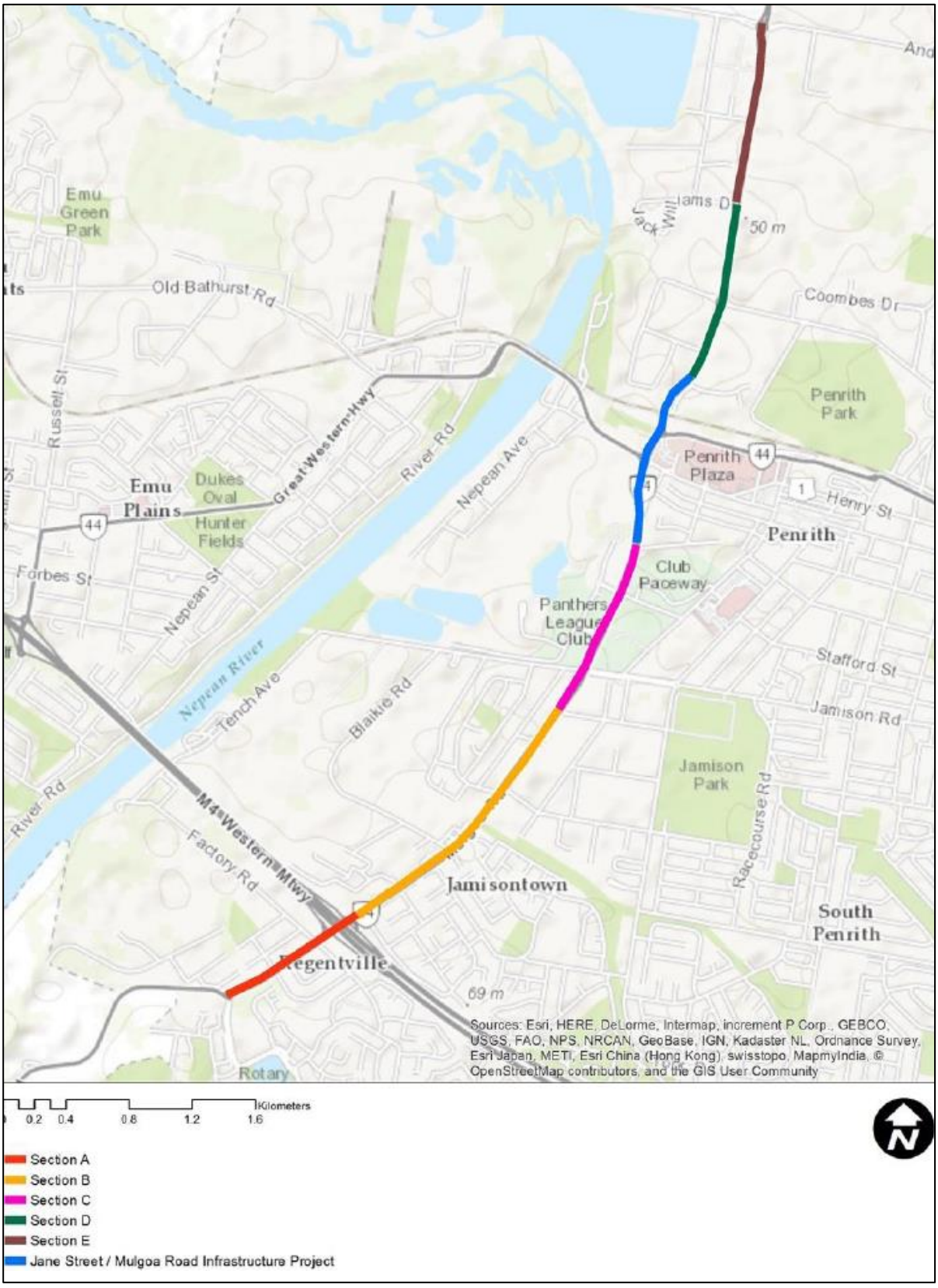


Figure 9: Corridor Widening – Proposal Sections (Sourced from *Preferred Option Report*)

Figure 10: Section E Strategic Concept Design (Sourced from *Preferred Option Report*)

6 Traffic Assessment

6.1 Traffic Generation

6.1.1 Standard Use Assessment

The traffic generation rates adopted for the large format industrial development on the Site are estimated having regard for the rates related to the *vehicle- trips during adjacent road* AM and PM peak periods for the following three (3) industrial sites included in Appendix E of the RMS Technical Direction TDT 2013/04a. It is noteworthy that the following three sites are the only references for Sydney Area which are predominantly for warehousing and therefore similar in nature to the proposed building.

- Site 1: Erskine Park Industrial Estate, Erskine Park;
- Site 3: Wonderland Business Park, Eastern Creek; and
- Site 4: Riverwood Business Park, Riverwood.

Accordingly, the average AM and PM peak hour trip rates are as follows:

- AM Rate 0.247 trip per 100m^2 of GFA.
- PM Rate 0.182 trip per 100m^2 of GFA.

Furthermore, Ason Group has recently conducted a 7-day tube count survey at a large format industrial area in Penrith LGA to further confirm the actual traffic generation of such developments. The analysis undertaken on the actual survey data suggests the following AM and PM peak hour rates:

- AM Rate 0.155 trip per 100m^2 of GFA.
- PM Rate 0.238 trip per 100m^2 of GFA.

Comparing the RMS rates and the actual survey results and for the purpose of a robust assessment this TIA adopts the following trip rates:

- AM & PM Rates 0.25 trip per 100m^2 of GFA

Having regard for the above traffic rates a standard large format industrial area would **conservatively** be expected to generate the following vehicular traffic volumes as summarised in **Table 4**.

Table 4: Summary of Future Development Traffic

Land-use	GFA (m^2)	AM Peak (veh/hr)	PM Peak (veh/hr)
Warehouse Development	50,150	125	125

According to the above the hourly traffic generation of the Site, based on a generic / standard use, could **conservatively** be assessed as 125 veh/hr during the road network AM and PM peak hours. It is noted that the above estimated traffic figures include both entry and exit movements.

It is emphasised that this traffic generation would relate to a potential future user and further discussion with regard to the future tenant operations and associated traffic generation is provided below.

6.1.2 Tennant-Specific Traffic Generation

Having regard for the proposed tenant's operational information detailed in Section 2.3, the following operational traffic generation is anticipated for the Site:

- **Commercial Vehicles**: future development is expected to generate in the order of 136 vehicle movements per day as discussed before. Of these, it is expected that roughly 8% of all movements will occur during the peak hours equating to approximately 11 trucks (combined IN and OUT).
- **Light Vehicle Movements**: It is **conservatively** assumed that all 30 staff would attend the Site using private vehicles and during AM and PM peak hours. In practice, these arrivals would be expected to occur over a longer period of time and unlikely to occur in any single one-hour period. Nevertheless, a vehicular generation of 30 veh/hr has **conservatively** been adopted for the purposes of this assessment.

Accordingly, the total site-specific traffic generation is **conservatively** estimated to be 41 veh/hr which is significantly (81 veh/hr) less than the theoretical traffic generation estimation should another more standard user operate out of the warehouse at some point in the future.

6.2 Traffic Distribution

The adopted traffic distribution for the Proposal is based on the following inbound / outbound percentage split assumption for the morning and evening peak hours:

- Morning Peak: 70% inbound / 30% outbound, and
- Evening Peak: 30% inbound / 70% outbound.

6.3 Traffic Assignment

The traffic assignment exercise has been undertaken having regard for the anticipated catchment of the area, existing traffic pattern on Andrews Road during AM and PM peak periods, identified key traffic routes and most importantly having regard for the existing warehouse development traffic at Lot 1.

Accordingly, the anticipated traffic movements associated with the proposed proposal (based on tenant-specific operational details) during AM and PM peak hours is shown in **Figure 11**.

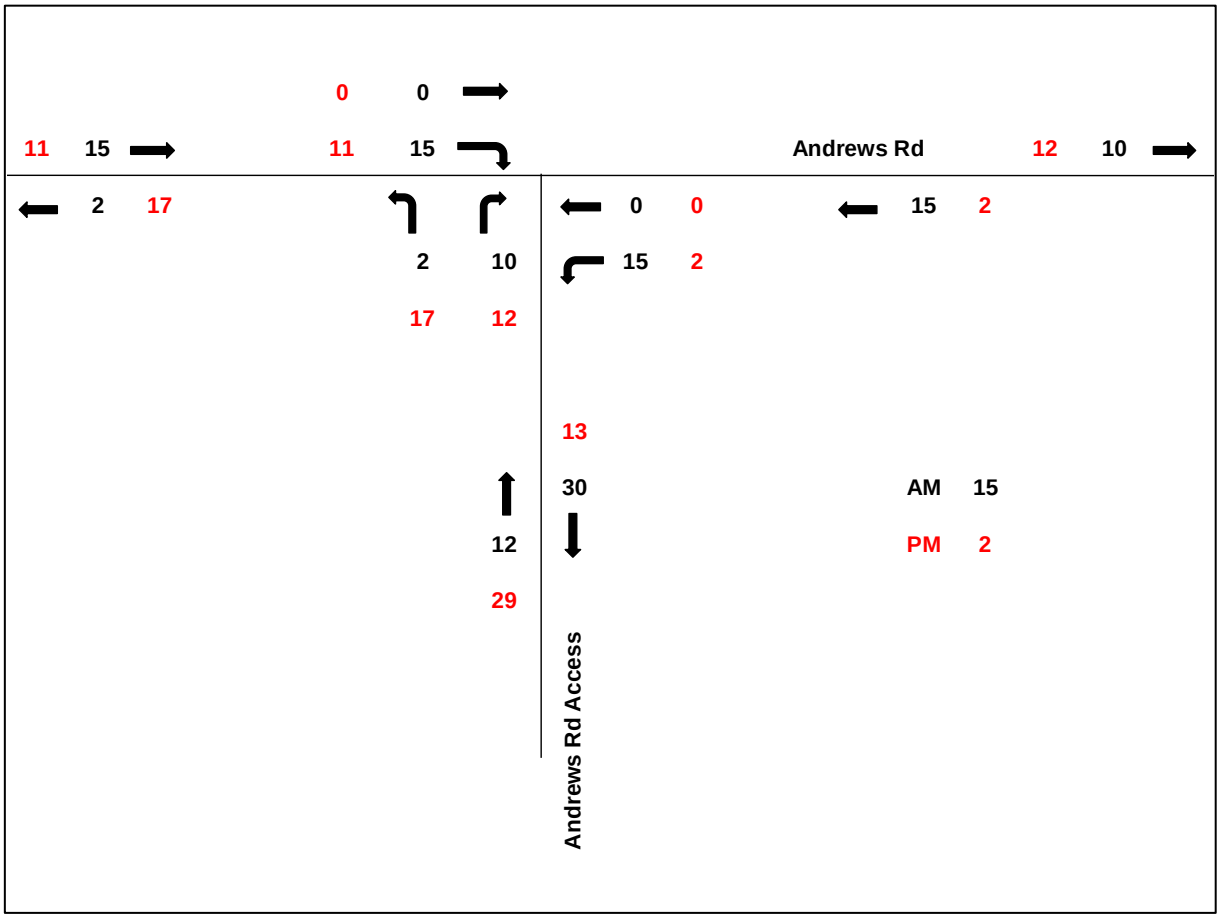


Figure 11: Proposed Development Traffic Profile – AM and PM Peak Hours

As can be seen in the above, the maximum additional traffic volumes associated with the Proposal on Andrews Road / The Northern Road intersection is only 15 veh/hr in any one direction. Noting that this comprises vehicles arriving from both north and south along The Northern Road; increased volumes on any one movement would be even lower. Similarly, the maximum additional volumes towards Andrews Road / Castlereagh Road is approximately 17 veh/hr. These are a relatively minor increase in turning movements at these intersection, particularly in the context of background traffic volumes.

Accordingly, the proposal is expected to have no material impacts on the operation of these intersections and hence no need for any further detailed traffic modelling. Accordingly, the scope of modelling included in this assessment is limited to the Andrews Road / site access driveway.

6.4 Traffic Impacts

6.4.1 Post Development Scenario

The impact of the proposed development on Andrews Road access have been assessed as a net increase over and above the existing traffic volumes and the results of this analysis are summarised in **Table 5**. SIDRA Network software has been used to model the proposed median storage and the nature of the two-stage right turn out movement from the access into Andrews Road eastbound (refer Appendix B for the Network Layout and SIDRA results). It is noted that this intersection analysis adopts the more **conservative** traffic generation of 125 veh/hr from above to ensure the access designed to accommodate not just the proposed tenant but also provide a reasonable capacity for potential future users.

Table 5 : Local Network Performance

Intersection	Scenario	Period	Intersection Delay	Level of Service
Andrews Road Access	Existing Baseline	AM	26.3 (0.4)	B
		PM	15.5 (0.2)	B
	Existing + Development	AM	30.2 (3.0)	C
		PM	17.0 (2.6)	B

Note: 1) The figures in bracket () show the average intersection delays.

The SIDRA Network analysis indicates that the access arrangements proposed at the Andrews Road access can comfortably accommodate development traffic volumes under short-term conditions (existing plus development).

Accordingly, this situation suggests that the operation of the proposed access (with median storage and right / left turn bays) is supported in terms of intersection capacity.

It is acknowledged that larger heavy vehicles (i.e. B-Doubles) may not have the benefit of using the median storage to make a two-stage right turn and as such they would likely wait for suitable gaps to

turn right in a single sweep (single-stage right turn). In this instance this TIA offers the following arguments for the B-Double movements:

- From the operational assumptions it is expected that the proposed end-user would only require 28 B-Double movements per day which is distributed throughout the day. Therefore, this occurrence would occur relatively infrequently during peak periods,
- To assess the operation of the access the SIDRA analysis has also been undertaken having regard for a single-stage right turn (as per the existing access configuration). The results of the SIDRA analysis for this option (Existing + Development) with the existing access configuration is also attached in Appendix B which confirm good operational performance with LoS "C" and "B" during the AM and PM peak hours. Average delays are increased when comparing to the scenario with two-stage right turn model but remain within acceptable limits, and
- Accordingly, it can be concluded that the Andrews Road access can accommodate the proposed development traffic with minimal operational issues.

In summary, the proposed access design will improve the vehicular movements at this access while still maintaining the existing full movement nature of this access.

It is however noted that the proposed access strategy will restrict the access to Lot 4 DP 595931 (to the north of Andrews Road) to LI/LO. However, as it relates to traffic movements, Ason Group has conducted morning and evening peak hour traffic surveys at this access and established that negligible vehicular movements occur at this access; hence maintaining that full-movement access is not necessarily required and restriction to LI/LO would not have any unacceptable impacts on Lot 4. Furthermore, the newly constructed road (Renshaw Street) between Laycock Street and Andrews Road can provide alternative route to access / depart Lot 4.

6.4.2 10-Years Post Development Traffic Impact

The adopted Background traffic growth factors for Andrews Road have been obtained from RMS strategic EMME modelling outputs to inform this future baseline scenario. It is noteworthy that these growth factor projections (from RMS strategic modelling) are an indication of future possibilities – based on a variety of land-use and employment assumptions - that may or may not eventuate. Furthermore, these future year projections may already include some level of development uplift on the subject site which could result in some level of 'double counting'.

In order to establish the operational impact of the Proposal, the SIDRA modelling has also been undertaken for the 10 Years post development (Year 2028) scenario, with relevant SIDRA results attached in Appendix B.

The 10-Years post development analysis have been undertaken for two scenarios as follows:

- Assuming the tenant-specific traffic generation, and
- Assuming a larger format industrial development.

6.4.2.1 Tenant Specific Traffic Generation

The analysis undertaken for the "Future Baseline + Development" scenario having regard for the tenant-specific traffic generation suggests that the proposed access will operate satisfactorily with minimum queues and significant spare capacity. The SIDRA results confirm respective level of service 'D' and 'C' during the AM and PM peak hours for this scenario.

6.4.2.2 Large Format Industrial Development Traffic Generation

The analysis undertaken for the "Future Baseline + Development" scenario having regard for this scenario indicates that the right turn entry movement from Andrews Road eastbound into the access will continue to operate at a LoS "C" and "B" during AM and PM peak hours and therefore it will not have any operational issues even considering 10 years background traffic growth. It is noted that the SIDRA results report larger delays (LoS "F") for the Stage 1 right turn out from the access into the median storage, particularly during the AM peak hour. These increased delays are primarily due to the projected traffic growth on Andrews Road westbound which, as discussed above, is subject to a level of uncertainty. Furthermore, the Stage 2 right turn from the median storage into the Andrews Road eastbound will operate satisfactorily and with no operational issues.

6.4.3 Summary of Traffic Impacts

In summary, the impacts of the development on the broader road network are acceptable.

In the short-term, the proposed access arrangements – permitting all turning movements – are acceptable and would not have any material impact on the surrounding road network.

In the longer-term, the background traffic growth may (depending on actual growth in background traffic volumes) result in larger delays for other future larger industrial developments on this Site. The larger delays are mainly for the vehicles turning right out from the Site and is because of the traffic growth assumptions on Andrews Road which is due to uncertainty. This can be reviewed over time in response to increased traffic flows and appropriate remedial measures taken, if required, only at such time that traffic delays do result in an unacceptable outcome for network safety. However, even in longer-term future the estimated tenant-specific traffic generation is not anticipated to result in failure at the proposed access arrangement. Overall, it is our view that the proposed access arrangement is supportable from operational prospective.

7 Parking Requirements

7.1 Tenant-Specific Parking Demand

According to the site-specific operational information provided in Section 2.3, the immediate future proposed tenant is expected to have a total of 30 staff on Site at any given time.

A total of 98 car parking spaces, including 2 disabled bays, are provided which can readily meet this demand.

7.2 Theoretical Parking Requirement for Typical Use

However, should a potential future tenant require more parking at this Site a “reasonable” contingency for parking provisions should be allowed for to best future-proof the parking supply on-site. In this instance a traditional car parking demand/supply analysis using appropriate parking rates is provided in the following Section.

7.2.1 Nominal Council DCP Parking Requirement

Significant technological advances in recent times have resulted in reduced employee densities within warehouse developments, with the 2012 Employment Typology Study for the WSEA, prepared for DP&E, indicating employment densities of less than 20 employees per hectare. As a consequence, many of the industrial developments within the broader WSEA provide car parking significantly in excess of the actual parking requirements of end users.

In this regard, Penrith Council’s DCP 2014 Section C10 “Transport, Access and Parking” requires car parking for warehouse or distribution centres to be provided at the rate of:

- 1 space per 100m^2 of GFA (including ancillary office).

This rate however applies to all lands within Council’s LGA and does not take into account the general type and scale of the developments proposed under this application. Adoption of this rate to the proposed 50,000 m^2 warehouse development at this Site result in a significant theoretical car parking requirement of 500 spaces.

7.2.2 RMS Guide Parking Requirement

Notwithstanding the above DCP rate, there is an opportunity to provide parking at a lower rate, consistent with recently approved developments at Oakdale South Industrial Estate and Mamre West Precinct. These developments have provided parking at rates consistent with the RMS requirements for warehouse uses being:

- 1 space per 300m^2 of warehouse GFA, and
- 1 space per 40m^2 of ancillary office GFA.

It is noteworthy that the car parking rate of 1 space per 300m^2 adopted in the RMS Guide was established through surveys of 10 facilities. The surveys undertaken by the RMS demonstrated car parking requirements that ranged between one space per 80m^2 and one space per 960m^2 with a mean and standard deviation of one space per 338m^2 and one space per 280m^2 respectively. The adopted rate of 1 space per 300m^2 therefore reflected a "middle range" parking rate. Furthermore, the adopted parking rate was also based on employee densities of approximately 45 employees per hectare – almost double the densities established by the DP&E for the WSEA.

Notwithstanding, application of the above RMS Guide rate would result in a demand of 172 spaces.

7.2.3 Standard Use Demands Derived from Other Similar Developments

For the purpose of this application, reference is made to surveys of eight comparable industrial developments have been undertaken to establish the effective parking rate of operational developments within the WSEA – adopting the same methodology as that used in establishing the RMS rate. The surveys included industrial developments (generally warehouse or freight forwarding facilities) in numerous locations including:

- Erskine Park,
- Oakdale Central; and
- M7 Business Hub.

The results of these surveys are summarised in **Table 6**.

Table 6: Effective Parking Rates for Surveyed Developments

Site Address	Car Parking Provided	Total GFA (m^2)	Maximum Parking Demand	Effective Parking Rate (1 space per Xm^2)
Bunning's – 8 Interchange Dr	140	55,550	68	817
Toll – Lot 11 Wonderland Dr	137	27,440	47	584
Ingram Micro – 23 Wonderland Dr	300	36,610	183	200
DHL – Milner Avenue	115	20,170	109	185
Kimberly Clarke – 35 Sarah Andrews Cl	100	45,210	78	580
Linfox – 25 Sarah Andrews Cl	217	51,200	116	441
Ubeeco – 28 Sarah Andrews Cl	150	10,865	71	153
Woolworths – 29 Sarah Andrews Cl	280	52,705	197	268

Upon review of the parking rates estimated for the above sites and considering the mathematical extrapolation of the data it has been established that the proposed warehouse on this Site will require a total of 98 car parking spaces.

The 98 car parking spaces provided thus meets this requirement. It is noteworthy that the adopted rates for the Proposal will enable the required flexibility in the design of future developments whilst still ensuring that parking is provided to accommodate both the current and potential future parking requirements of tenants.

Surplus hardstand areas could also accommodate further staff parking spaces if the Council decides that provisional bays are needed.

7.3 Accessible Parking

Council's DCP requires accessible parking to be provided in accordance with the Building Code of Australia (BCA). This Standard requires accessible parking for industrial developments to be provided at a rate of:

- 1 space for every 100 car parking spaces or part thereof (rounded up).

Therefore, the Proposal will require a total of 1 disabled car parking space. In response the Proposal seeks to provide 2 accessible bays and as such it meets and exceeds the DCP requirement.

7.4 Bicycle Facilities

Section 10.7 of Council's DCP, C10 (Transport, Access and Parking) outlines the bicycle requirements for commercial developments providing employment for 20 people or more. This Section requires bicycle parking to be provided in secured and accessible locations with weather protection in accordance with AS2890.3. Furthermore, this Section states that the bicycle parking and end-of-journey facilities (showers, change rooms, lockers) should be provided in accordance with the *Planning Guidelines for Walking and Cycling* (NSW Government 2004) document.

The relevant Guideline rates are therefore as follows:

- 3-5%S for staff, and
- 5-10%S for customers/visitors (short-term use).

Where S is the staff number (30 in this instance).

Accordingly, the Proposal requires total of 5 bicycle parking spaces (2 for staff and 3 for visitors). In response, bicycle parking in the form of bike racks which can comfortably accommodate a total of 6 bicycles on either side are proposed.

Furthermore, the Guideline suggests provision of the following minimum locker, shower and change rooms for 13-49 on-site staff:

- Lockers: 1 per 3 racks,
- Showers: 2 (1 for male and 1 for female), and
- Change rooms: 2 (1 for male and 1 for female).

The proposed site plan also shows a shower and toilets. The requirement for end-of-journey facilities (to the Council satisfaction) can be further investigated during the Construction Certificate stage of the project.

8 Design Commentary

8.1 Relevant Design Standards

The site access, car park and loading areas should be designed to comply with the following relevant Australian Standards:

- AS2890.1 for car parking areas,
- AS2890.2 for commercial vehicle loading areas, and
- AS2890.6 for accessible (disabled) parking.

It is expected that any detailed construction drawings in relation to the car park or site access would comply with these Standards. Furthermore, compliance with the above Standards would be expected to form a standard condition of consent to any development approval.

8.2 Design Vehicles

According to the operational details provided, access to the Site shall be required for articulated vehicles and B-Doubles. As such, a 26 metre B-double has been used as the relevant 'design vehicle' when assessing the site access driveway and internal layout.

The design vehicle for access to the RSD on the eastern side of the building shall be restricted to rigid vehicles and/or articulated vehicles 19 metres or less in size (i.e. no B-doubles).

8.3 Design Commentary

In general, the development has been designed having regard for the above Standards.

Final resolution of the site access and internal design would be expected to occur as part of Construction Certificate design coordination in response to a general condition of consent requiring compliance with AS2890. However, the initial swept path analysis undertaken confirms the general suitability of the proposed design for its intended purpose.Reference should be made to the swept paths included in **Appendix C** demonstrating access to the Site by B-doubles.

9 Conclusions

- This Traffic Impact Assessment (TIA) has been prepared on behalf of Cadence to investigate the traffic impact of a proposed 50,000 m^2 of warehouse development at 128 Andrews Road, Penrith with the Penrith City Council LGA.
- The Proposal seeks utilising the existing full movement access crossover on Andrews Road; with significant design improvement to this access. These improvements include introduction of a designated left and right turn bay on Andrews Road approaching the Site access and a median storage to allow for a 2-stage right turn out from the access to Andrews Road (eastbound).
- The traffic generation for the development has been assessed as follows:
  - 41 veh/hr, based on the operational details of this proposed tenant.
  - 125 veh/hr during peak periods, based on application of RMS Technical Direction and Ason Group's traffic surveys of similar developments in Penrith LGA. This is considered to reflect a potential traffic generation were the building to be used as a standard large-format warehouse in the future.
- Accordingly, a **conservative** hourly traffic generation of 125 veh/hr has been adopted for traffic modelling purposes of the site access driveway to future-proof the design for potential future users.
- SIDRA modelling of the access confirms that acceptable Level of Service (LoS) can be achieved under a short-term (Existing + Development) scenario.
- It is emphasised that, in accordance with the operational information provided by Cadence, the nominated tenant for this Site is expected to generate far less traffic onto the surrounding road network. In this regard, traffic volumes associated with the proposed development at this Site is in a low order when distributed onto the surrounding road network and as such is not anticipated to have any material impacts on the operation of the broader road network.
- Background growth factors on Andrews Road have been obtained from RMS strategic EMME modelling outputs to inform the future baseline scenario. It is emphasised that these strategic model outputs represent a 'possible' outcome, based on a number of cumulative assumptions and therefore cannot be regarded as a certainty.
- The SIDRA analysis undertaken as part of this TIA demonstrates that the proposed access arrangements – permitting all turning movements – are acceptable and would not have any material impact on the surrounding road network in the short-term future.
- In order to review the traffic impact of this specific tenant, the SIDRA analysis have been undertaken for the anticipated traffic volumes as a result of this tenant. The SIDRA results suggest

that the proposed tenant-specific traffic generation would not result in an unacceptable operational condition at the proposed access even considering the10 Years traffic growth.

- In the longer-term background traffic growth may (depending on actual growth in background traffic volumes) result in larger delays for some other larger format industrial developments - in particular – for the vehicles turning right out from the Site. However, this can be reviewed over time in response to the increased traffic flows and appropriate remedial measures taken, if required, only at such time that traffic delays do result in an unacceptable outcome for network safety.
- Accordingly, it is our view that the proposed access arrangement is supportable from operational prospective.
- Car parking requirements have been assessed by a number of methods:
  - 30 spaces based on tenant-specific operational details
  - 500 spaces based on strict application of Council's DCP
  - 98 spaces Potential future demand, based on surveys of other similar sized warehouse within WSEA
- A total of 98 on-site car parking spaces which readily satisfies the anticipated parking demand of both the future tenant and a reasonable contingency for other future users when reference the 98 space demand established by reference to other developments within WSEA. Accordingly, the proposed car parking provisions are considered appropriate for a development of this nature. Surplus hardstand areas could also accommodate further staff parking spaces if the Council decides that further provisional bays are needed.
- In addition to car parking, the Proposal includes 6 bicycle spaces (3 x double-sided rails) to satisfy relevant requirements. Provision of ancillary bicycle end-of-trip facilities (lockers, showers and change rooms) are also provided as part of the driver amenities.
- The access driveways, car parking and hardstand areas have generally been designed having regard for relevant Australian Standards (AS2890 series). A standard condition of consent requiring compliance with AS2890 would be considered sufficient to ensure that any minor changes to the plans required, if any, could be undertaken as part of detailed Construction Certificate documentation.

In summary, the Proposal is supportable and would not result in any adverse traffic or parking impacts on the surrounding road network.

Appendix A

Functional Layout Plan Andrews Road Intersection

FUNCTIONAL LAYOUT PLAN – ANDREWS ROAD INTERSECTION
1:250 SCALE

ANDREWS RD DESIGN SPEED 70km/Hr

2m 0 5 10 15 20 25m
1:250 SCALE AT A0 SHEET SIZE

FOR INFORMATION ONLY

AMENDMENTS	DATE	ISSUE
ISSUED FOR INFORMATION	12.09.18	A

AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

CLIENT
CADENCE
SUITE 2.02 785 TOORAK ROAD
HAWTHORN EAST VIC 3123
P: 03 9038 8686 F: 03 9888 1118

PROJECT
PROPOSED DEVELOPMENT
128 ANDREWS ROAD
PENRITH, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	JULY '18		A0	AS SHOWN	C013620.00- R01

Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 094 436 461
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9241-7699 Fax: (02) 9241-5721
email: mail@costinroe.com.au

Costin Roe Consulting
PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
FUNCTIONAL LAYOUT PLAN
ANDREWS ROAD INTERSECTION

DRAWING No C013620.00-R01
ISSUE A

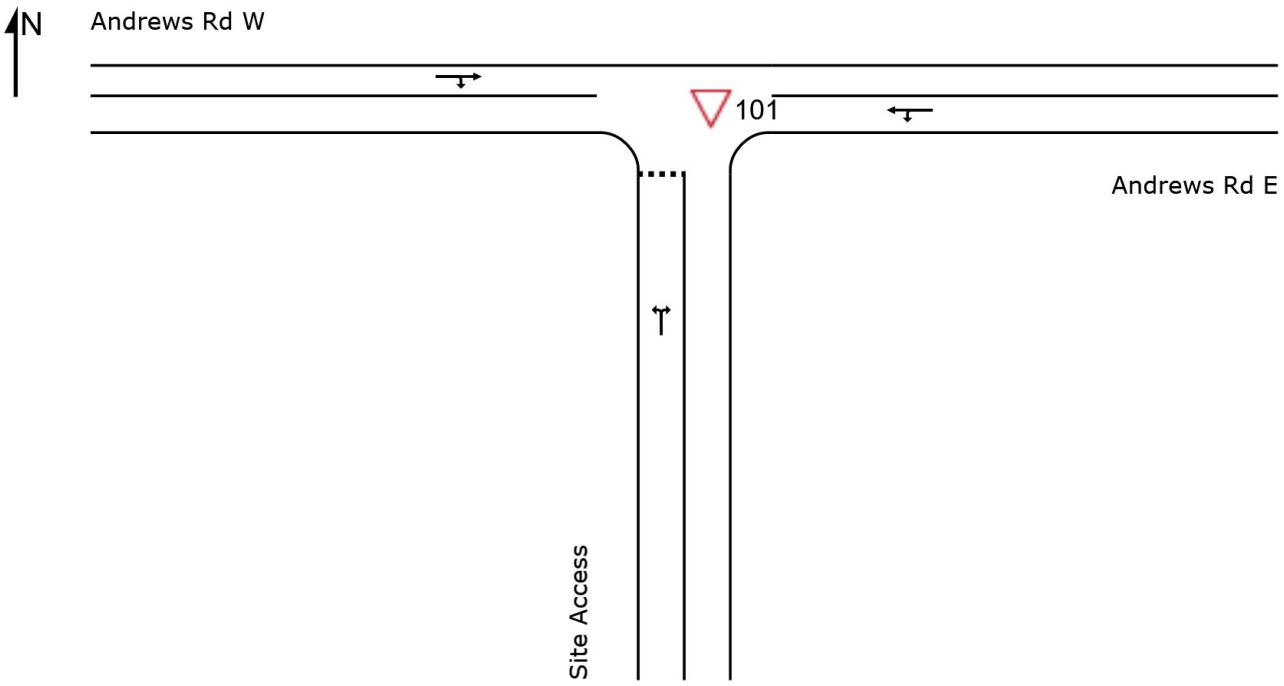
Appendix B

SIDRA Output Results

SITE LAYOUT

Site: 101 [Andrews Rd Access - Existing - AM Peak]

Andrews Rd Existing Access
Site Category: (None)
Giveway / Yield (Two-Way)



Organisation: ASON GROUP PTY LTD | Created: Monday, 10 September 2018 11:16:20 AM
Project: C:\Users\Alireza Rasouli\Desktop\Projects June onwards (2018)\Andrews Rd\0670m02 - Existing Access.sip8

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - Existing - AM Peak]

Andrews Rd Existing Access
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Site Access												
1	L2	1	100.0	0.038	17.4	LOS B	0.1	1.2	0.83	0.93	0.83	36.6
3	R2	5	60.0	0.038	26.3	LOS B	0.1	1.2	0.83	0.93	0.83	40.0
Approach		6	66.7	0.038	24.8	LOS B	0.1	1.2	0.83	0.93	0.83	39.4
East: Andrews Rd E												
4	L2	3	67.0	0.400	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	48.3
5	T1	737	14.0	0.400	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		740	14.2	0.400	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.7
West: Andrews Rd W												
11	T1	368	14.0	0.215	0.3	LOS A	0.2	1.2	0.03	0.01	0.03	69.4
12	R2	3	67.0	0.215	18.8	LOS B	0.2	1.2	0.03	0.01	0.03	55.7
Approach		372	14.5	0.215	0.5	NA	0.2	1.2	0.03	0.01	0.03	69.3
All Vehicles		1118	14.6	0.400	0.4	NA	0.2	1.2	0.02	0.01	0.02	69.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site 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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - Existing - PM Peak]

Andrews Rd Existing Access
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

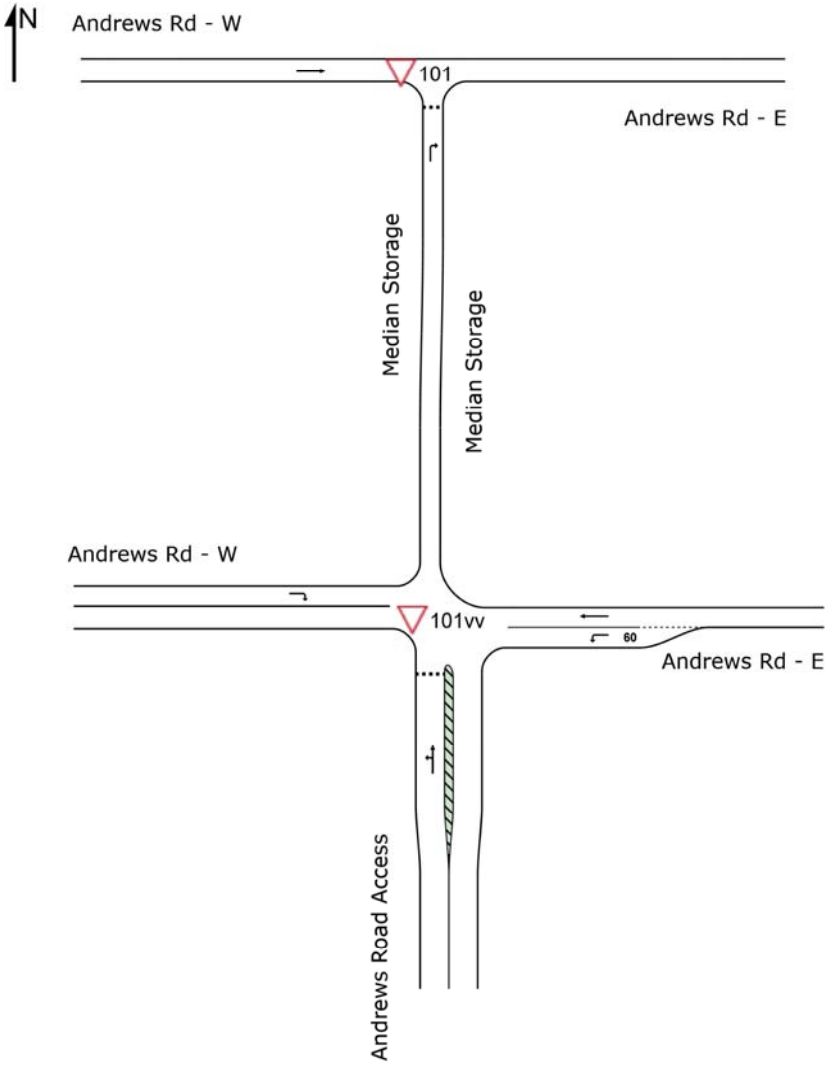
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Site Access												
1	L2	3	0.0	0.011	7.1	LOS A	0.0	0.2	0.60	0.70	0.60	50.0
3	R2	2	0.0	0.011	15.5	LOS B	0.0	0.2	0.60	0.70	0.60	47.7
Approach		5	0.0	0.011	10.4	LOS A	0.0	0.2	0.60	0.70	0.60	49.0
East: Andrews Rd E												
4	L2	1	0.0	0.276	6.4	LOS A	0.0	0.0	0.00	0.00	0.00	66.6
5	T1	551	2.0	0.276	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		552	2.0	0.276	0.0	NA	0.0	0.0	0.00	0.00	0.00	69.9
West: Andrews Rd W												
11	T1	727	2.0	0.385	0.1	LOS A	0.1	1.0	0.02	0.01	0.02	69.8
12	R2	7	0.0	0.385	10.1	LOS A	0.1	1.0	0.02	0.01	0.02	57.5
Approach		735	2.0	0.385	0.2	NA	0.1	1.0	0.02	0.01	0.02	69.6
All Vehicles		1292	2.0	0.385	0.2	NA	0.1	1.0	0.01	0.01	0.02	69.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site 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.

NETWORK LAYOUT

Network: N101 [Post Development - AM Peak Hour]

New Network
Network Category: (None)



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101vv	NA	Andrews Rd Access - Post Development - AM Peak Hour (Stage 1)
▽101	NA	Andrews Rd Access - Post Development - AM Peak Hour (Stage 2)

Organisation: ASON GROUP PTY LTD | Created: Tuesday, 11 September 2018 12:24:24 PM
Project: C:\Users\Alireza Rasouli\Desktop\Projects June onwards (2018)\Andrews Rd\Post Development SIDRA\0670m03 - Post Development - Access.sip8

MOVEMENT SUMMARY

Site: 101vv [Andrews Rd Access - Post Development - AM Peak Hour (Stage 1)]

Network: N101 [Post Development - AM Peak Hour]

Andrews Rd Access - AM Peak Hour - Stage 1
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Andrews Road Access														
1	L2	7	50.0	7	50.0	0.262	14.6	LOS B	0.4	4.3	0.86	0.96	0.96	33.8
2	T1	39	67.0	39	67.0	0.262	30.2	LOS C	0.4	4.3	0.86	0.96	0.96	28.7
Approach		46	64.3	46	64.3	0.262	27.7	LOS B	0.4	4.3	0.86	0.96	0.96	29.9
East: Andrews Rd - E														
4	L2	49	67.0	49	67.0	0.039	7.3	LOS A	0.0	0.0	0.00	0.60	0.00	44.6
5	T1	737	14.0	737	14.0	0.408	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		786	17.3	786	17.3	0.408	0.5	NA	0.0	0.0	0.00	0.04	0.00	67.4
West: Andrews Rd - W														
12	R2	49	67.0	49	67.0	0.190	18.6	LOS B	0.3	2.8	0.80	0.92	0.82	34.4
Approach		49	67.0	49	67.0	0.190	18.6	NA	0.3	2.8	0.80	0.92	0.82	34.4
All Vehicles		882	22.6	882	22.6	0.408	3.0	NA	0.4	4.3	0.09	0.14	0.10	62.8

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.
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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - Post Development - AM Peak Hour (Stage 2)]

Network: N101 [Post Development - AM Peak Hour]

Andrews Rd Access - AM Peak Hour - Stage 2
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Median Storage														
3	R2	49	67.0	49	67.0	0.071	7.9	LOS A	0.1	1.0	0.42	0.69	0.42	33.4
Approach		49	67.0	49	67.0	0.071	7.9	LOS A	0.1	1.0	0.42	0.69	0.42	33.4
West: Andrews Rd - W														
11	T1	368	14.0	368	14.0	0.199	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		368	14.0	368	14.0	0.199	0.0	NA	0.0	0.0	0.00	0.00	0.00	69.9
All Vehicles		418	20.3	418	20.3	0.199	1.0	NA	0.1	1.0	0.05	0.08	0.05	64.6

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.

MOVEMENT SUMMARY

Site: 101vv [Andrews Rd Access - Post Development - PM Peak Hour (Stage 1)]

Network: N101 [Post Development - PM Peak Hour]

Andrews Rd Access - PM Peak Hour - Stage 1
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Andrews Road Access														
1	L2	59	50.0	59	50.0	0.233	9.8	LOS A	0.4	4.0	0.67	0.85	0.71	39.2
2	T1	39	67.0	39	67.0	0.233	17.0	LOS B	0.4	4.0	0.67	0.85	0.71	37.5
Approach		98	56.8	98	56.8	0.233	12.7	LOS A	0.4	4.0	0.67	0.85	0.71	38.8
East: Andrews Rd - E														
4	L2	6	67.0	6	67.0	0.005	7.3	LOS A	0.0	0.0	0.00	0.60	0.00	44.6
5	T1	551	14.0	551	14.0	0.305	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		557	14.6	557	14.6	0.305	0.1	NA	0.0	0.0	0.00	0.01	0.00	69.4
West: Andrews Rd - W														
12	R2	42	67.0	42	67.0	0.096	11.5	LOS A	0.1	1.5	0.62	0.83	0.62	38.9
Approach		42	67.0	42	67.0	0.096	11.5	NA	0.1	1.5	0.62	0.83	0.62	38.9
All Vehicles		697	23.7	697	23.7	0.305	2.6	NA	0.4	4.0	0.13	0.18	0.14	61.8

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.
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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - Post Development - PM Peak Hour (Stage 2)]

Network: N101 [Post Development - PM Peak Hour]

Andrews Rd Access - PM Peak Hour - Stage 2
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

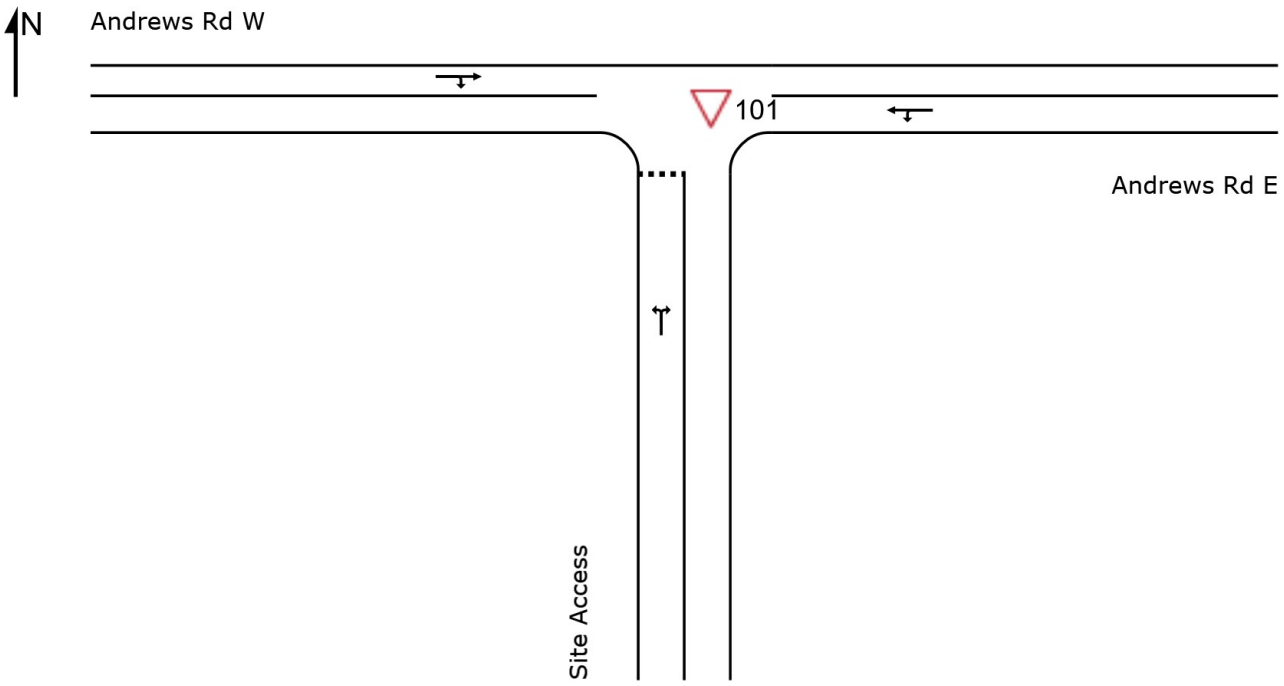
Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Median Storage														
3	R2	39	67.0	39	67.0	0.104	13.0	LOS A	0.1	1.4	0.68	0.87	0.68	31.0
Approach		39	67.0	39	67.0	0.104	13.0	LOS A	0.1	1.4	0.68	0.87	0.68	31.0
West: Andrews Rd - W														
11	T1	727	14.0	727	14.0	0.393	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		727	14.0	727	14.0	0.393	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.9
All Vehicles		766	16.7	766	16.7	0.393	0.7	NA	0.1	1.4	0.03	0.04	0.03	67.2

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.

SITE LAYOUT

Site: 101 [Andrews Rd Access - Existing - AM Peak]

Andrews Rd Existing Access
Site Category: (None)
Giveway / Yield (Two-Way)



Organisation: ASON GROUP PTY LTD | Created: Monday, 10 September 2018 11:16:20 AM
Project: C:\Users\Alireza Rasouli\Desktop\Projects June onwards (2018)\Andrews Rd\0670m02 - Existing Access.sip8

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - Post Development - AM Peak]

Andrews Rd Existing Access
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Site Access												
1	L2	7	50.0	0.322	17.0	LOS B	1.0	10.7	0.89	1.00	1.05	33.7
3	R2	39	60.0	0.322	36.8	LOS C	1.0	10.7	0.89	1.00	1.05	36.5
Approach		46	58.4	0.322	33.6	LOS C	1.0	10.7	0.89	1.00	1.05	36.0
East: Andrews Rd E												
4	L2	49	67.0	0.436	7.4	LOS A	0.0	0.0	0.00	0.04	0.00	48.2
5	T1	737	14.0	0.436	0.1	LOS A	0.0	0.0	0.00	0.04	0.00	69.6
Approach		786	17.3	0.436	0.5	NA	0.0	0.0	0.00	0.04	0.00	67.7
West: Andrews Rd W												
11	T1	368	14.0	0.363	6.3	LOS A	3.0	24.5	0.46	0.06	0.62	61.0
12	R2	49	67.0	0.363	22.7	LOS B	3.0	24.5	0.46	0.06	0.62	50.2
Approach		418	20.3	0.363	8.2	NA	3.0	24.5	0.46	0.06	0.62	59.5
All Vehicles		1251	19.8	0.436	4.3	NA	3.0	24.5	0.19	0.08	0.24	62.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site 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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - Post Development - PM Peak]

Andrews Rd Existing Access
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

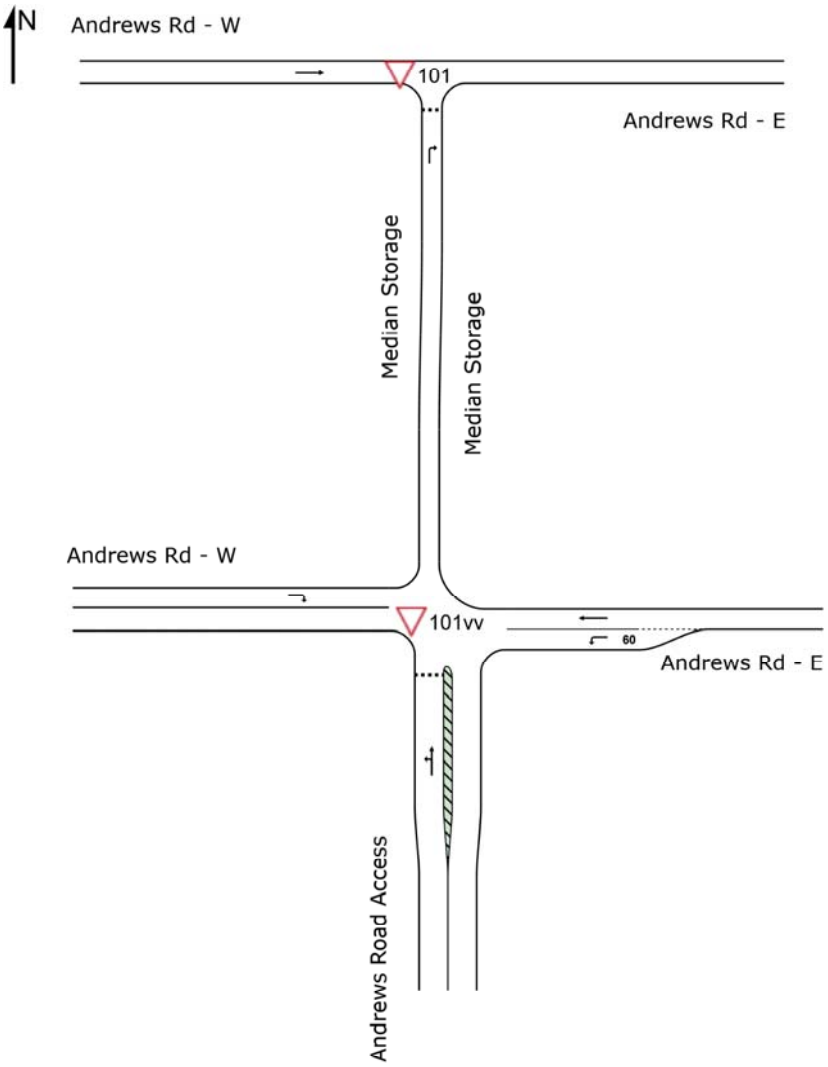
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Site Access												
1	L2	59	0.0	0.210	7.5	LOS A	0.7	5.0	0.65	0.82	0.67	49.1
3	R2	39	0.0	0.210	18.1	LOS B	0.7	5.0	0.65	0.82	0.67	46.9
Approach		98	0.0	0.210	11.7	LOS A	0.7	5.0	0.65	0.82	0.67	48.2
East: Andrews Rd E												
4	L2	6	0.0	0.279	6.4	LOS A	0.0	0.0	0.00	0.01	0.00	66.5
5	T1	551	2.0	0.279	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	69.8
Approach		557	2.0	0.279	0.1	NA	0.0	0.0	0.00	0.01	0.00	69.8
West: Andrews Rd W												
11	T1	727	2.0	0.420	0.5	LOS A	0.8	6.0	0.11	0.04	0.14	68.6
12	R2	42	0.0	0.420	10.4	LOS A	0.8	6.0	0.11	0.04	0.14	56.7
Approach		769	1.9	0.420	1.0	NA	0.8	6.0	0.11	0.04	0.14	67.9
All Vehicles		1424	1.8	0.420	1.4	NA	0.8	6.0	0.10	0.08	0.12	66.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site 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.

NETWORK LAYOUT

Network: N101 [10 Years Post Development - AM Peak Hour]

New Network
Network Category: (None)



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101vv	NA	Andrews Rd Access - 10 Years Post Development - AM Peak Hour (Stage 1)
▽101	NA	Andrews Rd Access - 10 Years Post Development - AM Peak Hour (Stage 2)

Organisation: ASON GROUP PTY LTD | Created: Tuesday, 18 September 2018 2:42:40 PM
Project: C:\Users\Alireza Rasouli\Desktop\Projects June onwards (2018)\Andrews Rd\10 Year Post plus Development\RMS Growth Rates\0670m05 - 10 Years Post Development - Access.sip8

MOVEMENT SUMMARY

Site: 101vv [Andrews Rd Access - 10 Years Post DA (Tenant Specific) - AM Peak Hour (Stage 1)]

Network: N101 [10 Years Post DA (Tenant Specific) - AM Peak Hour]

Andrews Rd Access - AM Peak Hour - Stage 1
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Andrews Road Access														
1	L2	3	50.0	3	50.0	0.217	23.5	LOS B	0.3	3.0	0.93	0.98	0.98	28.0
2	T1	16	67.0	16	67.0	0.217	55.2	LOS D	0.3	3.0	0.93	0.98	0.98	21.3
Approach		19	64.2	19	64.2	0.217	49.9	LOS D	0.3	3.0	0.93	0.98	0.98	22.9
East: Andrews Rd - E														
4	L2	19	67.0	19	67.0	0.015	7.3	LOS A	0.0	0.0	0.00	0.60	0.00	44.6
5	T1	982	14.0	982	14.0	0.544	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1001	15.0	1001	15.0	0.544	0.2	NA	0.0	0.0	0.00	0.01	0.00	69.0
West: Andrews Rd - W														
12	R2	19	67.0	19	67.0	0.142	31.7	LOS C	0.2	1.9	0.89	0.95	0.89	28.4
Approach		19	67.0	19	67.0	0.142	31.7	NA	0.2	1.9	0.89	0.95	0.89	28.4
All Vehicles		1039	16.8	1039	16.8	0.544	1.7	NA	0.3	3.0	0.03	0.05	0.03	66.5

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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - 10 Years Post DA (Tenant Specific) - AM Peak Hour (Stage 2)]

Network: N101 [10 Years Post DA (Tenant Specific) - AM Peak Hour]

Andrews Rd Access - AM Peak Hour - Stage 2
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Median Storage														
3	R2	16	67.0	16	67.0	0.032	10.2	LOS A	0.0	0.4	0.55	0.76	0.55	32.3
Approach		16	67.0	16	67.0	0.032	10.2	LOS A	0.0	0.4	0.55	0.76	0.55	32.3
West: Andrews Rd - W														
11	T1	585	14.0	585	14.0	0.316	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		585	14.0	585	14.0	0.316	0.0	NA	0.0	0.0	0.00	0.00	0.00	69.9
All Vehicles		601	15.4	601	15.4	0.316	0.3	NA	0.0	0.4	0.01	0.02	0.01	68.6

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.

MOVEMENT SUMMARY

Site: 101vv [Andrews Rd Access - 10 Years Post DA (Tenant Specific) - PM Peak Hour (Stage 1)]

Network: N101 [10 Years Post DA (Tenant Specific) - PM Peak Hour]

Andrews Rd Access - PM Peak Hour - Stage 1
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Andrews Road Access														
1	L2	21	50.0	21	50.0	0.216	18.7	LOS B	0.3	3.1	0.88	0.96	0.94	33.6
2	T1	15	67.0	15	67.0	0.216	42.0	LOS C	0.3	3.1	0.88	0.96	0.94	28.5
Approach		36	57.0	36	57.0	0.216	28.3	LOS B	0.3	3.1	0.88	0.96	0.94	32.1
East: Andrews Rd - E														
4	L2	3	67.0	3	67.0	0.002	7.3	LOS A	0.0	0.0	0.00	0.60	0.00	44.6
5	T1	906	14.0	906	14.0	0.502	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		909	14.2	909	14.2	0.502	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.6
West: Andrews Rd - W														
12	R2	19	67.0	19	67.0	0.110	25.3	LOS B	0.1	1.5	0.86	0.94	0.86	31.1
Approach		19	67.0	19	67.0	0.110	25.3	NA	0.1	1.5	0.86	0.94	0.86	31.1
All Vehicles		964	16.8	964	16.8	0.502	1.7	NA	0.3	3.1	0.05	0.06	0.05	66.3

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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - 10 Years Post DA (Tenant Specific) - PM Peak Hour (Stage 2)]

Network: N101 [10 Years Post DA (Tenant Specific) - PM Peak Hour]

Andrews Rd Access - PM Peak Hour - Stage 2
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

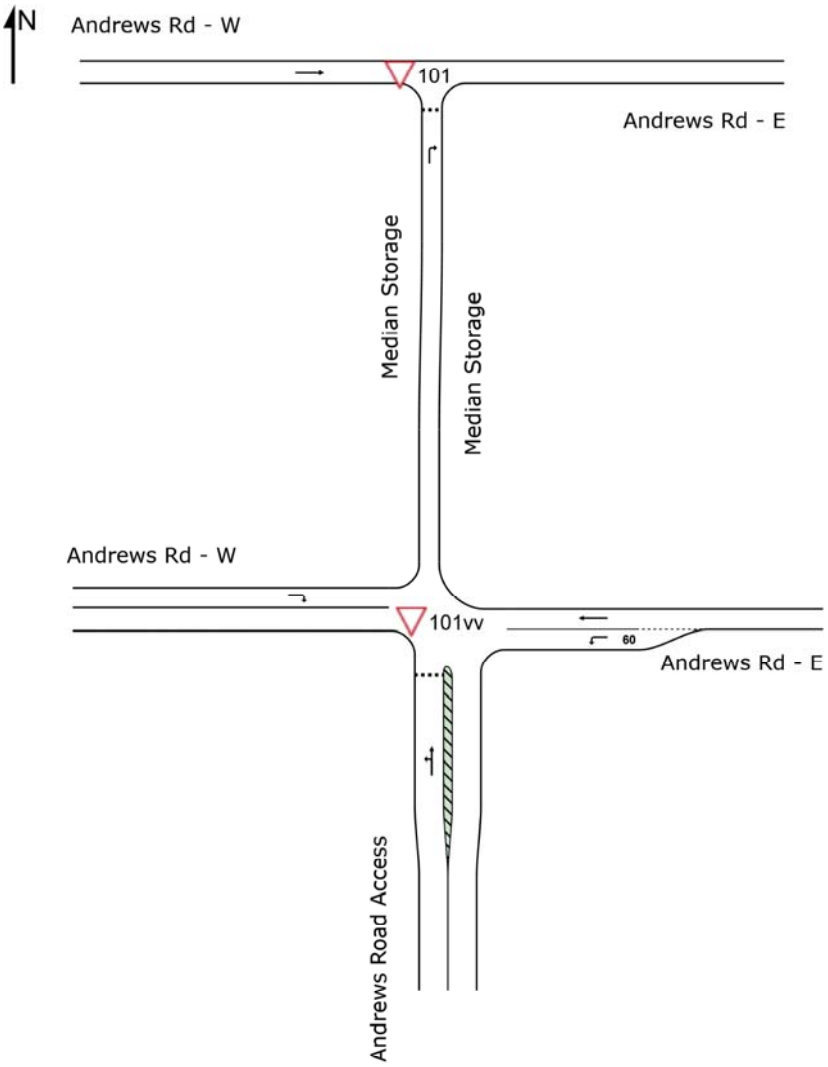
Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Median Storage														
3	R2	15	67.0	15	67.0	0.101	27.3	LOS B	0.1	1.2	0.88	0.95	0.88	25.8
Approach		15	67.0	15	67.0	0.101	27.3	LOS B	0.1	1.2	0.88	0.95	0.88	25.8
West: Andrews Rd - W														
11	T1	1069	14.0	1069	14.0	0.577	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1069	14.0	1069	14.0	0.577	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.7
All Vehicles		1084	14.7	1084	14.7	0.577	0.5	NA	0.1	1.2	0.01	0.01	0.01	68.7

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.

NETWORK LAYOUT

Network: N101 [10 Years Post Development - AM Peak Hour]

New Network
Network Category: (None)



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101vv	NA	Andrews Rd Access - 10 Years Post Development - AM Peak Hour (Stage 1)
▽101	NA	Andrews Rd Access - 10 Years Post Development - AM Peak Hour (Stage 2)

Organisation: ASON GROUP PTY LTD | Created: Tuesday, 18 September 2018 2:42:40 PM
Project: C:\Users\Alireza Rasouli\Desktop\Projects June onwards (2018)\Andrews Rd\10 Year Post plus Development\RMS Growth Rates\0670m05 - 10 Years Post Development - Access.sip8

MOVEMENT SUMMARY

Site: 101vv [Andrews Rd Access - 10 Years Post Development - AM Peak Hour (Stage 1)]

Network: N101 [10 Years Post Development - AM Peak Hour]

Andrews Rd Access - AM Peak Hour - Stage 1
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Andrews Road Access														
1	L2	7	50.0	7	50.0	0.591	49.0	LOS D	0.9	9.8	0.96	1.11	1.35	22.4
2	T1	39	67.0	39	67.0	0.591	88.3	LOS F	0.9	9.8	0.96	1.11	1.35	15.5
Approach		46	64.3	46	64.3	0.591	82.1	LOS F	0.9	9.8	0.96	1.11	1.35	17.0
East: Andrews Rd - E														
4	L2	49	67.0	49	67.0	0.039	7.3	LOS A	0.0	0.0	0.00	0.60	0.00	44.6
5	T1	982	14.0	982	14.0	0.544	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1032	16.5	1032	16.5	0.544	0.5	NA	0.0	0.0	0.00	0.03	0.00	67.9
West: Andrews Rd - W														
12	R2	49	67.0	49	67.0	0.394	41.5	LOS C	0.5	5.9	0.93	1.02	1.12	25.1
Approach		49	67.0	49	67.0	0.394	41.5	NA	0.5	5.9	0.93	1.02	1.12	25.1
All Vehicles		1127	20.7	1127	20.7	0.591	5.6	NA	0.9	9.8	0.08	0.12	0.10	60.6

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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - 10 Years Post Development - AM Peak Hour (Stage 2)]

Network: N101 [10 Years Post Development - AM Peak Hour]

Andrews Rd Access - AM Peak Hour - Stage 2
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Median Storage														
3	R2	39	67.0	39	67.0	0.079	10.4	LOS A	0.1	1.1	0.56	0.82	0.56	32.2
Approach		39	67.0	39	67.0	0.079	10.4	LOS A	0.1	1.1	0.56	0.82	0.56	32.2
West: Andrews Rd - W														
11	T1	585	14.0	585	14.0	0.316	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		585	14.0	585	14.0	0.316	0.0	NA	0.0	0.0	0.00	0.00	0.00	69.9
All Vehicles		624	17.3	624	17.3	0.316	0.7	NA	0.1	1.1	0.04	0.05	0.04	66.9

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.

MOVEMENT SUMMARY

Site: 101vv [Andrews Rd Access - 10 Years Post Development - PM Peak Hour (Stage 1)]

Network: N101 [10 Years Post Development - PM Peak Hour]

Andrews Rd Access - PM Peak Hour - Stage 1
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Andrews Road Access														
1	L2	59	50.0	59	50.0	0.604	31.9	LOS C	1.1	11.3	0.93	1.16	1.47	29.6
2	T1	39	67.0	39	67.0	0.604	59.8	LOS E	1.1	11.3	0.93	1.16	1.47	23.2
Approach		98	56.8	98	56.8	0.604	43.0	LOS D	1.1	11.3	0.93	1.16	1.47	27.7
East: Andrews Rd - E														
4	L2	6	67.0	6	67.0	0.005	7.3	LOS A	0.0	0.0	0.00	0.60	0.00	44.6
5	T1	906	14.0	906	14.0	0.502	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach		913	14.4	913	14.4	0.502	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.5
West: Andrews Rd - W														
12	R2	42	67.0	42	67.0	0.244	27.7	LOS B	0.3	3.5	0.87	0.97	0.96	30.0
Approach		42	67.0	42	67.0	0.244	27.7	NA	0.3	3.5	0.87	0.97	0.96	30.0
All Vehicles		1053	20.4	1053	20.4	0.604	5.2	NA	1.1	11.3	0.12	0.15	0.18	60.5

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.

MOVEMENT SUMMARY

Site: 101 [Andrews Rd Access - 10 Years Post Development - PM Peak Hour (Stage 2)]

Network: N101 [10 Years Post Development - PM Peak Hour]

Andrews Rd Access - PM Peak Hour - Stage 2
Site Category: (None)
Giveway / Yield (Two-Way)

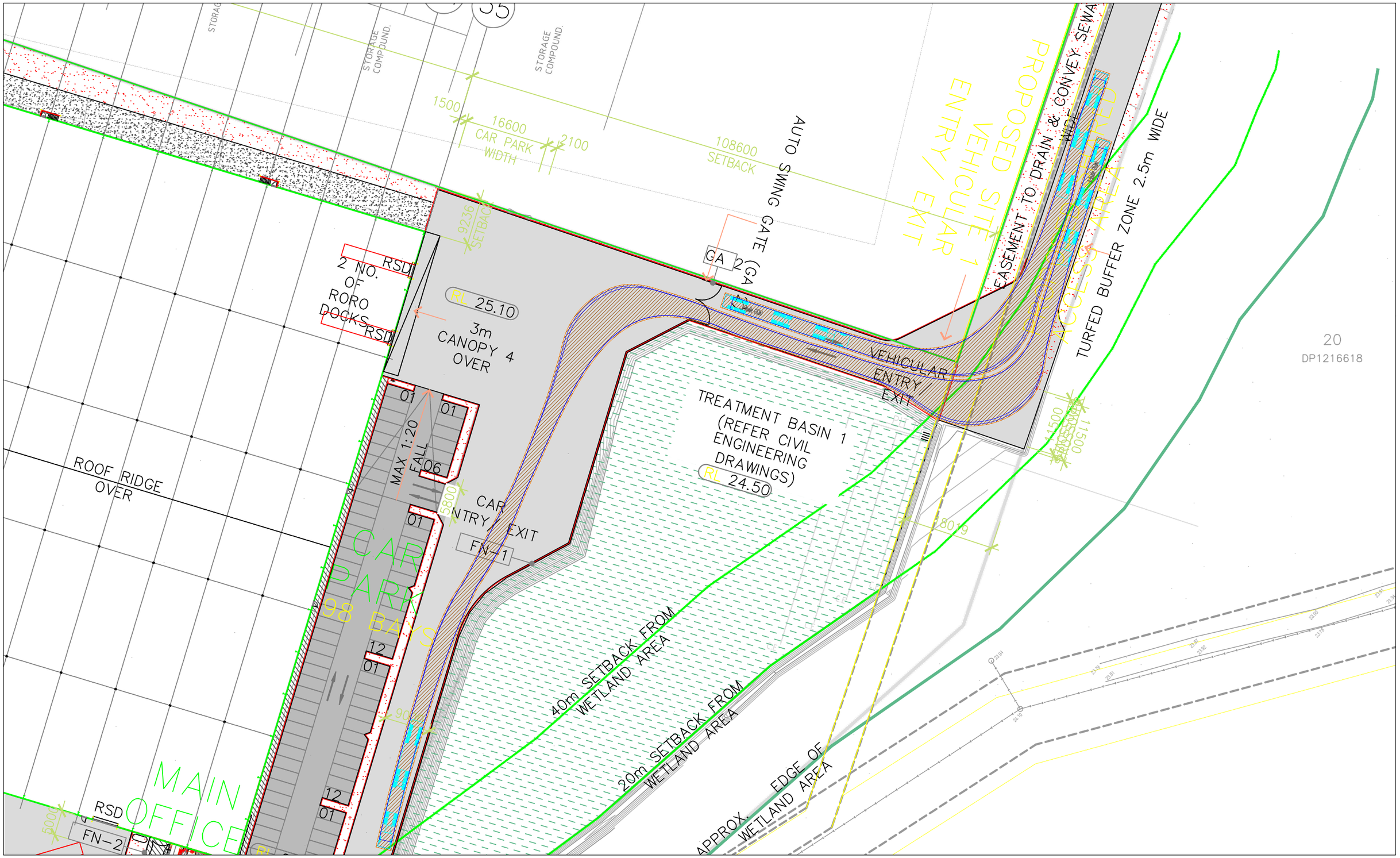
Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Median Storage														
3	R2	39	67.0	39	67.0	0.266	30.5	LOS C	0.3	3.5	0.90	0.99	1.00	24.9
Approach		39	67.0	39	67.0	0.266	30.5	LOS C	0.3	3.5	0.90	0.99	1.00	24.9
West: Andrews Rd - W														
11	T1	1069	14.0	1069	14.0	0.577	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1069	14.0	1069	14.0	0.577	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.7
All Vehicles		1108	15.9	1108	15.9	0.577	1.2	NA	0.3	3.5	0.03	0.03	0.04	67.1

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.

Appendix C

Swept Path Analysis



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

Project:
P0670
128 Andrews Road, Penrith

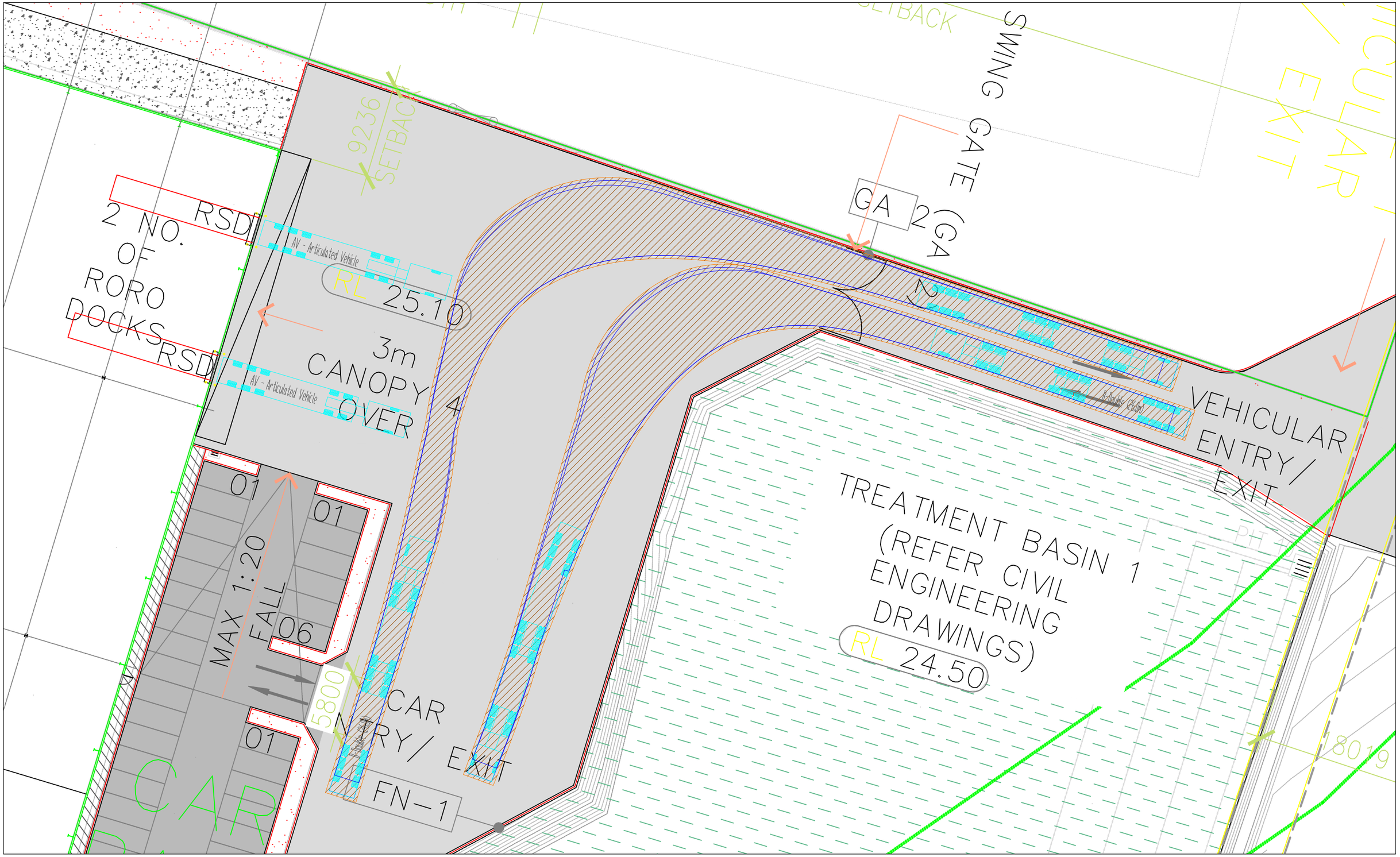
Drawing Title:
Swept Path Analysis

Date:
1 - Nov - 2018

Scale @ A3:
NTS

Drawing Number:
SK01

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:

Drawn by: Alireza Rasouli

File name: 0670d04_Design Review.dwg

Client:

Cadence

Project:

P0670

128 Andrews Road, Penrith

Drawing Title:

Swept Path Analysis

Date:

01 - Nov - 2018

Scale @ A3:

NTS

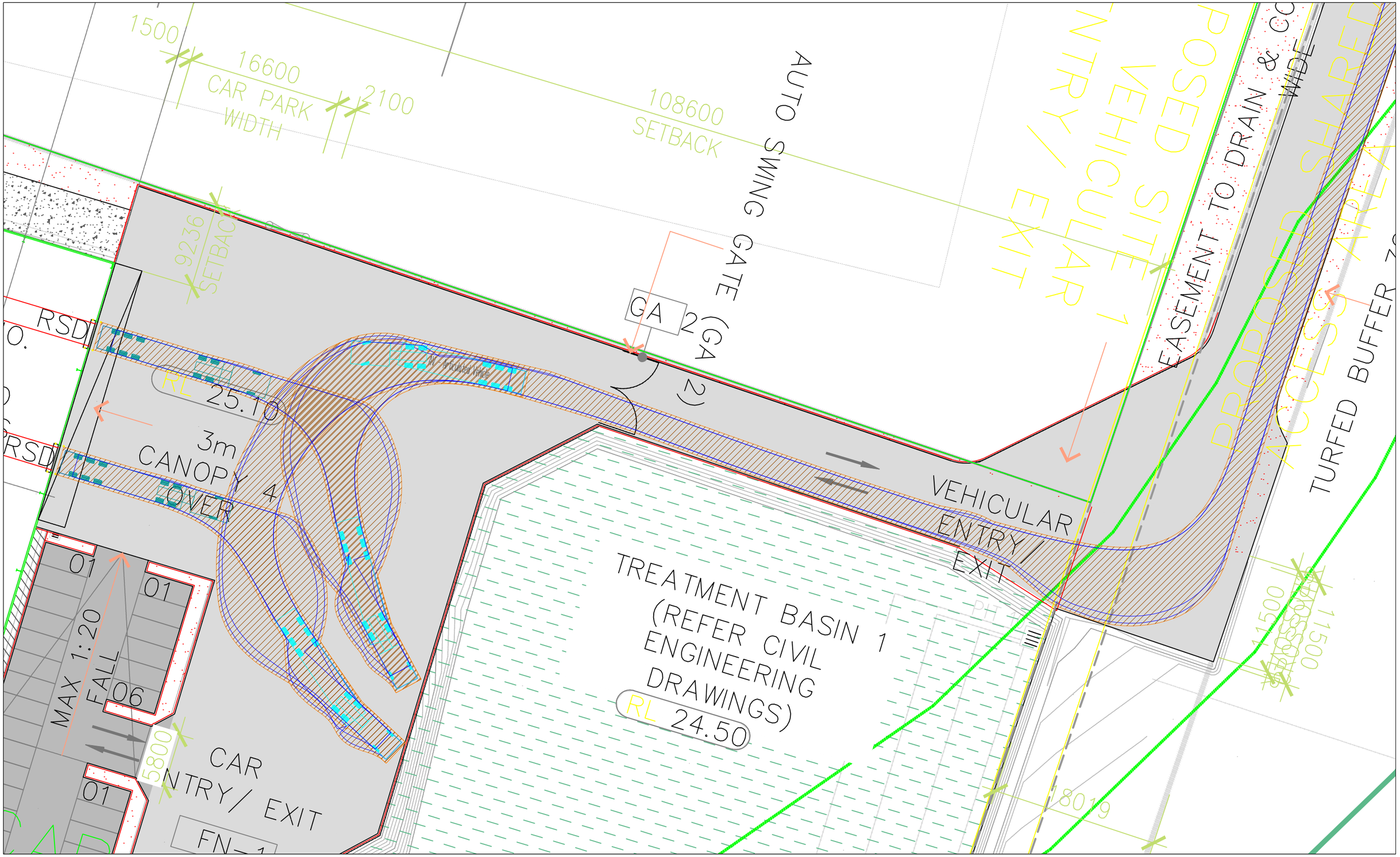
Drawing Number:

SK02

asongroup

Suite 1202, Level 12, 220 George Street
Sydney NSW 2000

info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

Project:
P0670
128 Andrews Road, Penrith

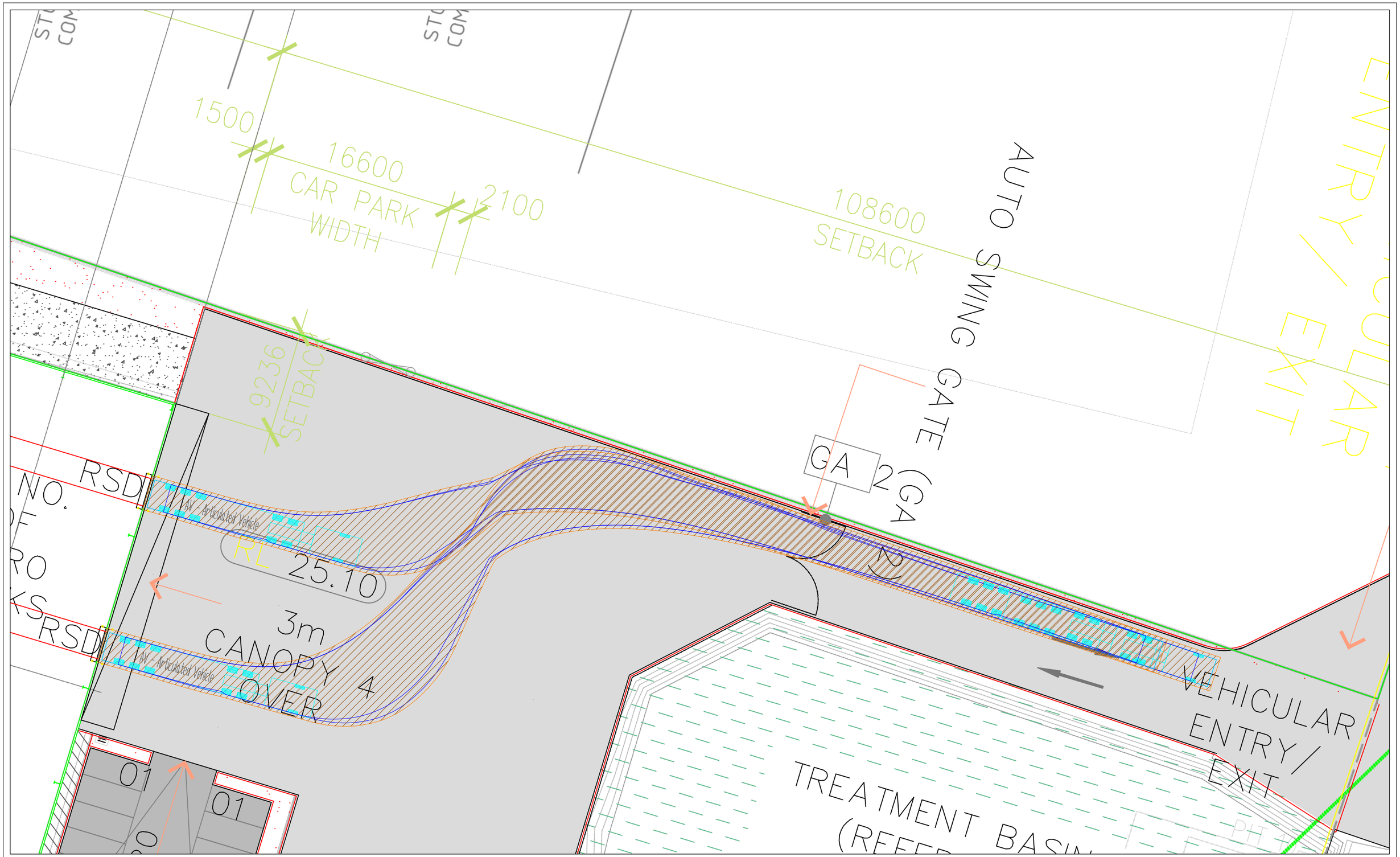
Drawing Title:
Swept Path Analysis

Date:
01 - Nov - 2018

Scale @ A3:
NTS

Drawing Number:
SK03

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

Project:
P0670
128 Andrews Road, Penrith

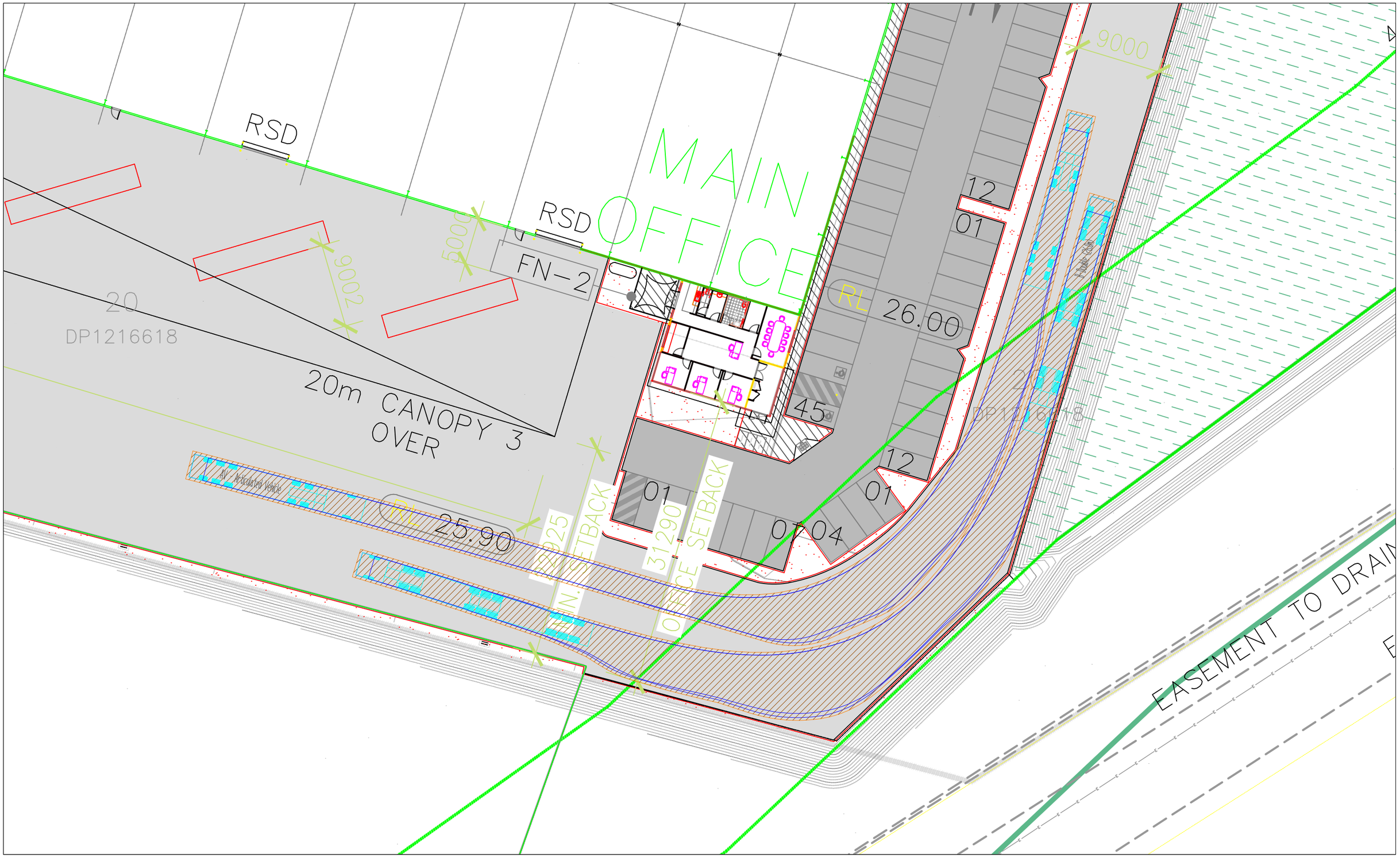
Drawing Title:
Swept Path Analysis

Date:
01 - Nov - 2018

Scale @ A3:
NTS

Drawing Number:
SK04

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



N o t e s:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

P r o j e c t:
P0670
128 Andrews Road, Penrith

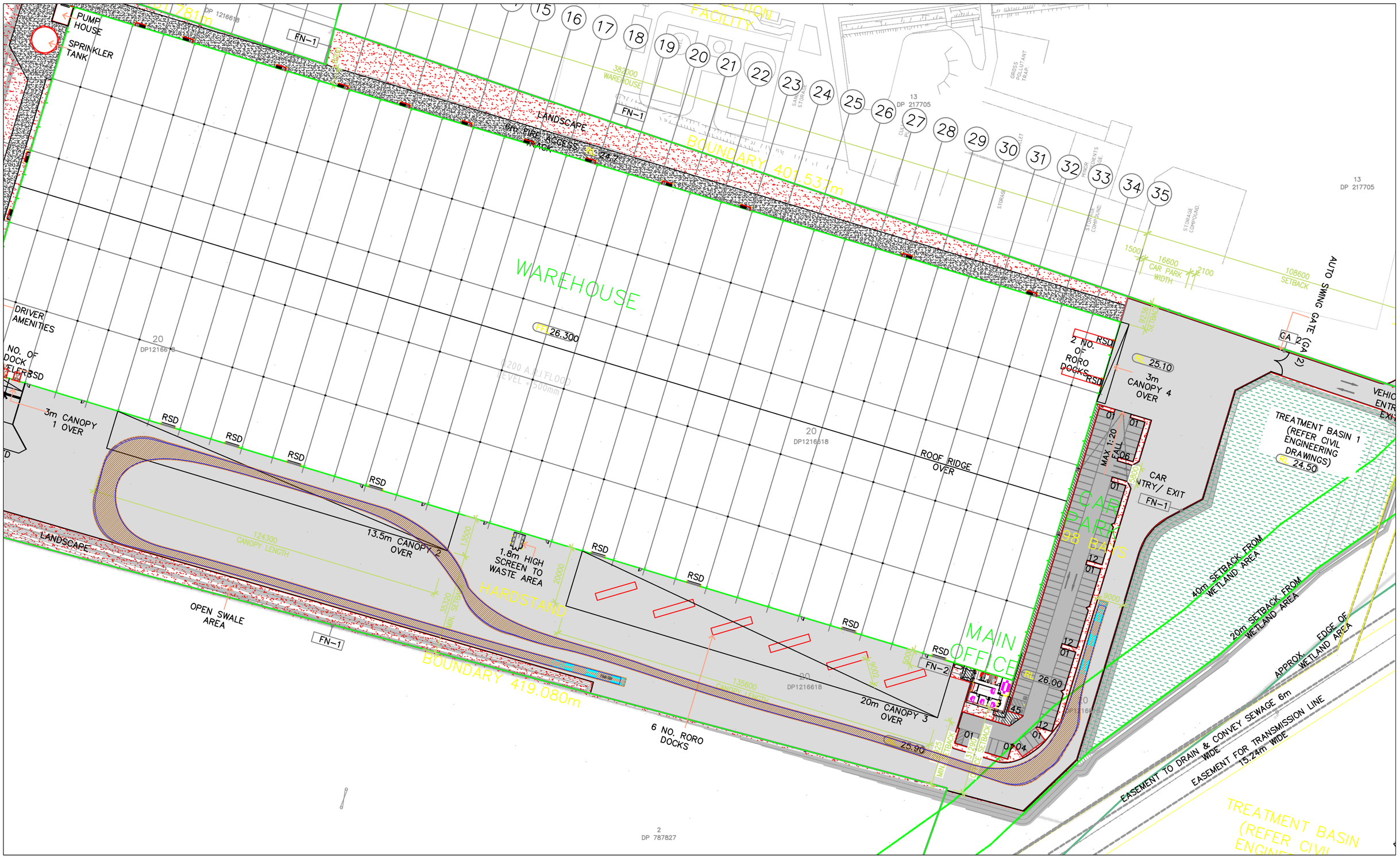
D r a w i n g T i t l e:
Swept Path Analysis

D a t e:
01 - Nov - 2018

S c a l e @ A3:
NTS

Drawing Number:
SK05

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

Project:
P0670
128 Andrews Road, Penrith

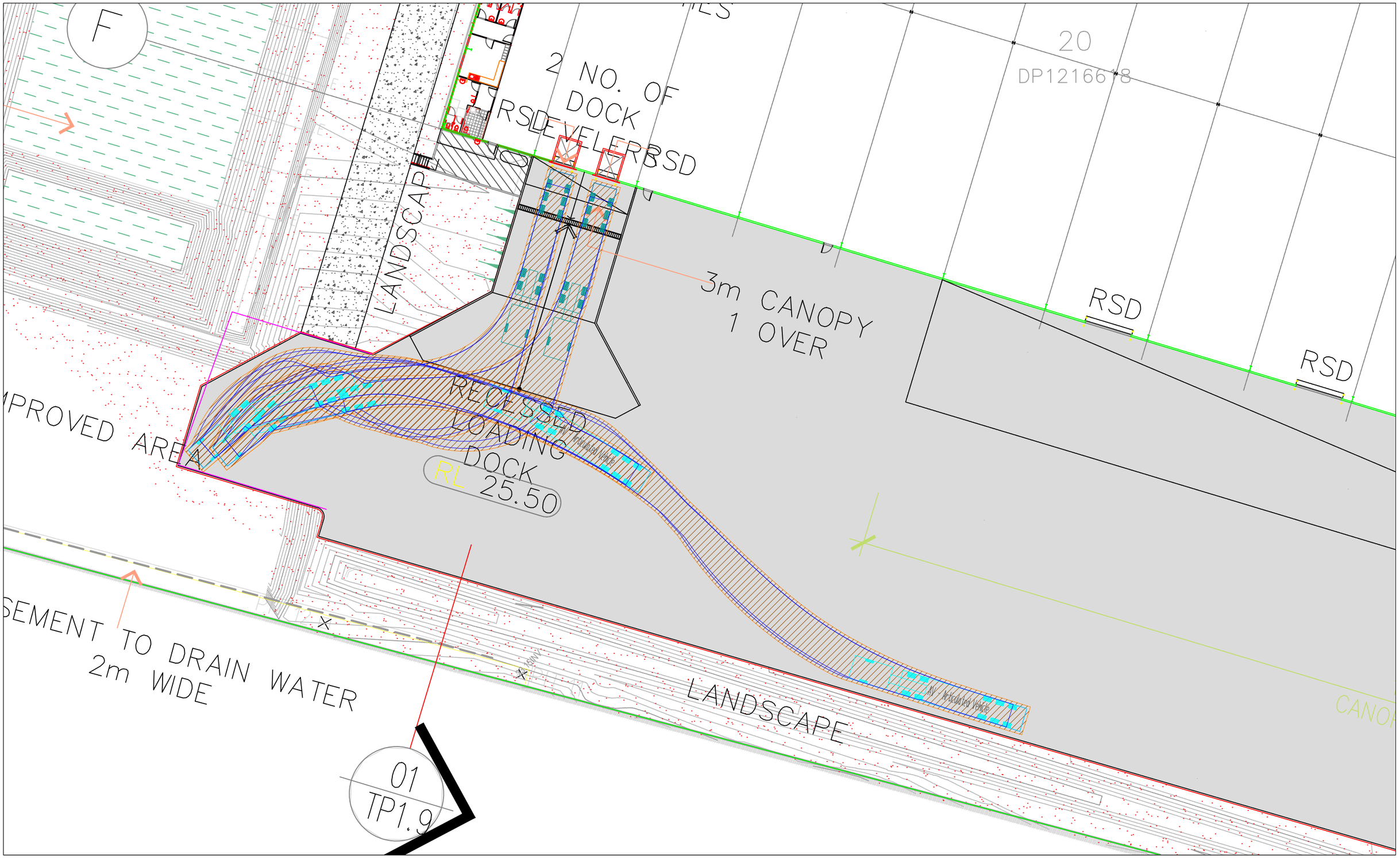
Drawing Title:
Swept Path Analysis

Date:
01 - Nov - 2018

Scale @ A3:
NTS

Drawing Number:
SK06

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:

Drawn by: Alireza Rasouli

File name: 0670d04_Design Review.dwg

Client:

Cadence

Project:

P0670

128 Andrews Road, Penrith

Drawing Title:

Swept Path Analysis

Date:

01 - Nov - 2018

Scale @ A3:

NTS

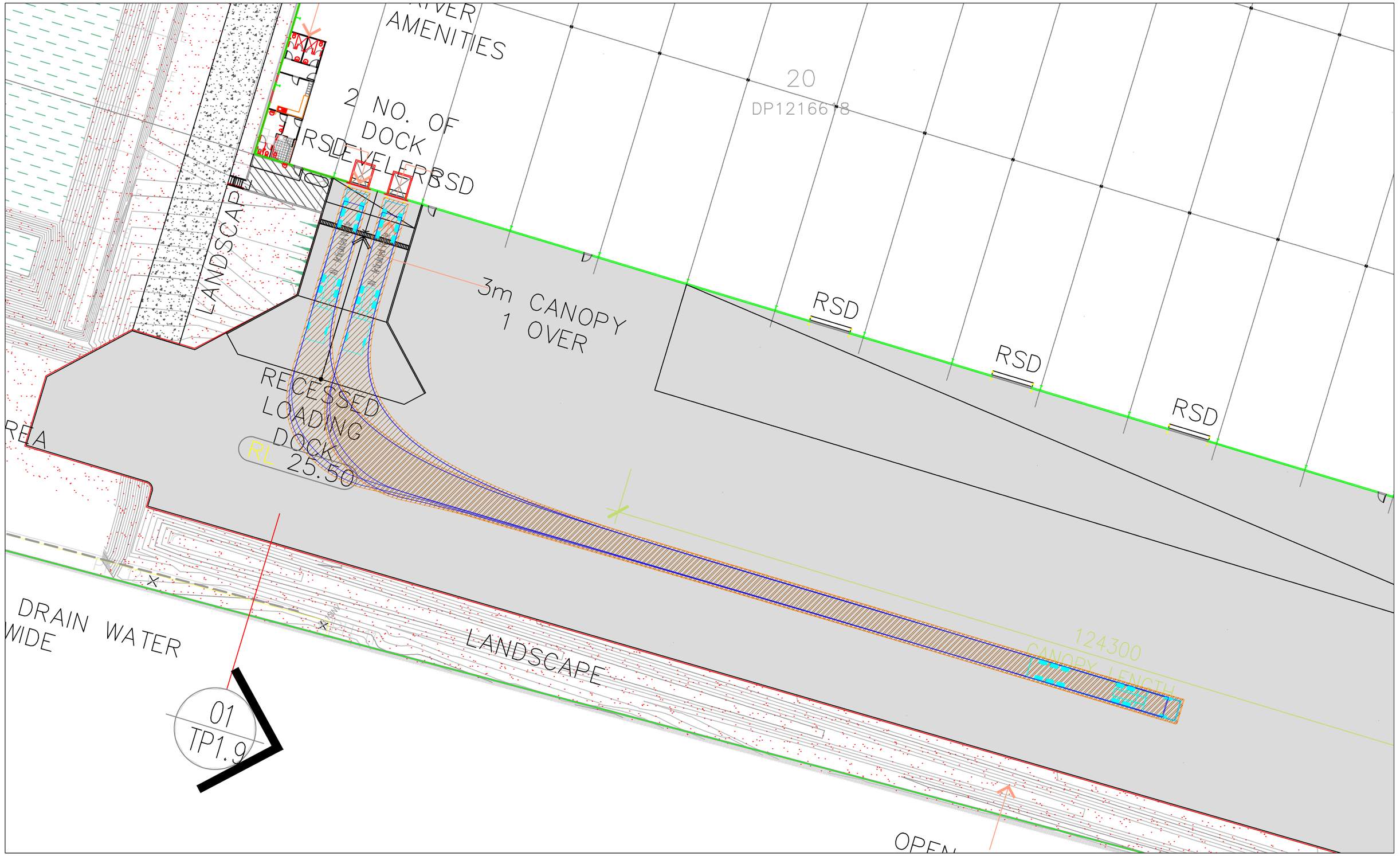
Drawing Number:

SK07

asongroup

Suite 1202, Level 12, 220 George Street
Sydney NSW 2000

info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:

Drawn by: Alireza Rasouli

File name: 0670d04_Design Review.dwg

Client:

Cadence

Project:

P0670

128 Andrews Road, Penrith

Drawing Title:

Swept Path Analysis

Date:

01 - Nov - 2018

Scale @ A3:

NTS

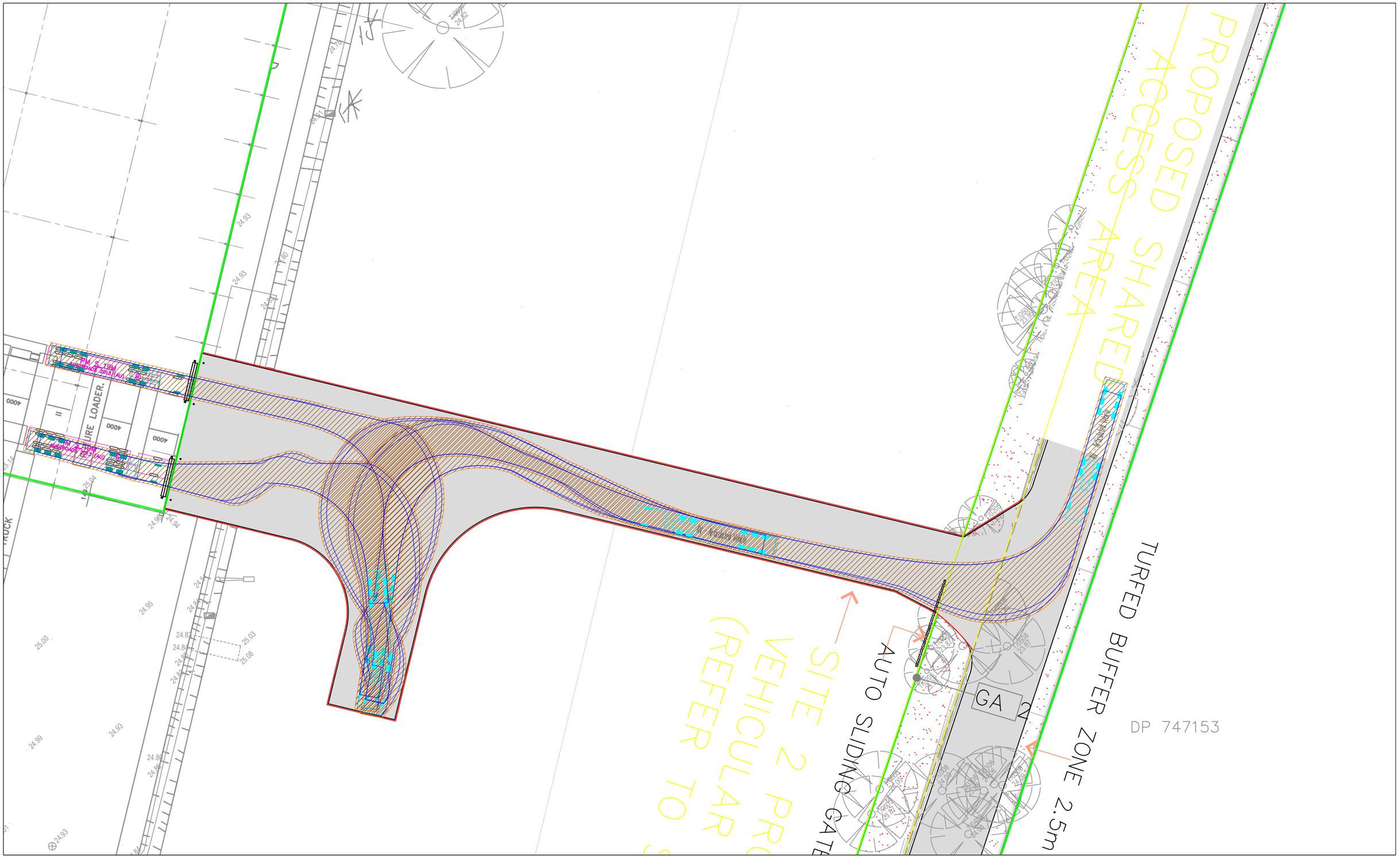
Drawing Number:

SK08

asongroup

Suite 1202, Level 12, 220 George Street
Sydney NSW 2000

info@asongroup.com.au



Notes:
This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

Project:
P0670
128 Andrews Road, Penrith

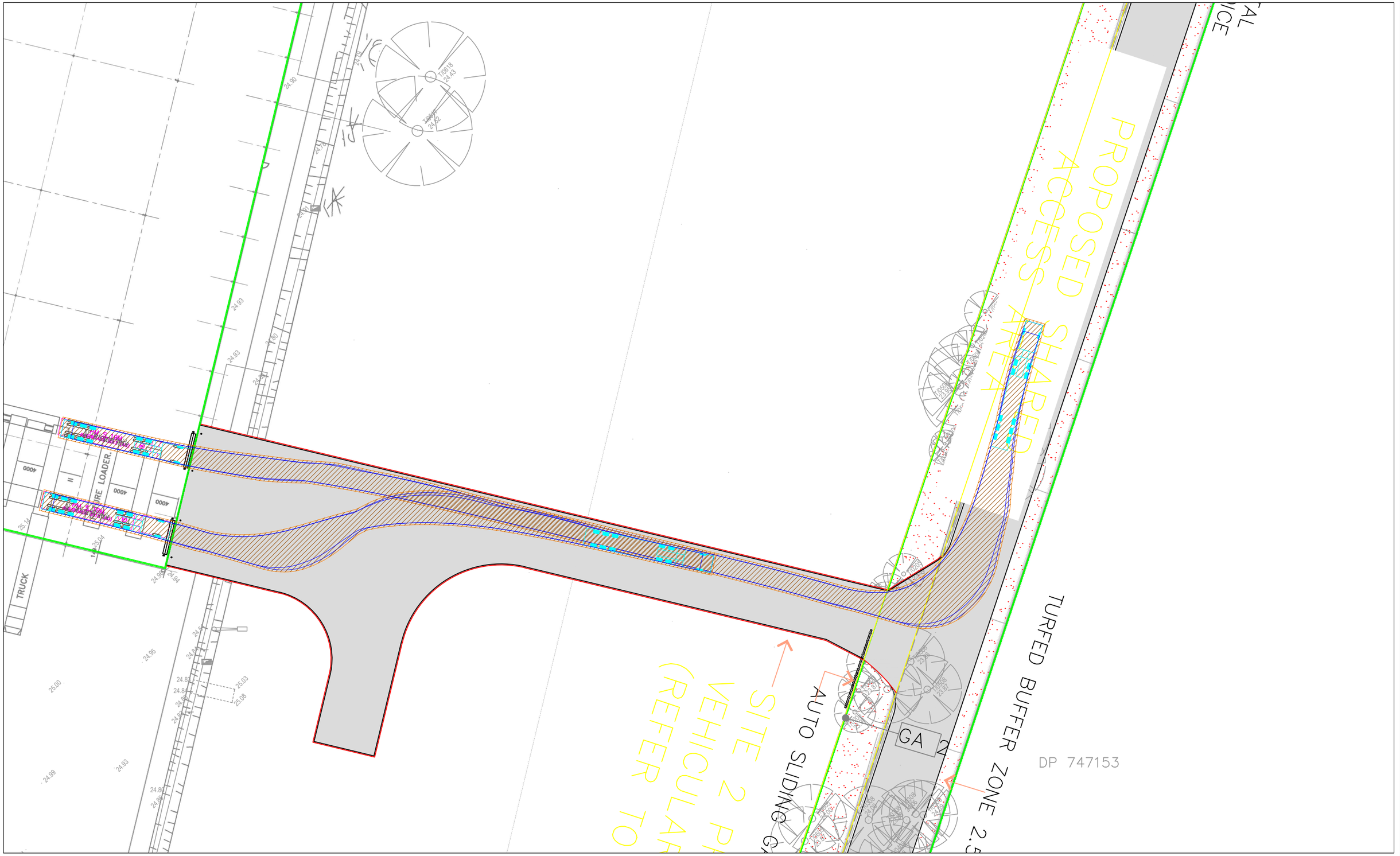
Drawing Title:
Swept Path Analysis

Date:
01 - Nov - 2018

Scale @ A3:
NTS

Drawing Number:
SK09

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au



Notes:

This drawing is provided for information purposes only and should not be used for construction.

Document Info:
Drawn by: Alireza Rasouli
File name: 0670d04_Design Review.dwg

Client:
Cadence

Project:
P0670
128 Andrews Road, Penrith

Drawing Title:
Swept Path Analysis

Date:
01 - Nov - 2018

Scale @ A3:
NTS

Drawing Number:
SK10

asongroup
Suite 1202, Level 12, 220 George Street
Sydney NSW 2000
info@asongroup.com.au