25 Dunheved Circuit, St Marys
Traffic Impact Assessment

Prepared for:

reDirect Recycling

26 November 2020

The Transport Planning Partnership

25 Dunheved Circuit, St Marys
Traffic Impact Assessment

Client: reDirect Recycling

Version: V01

Date: 26 November 2020

TTPP Reference: 20202

Quality Record

Version	Date	Prepared by	Reviewed by	Approved by	Signature
V01	26/11/20	Charbel Hanna	Santi Botross	Wayne Johnson	

Table of Contents

Tables

Figures

APPENDICES

1 Introduction

The Transport Planning Partnership (TTPP) has prepared this Transport Impact Assessment (TIA) for the St Marys Resource Recovery Facility (the Proposal). This report has been prepared as part of an Environmental Impact Statement (EIS) for a State significant Development (SSD-10474) application for the Proposal.

1.1 Proposal Overview

reDirect Recycling (the Proponent) is the new owner of the site at 25 Dunheved Circuit, St Marys ('the site'), and proposes to develop and operate a resource recovery facility (RRF) with a throughput of 150,000 tonnes per annum of timber material.

The site was previously owned and operated by Bingo Recycling Pty Ltd (Bingo Industries). The site was subject to a SSD application (SSD-8200) that was approved by The Department of Planning, Industry and Environment (DPI&E) on 6 November 2018. The approval granted permission for the site to be used as an RRF with a throughput of 350,000 tonnes per annum of non-putrescible waste. This approval has since recently been surrendered.

This SSD application (SSD-10474) seeks approval for the increase in waste material throughput at the existing RRF at 25 Dunheved Circuit. The site is currently approved for the storing and processing of 18,000 tonnes of waste per annum (DA01/1034 Penrith Council). The Proposal seeks to increase this throughput to 150,000 tonnes per annum.

The proposed RRF would utilise the buildings and facilities which already exist on the site. As such, there will be no construction works proposed to the existing site or buildings on the site.

It is proposed to operate the facility 24 hours a day, 7 days a week for waste material delivery and processing, and processed material collection activities. This is consistent with the approval which was granted for SSD-8200.

1.2 Purpose of this Report

This TIA supports the EIS for the Proposal and has been prepared as part of a SSD application (SSD-10474) for which approval is sought under Part 4, Division 4.1 of the EP&A Act.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) for the Proposal which were issued by DPI&E on 16 July 2020.

Table 1.1 lists the SEARs requirements and the corresponding sections of the report where these are addressed.

Table 1.1: SEARs Requirements and Relevant Report Sections

Traffic and Transport	Addressed in
Details of all traffic types and volumes likely to be generated during construction and operation, including a description of key access / haul routes. Traffic flows are to be shown diagrammatically to a level of sufficient detail for easy interpretation.	Section 4.2, 4.3 & 4.5
An assessment of the predicted impacts of this traffic on road safety and the capacity of the road network, including consideration of cumulative traffic impacts at key intersections using SIDRA or similar traffic model.	Section 4.5 & 4.6
Plans demonstrating how all vehicles likely to be generated during construction and operation and awaiting loading, unloading or servicing can be accommodated on the site to avoid queuing in the street network.	Section 6.2
Details and plans of any proposed internal road network, loading dock servicing and provisions, on-site parking provisions, and sufficient pedestrian and cyclist facilities, in accordance with the relevant Australian Standards.	Section 5.2, 5.3, 6.1 & 6.5
Swept path diagrams depicting the largest vehicles entering, exiting and manoeuvring throughout the site.	Appendix D
Details of road upgrades, infrastructure works or new roads or access points required for the development if necessary.	Section 4.6 & 6.4

Further to the above, Penrith City Council and Transport for NSW (formerly known as Roads and Maritime Services) require further details on specific requirements relating to their authority. These requirements are discussed throughout the report as indicated in Table 1.2.

Table 1.2: Further Requirements and Relevant Report Sections

Traffic and Transport	Addressed in
Penrith City Council	
PCC considers it necessary that a detailed traffic and parking study be prepared and submitted by the applicant as part of the SSD application that addresses traffic volumes, frequency of movements, road capacity and infrastructure impacts and required civil works. This includes analysis against the Australian Standards and Penrith DCP 2014. The report should also address the following: • Heavy vehicle traffic generation, access, and manoeuvring in the local road network, the site access and internal arrangements.	Section 4.2, 4.3 & 6.4
• The narrowness of Dunheved Circuit for the proposed heavy vehicle access	Section 6.4 & Appendix D
• Ongoing issues with heavy vehicle parking in the reserve area opposite the site	Section 5.1
• Impact on traffic safety and congestion in Dunheved Circuit, intersection with Links Road, Links Road other inspections and including the intersection with Forester Road	Section 4.5 & 4.6
• Consider and address the impact on traffic safety and congestion in Links Road which will increase due to current additional future traffic generated by the Lend Lease Central Precinct sub-division which will access Links Road	Section 4.5 & 4.6
• Confirm the largest heavy vehicle proposed to access the site and these B-double turn or other heavy vehicle paths for entering/exiting (left in/ left out, right in/ right out) at Dunheved Circuit / Dunheved Circuit loop (north leg and south leg) intersections. This will identify the road works required to accommodate this development and for which Council require the applicant to provide at their full cost. The applicant should then include suitable plans for works to accommodate these turns for assessment.	Section 4.2 Section 4.6 & 6.4

Traffic and Transport	Addressed in
• Demonstration that all vehicles are to enter and leave the site in a forward direction	Section 6.1 & Appendix D
• Demonstration that appropriate signage is to be installed to direct staff/delivery vehicle drivers/ visitors to on-site parking and delivery areas	Section 6.1 & Appendix E
• Demonstration that signage which is clearly visible from the public road shall be directional signage and line marking shall be installed indicating directional movements and the location of loading areas and visitor/staff car parking to the satisfaction of the Principal Certifying Authority;	Section 6.1 & Appendix E
• Demonstration that all vehicle parking and manoeuvring must be in accordance with AS/NZS 2890.1:2004, AS/NZS 2890.1:2004/Amdt 1:2005, AS/NZS 2890.2:2002, AS 2890.3:1993, AS 2890.5:1993, AS 2890.6:2009 and Council's requirements. This includes vehicular access from Dunheved Circuit / Dunheved Circuit loop, access driveway and internal manoeuvring for a 4.6 metre high 26 metre long B-Double vehicle in accordance with Roads and Maritime Services guidelines, Austroads guidelines and AS2890.2:2002;	Section 6.4 & Appendix D
• Demonstration that all car spaces and loading areas are to be sealed/line marked and dedicated for the parking of vehicles only and not be used for storage of materials/products/waste materials etc	Section 5.2
• Demonstration that secure bicycle parking is to be provided at convenient locations at the facility in accordance with AS 2890.3:1993	Section 5.3
• Demonstration that accessible parking is to be provided at accessible paths of travel at the facility in accordance with AS 2890.6:2009	Section 5.2
• Demonstration that the required sight lines around the driveway entrances and exits are not to be compromised by street trees, landscaping or fencing; and are to be in accordance with AS 2890.1:2009	Section 6.2
Roads and Maritime Services	
1. Details of all traffic types and volumes likely to be generated by the proposed redevelopment during construction and operation, including a description of haul route origins and destinations, including:	
• Daily inbound and outbound vehicle traffic profile by time of day and day of week (if travel patterns differ across the week);	Section 4.2
• Site and traffic management plan on how to manage number of vehicles likely to be generated during construction and operation and awaiting loading, unloading or servicing can be accommodated on the site to avoid queuing in the surrounding road network. Without extending the site to 21 Dunheved Circuit, the proponent to demonstrate that internal road network at the existing site can accommodate an increase in heavy vehicle traffic;	Chapter 6
• Detailed plan of proposed layout of internal road network to demonstrate that the site will be able to accommodate the most productive vehicle types (noting that the surrounding road network accommodates 25/26 metre B-doubles at HML) and parking on site in accordance with the relevant Australian Standard and Council's Development Control Plan	Section 3.4
• Swept path diagrams to demonstrate vehicles entering, exiting and manoeuvring throughout the site	Appendix D
• An assessment of the forecast impacts on traffic volume generated on road safety and capacity of road network including consideration of cumulative traffic impacts at key intersections using SIDRA or similar traffic model as prescribed by TfNSW (former Roads and Maritime). The traffic modelling should consider the scenarios of year 2026, 2031, 2036 and the year until the facility cease operation. These should include, but not be limited to: o Forester Road/Links Road/Ropes Crossing Boulevard; and o Forester Road/Christie Street/Boronia Road.	Section 4.5

Traffic and Transport	Addressed in
In addition to the above there are future plans to provide access to Christie Street with the extension to Links Road, this should be considered in the future year modelling.	Section 4.4
• Details plan of any proposed road upgrades, infrastructure works or new road required for the development and an assessment of potential impact on load road pavement lifespan;	Section 4.6
• To ensure that the above requirements are fully addressed, the traffic impact assessment must properly ascertain the cumulative study area traffic impacts associated with the redevelopment (and any other known proposed developments in the area);	Chapter 4.4 & Section 4.5
• An assessment of the accessibility and provision of public transport and active transport. TfNSW requires the Environmental Impact Assessment report to address these implications.	Section 2.5
2. The detailed traffic impact assessment should address the relevant planning provisions, goals and strategic planning objectives in the following: a. Future Transport 2056 and supporting documents; b. NSW Freight and Ports Plans 2018-2023; c. Guide to Traffic Generating Developments 2002(RTA); d. TDT 2013/04a Guide to Traffic Generating Developments; and e. Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development.	Throughout TIA

1.3 References

In preparing this report, reference has been made to the following:

- An inspection of the site and its surrounds
- Penrith City Council Local Environmental Plan (LEP) 2010
- Penrith City Council Development Control Plan (DCP) 2014
- Guide to Traffic Generating Developments 2002 (RTA);
- Technical Directions TDT 2013/04a Guide to Traffic Generating Developments.
- Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development
- Plans for the proposed development as prepared by Cross Muller Construction
- Swept path assessments undertaken by TTPP
- Other documents and data as referenced in this report.

2 Existing Conditions

2.1 Site Description

The site which the Proposal pertains to is located at 25 Dunheved Circuit St Marys, Lot 143 in DP 1013185. The site is located within the industrial district of the Penrith Local Government Area which is zoned as General Industrial Zone (IN1) under the *Penrith Local Environmental Plan* (LEP) *2010*.

Within the IN1 General Industrial zone, development for the purpose of a 'resource recovery facility' is prohibited under Penrith LEP 2010. However, *Clause 121 of State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) permits the establishment and operation of a waste or resource management facility on land zones IN1 General Industrial with development consent. The provisions of the ISEPP prevail over the Penrith LEP 2010 in this regard, and as such, the proposed development is permissible with development consent.

The surrounding land uses include general industrial, light industrial, low density residential and public and private recreational classifications. Nearby industries include storage businesses, transport depots, plant and equipment hire facilities, mechanical repair workshops and a number of waste facilities and other EPA licensed premises.

The site is situated within the Dunheved Business Park North Precinct which is accessed via Links Road from Forrester Road. The Dunheved Business Park South Precinct is located due-south while the Dunheved Business Park East Precinct is located on the east side of Forrester Road. The location of the site and its surrounds are shown in Figure 2.1 and Figure 2.2.

The existing site contains:

- a 3,455 m^2 waste processing building - constructed of concrete tilt panels and metal cladding with a ridge height of 11.9 m
- a site office and amenities building (of 153 m^2 GFA)
- two inground 20m weighbridges
- external areas sealed with concrete hardstand
- water tanks.

The site has a battle-axe block configuration. The site is accessed via two-way driveway having a width of 14m. It is a shared driveway with the neighbouring site, that is, 21 Dunheved Circuit. The neighbouring site has a total of three access driveways; the shared driveway plus two two-way driveways that are 5m in width.

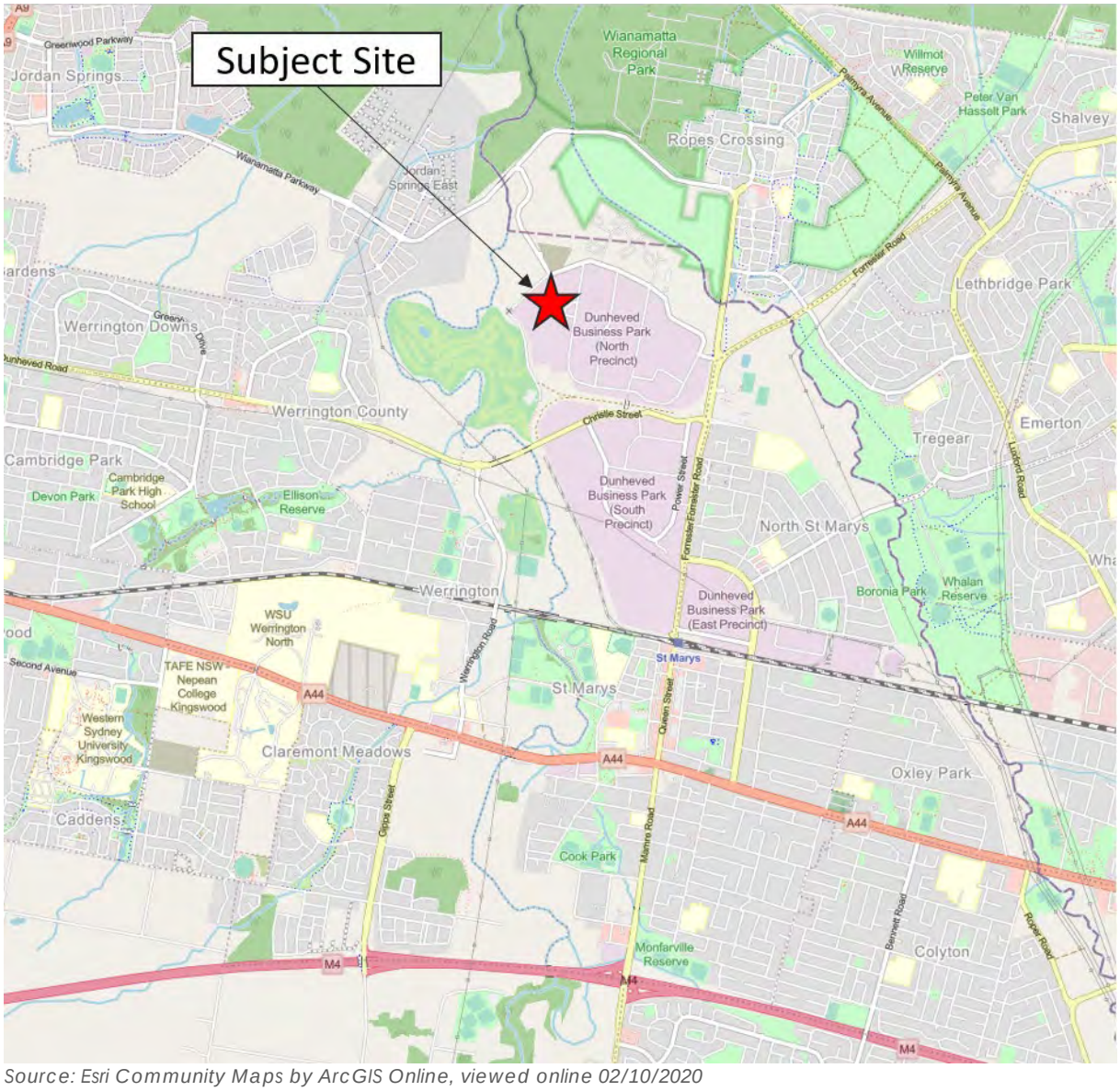
There is an inbound weighbridge and an outbound weighbridge locate on-site. These weighbridges are provided as separate inground weigh stations with dimensions 20 m long by

3.2 m wide. Vehicle circulation throughout the site follows a general clockwise direction over the inbound weighbridge, through the waste processing building, and over the outbound weighbridge. A wheel wash will be provided immediately prior to the outbound weighbridge.

When previously owned and operated by Bingo Industries, the site was approved for a total of 10 car parking spaces on-site (at 25 Dunheved Circuit), which will be maintained under this proposal.

An aerial photograph is provided in Figure 2.3 showing the existing buildings at the site.

Figure 2.1: Subject Site Location



Source: Esri Community Maps by ArcGIS Online, viewed online 02/10/2020

Figure 2.2: Site Aerial

Source: Nearmap, aerial imagery dated 2 October 2020

Figure 2.3: Existing Buildings at The Site

2.2 Local Road Network

Dunheved Circuit is a local road which runs in the north-south direction within the vicinity of the site. The site is accessed via an extension of Dunheved Circuit which is referred to throughout this report as the "loop road". Dunheved Circuit has an unmarked two-lane, two-way carriageway which is between 7.0 -7.4 m in width. There are 'No Stopping' restrictions on both sides of the Dunheved Circuit loop road. The sign posted speed limit along Dunheved Circuit is 60 km/h. There is no signposted speed limit on the Dunheved Circuit loop road. Therefore, by default of a build-up area the speed limit is 50 km/h (as per the RMS Road Users Handbook).

Krommer Place extends west off Dunheved Circuit loop road as a no-through local street. Krommer Place has a carriageway width of 12 m with unrestricted on-street parking.

Links Road functions as a collector street and is located towards the north and west of the site. It is configured as an undivided two-way, two-lane road with a 9 m width. At its eastern end, Links Road connects the Dunheved Business Park North Precinct to the surrounding arterial road network. Links Road has a posted speed of 60 km/h.

A notable collector road within the vicinity of the Proposal site is **Forrester Road.** It is a two-lane, two-way road which runs in a north-south and east-west direction. Forrester Road intersects with Links Road and Ropes Crossing Boulevard at a dual-lane roundabout which forms the main intersection to/from the Dunheved Business Park North Precinct.
Forrester Road south approach is a two-way four-lane road with a raised median and a speed limit of 60 km/h. Forrester Road east approach is a two-way two-lane road with a speed limit of 70 km/h. Ropes Crossing Boulevard has a speed limit of 50 km/h.

2.3 Traffic Volumes

Due to the irregular traffic climate caused by the COVID-19 pandemic at the time of this assessment, traffic surveys undertaken in 2020 would not be reflective of typical traffic conditions. As such, historic traffic survey data has been utilised from the Traffic Impact Assessment which was prepared as part of the application for SSD-8200.

Typical weekday traffic data was collected at the key nearby intersection of Ropes Crossing Boulevard-Forrester Road-Links Road on Wednesday 15th June 2016. Traffic surveys were undertaken during the following road network peak periods:

- AM survey period: 7:00am – 10:00am
- PM survey period: 3:00pm – 6:00pm.

At the time of the traffic data collection, the former site was in operation. Thus, the survey captured site-generated trips which will not occur in the future once the proposed RRF

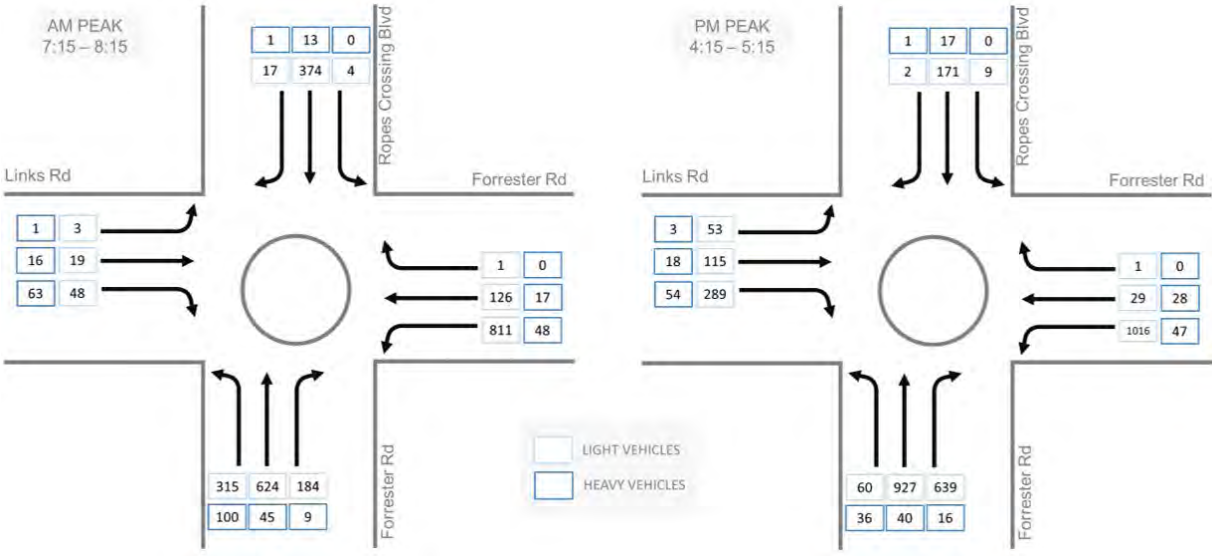
commences its operation. The trips associated with the former site have not been removed from the data, and therefore, the analysis presented herein is considered to be conservative.

The historic traffic survey data been extrapolated to the year 2020 by using on TfNSW's Strategic Travel Model (STM) growth forecast data which projects travel patterns in the Sydney Greater Metropolitan Area having consideration for approved large-scale road, rail and bus infrastructure projects.

From the traffic movement counts, the local road network peak hours have been identified as 7:15am – 8:15am and 4:15pm – 5:15pm. The 2020 peak hourly flows which have been derived from the traffic counts and STM data are presented in Figure 2.4.

The 2016 traffic survey data is contained in Appendix A while the STM data used to generate the 2020 traffic flows is contained in Appendix B.

Figure 2.4: Peak Hourly Traffic Turning Movements (2020)



2.4 Intersection Operation

SIDRA Intersection 9 modelling software has been used to assess the traffic implications arising from the proposal on the key nearby intersection of Ropes Crossing Boulevard, Forrester Road and Links Road.

SIDRA calculates intersection performance as a level of service (LoS). SIDRA provides analysis of the operating conditions which can be compared to the performance criteria set out in Table 2.1. Level of service is directly related to the delays experienced by traffic travelling through the intersection. Level of service ranges from LoS A to LoS F. LoS A indicates the

intersection is operating with spare capacity, while LoS F indicates the intersection is operating above capacity.

Table 2.1: RMS Level of Service Criteria

Level of Service (LoS)	Average Delay per vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	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	Greater than 70	Unsatisfactory, requires additional capacity	Unsatisfactory, requires other control mode or major treatment

At signalised intersections, the average delay is the volume weighted average of all movements. For roundabouts and priority (give way and stop sign) controlled intersections, the average delay relates to the worst movement. Ropes Crossing Boulevard, Forrester Road and Links Road intersect at a roundabout, and thus, the SIDRA modelling results pertaining to the worst performing movement are presented in Table 2.2.

Table 2.2: Existing Conditions SIDRA Modelling Results

Intersection	Worst Performing Movement	Peak Period	Average delay (s)	Level of Service (LoS)
Ropes Crossing Boulevard- Forrester Road- Links Road	Links Road (western approach), right turn	AM	14	A
	Links Road (western approach), right turn	PM	21	B

The modelling results indicate that the roundabout currently operates at a LoS A and LoS B during the AM and PM road network peak periods, respectively. The worst performing movement is determined based on the average delay which is the right turn movement from Links Road (western approach) to Forrester Road (southern approach). Vehicles undertaking this movement experience an average delay of 14 seconds in the and 21 seconds in the AM and PM peak periods, respectively.

The modelling results show that the roundabout operates satisfactorily under the existing conditions. The SIDRA modelling results for the roundabout are provided in Appendix C.

2.5 Roadway Capacity

To determine the operational capacity for urban roads, Roads and Maritime Services' *Guide to Traffic Generating Developments* (2002), typical mid-block capacities have been applied to the surrounding road network as shown in Figure 2.5. The operational capacity of a road is the number of vehicles that a road can physically accommodate. It is generally accepted that on a two-way undivided road, the operational capacity can be as high as 900 passenger car units (pcu) per hour per lane.

Figure 2.5: Operational Capacity for Urban Roads

Table 4.3
Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

Source: Guide to Traffic Generating Developments (2002)

Dunheved Circuit is a two-way undivided road with one lane per direction. In June 2016, traffic movements across a 24-hour/ 7-day period was recorded on Dunheved Circuit.

In order to assess the operational capacity of Dunheved Circuit, the number of light vehicles and heavy vehicles have been converted to a uniform unit of measure; passenger car units (pcu). To convert the volume of heavy vehicles into pcu, a multiplication factor of three has been applied based on an average PCU factor for rigid heavy vehicles and articulated heavy vehicles. These factors are specified in Figure 2.6.

Figure 2.6: Passenger Car Unit Equivalencies

Vehicle type	PCU factor
Passenger car	1.0
Light commercial vehicle (LCV)	1.0
Rigid heavy	2.0
Bus	2.0
Articulated heavy	4.0

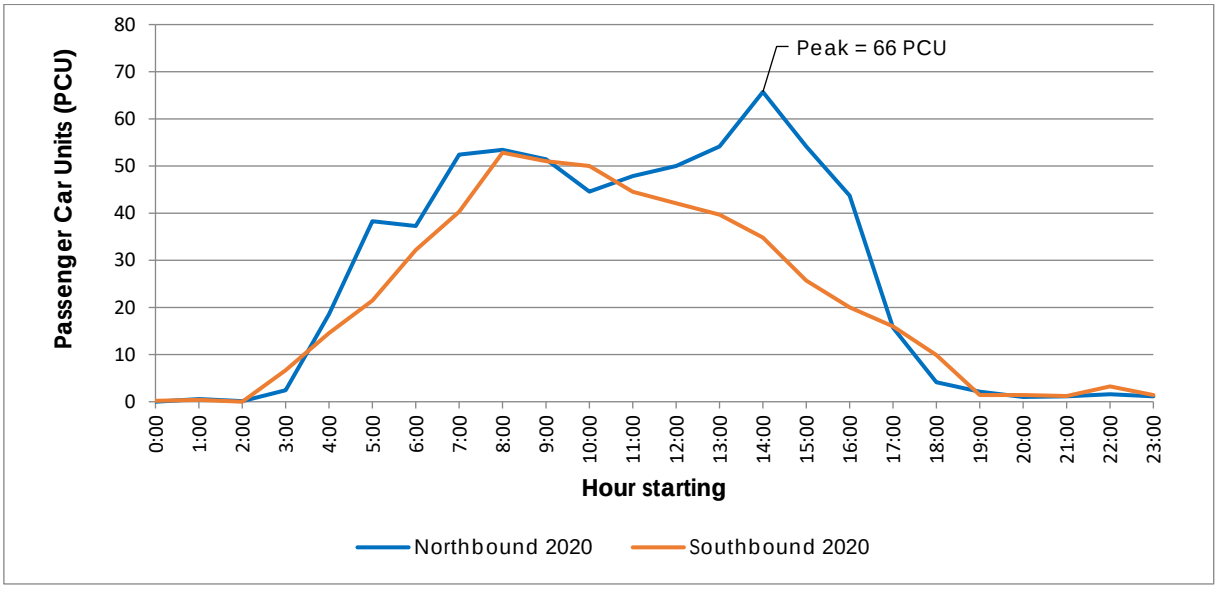
As with the traffic turning movements in Section 2.3, the June 2016 traffic flows on Dunheved Circuit have been extrapolated to 2020 using STM data. STM growth forecasts are not provided along Dunheved Circuit specifically. Therefore, 2020 traffic flows on Dunheved Circuit have been based on an average of the STM growth forecasts on Links Road which has been calculated as 0.3% per annum.

As such, the peak hourly traffic flows per direction are presented in Table 2.3 for 2016 and 2020. The average weekday traffic flows on Dunheved Circuit which have been derived for 2020 are illustrated in Figure 2.7. The raw tube count data is provided in Appendix A.

Table 2.3: Peak Passenger Car Units on Dunheved Circuit

Direction	Year 2016	Year 2020 (includes 0.3% p.a growth factor applied)
Northbound	65 vehicles/ hour (2pm-3pm)	66 vehicles/ hour (2pm-3pm)
Southbound	52 vehicles/ hour (9am-10am)	53 vehicles/ hour (9am-10am)

Figure 2.7: Passenger Car Units on Dunheved Circuit (2020)



From Figure 2.7, the maximum pcu per hour is 66 in the northbound direction which occurs between 2pm-3pm. This is well below Roads and Maritime's threshold of 900 pcu per lane per hour. Having regard for this, the surrounding road operates with traffic volumes well within its operational capacity threshold set within the Roads and Maritime's guidelines.

2.6 Public Transport

The nearest bus stop by is located along Forrester Road, approximately 1.9 km walking distance (23-minute walk) east of the site. Busways operate two services within the vicinity, namely, routes 759 and 780. Mount Druitt, Whalan, Tregear, Ropes Crossing, North St Marys, St Marys, Werrington, Cambridge Park, Kingswood, Wilmot, Lethbridge Park, Blackett, Dharruk, Hebersham, Emerton and Penrith.

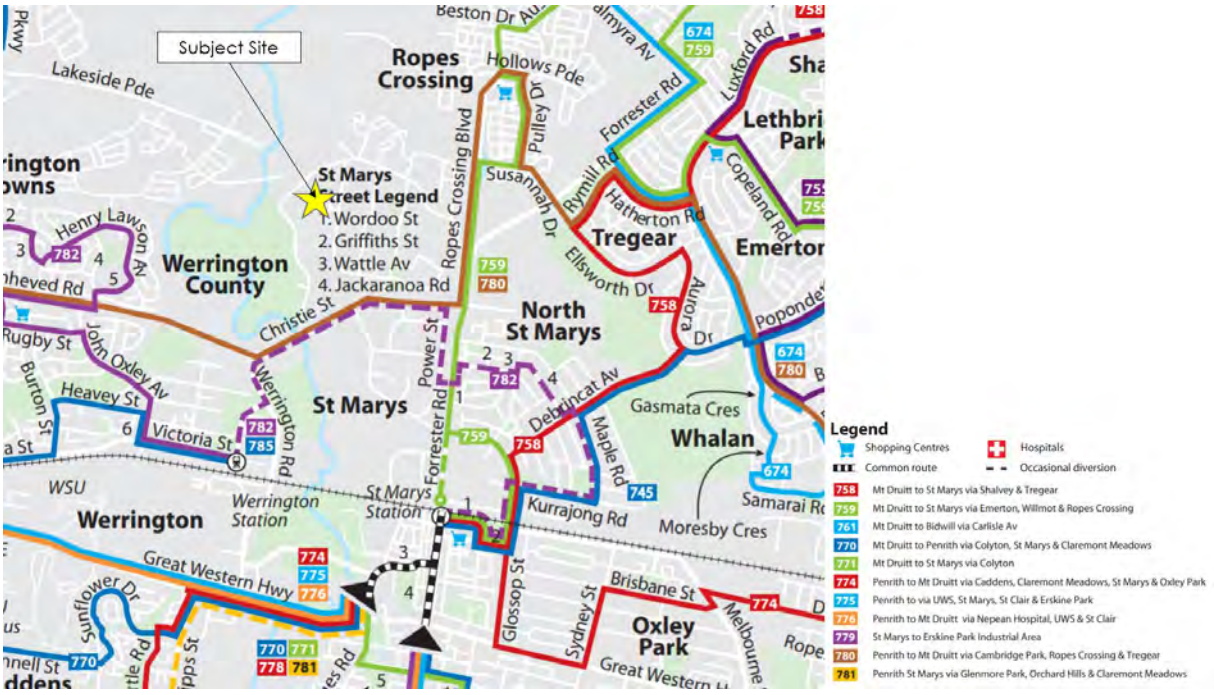
The site is located 3.3 km (40-minute walk) north of St Marys train station, which is serviced by the T1 Western Line. Express train services to St Marys station run from major transport interchanges including Penrith, Blacktown, Paramatta and Central.

A summary of public transport available within the vicinity of the Proposal site is provided in Table 2.4 while the proximity of services is shown in Figure 2.8.

Table 2.4: Public Transport Provision

Service	Route	Direction	Peak Frequency	Off-Peak Frequency
Train	T1 Western Line	To City from St Marys	3-10 mins	13-17 mins
		From Parramatta to St Marys	3-15 mins	5-19 mins
Bus	759	St Marys to Mount Druitt via Ropes Crossing	30 mins	60 mins
	780	Mount Druitt to Penrith via Ropes Crossing	10-15 mins	30 mins

Figure 2.8: Public Transport Routes



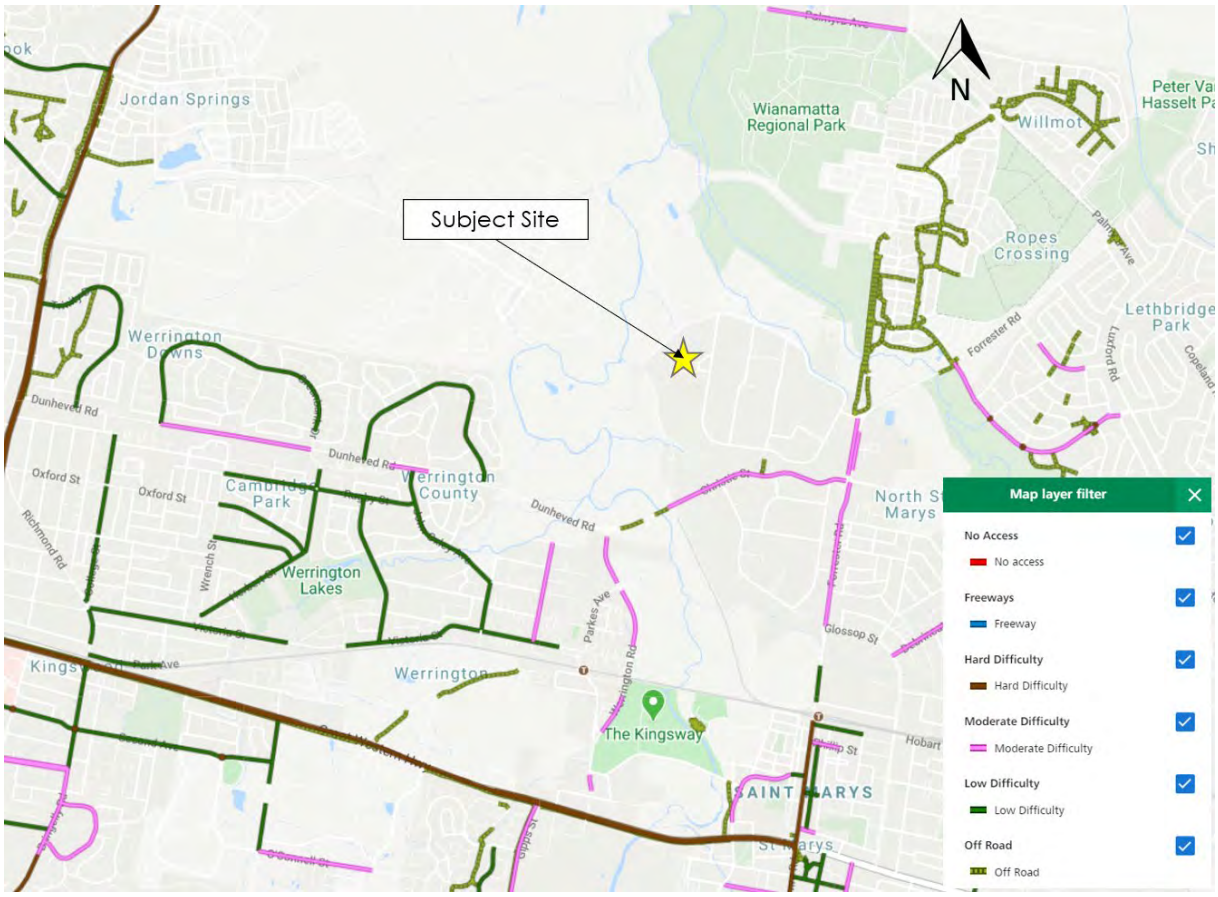
Source: Transport for NSW

2.7 Pedestrian and Cyclist Facilities

A footpath is located on Dunheved Circuit east side, however, there is no pathway within the Dunheved Circuit loop road.

According to Roads and Maritime's Cycleway Finder map, there is a mixture of off-road and on-road cycleways in the area. The on-road cycle route along Forrester Road is rated as medium difficulty and consists of riding in the road shoulder. As stated on the Cycleway Finder website, such a route is considered for usage by riders who are confident when riding with traffic. Cycling routes within the vicinity of the site are shown in Figure 2.9.

Figure 2.9: Surrounding Cycleways



Source: Roads and Maritime Services Cycleway Finder 2020

3 Proposed Development

3.1 Development Description

The Proposal seeks approval to utilise the existing facilities at 25 Dunheved Circuit to operate a resource recovery facility (RRF) with a waste material throughput of 150,000 tonnes per annum. The waste material will consist of 110,000 tonnes wood/timber waste and 30,000 tonnes of plasterboard. As a result of processing the timber materials, a minor amount of waste metals (10,000 tonnes) will be collected and transferred off-site for processing.

The proposed RRF would utilise the buildings and facilities which already exist on the site. As such, there will be no construction works proposed to the existing site or buildings on the site.

During the operation of the facility, it is proposed to have 15-18 full time employees across three shifts throughout the day; 6:30am-2:30pm, 2:30pm-10:30pm, and 10:30pm-6:30am. Standard daily operation would involve 5-6 employees on-site at any one time. During busy processing periods, there may be up to 10 employees on-site at a time.

3.2 Waste Material and Product

Processing of timber, wood and plasterboard material will occur within the existing material processing building by way of compaction and shredding/grinding. The majority of the processed wood will be transferred to the Borg Manufacturing site in Oberon, NSW to be used in the manufacture of particle board and MDF products, or to be used as fuel for dryers. The typical types of waste material include clean pallets, unlaminated particle board, MDF, LOSP pine and laminated MDF with coatings, along with other urban and raw wood materials deemed suitable.

Waste materials will come from a number of sources including Borg Panels customers (businesses), framing and truss builders, freight companies and other timber companies.

Plasterboard will be minimised and grinded, with paper removed during the grinding process. The gypsum generated by processing will be used for agricultural soil conditioning or re-used in plasterboard production.

Waste metals recovered during the timber processing will be manually sorted and separated, and then taken off-site to other waste facilities to be recycled or disposed of. All RRF activities (storage and processing) will be undertaken within the existing material processing building on-site.

Storage for 2,000-2,500 tonnes of incoming waste material and outgoing processed material will be provided inside the existing building. The maximum amount of stored material on-site at any one time will not exceed 5,000 tonnes. The materials will be stored in bunker areas inside of the building, with each stockpile less than 1000 m^3 in capacity (generally, 3-4m in height by 15-20m in length). There will be no external storage of materials.

3.3 Car Parking

It is proposed to maintain the existing 10 car parking spaces provided on-site within short walking distance of the site office.

The suitability of the parking provision and layout is discussed in Chapter 5 of this report.

3.4 Vehicle Access and Circulation

Access to the site will be maintained as existing; that is, via a single two-way driveway as shown in Figure 3.1.

Figure 3.1: Site Access

Source: TTPP, imagery dated 23/10/2020

The driveway within the site is approximately 100 m in length and has been fitted-out with bollards at the entry and a safety barrier along the southern site boundary. This driveway will be used by all vehicles accessing the site (light vehicles and heavy vehicles up to a 19m semi-trailer). As per the approval granted for SSD-8200, vehicles will enter the site by turning left-in and exit the site by turning left-out via Dunheved Circuit.

Delivery vehicles will enter the site and proceed to the inbound weighbridge located on the western side of the site. All delivery vehicles are to be weighed and recorded prior to waste tipping. Loads will be inspected at the inbound weighbridge as the load is being weighed.

The delivery vehicle will then proceed to the tip floor that is located within the waste processing building. Incoming loads will be discharged in a dedicated waste unloading area, which will be on the concrete hardstand floor within the building. Any small quantities of non-conforming material that can easily be removed will be separated and set aside for later disposal. Highly contaminated loads will be re-loaded and removed from the site. Inspected and cleared waste will be transferred to a concrete bunker within the building until ready for processing.

Once the delivery vehicle has tipped its load, it will then proceed to the outbound weighbridge on the eastern side of the site, and then exit the site.

The layout of the proposed RRF showing the path of travel for heavy vehicles as described above is illustrated on the site plan that is contained in Appendix E.

4 Traffic Impact Assessment

4.1 Design Rate

Under the State Environmental Planning Policy (Infrastructure) 2007, the Proposal site is considered a 'traffic-generating development'. Hence, it is a requirement to assess the impact of traffic associated with the future operation of the Proposal site.

Roads and Maritime's *Guide to Traffic Generating Developments* is used to determine the traffic generation for different developments types and land uses. The Guide states that *"…peak traffic generation period for industrial land use is generally determined by three key factors: employee density, travel mode and peak period travel distribution."* The Guide also recognises that peak period traffic generation of industrial land uses differs depending on the specific industrial development type.

The Guide contains traffic generation rates for industrial development types, including factories, warehouses, and business parks. Of these development types, factories and warehouses are most similar to that of the Proposal. The traffic generation rates for factories and warehouse are summarised in Table 4.1.

Table 4.1: Traffic Distribution Rates for Factories and Warehouses

Development Type	Traffic Generation Rate	
	Peak Hour Vehicle Trips	Daily Vehicle Trips
Factories	1 per 100m² of GFA	5 per 100m² of GFA
Warehouses	0.5 per 100m² of GFA	4 per 100m² of GFA

The abovementioned trip rates are based on the gross floor area (GFA) of the development. However, vehicle movements associated with the proposed RRF are not directly impacted by changes in the GFA; rather, it is influenced by the amount of material throughput. Hence, application of Roads and Maritime's traffic generation rates is not considered to be appropriate for the proposed RRF.

For a resource recovery facility, traffic generation is a function of the volume of waste throughput at the facility. Therefore, the traffic generation for the site is more appropriately determined based on an empirical traffic generation assessment which considers the tonnage of waste to be transported through the site. An analysis based on this method of estimation is carried-out in the following Section of this report.

4.2 Traffic Generation

Deliveries to the site are proposed across a 24-hours/ 7-day period. The majority of small to medium deliveries (around 95%) will be undertaken by rigid trucks during the day between 7am-4pm while most larger deliveries (around 80%) will occur at night between 6pm-3am. Timber waste material will come from other resource recovery centres, such as Bingo, Benedict, and Cleanaway.

Most of the processed material (around 80%) will be dispatched from the site after 6pm. Processed materials may be sent to the Borgs Manufacturing facility in Oberon to be used in the manufacture of particle board and MDF products or to be used as fuel for dryers in the manufacturing process. The gypsum generated by waste material processing is also used for agricultural soil conditioning or re-used in plasterboard production, and therefore, processed material may also be sent to agricultural sites in Forbes and the CSR Gyprock facility in Wetherill Park.

Delivery and collection vehicles will range in size from a 12.5 m heavy rigid vehicle (front lift truck/ hook-lift truck/ skip bin truck) to a 19 m semi-trailer (walking floor trailer). The general mass limit (GML) for each vehicle type (i.e. mass of vehicle plus load) as stipulated by the National Heavy Vehicle Register's *Common Heavy Freight Vehicle Configurations* is specified in Table 4.2. The average payload (i.e. mass of load only) as based on other similar RRFs which has been adopted in this analysis is also presented in Table 4.2. Using this information, the 24-hour profile for vehicle trips generated by the Proposal is expected to be as presented in Table 4.3.

Table 4.2: Heavy Vehicle Payloads

Vehicle Type	Typical Vehicle Configuration	Maximum Regulatory Mass under GML	Payload
12.5m Heavy Rigid Vehicle	 4 Axle Twin-steer Rigid Truck	26.5 tonnes	11 tonnes
19 m Semi-trailer	 5 Axle Semitrailer	35.0 tonnes	20 tonnes

Table 4.3: Future Traffic Generation

Hour Starting	Heavy Vehicles (Waste Deliveries and Product Collections)		Light Vehicle Trips (Employees)		Total (Light Vehicles + Heavy Vehicles)	
	No. of Vehicles	No. of Trips	No. of Vehicles	No. of Trips	No. of Vehicles	Total Trips
0:00	2	4	0	0	2	4
1:00	2	4	0	0	2	4
2:00	2	4	0	0	2	4
3:00	1	2	0	0	1	2
4:00	1	2	0	0	1	2
5:00	1	2	0	0	1	2
6:00	1	2	Shift change-over: 5 cars exit and 6 cars enter	11	12	13
7:00 [1]	2	4	0	0	2	4
8:00	2	4	0	0	2	4
9:00	2	4	0	0	2	4
10:00	2	4	0	0	2	4
11:00	2	4	0	0	2	4
12:00	2	4	0	0	2	4
13:00	2	4	0	0	2	4
14:00 [2]	2	4	Shift change-over: 6 cars exit and 6 cars enter	12	14	16
15:00	2	4	0	0	2	4
16:00 [3]	1	2	0	0	1	2
17:00	1	2	0	0	1	2
18:00	2	4	0	0	2	4
19:00	3	6	0	0	3	6
20:00	3	6	0	0	3	6
21:00	3	6	0	0	3	6
22:00	2	4	Shift change-over: 6 cars exit and 5 cars enter	11	13	15
23:00	3	6	0	0	3	6
Total	**46 HV**	**92 HV Trips**	**17 LV**	**34 LV Trips**	**80 Vehicles**	**126 Vehicles Trips**

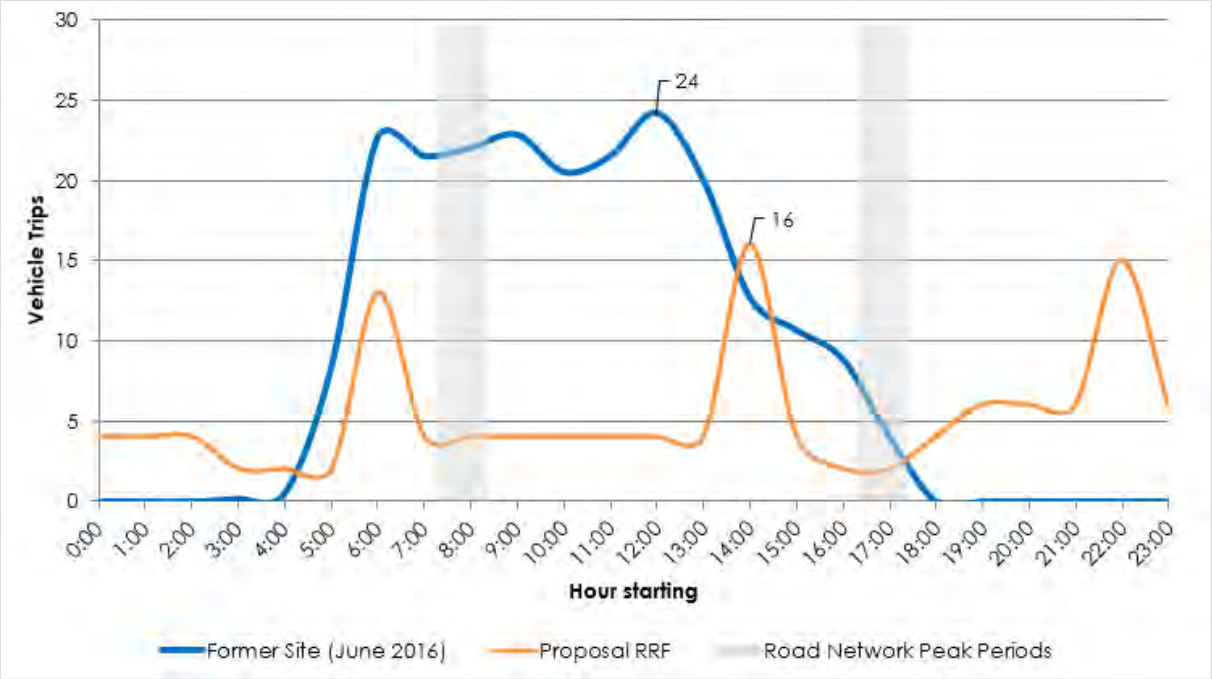
Notes:
[1] – Local road network AM peak hour
[2] – Site operational peak hour
[3] – Local road network PM peak hour

As presented in Table 4.3, a total of 126 daily vehicle trips are anticipated to be generated by the future RRF on an typical day. This number includes movements by waste delivery/ product collection vehicles and car trips by employees when arriving and departing the site. The site peak trip generation is expected to be 16 trips between 2pm-3pm (i.e. four heavy vehicle trips plus 14 car trips due to shift change-over at 2:30pm).

In any hour, the maximum number of heavy vehicles generated by the future RRF per hour would be in the order of three trucks (i.e. six trips). This would occur from 7pm each day, once the waste material received during the day has been processed and prepared for dispatch.

In June 2016, an automatic tube count across a 24-hour/ 7-day period was undertaken at the site access driveway to gain an appreciation of vehicle trips generated by the former site. At the time, the site generated an average of 220 trips per day and 24 trips in the site peak hour. The proposed RRF is estimated to generate an average of 126 trips per day and 16 trips in the site peak hour. A comparison of vehicle trip generation by the former site operation and the proposed RRF is illustrated in Figure 4.1.

Figure 4.1: Trip Generation Comparison



Comparatively, the proposed RRF will generate approximately half the amount of daily vehicle trips of the former site operation. Furthermore, the proposed RRF would generate a third less vehicle trips during the site peak period.

In addition to the above, SSD-8200 was granted approval for the operation of a RRF estimated to generate an average 194 trips per day (up to 239 trips at peak times) and 20 trips in the site peak hour (up to 24 trips at peak times in the year). In comparison to SSD-8200, the proposed RRF will also generate significantly less vehicle trips.

Table 4.4 presents a comparison of the hourly trip generation of the former site, the previously approved SSD-8200, and this Proposal.

Table 4.4: Site-Generated Trips Comparison

Hour Starting	Former Site	Approved SSD-8200 [1]		This Proposal
		Typical Day	Busy Day	
0:00	0	4	5	4
1:00	0	4	5	4
2:00	0	4	5	4
3:00	0	4	5	2
4:00	1	4	5	2
5:00	8	4	5	2
6:00	23	5	6	13
7:00 [2]	22	5	6	4
8:00	22	6	8	4
9:00	23	10	12	4
10:00	21	16	20	4
11:00	22	20	24	4
12:00	24	18	22	4
13:00	20	20	24	4
14:00	13	18	22	16
15:00	11	16	20	4
16:00 [3]	9	6	8	2
17:00	4	5	6	2
18:00	0	5	6	4
19:00	0	4	5	6
20:00	0	4	5	6
21:00	0	4	5	6
22:00	0	4	5	15
23:00	0	4	5	6
Total Trips	**220**	**194**	**239**	**126**

Notes:
[1] – Data extracted from the Transport Impact Assessment prepared on behalf of Bingo Industries (dated July 2017).
[2] – Local road network AM peak hour
[3] – Local road network PM peak hour

During the road network peak periods, the proposed RRF is estimated to generate 4 trips in the AM peak period and 2 trips in the PM peak period. Survey data collected at the former site indicates that is generated 22 trips in the AM peak and 7 trips in the PM peak periods. Hence, the peak hourly trip generation associated with the Proposal will be equivalent to approximately a quarter of the former site which is a significant reduction in vehicles.

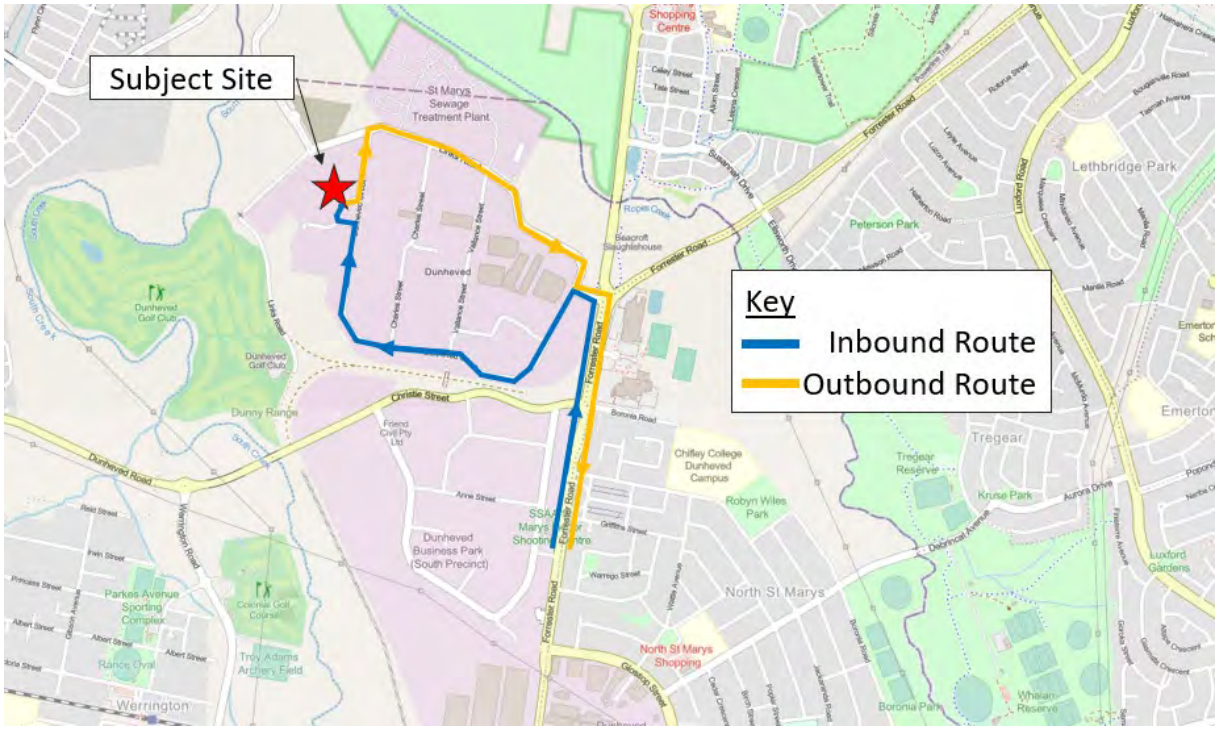
As such, the Proposal will have a reduced impact compared to the former site (and SSD-8200 which was previously granted approval), thereby generating a benefit for the surrounding road network by removing vehicles from the network. Overall, the proposal would have minimal impact on the surrounding road network.

4.3 Traffic Distribution

In the context of the wider road network, heavy vehicles will use Great Western Highway, M4 Western Motorway and M7 Westlink Motorway when travelling to/from the site. Within the vicinity of the site, heavy vehicles would travel to/from the site via Forrester Road, Links Road and Dunheved Circuit as shown in Figure 4.2.

As per Table 4.3, the proposal is estimated to generate 2 vehicle trips in the AM peak hour and 4 vehicle trips in the PM peak hour. This equates to an average of one truck movement every 15-30 minutes which would have a negligible impact on the intersection operation of the Ropes Crossing Boulevard- Forrester Road- Links Road roundabout.

Figure 4.2: Haul Route



4.4 Surrounding Key Developments

An appreciation for the development of the St Marys Development Site has been included as part of this TIA. The St Marys Development Site is located approximately 5 km to the north-east of Penrith, and comprises five discrete precincts identified as:

- Jordan Springs – formerly known as Western Precinct
- Jordan Springs East – formerly known as Central Precinct
- Ropes Crossing – formerly known as Eastern Precinct and Ropes Creek Precinct
- North Dunheved
- South Dunheved.

A map showing the location of the precincts within context of the proposed RRF at 25 Dunheved Circuit is provided in Figure 4.3.

The total development of the St Marys Development Site will be a total of 7,712 dwelling houses, 599 apartments, 14,335 m^2 retail/shopping centre and 99,000 m^2 industrial together with commercial, childcare, medical centre and school facilities. The Jordan Springs East (formerly Central Precinct) which is situated nearest to the Proposal site, is intended to accommodate a residential population of around 2,500, and light industrial and manufacturing sectors generating about 760 jobs.

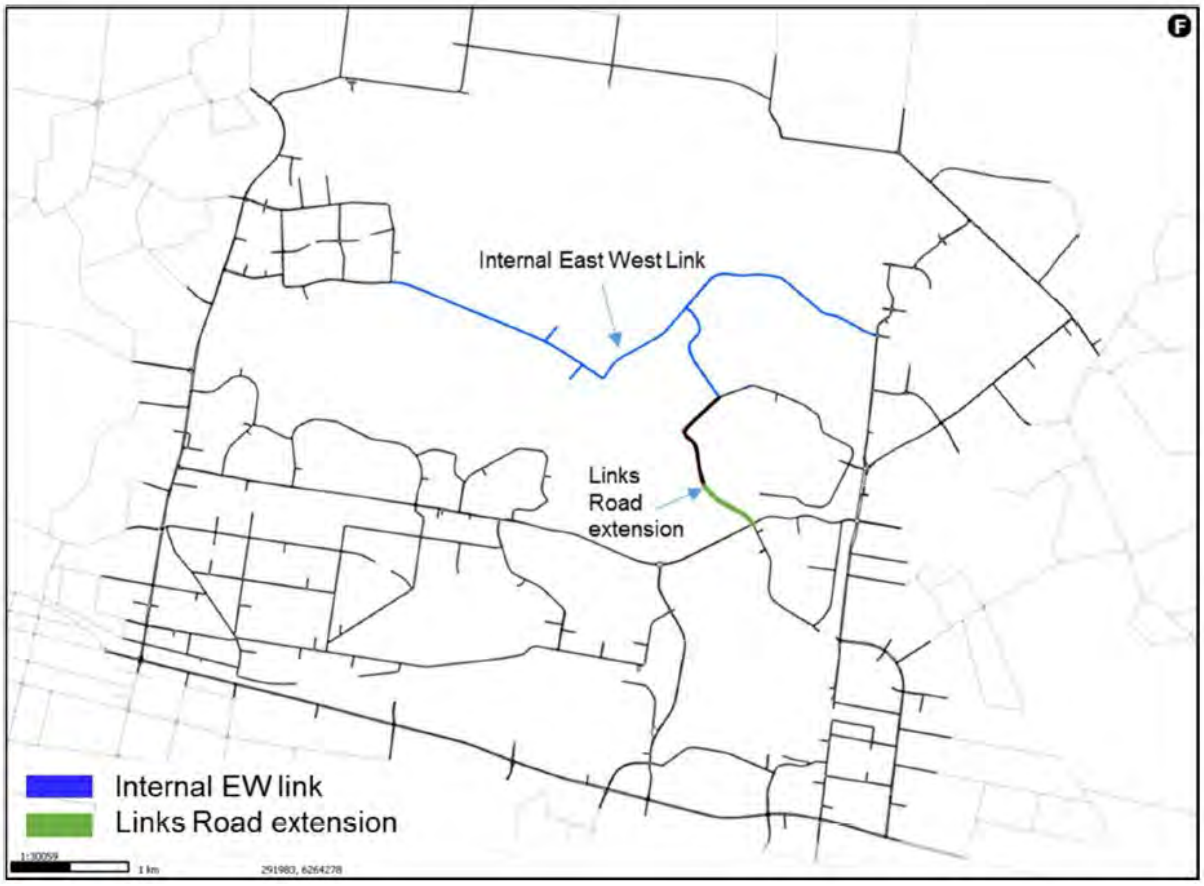
WSP was appointed by The Maryland Development Company Pty Ltd, a subsidiary of Lendlease, to undertake a traffic modelling study to evaluate the impact of the St Marys Development site on the surrounding road network. The Traffic and Transport assessment which was prepared in October 2017 assessed the development impact on the external road network having consideration for two new link roads in the vicinity, namely:

- A new internal east-west link between Jordan Springs and the Dunheved Business Park North Precinct, and
- A new extension of Links Road towards Christie Street, at a signalised intersection.

These new road links are illustrated in Figure 4.4.

Figure 4.3: St Marys Development Site Precinct Locations

Figure 4.4: New Future Road Links



Traffic modelling was carried out by WSP using mesoscopic modelling software, AIMSUM. Of particular interest to the Proposal (this TIA) is the intersection connecting the Dunheved Business Park North Precinct with the surrounding arterial road network, namely, the Forrester Road - Ropes Crossing Boulevard - Links Road roundabout.

Construction works for the St Marys Development Site have been underway since early 2016 and the development is anticipated to be completed by the end of 2021. A connection road between Jordan Springs East and Links Road within the Dunheved Business Park North Precinct is currently under construction. As part of this TIA, Penrith City Council was consulted by email and had advised that the opening date for the connection road is not yet known due to unresolved details of the project. On this basis, 'base case' modelling undertaken as part of this TIA is based on the existing road network arrangement whereby the connection road is not open to the public.

As assessed in Section 4.2, the Proposal is estimated to generate 4 vehicle trips in the AM peak and 2 vehicle trips in the PM peak periods. Comparatively, the Proposal will generate half the amount of daily vehicle trips of the former site operation. Having regard to the scale of development in the St Marys precinct, the Proposal would have a miniscule trip generation which would go unnoticed when cumulatively assessed with the St Marys Development Site.

In order to assess and draw conclusions on the impact of the Proposal the future modelling cases presented in this TIA adopt a similar road network configuration as current without the St Marys Development Site. Notwithstanding this, it is fully acknowledged that the future road network configuration is subject to changes which include the new link roads in the vicinity as shown in Figure 4.4 and varied traffic flow projections as associated with the St Marys Development Site.

4.5 Operational Traffic Impact

SIDRA modelling analysis has been undertaken to assess the impact of the proposal on the intersection operation of the nearby intersection Ropes Crossing Boulevard- Forrester Road-Links Road roundabout. The modelling analysis considers the opening year of the development which has been taken as by the end of year 2020, and opening year plus 10 years i.e. year 2030.

For the year 2030, background traffic growth plus (population increase) and growth in traffic due known proposed developments in the vicinity, are based on TfNSW's STM projections given for Links Road, Ropes Crossing Boulevard and Forrester Road. The SIDRA modelling results of both future cases are summarised in summarised in Table 4.5.

Traffic turning movements in both the future scenarios are shown in Figure 4.5 and Figure 4.6.

The 2016 traffic survey data is contained in Appendix A while the STM data used to generate the 2020 traffic flows is contained in Appendix B.

Figure 4.5: Future Traffic Turning Movements (Opening Year - 2020)

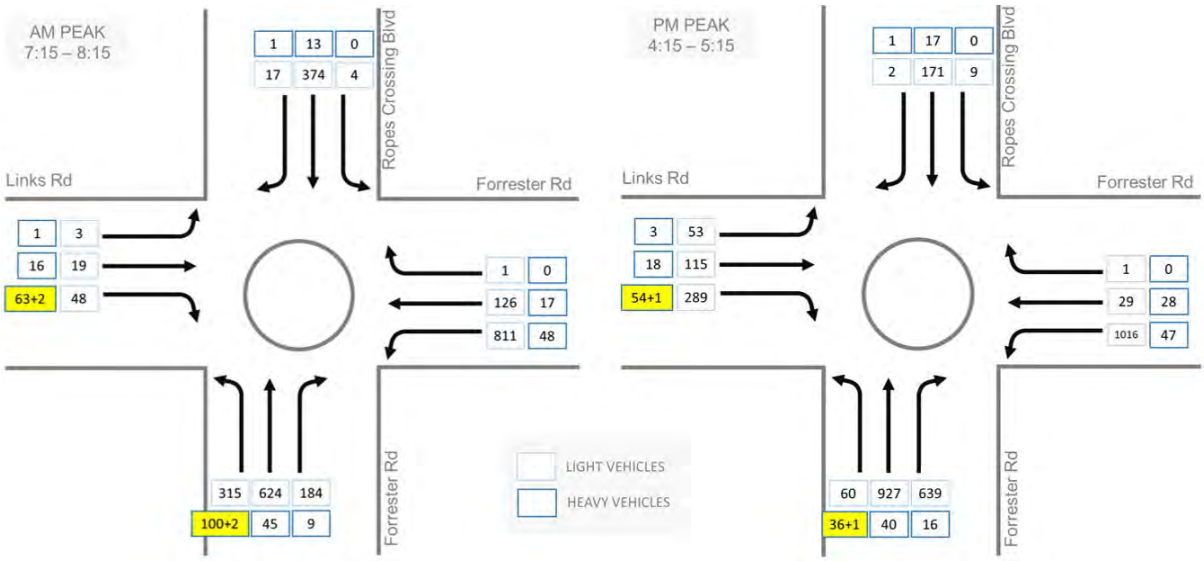


Figure 4.6: Future Traffic Turning Movements (Opening Year plus 10 Years - 2030)

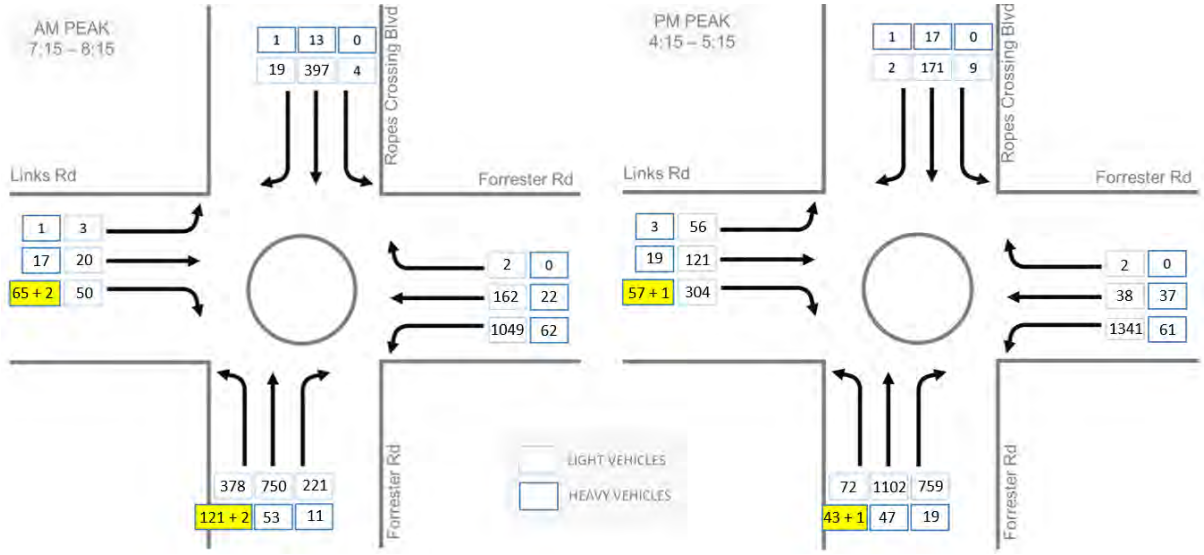


Table 4.5: Future Conditions SIDRA Modelling Results

Scenario	Worst Performing Movement	Peak Period	Existing Conditions		Future Conditions, Without Development Traffic [1]		Future Conditions, With Development Traffic [2]	
			Average delay (s)	LoS	Average delay (s)	LoS	Average delay (s)	LoS
Base Case (2020)	Links Road (western approach), right turn	AM	14	A	N/A			
	Links Road (western approach), right turn	PM	21	B				
Opening Year (2020)	Links Road (western approach), right turn	AM	N/A		14	A	14	A
	Links Road (western approach), right turn	PM			21	B	21	B
Future Year (2030)	Forrester Road (south approach), left turn	AM			108	F	110	F
	Links Road (western approach), right turn	PM			112	F	116	F

Notes:
[1] Future conditions without development traffic considers background traffic growth only
[2] Future conditions, with development traffic considers background traffic growth plus development traffic

The results of the intersection modelling analysis indicate that the intersection would continue to operate at a LoS A in the AM peak period and LoS B in the PM peak period, with no increase in average delay in the opening year of the proposed development. The worst performing movement remains as the right turn movement from Links Road (western approach) to Forrester Road (southern approach), experiencing the same average delay as under the existing conditions.

Modelling results for the future 2030 scenario indicates that background traffic growth which is unrelated to the proposed development would cause the intersection to operate poorly (LoS F) in the AM and PM peak periods. Inclusion of the development generated traffic results in a marginal increase in average delay; that is, plus 2 seconds in the AM peak hour and plus 4 seconds in the PM peak hour. As such, the impact to the intersection operation caused by the proposed development would be negligible.

The modelling results of future scenarios indicate that the Proposal is expected to generate a minor impact on the surrounding road network during at peak times. Detailed outputs of the SIDRA intersection analysis for the site operations are contained in Appendix C.

In response to the poor level of service in the 2030 future scenario, it is expected that the traffic flows through this junction would be alleviated through the construction of new link roads as described in Section 4.4. The new extension of Links Road towards Christie Street would alleviate pressure at this intersection by providing a more direct journey towards the south in comparison to travelling via Forrester Road. Furthermore, the new internal east-west link further assist providing a more direct connection towards the north for traffic travelling to/from the Jordan Springs vicinity.

It is acknowledged that TfNSW (RMS) has requested further detail as follows, "*the traffic modelling should consider the scenarios of year 2026, 2031, 2036 and the year until the facility cease operation"* To address this request, two future scenarios have been assessed, namely, the proposed development Opening Year and a plus 10 years scenario. In both cases, the Proposal is expected to have a negligible impact on the surrounding network which is also expected to continue into the future beyond 2030.

Furthermore, it is not known when the RRF is proposed to cease operation. However, for as long the Proposal operates as assessed within this TIA, it is not expected to have a noticeable impact on the surrounding road network.

Also, TfNSW has requested that the modelling analysis "*should include, but not be limited to the intersections of Forester Road/Links Road/Ropes Crossing Boulevard and Forester Road/Christie Street/Boronia Road."* The intersection of Forester Road/Links Road/Ropes Crossing Boulevard has been assessed in this TIA on the basis that it is the primary access point to the Dunheved Business Park North Precinct which is where the subject site is located. Following the proposed vehicle haul route (Figure 4.2), the number of vehicle trips passing through this roundabout would be equal to those passing through the Forester Road/Christie Street/Boronia Road intersection. The impact of the Proposal at the Forester Road/Links Road/Ropes Crossing Boulevard has been assessed to be minor. Therefore, it is expected that the Proposal would also generate a minor impact at the intersection of Forester Road/Christie Street/Boronia Road.

4.6 Roadway Capacity and Safety

As mentioned in Section 2.5, Dunheved Circuit carries a maximum of 66 pcu (in the northbound direction between 2pm-3pm) which is well below the threshold limit as specified by Roads and Maritime.

In the same hour, the former site operation generated 13 vehicle trips (12 heavy vehicle trips plus 1 light vehicle trip) which is the equivalent of 37 pcu per plane per hour. The proposed RRF is estimated to generate 16 vehicle trips (4 heavy vehicle trips plus 12 light vehicle trips) in the same period. Equivalently, that would be 24 pcu per lane per hour.

Theoretically, the proposal would result in a reduction in peak traffic flow on Dunheved Circuit by 13 pcu per lane per hour. As such, a reduction in traffic flow would benefit the surrounding road network in terms of safety and operation as there would be less vehicles travelling on the network. On this basis, road upgrades, infrastructure works or new roads would not be required for the proposed development.

5 Car Parking Assessment

5.1 Car Parking Rates

The *State Environmental Planning Policy (State and Regional Development) 2011*, Part 2, Clause 11 stipulates that Council's development control plans do not apply to state significant developments. However, having due regard to the objectives and guidelines as set by Council for industrial developments, the provision for car parking of the proposed development has been assessed in accordance with the Penrith City Council's Development Control Plan (DCP) 2014 as well as undertaking an assessment of the actual operation of the proposal.

Penrith City Council's DCP sets out a number of objectives to ensure the operational safety and amenity of parking and accessibility for industrial developments, which include:

- ensure the provision of an appropriate number of vehicular spaces having regard to the activities present and proposed on the land, the nature of the locality and the intensity of the use;
- require parking areas to be designed and constructed in accordance with the Australian Standards for efficient and safe vehicle circulation and parking
- reduce pedestrian and vehicle conflicts on development sites
- facilitate an appropriate level of on-site parking provision to cater for a mix of development types.

Typically, these objectives are satisfied through the application of Council's DCP parking provisions. Although the DCP does not stipulate parking rates for resource recovery centres exclusively, it does specify rates for industrial developments based on the type of development.

As per the Penrith LEP 2010, an 'industry' is defined as a general industry whereby 'industrial activity' is carried out. Such activities include processing, recycling and any storage or transportation associated with any such activity. Based on this definition, the Proposal site is classified as an 'industry' having a minimum onsite car parking requirement as summarised in Table 5.1.

Table 5.1: DCP Car Parking Requirements - Industrial Land Use

Development Type	Rate	Proposed Area	Minimum Required Parking
Industries, including ancillary office	1 space per 75m² of GFA or 1 space per 2 employees, whichever is the greater	3,455 m² waste processing building + 153 m² office/ amenities building Or 15-18 full-time employees	48 spaces or 9 spaces

Based on Council's DCP, the minimum required car parking provision would be 48 spaces. For the 5-6 employees (maximum 10) proposed to be present on-site at any given time, a parking provision for 48 spaces would be excessive. In this instance, the on-site parking provision would be more appropriately measured based on the number of staff on-site at any given time.

During the operation of the facility, there will be 15-18 full-time employees spread across three shifts throughout the day; 6:30am-2:30pm, 2:30pm-10:30pm, and 10:30pm-6:30am. Standard daily operation would involve 5-6 employees on-site at any one time. During busy processing periods, there may be up to 10 employees on-site at a time. Therefore, provision for 10 car parking spaces will sufficiently accommodate all staff on-site.

Day-to-day operation of the future facility will generate low and infrequent visitation. Therefore, visitor parking is not deemed to be required for the operation of the future facility. In the case that a visitor will be attending the site, the Operator will be informed prior to the appointment and parking arrangements on-site will be made accordingly.

Based on the above, a total of 10 car parking spaces would adequately accommodate the future staff parking demand on-site thereby fulfilling the objectives as set out in the DCP.

Parking, queuing, and storage of vehicles or any plant associated with the facility will not be permitted off-site within the surrounding area, which includes the reserve area opposite the site. As with all other road rules, vehicle drivers associated with the facility are expected to obey 'No Stopping' restrictions on Dunheved Circuit, particularly along the loop road and opposite the site access driveway. It is noted that the reserve area opposite the site is currently fenced off and no access to the area is permitted.

Council's DCP specifies that accessible parking spaces should be provided in accordance with Disability (Access to Premises - Buildings) Standards 2010 and Building Code of Australia (BCA). Under Clause D3.5, the proposed development is classified as a Class 5, 6, 7b, 8 and 9a building and has a disabled car parking provision of one space for every 100 car parking spaces or part thereof.

Applying the accessible parking rate as per the BCA it is required to provide 0.1 accessible parking spaces for the proposed development. This generates a miniscule accessible parking provision for a site which is considered to have infrequent disabled persons who require to park and leave their vehicle. Based on the operation and functionality of the site, accessible spaces would not be provided as part of the future development.

5.2 Parking Layout

The Australian Standard for Off-street car parking (AS2890.1:2004) requires car parking spaces for employee parking to be provided as Class 1A parking spaces. Class 1A car parking spaces are to have the following minimum dimensions:

- Bay length of 5.4m
- Bay width of 2.4m.

As per the previous development approval, the on-site car park has been designed in accordance with the above minimum requirements. Hence, the proposed car parking layout is satisfactory.

5.3 Bicycle Parking Requirements

The DCP states that bicycle parking should be provided in accordance with the suggested bicycle parking provision rates for different land use types in NSW Government's *Planning guidelines for walking and cycling* (2004). For industrial and warehousing land uses, the following bicycle parking rates are recommended:

- Staff (long-term use), 3-5% of staff
- Visitor (short-term use), 5-10% of staff.

Applying an average of the above rates, the allocation of bicycle parking would be less than one space for staff and one space for visitors. Due to the low number of bicycle parking spaces that these rates generate, it is not proposed to provide designated bicycle racks or parking spaces onsite. However, if a visitor or member of staff rides to the site there would be sufficient space in the site office to safely store the bicycle.

6 Site Layout

6.1 Site Access and Circulation

Penrith City Council's DCP outlines the design controls for accessing industrial developments. It states that the development shall be designed to permit the following:

- allow all vehicles to enter and leave the site in a forward direction
- accommodate heavy vehicle parking and manoeuvring areas
- avoid conflict with staff, visitor vehicular and cycle movements, and
- ensure satisfactory and safe operation within the adjacent road system.

All vehicle movements in/out of the site will be undertaken in a forward direction only. Reversing into and out of the site would not be permitted under any circumstance.

Similarly, vehicle circulation routes within the site would occur in a forward direction.

Prior to site entry, all waste contractors will have received an electronic information pack from the Site Operator containing a map of the site layout. Truck drivers travelling to the site would be repeat drivers and therefore would be familiar with the access procedures on-site. The one-way traffic flow arrangement on-site also provides drivers a simple and transparent travel route through the site. Notwithstanding, signage and line marking would be provided on-site for guidance. Also, site personnel would be present on-site to direct a delivery driver should there be any uncertainty. Similarly, any special visitors scheduled at the site will receive information showing the site entry, allocated parking bay, and site exit.

6.2 Sight Distance

The minimum requirement for sight distance for cars and commercial vehicles (heavy vehicles) at an access driveway are stipulated by Australian Standards AS 2890.1:2009 and AS 2890.2:2018, respectively. Along a street with a speed limit of 50 km/h, the sight distance requirements are as follows:

- For cars, minimum sight distance is 45 m.
- For heavy vehicles, minimum sight distance is 69 m.

As shown in Figure 6.1, sight distance to the Dunheved Circuit loop road north approach is satisfactory as there are no obstructions between the driveway and an oncoming vehicle. Looking towards the south approach, there is an existing tree located within the reserve area opposite the site. As observed on-site, the existing tree does not impede visibility between the driveway and an oncoming vehicle. The driving view towards the site driveway as shown in Figure 6.1 demonstrates that driver visibility is sufficient past the tree and would not compromise sight distance at the site access driveway.

Furthermore, sight distance for heavy vehicles is measured at 2.4 m above the road level (and 1.1 m for a car) which would further enhance sight distance from a truck towards the frontage road.

It is noted that there is wire mesh fencing located along the boundary of the reserve area opposite the site driveway. However, it does not impede sight distance as can be seen in Figure 6.1.

Figure 6.1: Sight Distance at Access Driveway

On this basis, the sight lines around the site access driveway is provided in accordance with Australian Standards, and is not comprised by street trees, landscaping or fencing.

6.3 On-site Vehicle Stacking

The site access driveway is approximately 100 m in length and is able to accommodate the stacking of five (x5) 19 m semi-trailers or seven (x7) 12.5 m heavy rigid vehicles at one time. In addition, one vehicle can be accommodated on the inbound weighbridge while another vehicle is located within the material processing building. Therefore, the site is able to accommodate between 7-9 heavy vehicles on-site, subject to the type of vehicle.

As assessed in Section 4.2, the maximum number of heavy vehicles generated by the future RRF per hour would be in the order of three trucks. This would occur from 7pm each day, once the waste material received during the day has been processed and prepared for dispatch. These three vehicles would be sufficiently accommodated within the available stacking space internal to the site.

As such, queuing of site-generated vehicles would be entirely accommodated on-site and there would be no queueing from the site onto the frontage road.

6.4 Vehicle Swept Paths

The circulation road layout on-site has been designed to accommodate forward movements by the largest vehicle accessing the site, that is, a 19m semi-trailer. Circulation aisles within the site provide sufficient width for the 19m semi-trailer (longest vehicle) to adequately move through the site.

All heavy vehicles accessing the site would enter by turning left-in off the Dunheved Circuit loop road. Upon exit, all trucks would turn left-out from the same driveway.

A swept path analysis showing the turning movements on-site and at the site access driveway are contained in Appendix D. When turning in and out of the site, a large heavy vehicle (19m semi-trailer) would require the full width of the roadway on Dunheved Circuit. As per AS2890.2 Parking facilities, it is considered acceptable for a heavy rigid vehicle or articulated vehicle to take up most of the public road width when turning left into/ out of a driveway. Thus, turning movements at the site access can be undertaken adequately without any need for road upgrades, infrastructure works or new roads.

According to the Roads and Maritime Services' Performance Based Standards (PBS) map online, the Dunheved Business Park North Precinct is approved for PBS Level 1 vehicles as shown in Figure 6.2. The PBS Level 1 classification includes 19m semi-trailers. As such, these vehicles are permitted to travel to/from the subject site through the approved areas.

Figure 6.2: Performance Based Standards Approved Area

6.5 Pedestrian Access and Internal Movements

All vehicle and pedestrian routes within the site would be separated, and signposted and/ or delineated as such. Pedestrians must give way to all vehicles onsite, including trucks and mobile plants. When moving around onsite, pedestrians must keep to the designated pathway. Where the pathway intersects with a traffic route, pedestrians are required to give-way to vehicles before crossing the traffic lane.

As a rule-of-thumb, Personal Protective Equipment (PPE) must be worn by all persons when on-site. All persons on site are required to wear high visibility clothing to enhance discernibility of pedestrians during day and night conditions.

The number of pedestrian movements throughout the site would be low and generally limited to the start/end of work shifts and at lunch time. Therefore, interaction between vehicles and pedestrians would be minimal.

7 Conclusion and Summary

Based on the analysis and discussions presented within this report, the following summary and conclusions are made:

- The proposal seeks to facilitate an annual waste throughput of 150,000 tonnes of timber waste material and increase its hours of operations to 24-hours per day, 7 days per week.
- Having regard to Penrith City Council's DCP the proposed development generates a parking requirement of 48 car parking spaces. However, based on first principles, the proposed provision of 10 off-street parking spaces would adequately accommodate the 5-6 employees (or maximum 10) proposed to be on-site at any given time.
- The proposed parking layout is consistent with the dimensional requirements as set out in the Penrith City Council DCP and Australian Standard for Off Street Car Parking (AS2890.1:2004 and AS2890.6:2009).
- The proposed site ingress and egress points are consistent with the requirements as set out in the Council's DCP and Australian Standards.
- The proposed RRF is estimated to generate an average of 126 vehicle trips per day and 16 vehicle trips in the peak hour vehicle trips in the peak hour (site peak period).
- Comparatively, the proposed RRF will generate approximately half the amount of daily vehicle trips of the former site operation. Furthermore, the proposed RRF would generate a third less vehicle trips during the site peak period.
- In addition, SSD-8200 was granted approval for the operation of a RRF estimated to generate an average 194 trips per day (and up to 239 trips at peak times) and 20 trips in the peak hour (and up to 24 trips at peak times). Therefore, the proposed RRF will also generate significantly less vehicle trips in comparison to the previous development approval.

The traffic impacts due to the proposed operation of a timber waste resource recovery facility have been assessed to be minor. Theoretically, the proposal would result in a reduction in peak traffic flow on the local road network in comparison with the former site and previously approved development (SSD-8200).

Appendix A

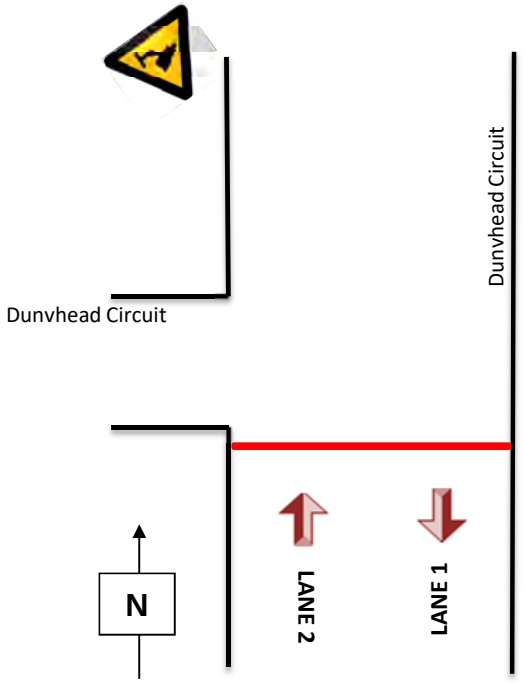
Traffic Surveys (June 2016)

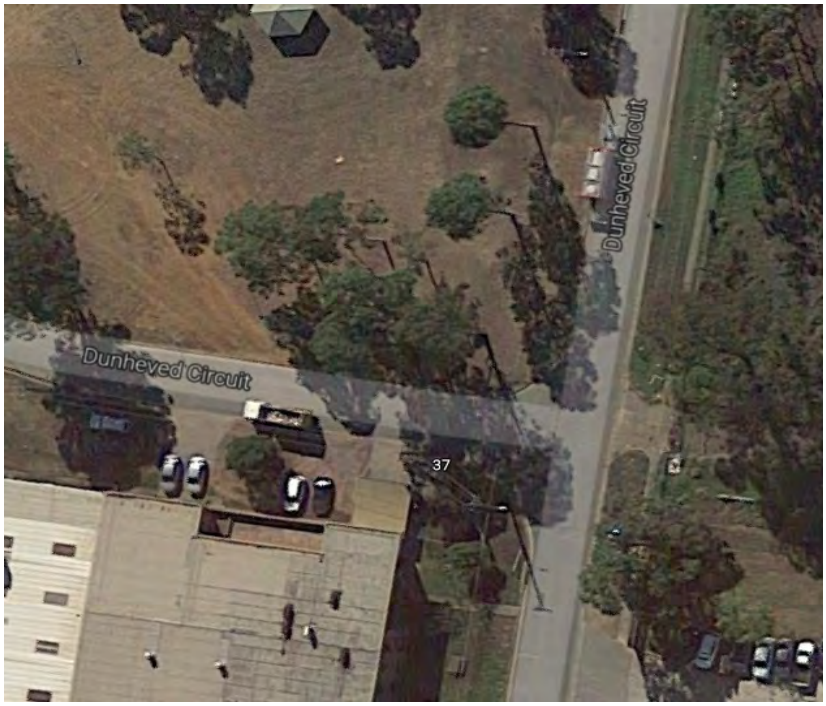
Location	**Ropes Crossinng BLVD**	**Duration**	**0700 - 1000**
	Forrester Road		**1500 - 1800**
	Forrester Road		**-**
	Link Road	**Day/Date**	**Wednesday, 15 June 2016**
Suburb	**St. Mary**	**Weather**	**Raining**

All Vehicles	**NORTH**													**EAST**												
Time Per 15 Mins	***Ropes Crossinng BLVD***													***Forrester Road***												
	L			**T**			**R**			**U**				**L**			**T**			**R**			**U**			
	LIGHT	HEAVY	**Σ**	LIGHT	HEAVY	**Σ**	LIGHT	HEAVY	**Σ**	LIGHT	HEAVY	**Σ**	**TOTAL**	LIGHT	HEAVY	**Σ**	LIGHT	HEAVY	**Σ**	LIGHT	HEAVY	**Σ**	LIGHT	HEAVY	**Σ**	**TOTAL**	**TOTAL**
7:00 - 7:15	0	0	**0**	81	3	**84**	10	1	**11**	0	0	0	**95**	131	9	**140**	31	1	**32**	0	1	**1**	0	0	0	**173**	**562**
7:15 - 7:30	1	0	**1**	107	5	**112**	6	1	**7**	0	0	0	**120**	141	13	**154**	29	3	**32**	1	0	**1**	0	0	0	**187**	**638**
7:30 - 7:45	1	0	**1**	89	1	**90**	3	0	**3**	0	0	0	**94**	169	5	**174**	21	1	**22**	0	0	**0**	0	0	0	**196**	**603**
7:45 - 8:00	1	0	**1**	101	4	**105**	5	0	**5**	0	0	0	**111**	176	15	**191**	26	5	**31**	0	0	**0**	0	0	0	**222**	**648**
8:00 - 8:15	1	0	**1**	88	3	**91**	4	0	**4**	0	0	0	**96**	173	6	**179**	26	5	**31**	0	0	**0**	0	0	0	**210**	**616**
8:15 - 8:30	0	0	**0**	70	3	**73**	3	0	**3**	0	0	0	**76**	167	10	**177**	23	6	**29**	1	0	**1**	0	1	1	**208**	**605**
8:30 - 8:45	1	2	**3**	90	3	**93**	2	0	**2**	0	0	0	**98**	162	10	**172**	15	6	**21**	0	0	**0**	0	0	0	**193**	**561**
8:45 - 9:00	1	0	**1**	75	0	**75**	4	0	**4**	0	0	0	**80**	160	8	**168**	14	6	**20**	0	0	**0**	0	0	0	**188**	**542**
9:00 - 9:15	1	0	**1**	67	4	**71**	3	0	**3**	0	0	0	**75**	133	8	**141**	17	2	**19**	0	0	**0**	0	0	0	**160**	**504**
9:15 - 9:30	0	0	**0**	53	3	**56**	0	1	**1**	0	0	0	**57**	144	13	**157**	6	1	**7**	1	0	**1**	0	0	0	**165**	**476**
9:30 - 9:45	1	0	**1**	42	5	**47**	1	0	**1**	0	0	0	**49**	113	14	**127**	8	4	**12**	0	0	**0**	0	0	0	**139**	**449**
9:45 - 10:00	0	0	**0**	48	3	**51**	2	0	**2**	0	0	0	**53**	114	13	**127**	11	6	**17**	1	0	**1**	1	0	1	**146**	**436**
Period End	**8**	**2**	**10**	**911**	**37**	**948**	**43**	**3**	**46**	**0**	**0**	**0**	**1004**	**1783**	**124**	**1907**	**227**	**46**	**273**	**4**	**1**	**5**	**1**	**1**	**2**	**2187**	**6640**
15:00 - 15:15	2	0	**2**	46	3	**49**	0	0	**0**	0	0	0	**51**	152	15	**167**	12	3	**15**	1	0	**1**	0	0	0	**183**	**676**
15:15 - 15:30	5	0	**5**	43	5	**48**	0	1	**1**	0	0	0	**54**	211	13	**224**	6	6	**12**	0	0	**0**	0	0	0	**236**	**688**
15:30 - 15:45	2	0	**2**	37	4	**41**	0	0	**0**	0	0	0	**43**	152	15	**167**	11	10	**21**	0	1	**1**	0	0	0	**189**	**695**
15:45 - 16:00	1	0	**1**	47	0	**47**	0	0	**0**	0	0	0	**48**	195	18	**213**	6	13	**19**	2	0	**2**	0	0	0	**234**	**714**
16:00 - 16:15	3	0	**3**	41	6	**47**	0	0	**0**	0	0	0	**50**	175	16	**191**	5	5	**10**	0	0	**0**	0	0	0	**201**	**745**
16:15 - 16:30	1	0	**1**	40	6	**46**	0	0	**0**	0	0	0	**47**	193	12	**205**	7	7	**14**	0	0	**0**	0	0	0	**219**	**807**
16:30 - 16:45	3	0	**3**	42	3	**45**	0	0	**0**	0	0	0	**48**	217	6	**223**	5	10	**15**	1	0	**1**	0	0	0	**239**	**815**
16:45 - 17:00	2	0	**2**	53	5	**58**	1	0	**1**	0	0	0	**61**	193	12	**205**	8	2	**10**	0	0	**0**	0	0	0	**215**	**731**
17:00 - 17:15	4	0	**4**	51	4	**55**	1	1	**2**	0	0	0	**61**	204	7	**211**	3	3	**6**	0	0	**0**	0	0	0	**217**	**785**
17:15 - 17:30	2	0	**2**	52	5	**57**	1	0	**1**	0	0	0	**60**	209	2	**211**	3	3	**6**	0	0	**0**	0	0	0	**217**	**684**
17:30 - 17:45	2	0	**2**	58	4	**62**	0	0	**0**	0	0	0	**64**	194	8	**202**	2	2	**4**	0	0	**0**	0	0	0	**206**	**642**
17:45 - 18:00	1	0	**1**	61	0	**61**	0	0	**0**	0	0	0	**62**	197	10	**207**	6	4	**10**	0	0	**0**	0	0	0	**217**	**615**
Period End	**28**	**0**	**28**	**571**	**45**	**616**	**3**	**2**	**5**	**0**	**0**	**0**	**649**	**2292**	**134**	**2426**	**74**	**68**	**142**	**4**	**1**	**5**	**0**	**0**	**0**	**2573**	**8597**

All Vehicles	**SOUTH**													**WEST**												
Time Per 15 Mins	***Forrester Road***													***Link Road***												
	L			**T**			**R**			**U**				**L**			**T**			**R**			**U**			
	LIGHT	HEAVY	**S**	LIGHT	HEAVY	**S**	LIGHT	HEAVY	**S**	LIGHT	HEAVY	**S**	**TOTAL**	LIGHT	HEAVY	**S**	LIGHT	HEAVY	**S**	LIGHT	HEAVY	**S**	LIGHT	HEAVY	**S**	**TOTAL**	**TOTAL**
7:00 - 7:15	74	12	**86**	129	8	**137**	36	2	**38**	0	0	**0**	**261**	2	0	**2**	4	3	**7**	13	11	**24**	0	0	**0**	**33**	**294**
7:15 - 7:30	81	22	**103**	130	8	**138**	49	3	**52**	0	0	**0**	**293**	1	0	**1**	3	8	**11**	11	15	**26**	0	0	**0**	**38**	**331**
7:30 - 7:45	58	16	**74**	146	8	**154**	48	3	**51**	0	0	**0**	**279**	1	1	**2**	6	1	**7**	8	17	**25**	0	0	**0**	**34**	**313**
7:45 - 8:00	80	26	**106**	127	18	**145**	27	2	**29**	0	0	**0**	**280**	0	0	**0**	6	3	**9**	8	18	**26**	0	0	**0**	**35**	**315**
8:00 - 8:15	57	24	**81**	144	5	**149**	37	0	**37**	0	0	**0**	**267**	1	0	**1**	4	4	**8**	21	13	**34**	0	0	**0**	**43**	**310**
8:15 - 8:30	67	29	**96**	117	10	**127**	34	2	**36**	0	0	**0**	**259**	1	0	**1**	9	7	**16**	17	28	**45**	0	0	**0**	**62**	**321**
8:30 - 8:45	56	23	**79**	97	7	**104**	35	2	**37**	0	0	**0**	**220**	1	0	**1**	6	6	**12**	14	23	**37**	0	0	**0**	**50**	**270**
8:45 - 9:00	50	30	**80**	91	8	**99**	39	2	**41**	0	0	**0**	**220**	1	0	**1**	13	7	**20**	15	18	**33**	0	0	**0**	**54**	**274**
9:00 - 9:15	46	19	**65**	86	6	**92**	52	2	**54**	0	0	**0**	**211**	2	0	**2**	6	6	**12**	27	17	**44**	0	0	**0**	**58**	**269**
9:15 - 9:30	51	17	**68**	71	6	**77**	39	2	**41**	0	0	**0**	**186**	0	1	**1**	10	5	**15**	22	30	**52**	0	0	**0**	**68**	**254**
9:30 - 9:45	53	19	**72**	70	7	**77**	36	2	**38**	0	0	**0**	**187**	2	1	**3**	6	6	**12**	42	17	**59**	0	0	**0**	**74**	**261**
9:45 - 10:00	43	20	**63**	68	7	**75**	35	0	**35**	0	0	**0**	**173**	6	0	**6**	7	7	**14**	31	13	**44**	0	0	**0**	**64**	**237**
Period End	**716**	**257**	**973**	**1276**	**98**	**1374**	**467**	**22**	**489**	**0**	**0**	**0**	**2836**	**18**	**3**	**21**	**80**	**63**	**143**	**229**	**220**	**449**	**0**	**0**	**0**	**613**	**3449**
15:00 - 15:15	20	22	**42**	192	9	**201**	42	1	**43**	0	0	**0**	**286**	8	0	**8**	35	12	**47**	78	23	**101**	0	0	**0**	**156**	**442**
15:15 - 15:30	33	31	**64**	167	7	**174**	45	3	**48**	0	0	**0**	**286**	10	1	**11**	24	9	**33**	50	18	**68**	0	0	**0**	**112**	**398**
15:30 - 15:45	20	23	**43**	182	4	**186**	71	2	**73**	0	0	**0**	**302**	11	12	**23**	40	3	**43**	77	18	**95**	0	0	**0**	**161**	**463**
15:45 - 16:00	22	22	**44**	187	5	**192**	83	2	**85**	0	0	**0**	**321**	5	0	**5**	23	1	**24**	61	21	**82**	0	0	**0**	**111**	**432**
16:00 - 16:15	25	26	**51**	190	4	**194**	95	1	**96**	0	0	**0**	**341**	12	0	**12**	46	3	**49**	83	9	**92**	0	0	**0**	**153**	**494**
16:15 - 16:30	26	12	**38**	210	15	**225**	149	4	**153**	0	0	**0**	**416**	17	1	**18**	23	3	**26**	61	20	**81**	0	0	**0**	**125**	**541**
16:30 - 16:45	16	7	**23**	204	9	**213**	144	3	**147**	0	0	**0**	**383**	15	1	**16**	33	6	**39**	80	10	**90**	0	0	**0**	**145**	**528**
16:45 - 17:00	7	9	**16**	199	6	**205**	138	5	**143**	0	0	**0**	**364**	6	1	**7**	28	4	**32**	39	13	**52**	0	0	**0**	**91**	**455**
17:00 - 17:15	4	4	**8**	201	5	**206**	130	2	**132**	0	0	**0**	**346**	14	0	**14**	29	5	**34**	103	10	**113**	0	0	**0**	**161**	**507**
17:15 - 17:30	7	6	**13**	156	4	**160**	124	1	**125**	0	0	**0**	**298**	4	0	**4**	19	2	**21**	74	10	**84**	0	0	**0**	**109**	**407**
17:30 - 17:45	13	5	**18**	130	6	**136**	123	2	**125**	0	0	**0**	**279**	6	1	**7**	22	2	**24**	55	7	**62**	0	0	**0**	**93**	**372**
17:45 - 18:00	16	4	**20**	117	7	**124**	135	5	**140**	0	0	**0**	**284**	5	0	**5**	14	2	**16**	29	2	**31**	0	0	**0**	**52**	**336**
Period End	**209**	**171**	**380**	**2135**	**81**	**2216**	**1279**	**31**	**1310**	**0**	**0**	**0**	**3906**	**113**	**17**	**130**	**336**	**52**	**388**	**790**	**161**	**951**	**0**	**0**	**0**	**1469**	**5375**

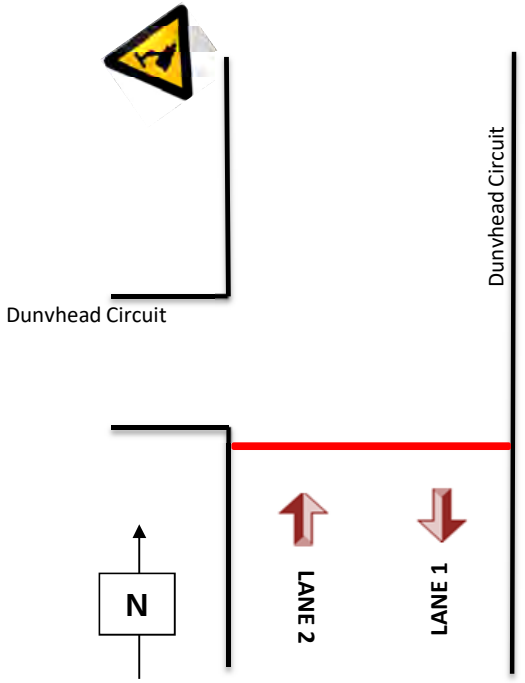
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Wednesday, 15 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

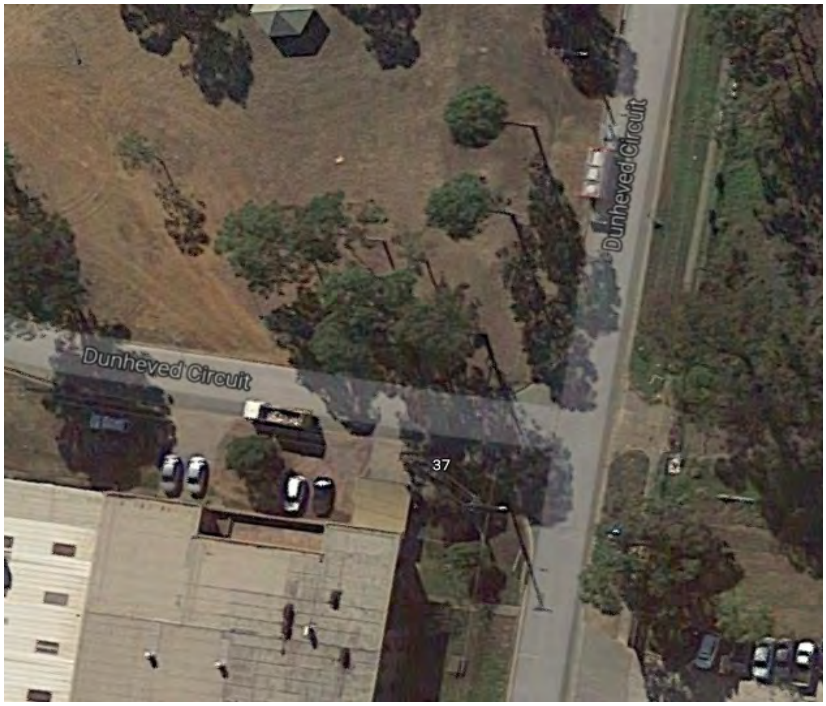




DATE			Wednesday, June 15, 2016						
			LANE 1			LANE 2			**TOTAL**
Time Period			**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00	-	1:00	0	0	**0**	0	0	0	**0**
1:00	-	2:00	0	0	**0**	0	0	0	**0**
2:00	-	3:00	0	0	**0**	0	0	0	**0**
3:00	-	4:00	3	4	**7**	0	0	0	**7**
4:00	-	5:00	6	4	**10**	17	17	34	**44**
5:00	-	6:00	10	11	**21**	19	14	33	**54**
6:00	-	7:00	10	12	**22**	15	17	32	**54**
7:00	-	8:00	12	9	**21**	18	19	37	**58**
8:00	-	9:00	11	16	**27**	15	18	33	**60**
9:00	-	10:00	13	14	**27**	13	16	29	**56**
10:00	-	11:00	9	13	**22**	9	7	16	**38**
11:00	-	12:00	13	2	**15**	12	9	21	**36**
12:00	-	13:00	9	0	**9**	11	15	26	**35**
13:00	-	14:00	12	0	**12**	22	22	44	**56**
14:00	-	15:00	8	1	**9**	21	26	47	**56**
15:00	-	16:00	12	0	**12**	25	14	39	**51**
16:00	-	17:00	4	1	**5**	14	11	25	**30**
17:00	-	18:00	0	0	**0**	3	0	3	**3**
18:00	-	19:00	0	2	**2**	1	0	1	**3**
19:00	-	20:00	0	0	**0**	0	0	0	**0**
20:00	-	21:00	0	0	**0**	0	0	0	**0**
21:00	-	22:00	0	0	**0**	1	0	1	**1**
22:00	-	23:00	0	1	**1**	0	1	1	**2**
23:00	-	Total	0	0	**0**	0	0	0	**0**
Total			132	90	**222**	216	206	422	**644**

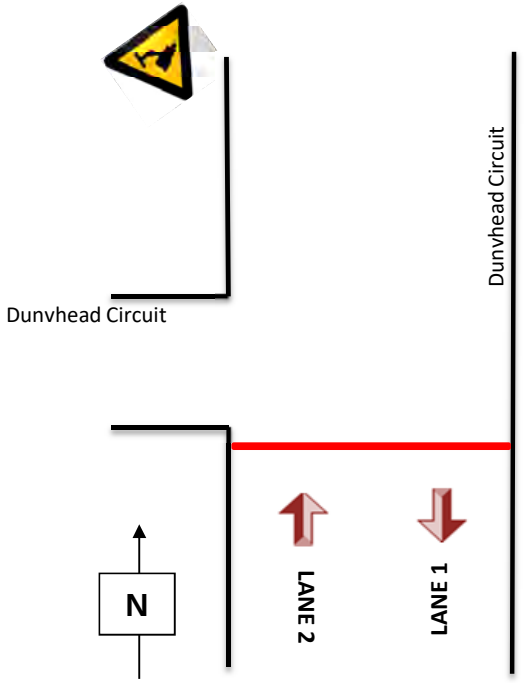
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Thursday, 16 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

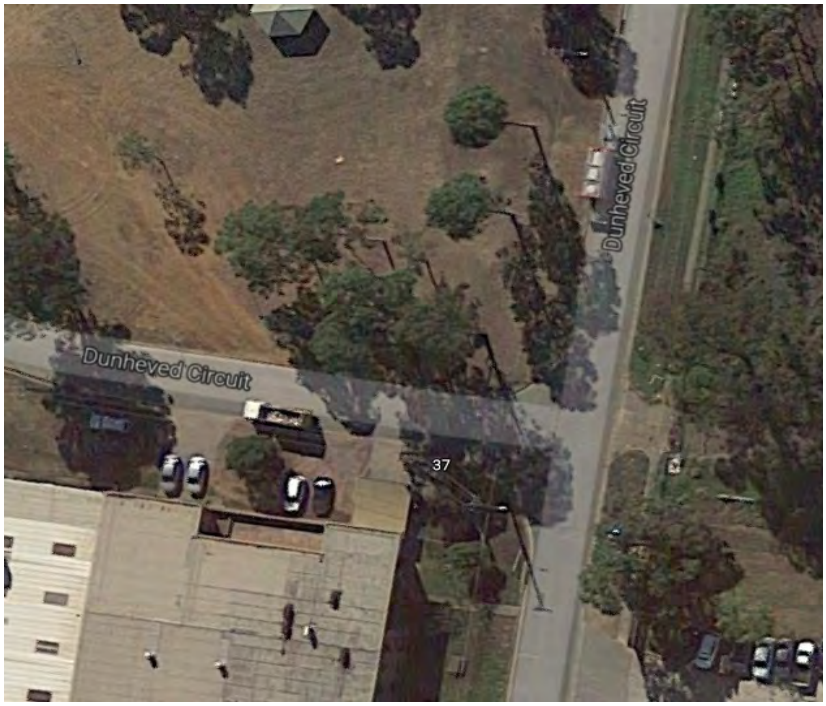




DATE			Thursday, June 16, 2016						
			LANE 1			LANE 2			**TOTAL**
Time Period			**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00	-	1:00	0	0	**0**	0	0	0	**0**
1:00	-	2:00	0	0	**0**	1	0	1	**1**
2:00	-	3:00	0	0	**0**	0	0	0	**0**
3:00	-	4:00	1	2	**3**	0	0	0	**3**
4:00	-	5:00	5	3	**8**	21	1	22	**30**
5:00	-	6:00	2	5	**7**	18	16	34	**41**
6:00	-	7:00	4	4	**8**	17	17	34	**42**
7:00	-	8:00	9	8	**17**	16	18	34	**51**
8:00	-	9:00	13	11	**24**	17	21	38	**62**
9:00	-	10:00	9	14	**23**	11	19	30	**53**
10:00	-	11:00	11	13	**24**	11	18	29	**53**
11:00	-	12:00	14	11	**25**	10	7	17	**42**
12:00	-	13:00	11	16	**27**	13	11	24	**51**
13:00	-	14:00	15	9	**24**	14	16	30	**54**
14:00	-	15:00	9	1	**10**	25	20	45	**55**
15:00	-	16:00	17	3	**20**	24	24	48	**68**
16:00	-	17:00	5	2	**7**	27	15	42	**49**
17:00	-	18:00	0	0	**0**	16	9	25	**25**
18:00	-	19:00	0	1	**1**	5	1	6	**7**
19:00	-	20:00	1	0	**1**	5	2	7	**8**
20:00	-	21:00	0	1	**1**	0	1	1	**2**
21:00	-	22:00	0	2	**2**	0	0	0	**2**
22:00	-	23:00	0	1	**1**	0	0	0	**1**
23:00	-	Total	1	0	**1**	2	0	2	**3**
Total			127	107	**234**	253	216	469	**703**

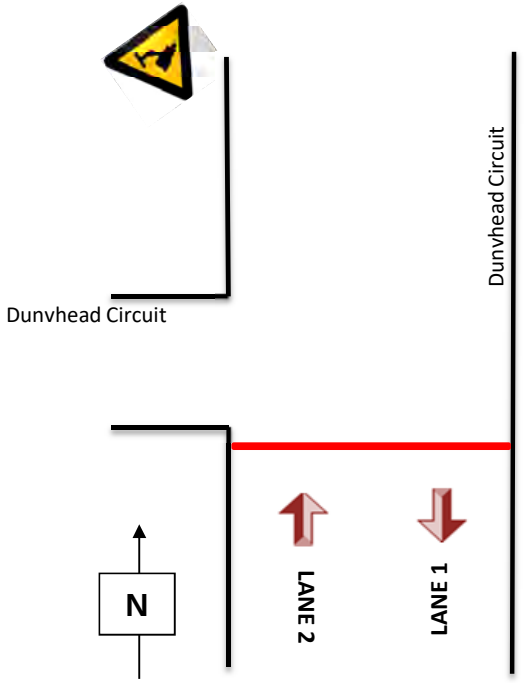
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Friday, 17 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

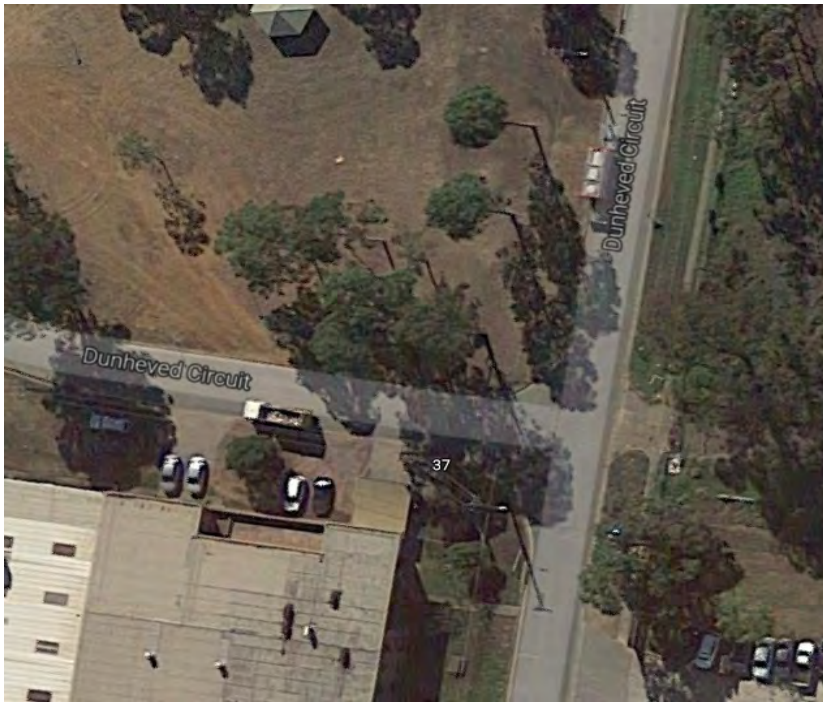




DATE			Friday, June 17, 2016						
			LANE 1			LANE 2			**TOTAL**
Time Period			**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00	-	1:00	1	0	**1**	0	0	0	**1**
1:00	-	2:00	0	0	**0**	0	0	0	**0**
2:00	-	3:00	0	0	**0**	0	0	0	**0**
3:00	-	4:00	0	1	**1**	1	0	1	**2**
4:00	-	5:00	2	1	**3**	0	1	1	**4**
5:00	-	6:00	8	4	**12**	6	19	25	**37**
6:00	-	7:00	2	7	**9**	7	13	20	**29**
7:00	-	8:00	9	11	**20**	21	20	41	**61**
8:00	-	9:00	12	11	**23**	22	14	36	**59**
9:00	-	10:00	18	11	**29**	23	20	43	**72**
10:00	-	11:00	15	9	**24**	30	10	40	**64**
11:00	-	12:00	12	15	**27**	21	25	46	**73**
12:00	-	13:00	16	11	**27**	28	31	59	**86**
13:00	-	14:00	18	14	**32**	13	17	30	**62**
14:00	-	15:00	6	9	**15**	14	19	33	**48**
15:00	-	16:00	14	7	**21**	9	17	26	**47**
16:00	-	17:00	3	12	**15**	10	14	24	**39**
17:00	-	18:00	3	13	**16**	2	7	9	**25**
18:00	-	19:00	0	10	**10**	4	2	6	**16**
19:00	-	20:00	0	0	**0**	0	1	1	**1**
20:00	-	21:00	0	1	**1**	3	0	3	**4**
21:00	-	22:00	0	0	**0**	0	1	1	**1**
22:00	-	23:00	0	2	**2**	1	0	1	**3**
23:00	-	Total	0	1	**1**	0	0	0	**1**
Total			139	150	**289**	215	231	446	**735**

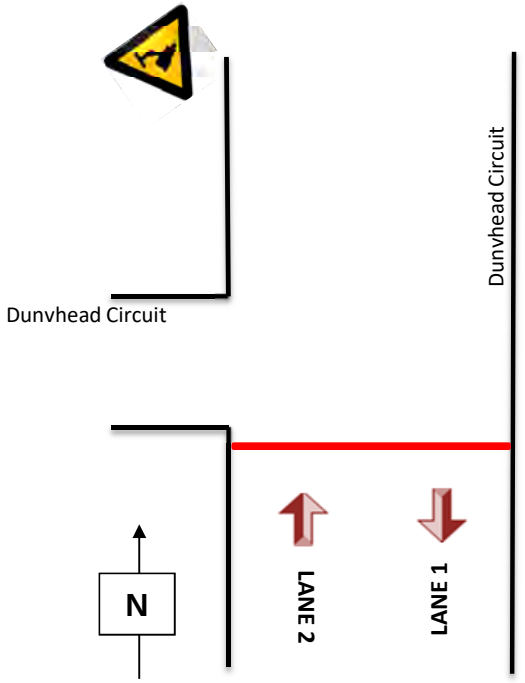
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Saturday, 18 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

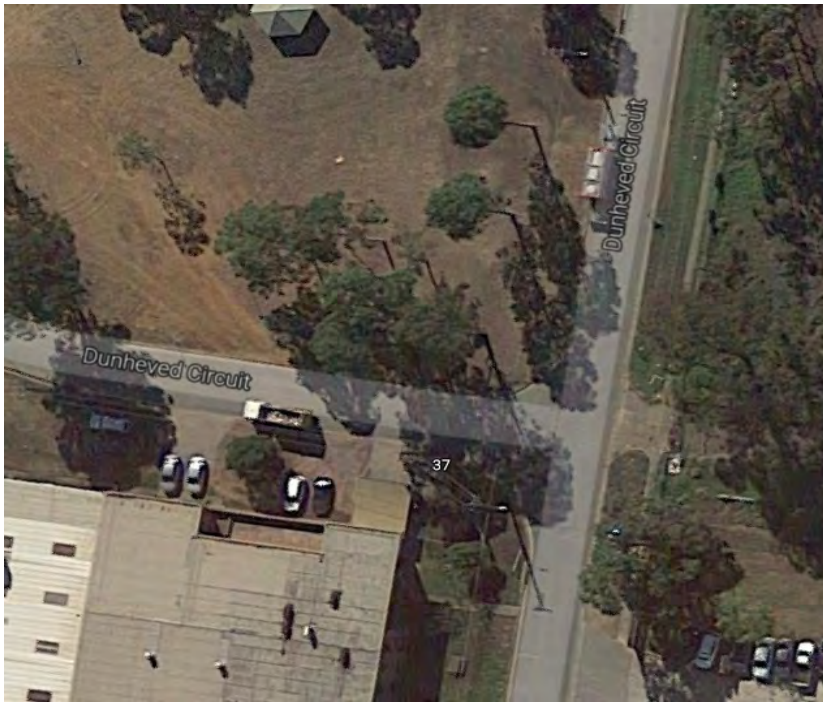




DATE			Saturday, June 18, 2016						
			LANE 1			LANE 2			**TOTAL**
Time Period			**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00	-	1:00	0	0	**0**	1	1	2	**2**
1:00	-	2:00	0	2	**2**	2	0	2	**4**
2:00	-	3:00	4	0	**4**	3	1	4	**8**
3:00	-	4:00	2	2	**4**	3	0	3	**7**
4:00	-	5:00	0	1	**1**	3	5	8	**9**
5:00	-	6:00	0	1	**1**	9	7	16	**17**
6:00	-	7:00	5	5	**10**	8	4	12	**22**
7:00	-	8:00	1	2	**3**	1	5	6	**9**
8:00	-	9:00	6	0	**6**	3	10	13	**19**
9:00	-	10:00	7	4	**11**	6	8	14	**25**
10:00	-	11:00	8	3	**11**	6	7	13	**24**
11:00	-	12:00	5	5	**10**	6	9	15	**25**
12:00	-	13:00	11	2	**13**	6	12	18	**31**
13:00	-	14:00	8	1	**9**	5	4	9	**18**
14:00	-	15:00	4	3	**7**	5	1	6	**13**
15:00	-	16:00	4	2	**6**	6	1	7	**13**
16:00	-	17:00	1	1	**2**	3	0	3	**5**
17:00	-	18:00	1	1	**2**	2	0	2	**4**
18:00	-	19:00	0	1	**1**	0	0	0	**1**
19:00	-	20:00	0	0	**0**	0	0	0	**0**
20:00	-	21:00	0	0	**0**	1	0	1	**1**
21:00	-	22:00	1	0	**1**	0	0	0	**1**
22:00	-	23:00	0	0	**0**	0	0	0	**0**
23:00	-	Total	0	1	**1**	2	0	2	**3**
Total			68	37	**105**	81	75	156	**261**

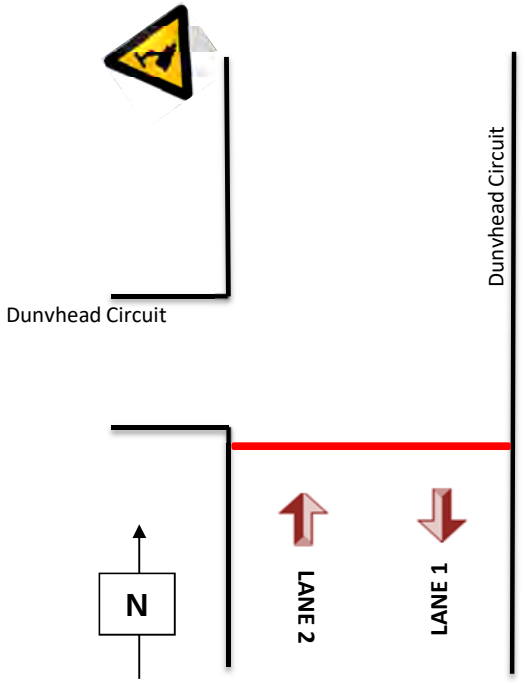
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Sunday, 19 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

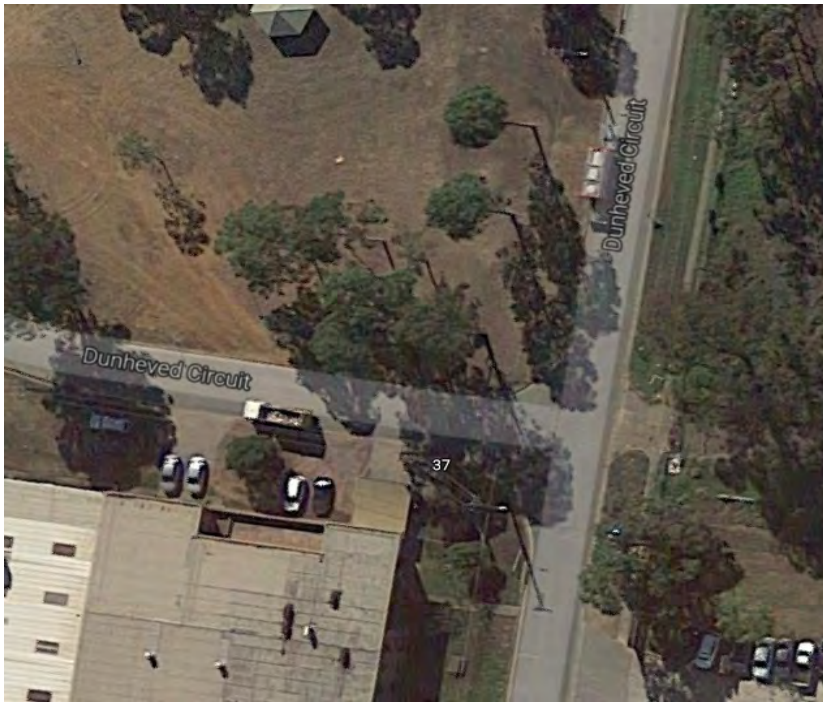




DATE			Sunday, June 19, 2016						
			LANE 1			LANE 2			**TOTAL**
Time Period			**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00	-	1:00	0	0	**0**	0	0	0	**0**
1:00	-	2:00	0	0	**0**	0	0	0	**0**
2:00	-	3:00	0	0	**0**	2	0	2	**2**
3:00	-	4:00	0	1	**1**	2	0	2	**3**
4:00	-	5:00	0	0	**0**	1	1	2	**2**
5:00	-	6:00	0	0	**0**	0	2	2	**2**
6:00	-	7:00	1	0	**1**	1	0	1	**2**
7:00	-	8:00	0	0	**0**	1	1	2	**2**
8:00	-	9:00	0	0	**0**	0	0	0	**0**
9:00	-	10:00	4	0	**4**	2	4	6	**10**
10:00	-	11:00	0	0	**0**	1	3	4	**4**
11:00	-	12:00	5	0	**5**	4	4	8	**13**
12:00	-	13:00	3	0	**3**	4	2	6	**9**
13:00	-	14:00	4	2	**6**	5	4	9	**15**
14:00	-	15:00	2	0	**2**	3	2	5	**7**
15:00	-	16:00	4	2	**6**	6	2	8	**14**
16:00	-	17:00	4	4	**8**	7	3	10	**18**
17:00	-	18:00	4	2	**6**	2	2	4	**10**
18:00	-	19:00	0	1	**1**	1	0	1	**2**
19:00	-	20:00	1	0	**1**	5	0	5	**6**
20:00	-	21:00	0	0	**0**	5	0	5	**5**
21:00	-	22:00	1	0	**1**	4	0	4	**5**
22:00	-	23:00	0	0	**0**	0	0	0	**0**
23:00	-	Total	0	0	**0**	0	0	0	**0**
Total			33	12	**45**	56	30	86	**131**

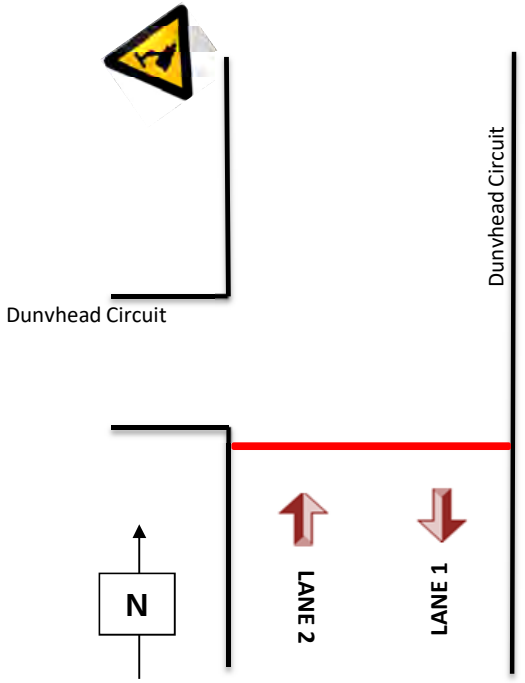
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Monday, 20 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

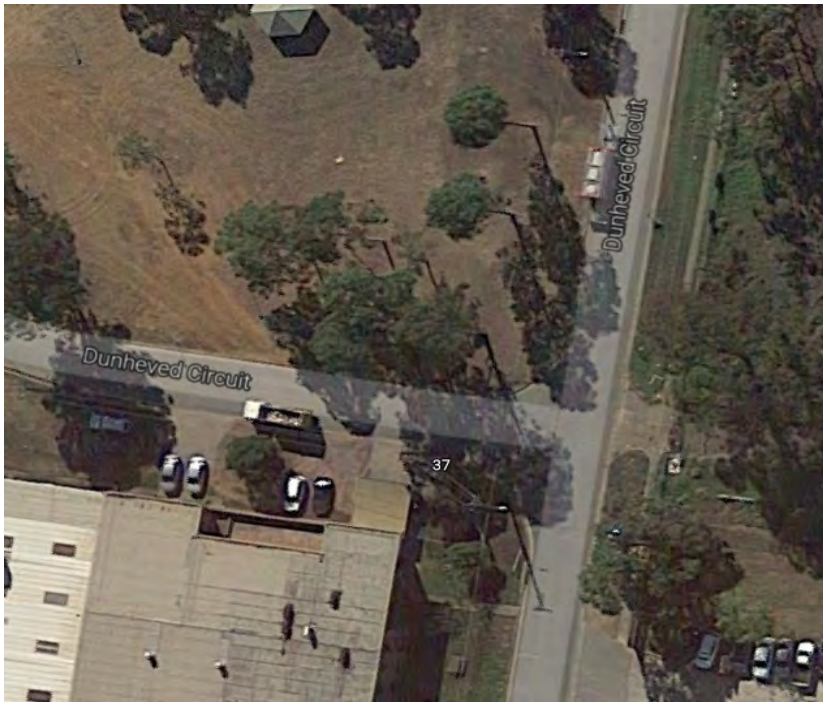




DATE	Monday, June 20, 2016						
	LANE 1			LANE 2			**TOTAL**
Time Period	**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00 - 1:00	0	0	**0**	0	0	0	**0**
1:00 - 2:00	2	0	**2**	1	0	1	**3**
2:00 - 3:00	0	0	**0**	0	0	0	**0**
3:00 - 4:00	0	0	**0**	0	0	0	**0**
4:00 - 5:00	2	7	**9**	17	0	17	**26**
5:00 - 6:00	3	1	**4**	22	3	25	**29**
6:00 - 7:00	10	11	**21**	17	6	23	**44**
7:00 - 8:00	10	12	**22**	17	18	35	**57**
8:00 - 9:00	16	11	**27**	14	24	38	**65**
9:00 - 10:00	8	16	**24**	12	16	28	**52**
10:00 - 11:00	11	13	**24**	9	18	27	**51**
11:00 - 12:00	15	10	**25**	10	22	32	**57**
12:00 - 13:00	7	9	**16**	17	7	24	**40**
13:00 - 14:00	12	5	**17**	19	22	41	**58**
14:00 - 15:00	7	15	**22**	22	24	46	**68**
15:00 - 16:00	8	9	**17**	29	12	41	**58**
16:00 - 17:00	11	7	**18**	17	15	32	**50**
17:00 - 18:00	13	0	**13**	7	2	9	**22**
18:00 - 19:00	1	0	**1**	2	1	3	**4**
19:00 - 20:00	5	0	**5**	0	0	0	**5**
20:00 - 21:00	1	0	**1**	1	0	1	**2**
21:00 - 22:00	0	0	**0**	3	0	3	**3**
22:00 - 23:00	0	0	**0**	2	0	2	**2**
23:00 - Total	0	1	**1**	1	1	2	**3**
Total	142	127	**269**	239	191	430	**699**

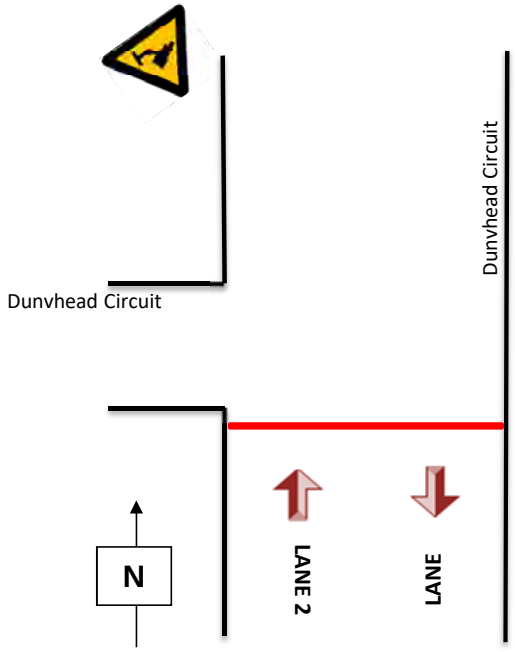
Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 Tuesday, 21 June 2016
Day/Date	Tuesday, 21 June 2016
Weather Condition	
Classification	HEAVY/LIGHT

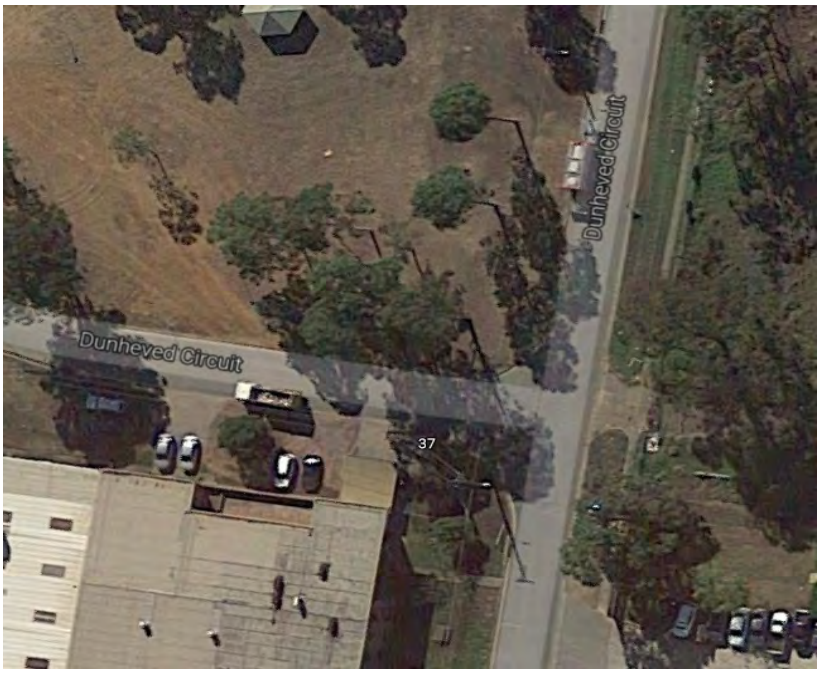




DATE			Tuesday, June 21, 2016						
			LANE 1			LANE 2			**TOTAL**
Time Period			**Light**	**Heavy**	**Σ**	**Light**	**Heavy**	**Σ**	
0:00	-	1:00	0	0	**0**	0	0	0	**0**
1:00	-	2:00	0	0	**0**	2	0	2	**2**
2:00	-	3:00	0	0	**0**	1	0	1	**1**
3:00	-	4:00	2	2	**4**	7	3	10	**14**
4:00	-	5:00	3	3	**6**	6	4	10	**16**
5:00	-	6:00	5	5	**10**	29	6	35	**45**
6:00	-	7:00	10	7	**17**	13	11	24	**41**
7:00	-	8:00	6	11	**17**	15	16	31	**48**
8:00	-	9:00	8	18	**26**	5	21	26	**52**
9:00	-	10:00	9	10	**19**	15	22	37	**56**
10:00	-	11:00	15	14	**29**	15	24	39	**68**
11:00	-	12:00	19	11	**30**	11	25	36	**66**
12:00	-	13:00	15	14	**29**	10	24	34	**63**
13:00	-	14:00	13	14	**27**	13	20	33	**60**
14:00	-	15:00	10	18	**28**	23	27	50	**78**
15:00	-	16:00	13	2	**15**	18	22	40	**55**
16:00	-	17:00	10	0	**10**	18	16	34	**44**
17:00	-	18:00	15	3	**18**	7	7	14	**32**
18:00	-	19:00	6	1	**7**	2	1	3	**10**
19:00	-	20:00	1	0	**1**	1	0	1	**2**
20:00	-	21:00	0	0	**0**	0	0	0	**0**
21:00	-	22:00	0	0	**0**	1	0	1	**1**
22:00	-	23:00	1	1	**2**	2	1	3	**5**
23:00	-	Total	0	0	**0**	2	0	2	**2**
Total			161	134	**295**	216	250	466	**761**

Location	Dunvhead Circuit
Suburb	ST. MARY
Client	TTPP
Job No/Name	16054
Survey Duration	Wednesday, 15 June 2016 — Tuesday, 21 June 2016
Day/Date	Average Daily
Weather Condition	
Classification	Passenger Car Vehicles (PCU)



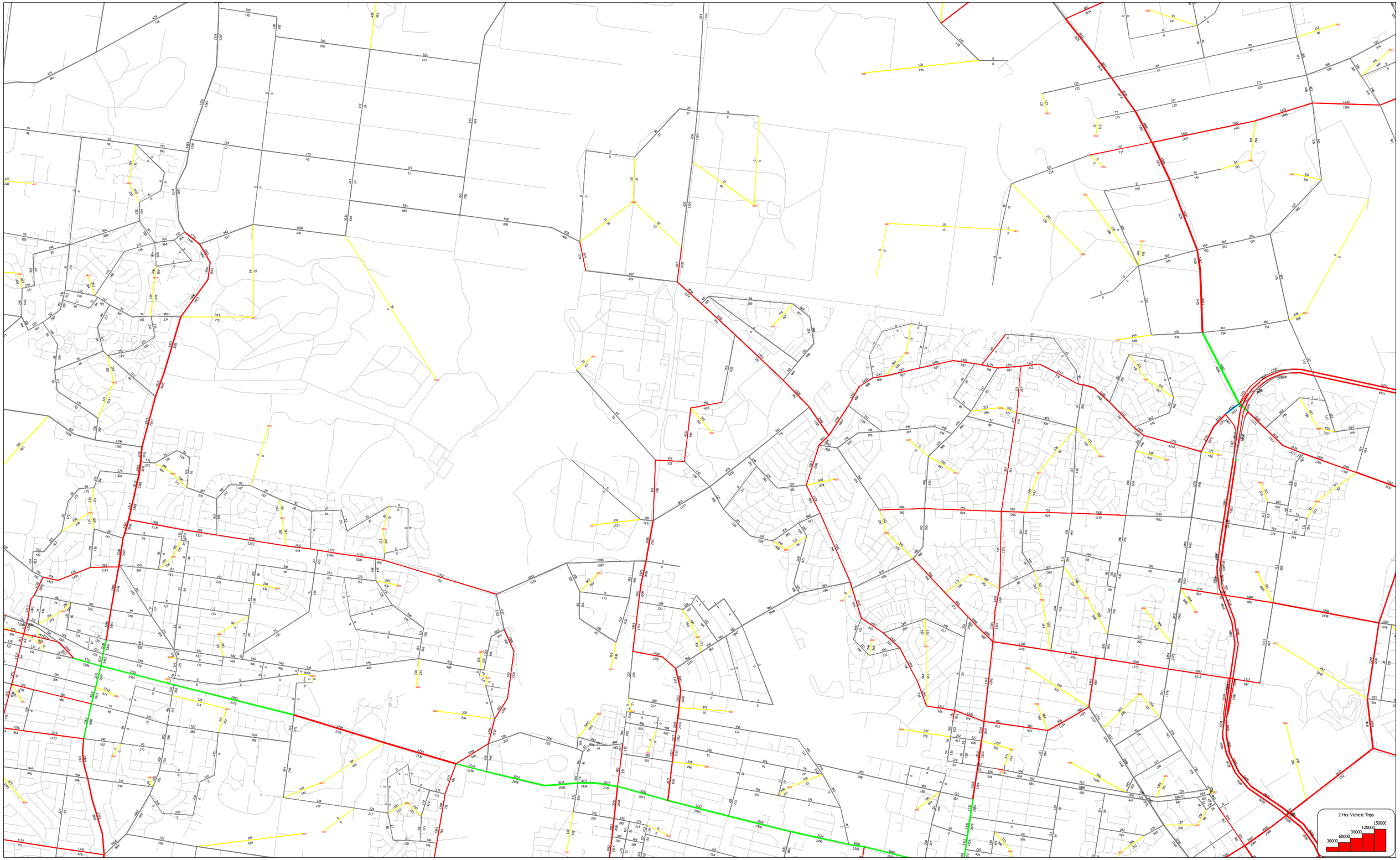


DATE			Average Daily PCUs			
			LANE 1		LANE 2	Two-way
Time Period			Σ (PCU)		Σ (PCU)	Σ (PCU)
0:00	-	1:00	**0**		**0**	**1**
1:00	-	2:00	**1**		**1**	**2**
2:00	-	3:00	**1**		**1**	**2**
3:00	-	4:00	**4**		**3**	**7**
4:00	-	5:00	**7**		**18**	**25**
5:00	-	6:00	**8**		**38**	**46**
6:00	-	7:00	**17**		**31**	**48**
7:00	-	8:00	**21**		**38**	**58**
8:00	-	9:00	**26**		**37**	**63**
9:00	-	10:00	**28**		**40**	**67**
10:00	-	11:00	**28**		**36**	**63**
11:00	-	12:00	**29**		**37**	**66**
12:00	-	13:00	**28**		**45**	**73**
13:00	-	14:00	**27**		**38**	**65**
14:00	-	15:00	**21**		**46**	**67**
15:00	-	16:00	**18**		**47**	**65**
16:00	-	17:00	**14**		**35**	**50**
17:00	-	18:00	**12**		**17**	**29**
18:00	-	19:00	**6**		**4**	**10**
19:00	-	20:00	**1**		**3**	**4**
20:00	-	21:00	**1**		**2**	**3**
21:00	-	22:00	**1**		**3**	**4**
22:00	-	23:00	**2**		**2**	**3**
23:00	-	Total	**1**		**2**	**3**
Total			**301**		**524**	**825**

Appendix B

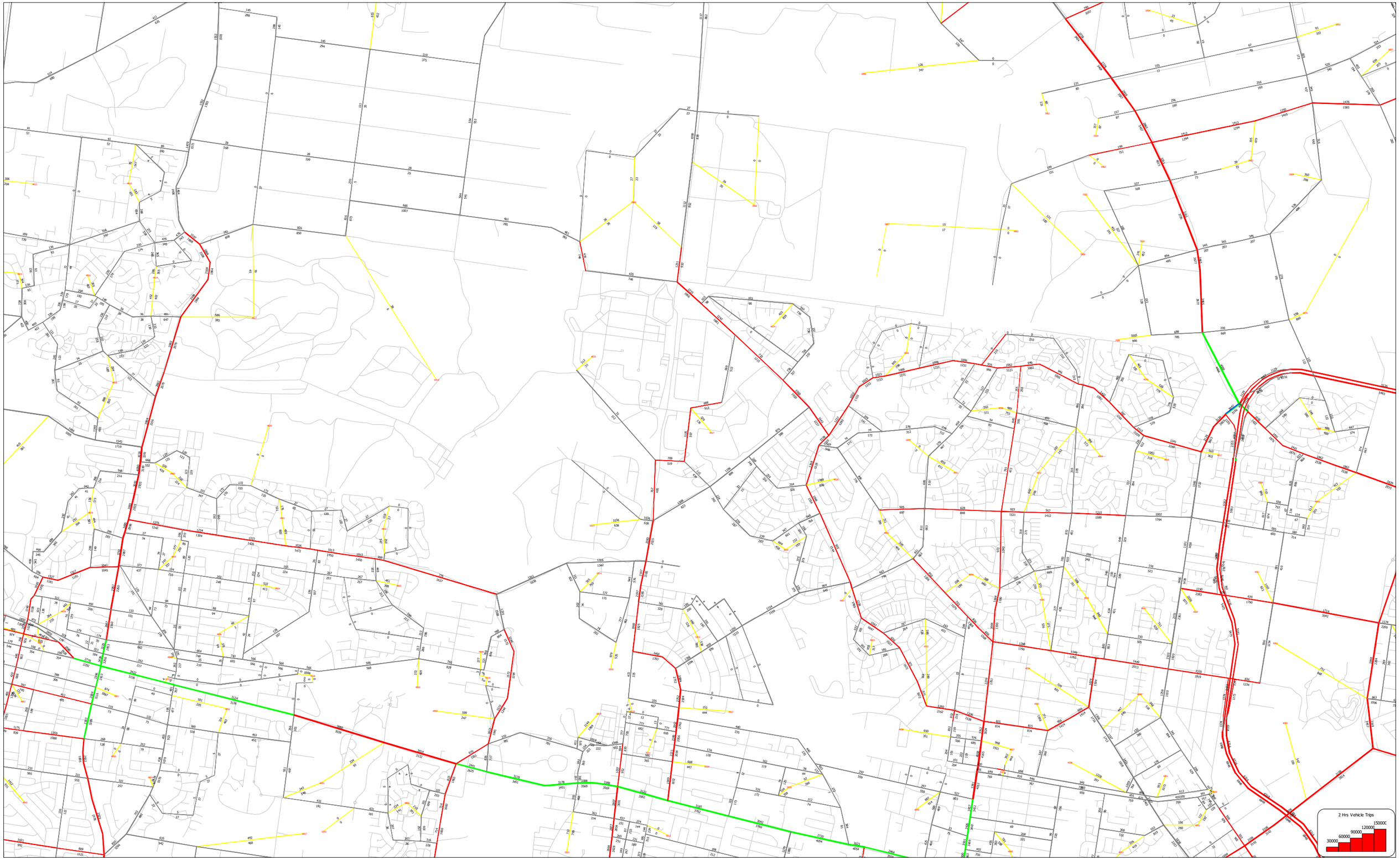
Strategic Travel Model (STM) Growth Forecast Data by Transport for NSW

TRAFFIC VOLUMES__



2011TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 2017: 2019 SYDTRAFFICFORECASTMODELTZ11LU16V151STMV362_7-9AM(mf40)
2020-07-31 12:55

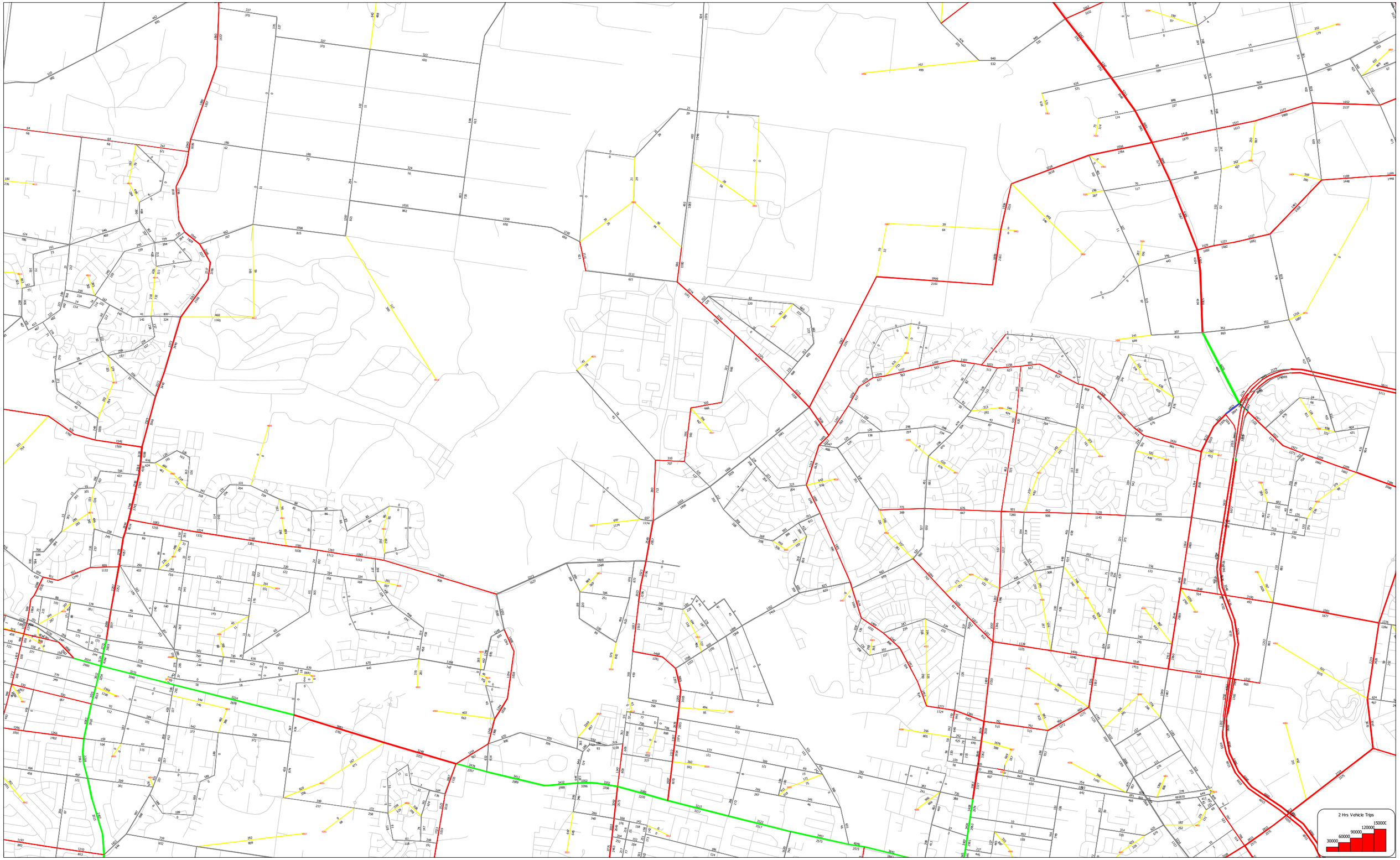
TRAFFIC VOLUMES__



2011TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 20170: 2019 SYDTRAFFICFORECASTMODELTZ11LU16V151STMV362_4-6PM(mf46)
2020-07-31 12:55

LANE (1WAY):
1
2
3
4
5

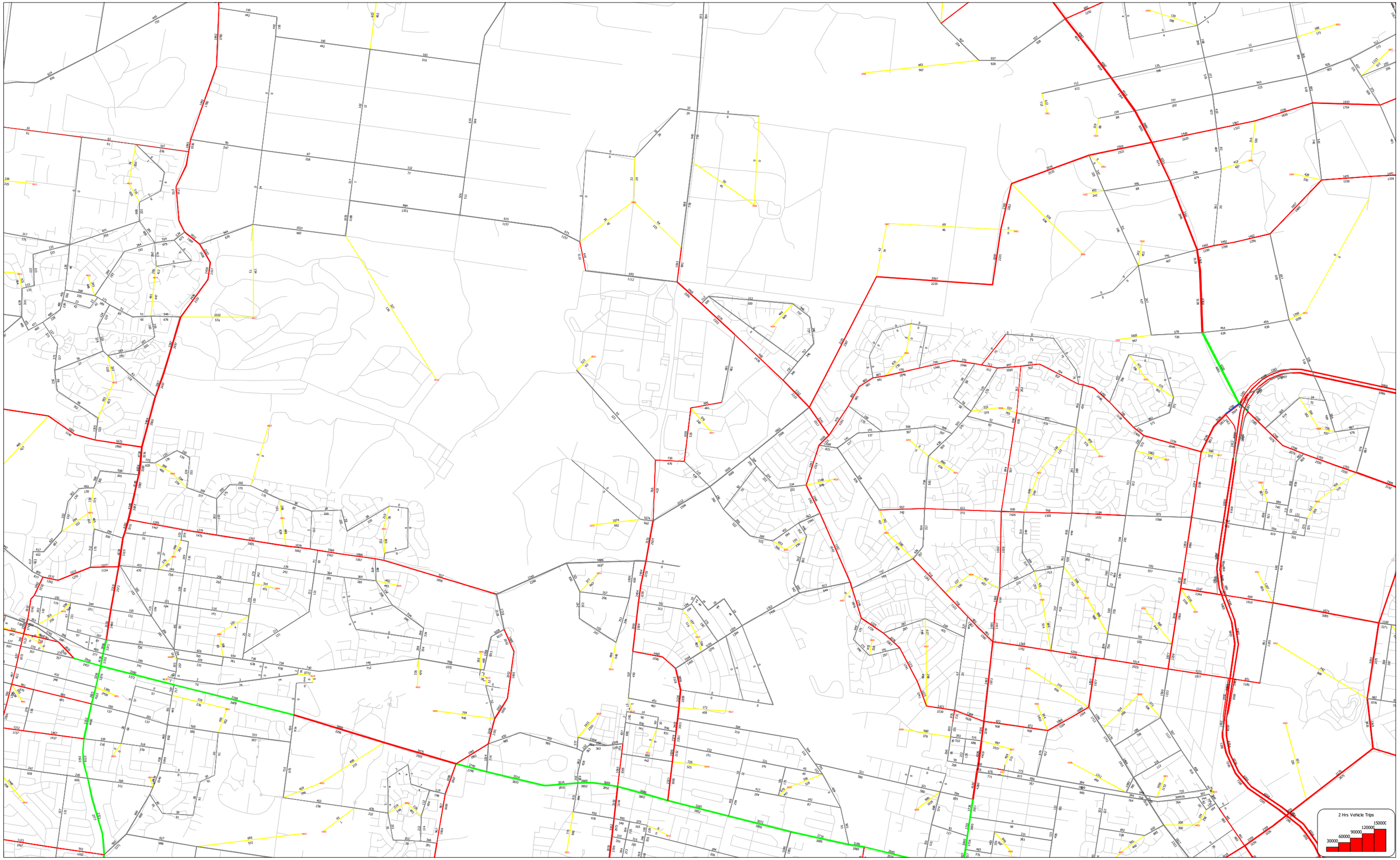
TRAFFIC VOLUMES__



2011TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 2026: 2026 SYDTRAFFICFORECASTMODELTZ11LU16V151STMV362-7-9AM(mf34)
2020-07-31 12:55

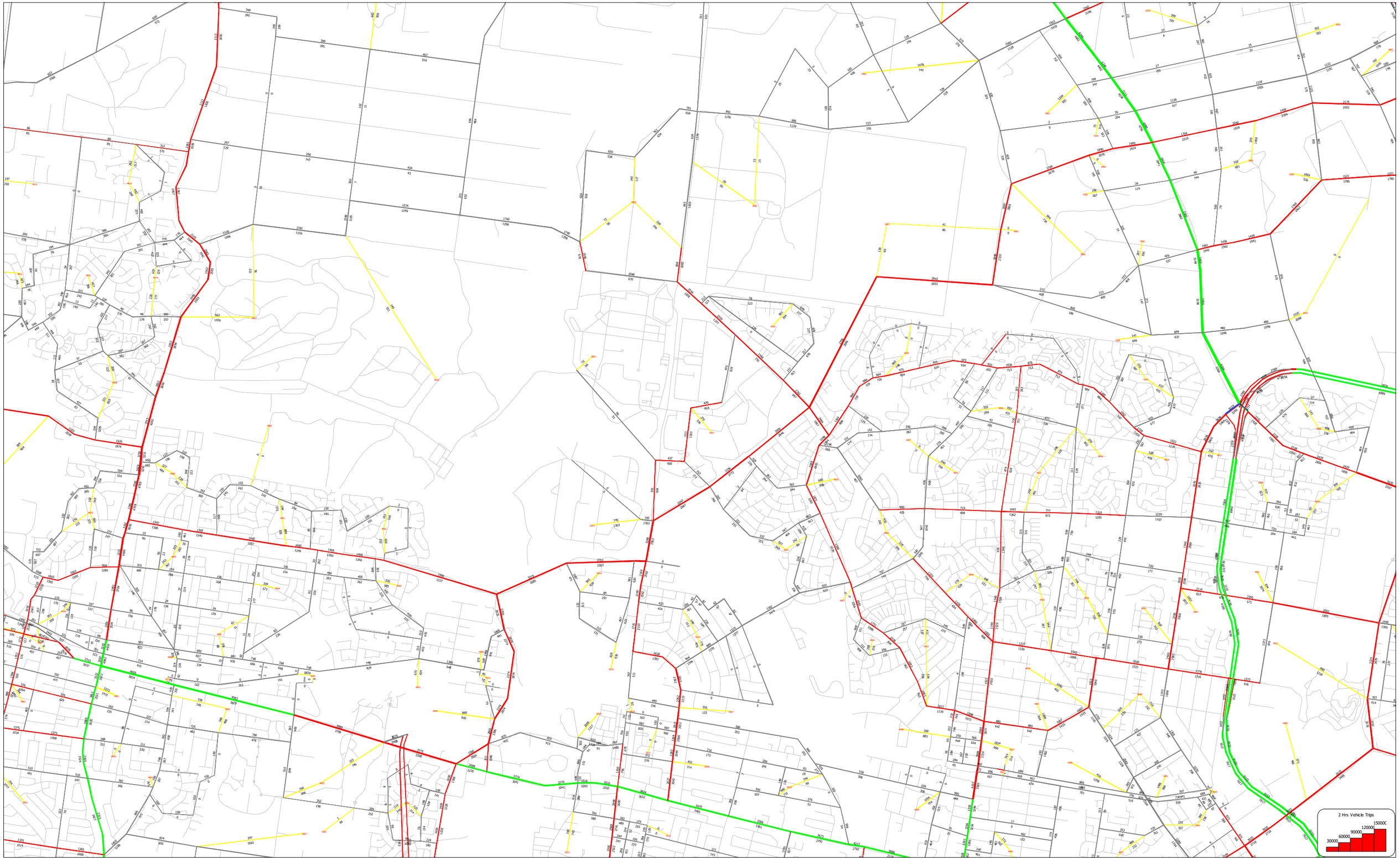
LANE (1WAY):
1
2
3
4
5

TRAFFIC VOLUMES__



2011TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 20260: 2026 SYDTRAFFICFORECASTMODELTZ11LU16V151STMV362-4-6PM(mf54)
2020-07-31 12:56

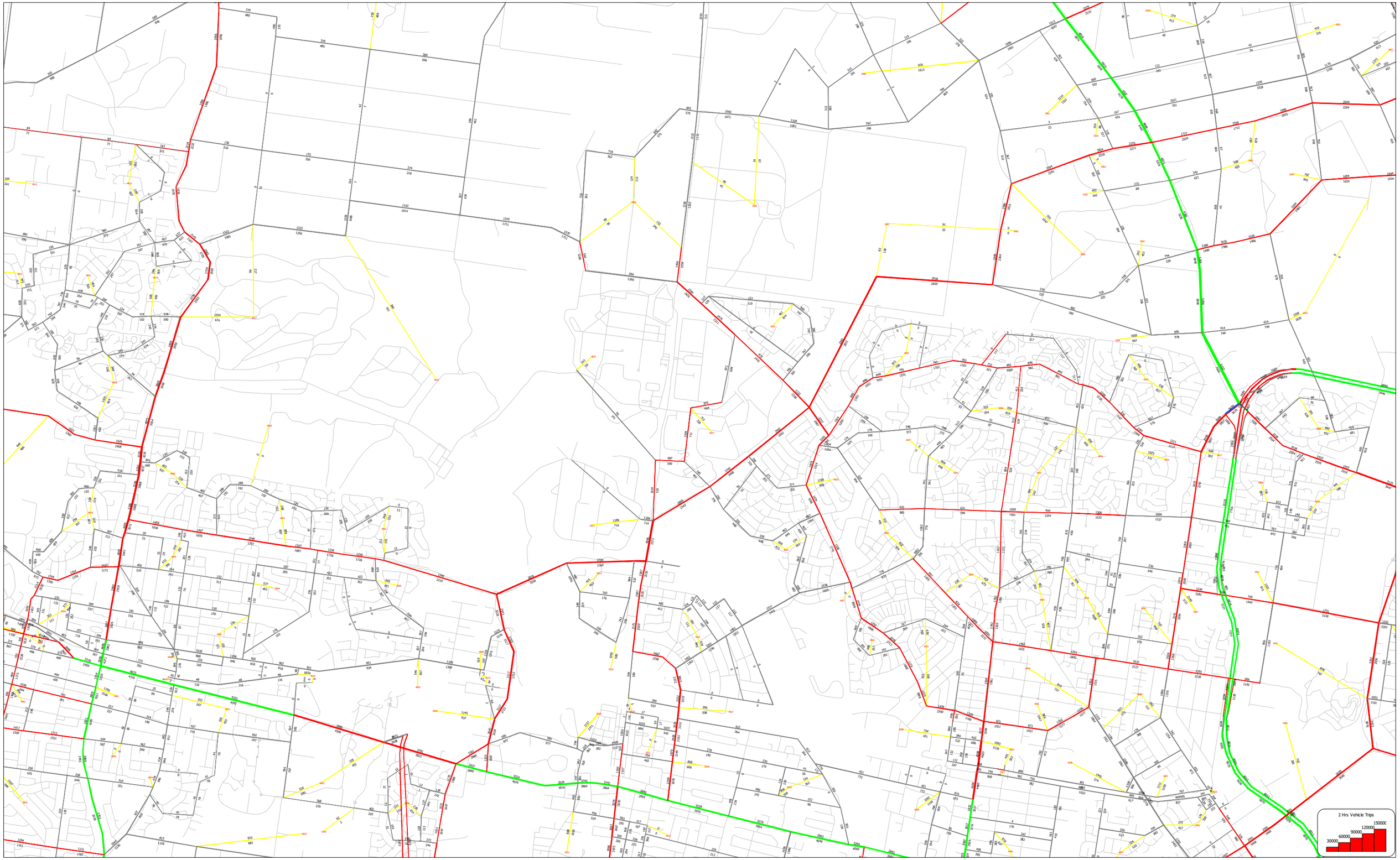
TRAFFIC VOLUMES__



2011TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 2036: 2036 SYDTRAFFICFORECASTMODELTZ11LU16V151STMV362-7-9AM(mf36)
2020-07-31 12:55

LANE (1WAY):
1
2
3
4
5

TRAFFIC VOLUMES__



2011TZ SYDNEY GMA STRATEGIC TRAFFIC FORECASTING MODEL
Scenario 20360: 2036 SYDTRAFFICFORECASTMODELTZ11LU16V151STMV362-4-6PM(mf56)
2020-07-31 12:56

LANE (1WAY):
1
2
3
4
5

Appendix C

SIDRA Modelling Results

MOVEMENT SUMMARY

Site: [EX-AM (Site Folder: General)]

Existing Base Case 2020
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	415	100	437	24.2	0.883	8.8	LOS A	17.0	132.6	0.93	0.73	1.04	45.5
2	T1	669	45	704	6.7	0.883	8.3	LOS A	17.0	132.6	0.93	0.73	1.04	49.1
3	R2	193	9	203	4.7	0.256	10.5	LOS A	1.3	9.3	0.42	0.67	0.42	51.7
Approach		1277	154	1345	12.1	0.883	8.8	LOS A	17.0	132.6	0.86	0.72	0.95	48.7
East: Forrester Road														
4	L2	859	48	904	5.6	0.488	3.6	LOS A	0.0	0.0	0.00	0.43	0.00	56.0
5	T1	143	17	150	12.1	0.142	6.5	LOS A	0.9	7.0	0.65	0.62	0.65	31.0
6	R2	1	0	1	0.0	0.142	11.3	LOS A	0.9	7.0	0.65	0.62	0.65	51.1
Approach		1003	65	1056	6.5	0.488	4.0	LOS A	0.9	7.0	0.09	0.45	0.09	51.7
North: Rope Crossing Boulevard														
7	L2	4	0	4	0.0	0.003	3.5	LOS A	0.0	0.1	0.32	0.39	0.32	51.2
8	T1	387	13	407	3.3	0.377	4.1	LOS A	2.1	14.8	0.53	0.48	0.53	50.4
9	R2	18	1	19	5.3	0.377	9.1	LOS A	2.1	14.8	0.53	0.48	0.53	37.4
Approach		409	14	431	3.3	0.377	4.3	LOS A	2.1	14.8	0.53	0.48	0.53	49.9
West: Links Road														
10	L2	4	1	4	25.0	0.102	8.9	LOS A	0.4	4.2	0.70	0.81	0.70	42.9
11	T1	35	16	37	45.7	0.102	10.1	LOS A	0.4	4.2	0.70	0.81	0.70	48.5
12	R2	111	63	117	56.8	0.210	13.5	LOS A	1.0	10.7	0.72	0.89	0.72	43.0
Approach		151	80	159	53.3	0.210	12.6	LOS A	1.0	10.7	0.71	0.87	0.71	44.2
All Vehicles		2840	313	2989	11.0	0.883	6.6	LOS A	17.0	132.6	0.53	0.60	0.57	49.8

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [EX-PM (Site Folder: General)]

Existing Base Case 2020
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	97	36	102	37.6	0.751	5.2	LOS A	9.6	71.0	0.50	0.44	0.50	47.5
2	T1	967	40	1018	4.1	0.751	4.6	LOS A	9.6	71.0	0.50	0.44	0.50	50.8
3	R2	655	16	690	2.4	0.542	9.6	LOS A	4.4	31.7	0.36	0.60	0.36	52.0
Approach		1719	92	1810	5.4	0.751	6.5	LOS A	9.6	71.0	0.45	0.50	0.45	51.1
East: Forrester Road														
4	L2	1063	47	1119	4.4	0.599	3.7	LOS A	0.0	0.0	0.00	0.42	0.00	55.8
5	T1	57	28	60	48.9	0.074	7.3	LOS A	0.4	4.4	0.67	0.63	0.67	30.7
6	R2	1	0	1	0.0	0.074	11.2	LOS A	0.4	4.4	0.67	0.63	0.67	50.9
Approach		1121	74	1180	6.6	0.599	3.9	LOS A	0.4	4.4	0.03	0.44	0.03	54.3
North: Rope Crossing Boulevard														
7	L2	9	0	10	0.0	0.011	6.5	LOS A	0.0	0.3	0.58	0.54	0.58	50.3
8	T1	187	17	197	8.8	0.313	8.3	LOS A	1.8	13.9	0.82	0.88	0.82	48.6
9	R2	3	1	3	33.3	0.313	14.3	LOS A	1.8	13.9	0.82	0.88	0.82	35.5
Approach		199	17	210	8.8	0.313	8.3	LOS A	1.8	13.9	0.81	0.86	0.81	48.5
West: Links Road														
10	L2	56	3	59	5.5	0.486	14.7	LOS B	2.7	20.6	0.84	0.99	1.10	39.0
11	T1	134	18	141	13.7	0.486	16.9	LOS B	2.7	20.6	0.84	0.99	1.10	44.1
12	R2	343	54	361	15.8	0.641	20.6	LOS B	4.7	37.7	0.90	1.12	1.36	38.8
Approach		533	75	561	14.2	0.641	19.0	LOS B	4.7	37.7	0.88	1.07	1.26	40.1
All Vehicles		3572	260	3760	7.3	0.751	7.7	LOS A	9.6	71.0	0.40	0.59	0.46	50.5

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [EX-AM+Dev (Site Folder: General)]

Existing Base Case 2020 + Development Traffic
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	417	102	439	24.5	0.885	8.9	LOS A	17.3	134.8	0.94	0.73	1.06	45.5
2	T1	669	45	704	6.7	0.885	8.3	LOS A	17.3	134.8	0.94	0.73	1.06	49.1
3	R2	193	9	203	4.7	0.256	10.5	LOS A	1.3	9.3	0.42	0.67	0.42	51.7
Approach		1279	156	1347	12.2	0.885	8.8	LOS A	17.3	134.8	0.86	0.72	0.96	48.6
East: Forrester Road														
4	L2	859	48	904	5.6	0.488	3.6	LOS A	0.0	0.0	0.00	0.43	0.00	56.0
5	T1	143	17	150	12.1	0.142	6.5	LOS A	0.9	7.0	0.65	0.63	0.65	31.0
6	R2	1	0	1	0.0	0.142	11.3	LOS A	0.9	7.0	0.65	0.63	0.65	51.1
Approach		1003	65	1056	6.5	0.488	4.0	LOS A	0.9	7.0	0.09	0.46	0.09	51.7
North: Rope Crossing Boulevard														
7	L2	4	0	4	0.0	0.003	3.5	LOS A	0.0	0.1	0.32	0.39	0.32	51.2
8	T1	387	13	407	3.3	0.378	4.1	LOS A	2.1	14.9	0.53	0.48	0.53	50.4
9	R2	18	1	19	5.3	0.378	9.1	LOS A	2.1	14.9	0.53	0.48	0.53	37.4
Approach		409	14	431	3.3	0.378	4.3	LOS A	2.1	14.9	0.53	0.48	0.53	49.9
West: Links Road														
10	L2	4	1	4	25.0	0.103	8.9	LOS A	0.4	4.2	0.70	0.81	0.70	42.9
11	T1	35	16	37	45.7	0.103	10.1	LOS A	0.4	4.2	0.70	0.81	0.70	48.4
12	R2	113	65	119	57.5	0.215	13.5	LOS A	1.1	11.0	0.72	0.89	0.72	42.9
Approach		153	82	161	53.9	0.215	12.6	LOS A	1.1	11.0	0.72	0.87	0.72	44.1
All Vehicles		2844	317	2994	11.2	0.885	6.7	LOS A	17.3	134.8	0.53	0.60	0.58	49.7

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [EX-PM+Dev (Site Folder: General)]

Existing Base Case 2020 + Development Traffic
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	98	37	103	38.3	0.752	5.2	LOS A	9.6	71.4	0.50	0.44	0.50	47.4
2	T1	967	40	1018	4.1	0.752	4.6	LOS A	9.6	71.4	0.50	0.44	0.50	50.8
3	R2	655	16	690	2.4	0.542	9.6	LOS A	4.4	31.7	0.36	0.60	0.36	52.0
Approach		1720	93	1811	5.4	0.752	6.5	LOS A	9.6	71.4	0.45	0.50	0.45	51.1
East: Forrester Road														
4	L2	1063	47	1119	4.4	0.599	3.7	LOS A	0.0	0.0	0.00	0.42	0.00	55.8
5	T1	57	28	60	48.9	0.074	7.3	LOS A	0.4	4.4	0.67	0.63	0.67	30.7
6	R2	1	0	1	0.0	0.074	11.2	LOS A	0.4	4.4	0.67	0.63	0.67	50.9
Approach		1121	74	1180	6.6	0.599	3.9	LOS A	0.4	4.4	0.03	0.44	0.03	54.3
North: Rope Crossing Boulevard														
7	L2	9	0	10	0.0	0.011	6.5	LOS A	0.0	0.3	0.58	0.54	0.58	50.3
8	T1	187	17	197	8.8	0.313	8.4	LOS A	1.8	14.0	0.83	0.88	0.83	48.6
9	R2	3	1	3	33.3	0.313	14.3	LOS A	1.8	14.0	0.83	0.88	0.83	35.5
Approach		199	17	210	8.8	0.313	8.4	LOS A	1.8	14.0	0.81	0.86	0.81	48.5
West: Links Road														
10	L2	56	3	59	5.5	0.487	14.7	LOS B	2.7	20.7	0.84	0.99	1.10	39.0
11	T1	134	18	141	13.7	0.487	16.9	LOS B	2.7	20.7	0.84	0.99	1.10	44.1
12	R2	344	55	362	16.0	0.644	20.7	LOS B	4.8	38.1	0.90	1.12	1.36	38.8
Approach		534	76	562	14.3	0.644	19.1	LOS B	4.8	38.1	0.88	1.08	1.27	40.1
All Vehicles		3574	262	3762	7.3	0.752	7.7	LOS A	9.6	71.4	0.40	0.59	0.46	50.5

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [FU-AM (Site Folder: General)]

Future Base Case 2030
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	499	121	525	24.2	1.105	108.3	LOS F	113.6	886.4	1.00	3.03	4.89	14.3
2	T1	804	53	846	6.7	1.105	107.6	LOS F	113.6	886.4	1.00	3.03	4.89	20.5
3	R2	232	11	244	4.7	0.322	11.0	LOS A	1.7	12.5	0.49	0.71	0.49	51.4
Approach		1534	185	1615	12.1	1.105	93.2	LOS F	113.6	886.4	0.92	2.68	4.23	20.7
East: Forrester Road														
4	L2	1111	62	1169	5.6	0.632	3.7	LOS A	0.0	0.0	0.00	0.42	0.00	55.8
5	T1	185	22	194	12.1	0.189	6.8	LOS A	1.3	9.7	0.69	0.66	0.69	30.9
6	R2	2	0	2	0.0	0.189	11.6	LOS A	1.3	9.7	0.69	0.66	0.69	50.9
Approach		1297	84	1365	6.5	0.632	4.2	LOS A	1.3	9.7	0.10	0.46	0.10	51.5
North: Rope Crossing Boulevard														
7	L2	4	0	4	0.0	0.004	3.7	LOS A	0.0	0.1	0.35	0.40	0.35	51.0
8	T1	410	13	432	3.3	0.410	4.4	LOS A	2.3	16.6	0.57	0.51	0.57	50.2
9	R2	20	1	21	5.3	0.410	9.3	LOS A	2.3	16.6	0.57	0.51	0.57	37.3
Approach		434	14	457	3.3	0.410	4.6	LOS A	2.3	16.6	0.57	0.51	0.57	49.7
West: Links Road														
10	L2	4	1	4	25.0	0.117	9.4	LOS A	0.5	4.9	0.73	0.83	0.73	42.4
11	T1	36	17	38	45.7	0.117	10.8	LOS A	0.5	4.9	0.73	0.83	0.73	47.9
12	R2	115	65	121	56.8	0.240	14.0	LOS A	1.2	12.5	0.76	0.91	0.76	42.6
Approach		155	83	163	53.3	0.240	13.1	LOS A	1.2	12.5	0.75	0.89	0.75	43.8
All Vehicles		3421	367	3601	10.7	1.105	44.6	LOS D	113.6	886.4	0.56	1.48	2.04	31.1

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [FU-PM (Site Folder: General)]

Future Base Case 2030
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	115	43	121	37.6	0.915	6.4	LOS A	21.0	156.0	0.94	0.54	0.94	44.7
2	T1	1149	47	1210	4.1	0.915	5.6	LOS A	21.0	156.0	0.94	0.54	0.94	48.9
3	R2	778	19	819	2.4	0.661	9.9	LOS A	6.6	46.9	0.50	0.61	0.50	51.5
Approach		2043	110	2150	5.4	0.915	7.3	LOS A	21.0	156.0	0.77	0.56	0.77	49.7
East: Forrester Road														
4	L2	1402	61	1476	4.4	0.791	4.1	LOS A	0.0	0.0	0.00	0.42	0.00	55.2
5	T1	75	37	79	48.9	0.100	7.4	LOS A	0.6	6.1	0.69	0.65	0.69	30.6
6	R2	2	0	2	0.0	0.100	11.3	LOS A	0.6	6.1	0.69	0.65	0.69	50.8
Approach		1478	98	1556	6.6	0.791	4.2	LOS A	0.6	6.1	0.04	0.43	0.04	53.7
North: Rope Crossing Boulevard														
7	L2	9	0	10	0.0	0.012	7.7	LOS A	0.1	0.4	0.67	0.59	0.67	50.0
8	T1	188	17	198	8.8	0.362	10.6	LOS A	2.3	17.4	0.88	0.94	0.94	47.1
9	R2	3	1	3	33.3	0.362	16.7	LOS B	2.3	17.4	0.88	0.94	0.94	34.4
Approach		200	17	210	8.8	0.362	10.6	LOS A	2.3	17.4	0.87	0.92	0.93	47.1
West: Links Road														
10	L2	59	3	62	5.5	0.822	40.5	LOS C	6.4	49.2	0.97	1.27	1.89	27.2
11	T1	141	19	148	13.7	0.822	43.5	LOS D	6.4	49.2	0.97	1.27	1.89	29.5
12	R2	361	57	380	15.8	1.046	111.9	LOS F	26.1	207.7	1.00	2.32	4.88	14.7
Approach		561	80	590	14.2	1.046	87.2	LOS F	26.1	207.7	0.99	1.95	3.81	18.0
All Vehicles		4282	305	4507	7.1	1.046	16.8	LOS B	26.1	207.7	0.55	0.72	0.92	43.8

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [FU-AM+Dev (Site Folder: General)]

Future Base Case 2030 + Development Traffic
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	501	123	528	24.5	1.108	110.4	LOS F	115.4	900.9	1.00	3.07	4.96	14.1
2	T1	804	53	846	6.7	1.108	109.7	LOS F	115.4	900.9	1.00	3.07	4.96	20.2
3	R2	232	11	244	4.7	0.322	11.0	LOS A	1.7	12.5	0.49	0.71	0.49	51.4
Approach		1536	187	1617	12.2	1.108	95.1	LOS F	115.4	900.9	0.92	2.72	4.29	20.5
East: Forrester Road														
4	L2	1111	62	1169	5.6	0.632	3.7	LOS A	0.0	0.0	0.00	0.42	0.00	55.8
5	T1	185	22	194	12.1	0.189	6.8	LOS A	1.3	9.7	0.69	0.66	0.69	30.9
6	R2	2	0	2	0.0	0.189	11.6	LOS A	1.3	9.7	0.69	0.66	0.69	50.9
Approach		1297	84	1365	6.5	0.632	4.2	LOS A	1.3	9.7	0.10	0.46	0.10	51.5
North: Rope Crossing Boulevard														
7	L2	4	0	4	0.0	0.004	3.7	LOS A	0.0	0.1	0.35	0.40	0.35	51.0
8	T1	410	13	432	3.3	0.411	4.4	LOS A	2.3	16.6	0.57	0.51	0.57	50.2
9	R2	20	1	21	5.3	0.411	9.3	LOS A	2.3	16.6	0.57	0.51	0.57	37.3
Approach		434	14	457	3.3	0.411	4.6	LOS A	2.3	16.6	0.57	0.51	0.57	49.7
West: Links Road														
10	L2	4	1	4	25.0	0.117	9.4	LOS A	0.5	4.9	0.73	0.83	0.73	42.4
11	T1	36	17	38	45.7	0.117	10.8	LOS A	0.5	4.9	0.73	0.83	0.73	47.9
12	R2	117	65	123	55.8	0.242	13.9	LOS A	1.2	12.6	0.76	0.91	0.76	42.6
Approach		157	83	165	52.7	0.242	13.1	LOS A	1.2	12.6	0.75	0.89	0.75	43.8
All Vehicles		3425	369	3605	10.8	1.108	45.4	LOS D	115.4	900.9	0.56	1.50	2.07	30.9

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [FU-PM+Dev (Site Folder: General)]

Future Base Case 2030 + Development Traffic
Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Forrester Road														
1	L2	116	44	122	38.2	0.916	6.5	LOS A	21.1	157.1	0.94	0.54	0.94	44.7
2	T1	1149	47	1210	4.1	0.916	5.6	LOS A	21.1	157.1	0.94	0.54	0.94	48.9
3	R2	778	19	819	2.4	0.661	9.9	LOS A	6.6	46.9	0.50	0.61	0.50	51.5
Approach		2044	111	2151	5.4	0.916	7.3	LOS A	21.1	157.1	0.77	0.56	0.77	49.7
East: Forrester Road														
4	L2	1402	61	1476	4.4	0.791	4.1	LOS A	0.0	0.0	0.00	0.42	0.00	55.2
5	T1	75	37	79	48.9	0.100	7.4	LOS A	0.6	6.0	0.69	0.65	0.69	30.6
6	R2	2	0	2	0.0	0.100	11.3	LOS A	0.6	6.0	0.69	0.65	0.69	50.8
Approach		1478	98	1556	6.6	0.791	4.2	LOS A	0.6	6.0	0.04	0.43	0.04	53.7
North: Rope Crossing Boulevard														
7	L2	9	0	10	0.0	0.012	7.7	LOS A	0.1	0.4	0.67	0.59	0.67	50.0
8	T1	188	17	198	8.8	0.361	10.6	LOS A	2.3	17.3	0.88	0.94	0.94	47.1
9	R2	3	1	3	33.3	0.361	16.7	LOS B	2.3	17.3	0.88	0.94	0.94	34.4
Approach		200	17	210	8.8	0.361	10.5	LOS A	2.3	17.3	0.87	0.92	0.93	47.1
West: Links Road														
10	L2	59	3	62	5.5	0.824	40.8	LOS C	6.4	49.4	0.97	1.27	1.90	27.1
11	T1	141	19	148	13.7	0.824	43.8	LOS D	6.4	49.4	0.97	1.27	1.90	29.4
12	R2	362	58	381	16.0	1.053	116.2	LOS F	27.3	217.1	1.00	2.37	5.03	14.3
Approach		562	81	591	14.3	1.053	90.1	LOS F	27.3	217.1	0.99	1.98	3.92	17.5
All Vehicles		4284	307	4509	7.2	1.053	17.2	LOS B	27.3	217.1	0.55	0.72	0.94	43.6

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix D

Swept Path Analysis

VEHICLE ENTERING

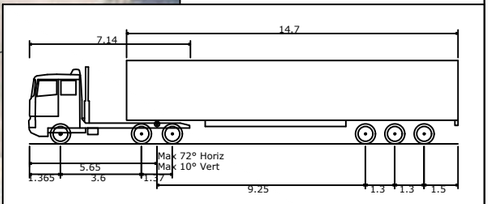
VEHICLE EXITING

DUNHEVED CCT

KOMMER PL

KEY:

	Forward	Reverse
Wheel path		
Body envelope		
300mm clearance		



19m FH13 Articulated Vehicle

Overall Length	19000mm
Overall Width	2500mm
Overall Body Height	3695mm
Min Body Ground Clearance	332mm
Track Width	2500mm
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	7550mm

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	WJ	23/11/20

ttpp transport planning

PROJECT: 25 DUNHEVED CIRCUIT, ST MARYS

TITLE: SWEPT PATH ANALYSIS - DUNHEVED CKT
19m FH13 ARTICULATED VEHICLE

DWG No. 20202CAD004
FIGURE 1

DATE STAMP: 23 NOVEMBER 2020

PROJECT No.	SCALE	REV.
20202	1:400 @A3	A

Filename: 20202CAD004-201123-SWEPT PATH.dwg
Date: 26 November 2020
By: Karl.majstorado

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	WJ	23/11/20

ttpp transport planning

PROJECT

25 DUNHEVED CIRCUIT, ST MARYS

TITLE

SWEPT PATH ANALYSIS - SUBJECT SITE - VEHICLE ENTERING WAREHOUSE
19m FH13 ARTICULATED VEHICLE

DWG No. 20202CAD004 FIGURE 2

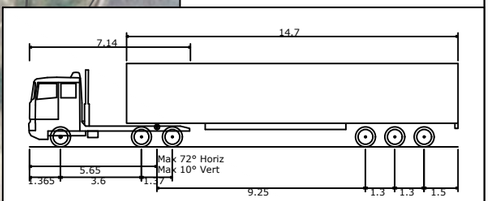
DATE STAMP 23 NOVEMBER 2020

PROJECT No.	SCALE	REV.
20202	1:400 @A3	A

Filename: 20202CAD004-201123-SWEPT PATH.dwg Date: 26 November 2020 By: Karl.magistrado

KEY:

	Forward	Reverse
Wheel path		
Body envelope		
300mm clearance		



19m FH13 Articulated Vehicle

Overall Length	19000mm
Overall Width	2500mm
Overall Body Height	3695mm
Min Body Ground Clearance	332mm
Track Width	2500mm
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	7550mm

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	WJ	23/11/20

ttpp transport planning

PROJECT

25 DUNHEVED CIRCUIT, ST MARYS

TITLE

SWEPT PATH ANALYSIS - SUBJECT SITE - VEHICLE EXITING WAREHOUSE
19m FH13 ARTICULATED VEHICLE

DWG No. 20202CAD004 FIGURE 3

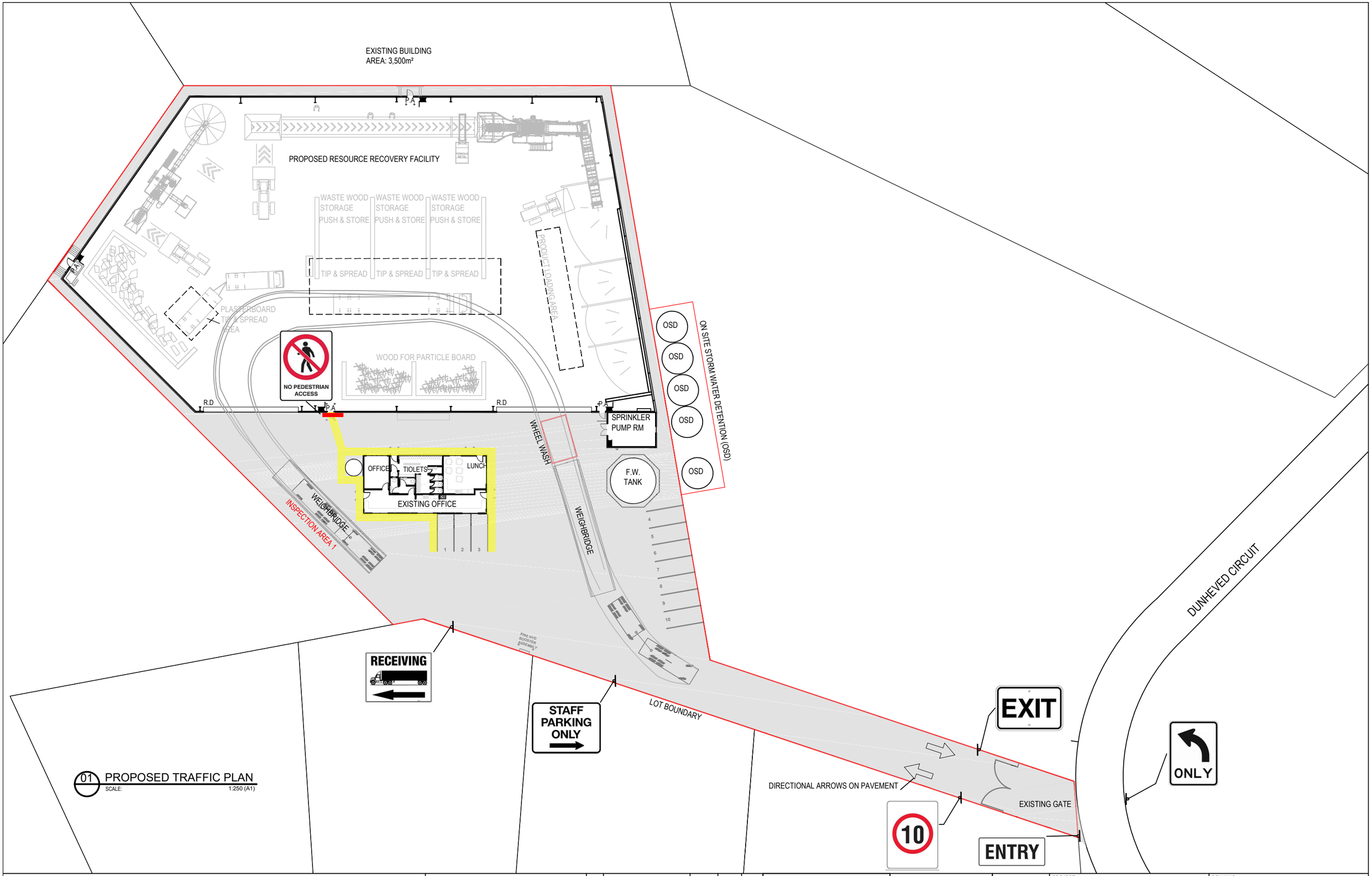
DATE STAMP 23 NOVEMBER 2020

PROJECT No.	SCALE	REV.
20202	1:400 @A3	A

Filename: 20202CAD004-201123-SWEPT PATH.dwg Date: 26 November 2020 By: Karl.magistrado

Appendix E

Site Plan



01 PROPOSED TRAFFIC PLAN
SCALE: 1:250 (A1)

LEGEND:

- PEDESTRIAN FOOTPATH
- AUTHORISED PERSONNEL ENTRY ONLY

NOTES:

TOTAL SITE AREA: 6,253m²

TOTAL BUILT UP AREA: 3,660m²

ISSUE	DESCRIPTION	DATE	DRAWN	AUTH
B	Development Application	02-02-2021	DC	SC/JB
A	Development Application	26-11-2020	DC	SC/JB

reDirect RECYCLING

CROSSMULLER CONSTRUCTION

OFFICE:
2 WELLA WAY SOMERSBY, N.S.W. 2250 AUSTRALIA
Tel: 02 4340 9800 Fax: 02 4340 8293

PROJECT: RESOURCE RECOVERY FACILITY

DRAWING: PROPOSED TRAFFIC AND SIGNAGE PLAN

LOCATION: 25 DUNHEVED CIRCUIT, ST MARYS

SCALE: 1:250 @ A1, 1:500@A3

STAGE: DA

PROJECT NUMBER: 2020/01

DRAWING NUMBER: DA04

ISSUE: B

The Transport Planning Partnership
Suite 402 Level 4, 22 Atchison Street
St Leonards NSW 2065

P.O. Box 237
St Leonards NSW 1590

02 8437 7800

info@ttpp.net.au

www.ttpp.net.au