Oran Park and Turner Road Precinct Plan Transport Assessment

Growth Centres Commission

29 August 2007

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Transport Assessment

Prepared for

Growth Centres Commission

Prepared by

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A	18/01/2007	Draft Report	Sigrid Sanderson Technical Director	Original Signed
B	26/03/2007	Final Draft Report	Sigrid Sanderson Technical Director	Original Signed
C	19/04/2007	Final Draft Report (Section 6 Inserted)	Sigrid Sanderson Technical Director	Original Signed
D	27/07/2007	Final Draft Report (revised network modelling assumptions)	Sigrid Sanderson Technical Director	Original Signed
0	29/08/2007	Final report (minor text edits)	Sigrid Sanderson Technical Director	

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Executive Summary

The NSW Government has established the South West Growth Centre to provide residential dwellings for the expanding population. Edmondson Park, Oran Park and Turner Road are the first three precincts to be developed within the South West Growth Centre. Edmondson Park has been released, while Oran Park and Turner Road are being progressed for release through the Growth Centres SEPP.

The NSW Government transport agencies have expressed a desire, as have the land owners, to achieve high quality transport systems for the Growth Centres. This includes planning the Precincts from the outset to provide transport choice. This will be achieved through appropriate densities, land uses in the right places and a high quality multi-modal transport system.

Maunsell has been appointed by the Growth Centres Commission to provide transport advice into the Precinct Planning process for Oran Park and Turner Road Precincts. The purpose of this assessment is to review the Indicative Layout Plans for each transport mode and to design transport networks that could be achieved for each Precinct. Where improvements could be made to the Indicative Layout Plans these have been recommended for adoption.

Walking

In general the Indicative Layout Plans provide the opportunity to create high quality connected pedestrian networks. In accordance with the Growth Centres Development Code, pedestrian footpaths should be provided on all roads. This provides connectivity for local walking trips and public transport access trips.

The following aspects of the Indicative Layout Plans should be reviewed to improve pedestrian accessibility:

- High quality, safe and visible pedestrian/cycle connections should be provided from cul-de-sacs to adjacent streets and/or green spaces.
- The streetscape of major streets should be activated (through improved visibility), including Badgally Road, Southern Boulevard, Turner Road, East-West Link Road 1, East-West Link Road 2 and Southern Boulevard East.
- The gradient of some links may affect pedestrian comfort. This can be avoided in some cases but need to be considered in the detailed design of new roads, in particular Badgally Road at the southeast corner of Turner Road Precinct and the Turner Road North Spine Road.

Important points to consider when entering next stages of planning when lot layouts and building sizes are:

- Allowing ‘space’ for pedestrian waiting areas at bus stops/ interchanges; and
- Retaining pathways in linear green spaces.

Cycling

A hierarchy of cycle routes has been developed to ensure that new residents in the Precincts have the opportunity to cycle to schools, shops and to work. This network has been developed using a hierarchy of routes, from Recreational Routes through green spaces to Regional Routes on major arterial roads.

The network review has found that some sections of the cycle network are affected by the natural topography of the area, including:

Oran Park

- Southern Boulevard East, on the approach to The Northern Road;
- Southern Boulevard East, between the North Spine Road and the north-South East Road (alternative routes are available via East West Road 1 and North-South East Road);
- North Spine Road, on the approach to Cobbitty Road;

Turner Road

- Smeaton Grange Link Road, on the approach to South Spine Road 2 (alternative routes are available via Camden Valley Way or Industrial Road 1);
- South Spine Road 1, on the approach to the Southern Boulevard (an alternative route is available via Industrial Road 1);
- South Spine Road 2, south of Southern Boulevard;
- Central Spine Road, in the vicinity of the Clubhouse Precinct.

Public Transport

The bus network plan provides for a bus interchange at the Oran Park Town Centre and for connections through to adjacent District Centres of Camden, Narellan, Macarthur and Campbelltown (for access to the rail network). Connectivity is also provided to the town/locality centres of Harrington Park and Turner Road. The bus network provides coverage for the majority of the Turner Road and Oran Park Precincts.

Opportunities for expansion of the bus network exist as future Precincts are developed, with latent capacity identified for the Oran Park interchange. However, it has been noted that fragmented ownership within the Catherine Fields Precinct may limit connectivity between Oran Park and Leppington in the short-term. This would need to be resolved through the Precinct planning process for Catherine Fields.

Road Networks

While it is recognised that the Precincts will have impacts on the wider transport networks, it is beyond the scope of this study to identify those impacts. It is assumed that transport infrastructure for the South West Growth Centre has been identified through the NSW Growth Centres Commission structure planning process and will be provided to meet demands.

The road network within the two precincts has been assessed with the aid of Cube Voyager, a strategic transport model. Internal demand has been derived through analysis of the proposed land uses, while external trips have been calibrated to RTA forecasts for the South West Growth Centre.

1.0 Introduction

1.1 Background

The NSW Metropolitan Strategy (December, 2005) reaffirmed the pressures being faced by the metropolitan area in terms of residential growth and associated demands for the economy and employment, housing, transport, environment and resources, parks and public places.

In response, the Metropolitan Strategy identifies strategies to accommodate a third of the residential demands through the provision of new urban areas in the north-west and south-west growth centres. The two growth centres have been divided into Precincts to ensure that planning is undertaken in an integrated manner.

Edmondson Park, Oran Park and Turner Road are the first Precincts to be released in the South West Growth Centre. Edmondson Park has been released already, with Oran Park and Turner Road to be planned and released under the provisions of the State Environmental Planning Policy (Sydney Region Growth Centres) 2006.

As discussed in the Growth Centres Development Code (October 2006), Precinct Plans are a new approach to the delivery of greenfield residential developments. The intention being to achieve high quality outcomes, including easy access to jobs and major town centres, streets and suburbs planned so that people can walk to shops and frequent bus services that link to the rail network for longer journeys.

1.2 Report Purpose and Scope

Maunsell has been appointed by the Growth Centres Commission to undertake a transport review of the Indicative Layout Plans for the Oran Park and Turner Road Precincts. The purpose of this study is to provide a transparent and robust assessment of the Indicative Layout Plans by all modes of transport, including walking, cycling, public transport, cars and freight vehicles.

It is not the scope of this study to review the impacts of the Precincts on the adjacent transport networks. It is assumed that this process has been completed through structure planning for the South West Growth Centre by the NSW Growth Centres Commission.

The outcomes of the study are threefold:

- consultation with NSW Government Stakeholders;
- confirmation of walking, cycling, public transport and road networks;
- identification of opportunities to improve the networks through changes to the Indicative Layout Plans.

The findings of this transport assessment will be considered by the Precinct Project Control Group and the recommendations may be incorporated into a preferred Indicative Layout Plan. This report may be used to support the Indicative Layout Plans and for use in preparation of planning documents, including the Statutory Provisions to be prepared by others.

1.3 Report Structure

Each section of this report considers one mode of transport and has (as specified by the Precinct Project Control Group) been structured into the following sections:

- Summary of approach/methodology to investigations;
- Description of existing conditions/situation;
- Description of impacts of the ILP/proposed development; and
- Recommended management response/measures to manage the impacts.

As the sites are greenfield, with little or no existing transport infrastructure within the Precincts, the transport analysis of the Indicative Layout Plan focuses on designing transport networks that can be achieved and to recommend improvements to the Plans. This analysis also considers integration into the wider transport networks.

2.0 Land Use and Built Form

2.1 Introduction

The NSW Government has clearly identified its vision for the growth centres as an opportunity to deliver new homes in a sustainable way with new infrastructure planned, funded and linked to the properly sequenced release of land.

To achieve this outcome, it is necessary to plan for a range of land uses that will provide the right mix of houses, jobs, open and recreational space and green spaces. Land use, built form and transport are intrinsically linked in planning terms, with good urban design helping to achieve good transport outcomes and vice versa. Oran Park and Turner Road need easy access to major town centres such as Narellan and Leppington with a full range of shops, recreational facilities and services along with its own smaller village centres and neighbourhood shops for daily needs.

A range of housing choices provides for different needs and different incomes, such as houses on their own block of land along with smaller homes, units and terraces for older people and young singles or couples. The final mix will obviously be dependent on economic assessments, but the population mix and density is an important consideration in the transport assessment as it can affect the peak hour trip generation of the precinct and hence the infrastructure requirements.

This report identifies suitable facilities for people to walk, cycle, catch buses or use private cars. This process enables people to make the most appropriate choice of transport mode for their journey, be it walking to local shops, cycling to community centres or catching a bus to work. The communities are therefore being designed to reduce dependency on private cars and hence reduce the associated emissions generated by high levels of private car use.

2.2 Residential Land Uses

The Oran Park Precinct will accommodate approximately 7,600 dwellings and the Turner Road Precinct around 4,000 dwellings, a total of 11,600 dwellings.

The population density will determine the level of transport demand generated by the residences in various parts of the precincts. Estimates of population density by Elton Consulting suggest an average of 3 persons per dwelling or 34,800 people. Actual densities range from 1.8 persons per high density dwelling, 2.9 persons per medium density dwelling to 3.3 persons per low density dwelling.

2.3 Employment Land Uses

Employment land is highlighted on the Indicative Layout Plans in four categories of uses:

- Light industry;
- Mixed Use;
- Commercial/ retail; and
- Employment land.

Employment land is located in the Oran Park Precinct adjacent to the intersection of The Northern Road and East-West Road 1 and the Oran Park Town Centre includes commercial and mixed use sites.

In Turner Road, a small town centre is planned with commercial uses. The large blocks adjacent to Camden Valley Way contain blocks categorised as commercial/ retail, light industry and employment land.

The employment areas will provide a significant amount of jobs in close proximity to households. This will enable people to work close to their homes and reduce distances for journeys to work.

2.4 Educational Land Uses

The precincts include six primary schools and three high schools; two of each are private schools. It is important to provide schools within easy walking distance of households. The majority of the two precincts will be within 400m walking distance of a school.

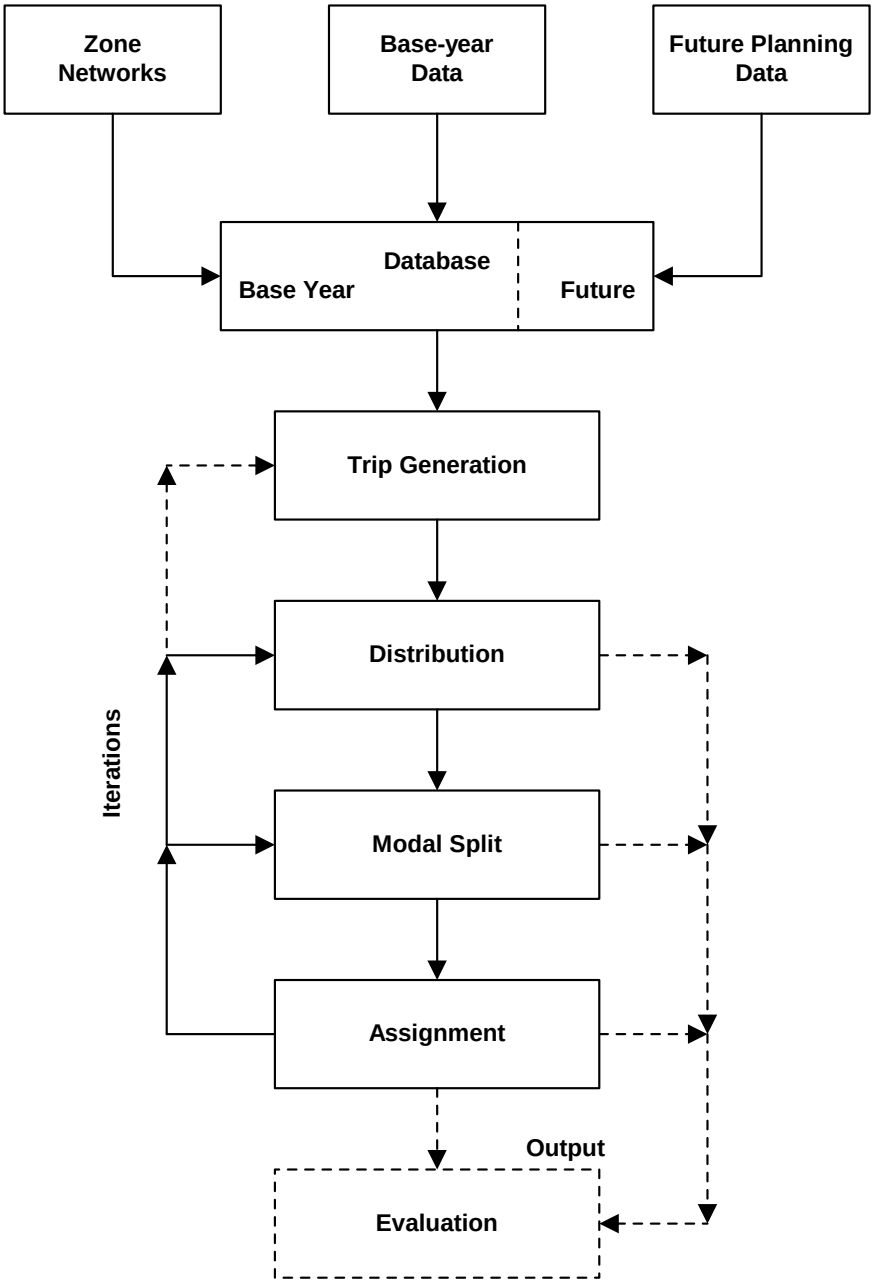
3.0 Road Network

3.1 Introduction

This section establishes principles for the design of road networks and then describes how the Precinct Plans have been tested against these guidelines. Discussion of heavy vehicle routes to and from the precincts is also included.

Transport modelling is generally considered as a sequence of steps relating to the supply and demand of transport systems. The general structure of these steps is known as the classic four-stage transport model and is illustrated in **Figure 3.1**.

Figure 3.1 – Four-Step Model Procedure



Source: Maunsell, 2007

Traffic models are an important step in the transportation planning process because decisions and investments are often influenced by predicted travel demand. Models are used to estimate the number of trips that will be made on a transportation system at some future date as a result of change in travel demand (for instance, the impact of a local development) or a change in supply (for example, the introduction of a new highway scheme).

However, traffic models will only provide forecasts for those factors that are explicitly accounted for in the modelling approach. For instance, traffic models generally exclude pedestrian and bicycle trips, expressing demand only as vehicular traffic, and cannot therefore be used to assess a bicycle improvement scheme. It is critical that model assumptions, simplifications and limitations are understood before a modelling exercise is entered into.

It is important to recognise that models are underpinned by a series of assumptions and are limited by the data availability. Therefore model output should be considered as part of the study input and not 'the answer'.

3.2 Principles and Guidelines

Guidelines for road network design can be allocated into three main categories:

- Road capacity – are adequate lanes provided on the streets to accommodate traffic without significant congestion?
- Road classification (road hierarchy) – how will traffic move through the precincts and are roads designed to accommodate with function in mind?
- Intersection performance – are delays at intersections acceptable?

3.2.1 Road Capacity

Level of Service (LoS) is an index of the operational efficiency of a roadway or intersection. The analysis is essential in planning and design of the transport network and can influence the number of lanes provided or the arrangement of a traffic control system under study.

LoS can be measured mid-block or at intersections. As a mid block measure, LoS is a qualitative measure describing the operational conditions on a road and their perception by a driver. At intersection, LoS is considered in terms of average delay experienced by drivers. Intersection LoS is discussed at **Section 3.2.3**.

The capacity of urban lanes with interrupted flow is provided in **Table 3.1** for each LoS. These capacities may increase when priority is given to the major traffic flow at intersections or if there is flaring at intersections to accommodate more traffic. The spacing of intersections will differ with the hierarchy and function of the road.

Table 3.1 – Mid-block Level of Service and Capacity

LoS	Description	Hourly flow (vehicles)	
		1 Lane	2 Lanes
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.	200	900
B	In the zone of stable flow and drivers still have the reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is a little less than with LOS A.	380	1,400

LoS	Description	Hourly flow (vehicles)	
		1 Lane	2 Lanes
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	600	1,800
D	Close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.	900	2,200
E	Occurs when traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause break-down.	1,400	2,800

Source: Guide to Traffic Generating Developments, RTA, 1994

It is acceptable to provide road capacity at Level of Service D in the peak hour since overprovision of road capacity is not conducive to promoting alternative transport modes to the car.

3.2.2 Road Classification

Both the NSW Roads and Traffic Authority and Growth Centres Commission have developed guidelines for classification of roads. **Table 3.2** summarises the RTA functional classification system.

Table 3.2 – Functional Classification of Roads (NSW Roads and Traffic Authority)

Road Type	Traffic Volume (AADT)	Through Traffic	Inter-Connections	Speed Limit (km/h)
Arterial/Freeway	No limit	Yes	Sub-arterial	70-110
Sub-Arterial	<20,000	Some	Arterial/Collector	60-80
Collector	<5,000	Little	Sub-arterial/Local	40-60
Local	<2,000	No	Collector	40

Source: Updated Guidelines for Functional Classification of Roads in Urban Areas, RTA, 1993

The Growth Centres Development Code classifications, shown in **Table 3.3**, are consistent with the RTA classifications. These classifications have been designed for the growth centres and have therefore been adopted in this study.

Table 3.3 – Functional Classification of Roads (Growth Centres Commission)

Road Type	AADT	Functions and Connections	Speed Limit
Arterial/Freeway	35,000+	Connects large urban areas	Up to 80km/h
Sub-Arterial	10,000 – 35,000	Arterial roads to town centres Carries major bus routes	Up to 70km/h
Collector	3,000 – 10,000	Connects neighbourhoods Can accommodate public transport	Up to 60km/h
Local	1,000 – 3,000	Priority to pedestrians and cyclists Designed to slow residential traffic	Up to 50km/h

Source: Growth Centres Development Code, Growth Centres Commission, October 2006

3.2.3 Intersection Performance

The capacity of an urban road network is controlled by the capacity of the intersections within that network. Average delay is commonly used to assess the actual performance of intersections, with Level of Service used as an index. A summary of the Level of Service index is shown in **Table 3.4**.

Table 3.4: Level of Service Criteria for Intersections

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

Source: Guide to Traffic Generating Developments, RTA 1993

Level of Service D is generally accepted by the NSW Roads and Traffic Authority as design constraint. It should also be noted that capacity constraint can be used as a demand management technique and that over-provision of capacity can encourage more car use.

The other important intersection metric is Degree of Saturation (DoS), or the ratio of flow to capacity. It is generally accepted that intersections should have a degree of saturation of less than 0.9.

3.3 Road Network Analysis

3.3.1 Structure Plan Amendments

Early in the ILP design process, the role and function of the Southern Boulevard East between The Northern Road and Camden Valley Way was reviewed, in particular whether Cobbitty Road should have a higher order function given its connections to Badgally Road. Southern Boulevard East is included as an item within the South West Growth Centre Special Infrastructure Plan.

Since land use assumptions for the town centre adjacent to the intersection of Oran Park Link Road/ North South Spine Road are not yet finalised, items such as junction delay, and therefore journey time are unknown. Therefore, the functional comparison is primarily qualitative using the following criteria:

- Length: Oran Park town centre to Camden Valley Way/ Badgally Road.
- Number of conflict points to reach Camden Valley Way/ Badgally Road: A conflict point is defined as any occasion where a minor flow enters the main traffic flow, or the main traffic flow crosses a major intersection.
- Number of major intersections between Oran Park town centre and Camden Valley Way/ Badgally Road.
- Journey time to reach Camden Valley Way/ Badgally Road: Qualitative comment as a function of the distance and signposted speed, including a nominal delay of 30 seconds per right turn and through movement at intersections. No delay is included for left turns; it is assumed that in most cases a left slip lane or a permitted right turn on red will be provided.

- Vehicle operating cost (VOC): VOC is a function of topography, distance, speed and stop/ start conditions. A qualitative statement has been made to compare the relative VOCs incurred between the Oran Park town centre and Camden Valley Way/ Badgally Road.
- Construction cost: Relative unit costs for the two projects have been sourced from the South West Sydney Urban Expansion Area Transport Issues and Proposals (TTM, 2003).
- Accessibility to/ from other precincts.

The start point for both routes is considered to be the Oran Park town centre, specifically a mid block point at the town centre access on Southern Boulevard.

Southern Boulevard East is expected to pass through the following major intersections:

- Southern Boulevard/ Town Centre access
- Southern Boulevard/ North-South East Road
- Southern Boulevard/ East West Road 2
- Southern Boulevard/ Catherine Field Access (assumed)
- Southern Boulevard/ Camden Valley Way
- Cobbitty Road/ Camden Valley Way/ Badgally Road

The Cobbitty Road route is expected to pass through the following major intersections:

- Southern Boulevard/ Town Centre access
- Southern Boulevard/ North South Link Road
- North South Link Road/ Collector Road (serving private school)
- North South Link Road/ North-South East Road
- Cobbitty Road/ North South Link Road
- Cobbitty Road/ Harrington Grove Access
- Cobbitty Road/ Camden Valley Way/ Badgally Road

Southern Boulevard East is noted within the South West Sydney Urban Expansion Area Transport Issues and Proposals report (TTM, 2003) to have a cost of $71.237 million, with the length of the route from Northern Road to Camden Valley Way being 4.7km. If the cost is scaled down to represent the length of the route between the town centre and Camden Valley Way, the approximate cost is estimated to be $43.197 million (2.85km/4.7km x $71.237 million).

Cobbitty Road is currently a lightly trafficked rural two lane road. This would require upgrade and widening to a four lane sub arterial road. Unit costs for this type of upgrade are included within the Urban Expansion Area Transport Issues and Proposals report (TTM, 2003) at a rate of $11,765 per metre. At a length of 3.77 kilometres, the Cobbitty Road link would be upgraded at an approximate cost of $44.178 million.

For the purposes of the journey time calculation the following link speeds have been assumed:

- Southern Boulevard at town centre: 60 kilometres per hour
- North South Link Road: 60 kilometres per hour
- Cobbitty Road: 60 kilometres per hour
- Southern Boulevard East beyond town centre limits: 60 kilometres per hour
- Camden Valley Way: 70 kilometres per hour

Table 3.5 summarises the results of the comparison.

Table 3.5: Functional Comparison of Southern Boulevard East

Criteria	Oran Park Link Road	Cobbitty Road
Length of upgrade	2.85km	3.67km
Travel length	3.77km	3.67km
Number of conflict points	11	8
Number of major intersections	6	7
Journey time	5.2 minutes	5.2 minutes
Vehicle operating cost	• Less hilly • More signalised intersections, therefore more likely to stop start • Speed 60km/h • Longer distance • Similar relative VOC likely	• More hilly • Less signalised intersections, therefore less likely to stop start • Speed 60km/h • Shorter distance • Similar relative VOC likely
Cost	43.197 million	43.178 million
Accessibility	Provides access to Catherine Fields, expected to be developed in the long term.	Provides access to Harrington Grove, expected to be developed in the short term.

Cobbitty Road is preferable to Southern Boulevard East as the primary link between Oran Park town centre and Camden Valley Way and on to Badgally Road as:

- it provides a slightly shorter travel length between Oran Park Town Centre and Badgally Road;
- it removes the 'dog leg' in the route between the town centre and Badgally Road, creating fewer conflict points and therefore a safer journey;
- removal of the 'dog leg' increases the perceived directness of the journey, even though journey distances and times could be similar;
- it could be constructed at a marginally lower cost; and
- Cobbitty Road provides access to Harrington Grove which is forecast to be developed considerably earlier than the Catherine Fields Precinct.

3.3.2 Development of the Strategic Traffic Model

The intent of the model is to identify likely volumes on the strategic road network within the precinct such that the form of the precinct plan can be confirmed as being appropriate. Information extracted from the model for this purpose includes link flows to confirm number of lanes required and whether road hierarchy assumptions and network density are appropriate.

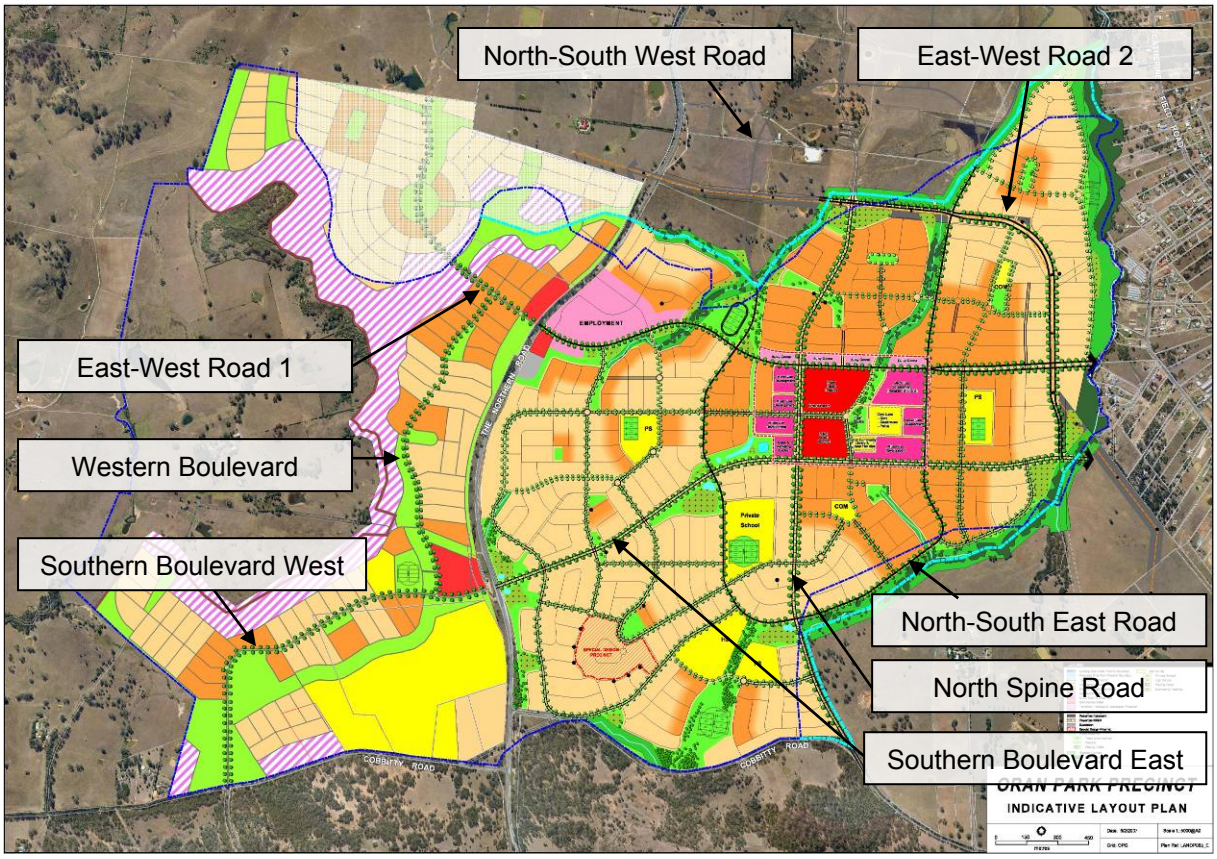
This study has not considered road requirements beyond the boundary of the precincts. Assessing the capacity of this infrastructure is structure planning and that process was undertaken to develop the Infrastructure Plan for the South West Growth Centre by the NSW Government.

The highway assignment model for this study has been developed within Cube Voyager. Cube Voyager allows for the easy assessment of the impact of locally generated car trips on the precinct highway network and provides a framework for network and travel demand scenario testing.

3.3.3 Indicative Layout Plans and Road Names

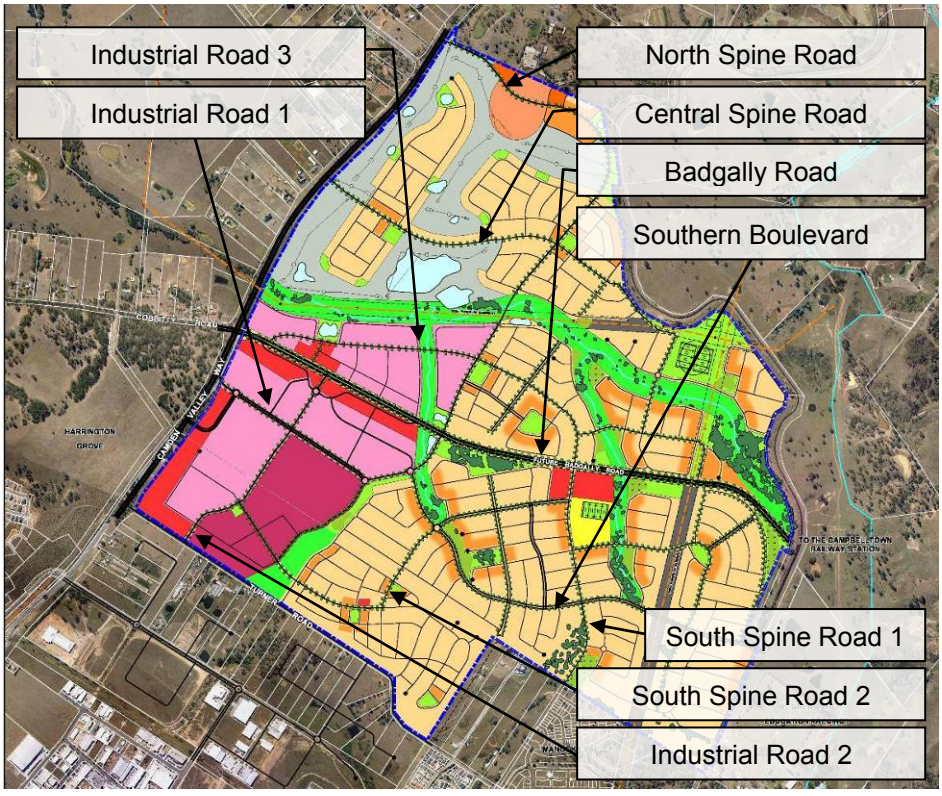
The inputs to this study are the indicative layout plans prepared by the project team, which are provided at **Appendix A** for reference. Proposed roads within the precincts have been given reference names by the Project Team as shown in **Figure 3.2** and **Figure 3.3**.

Figure 3.2 – Oran Park Reference Names



Source: Camden Council 2007

Figure 3.3 – Turner Road Reference Names



Source: Camden Council 2007

3.3.4 Model Assumptions

Morning peak hour and evening peak hour models have been developed to test the road network infrastructure within the two precincts. The morning peak hour is assumed to be 8.00am to 9.00am, while the evening peak hour is 5.00pm to 6.00pm. The model input is provided in **Appendix B**.

The model assumes 60% development of the Oran Park and Turner Road precincts by 2016, with full development by 2026.

External traffic flows on The Northern Road and Camden Valley Way have been extracted from 2016 and 2026 RTA forecasts to ensure that precinct access intersections are sized appropriately. These inputs are included at **Appendix B**.

Demand for travel within the models has been calculated on the basis of residential households. Trip rates for the following dwelling types have been taken from the Guide to Traffic Generating Developments (RTA, 1993):

- Low density at 0.85 car trips per dwelling;
- Medium density at 0.53 car trips per dwelling; and
- High density at 0.29 car trips per dwelling.

Providing a high quality bus network, together with a comprehensive cycle network and footpaths will likely result in lower trip rates than those specified above and opportunities to reduce vehicle trip rates should be explored during subsequent stages of planning. It is appropriate to use the higher trip rates at this stage to ensure that sufficient space is allocated to infrastructure.

A sensitivity test undertaken to assess the effects of reducing the number of vehicles by 10-20 percent found that this would not change the number of lanes required on roads within the precinct.

Household Travel Survey data has been used to split demand for travel within the model into the following three trip purposes:

- Employment trips;
- Education trips; and
- 'Other' trips (including retail and leisure).

It has been assumed that 25 percent of employment trips generated within the Precincts are internal (to destinations within the Precincts). The remaining trips have been apportioned to external destinations. It has also been assumed that external origins would generate trips to internal employment destinations.

Trip containment for education trips has been assumed to be 75 percent for both primary and secondary schools, with the remaining trips apportioned to external destinations. It has been assumed that 3 percent of primary school trips would be made from external destinations to internal schools, while 9 percent of secondary school trips would be made from external destinations. It has also been assumed that 50 percent of education trips would be 'linked' trips, with the driver dropping off children while making an employment or 'other' trip.

Internal to external trips have been distributed using the *South West Investigation Area: Oran Park Development – Transport Overview* (Parsons Brinkerhoff, August 2004). This distribution forecast is for 2016 and accounts for the changing land use patterns in the South West Sector and increasing trip containment into the future:

- Camden 4 percent;
- Campbelltown 9 percent;
- Bankstown 4 percent;
- Sydney CBD 4 percent;
- Inner West 5 percent;
- Liverpool 8 percent;
- Other Metro 5 percent;
- Fairfield 5 percent; and
- Other West 6 percent.

3.3.5 Model Findings

Model outputs for the Indicative Layout Plans are provided at **Figure 3.4** and **Figure 3.5** for the 2016 morning and evening peak hours, and **Figure 3.6** and **Figure 3.7** for the 2026 morning and evening peak hours.

The model results show that the majority of the proposed roads within the two precincts are likely to operate with appropriate mid-block capacities. However, the traffic model highlights the following areas for consideration:

- A high right turn movement is being seen into the Southern Boulevard eastbound from The Northern Road northbound, which will need to be managed.
- High traffic volumes on Southern Boulevard East towards Camden Valley Way. It is suggested that the Oran Park Southern Boulevard East/Camden Valley Way intersection and Turner Road North Spine Road/Camden Valley Way intersection be integrated into a four-way signalised intersection to improve traffic efficiency on Camden Valley Way.

3.3.6 Road Classification (Hierarchy)

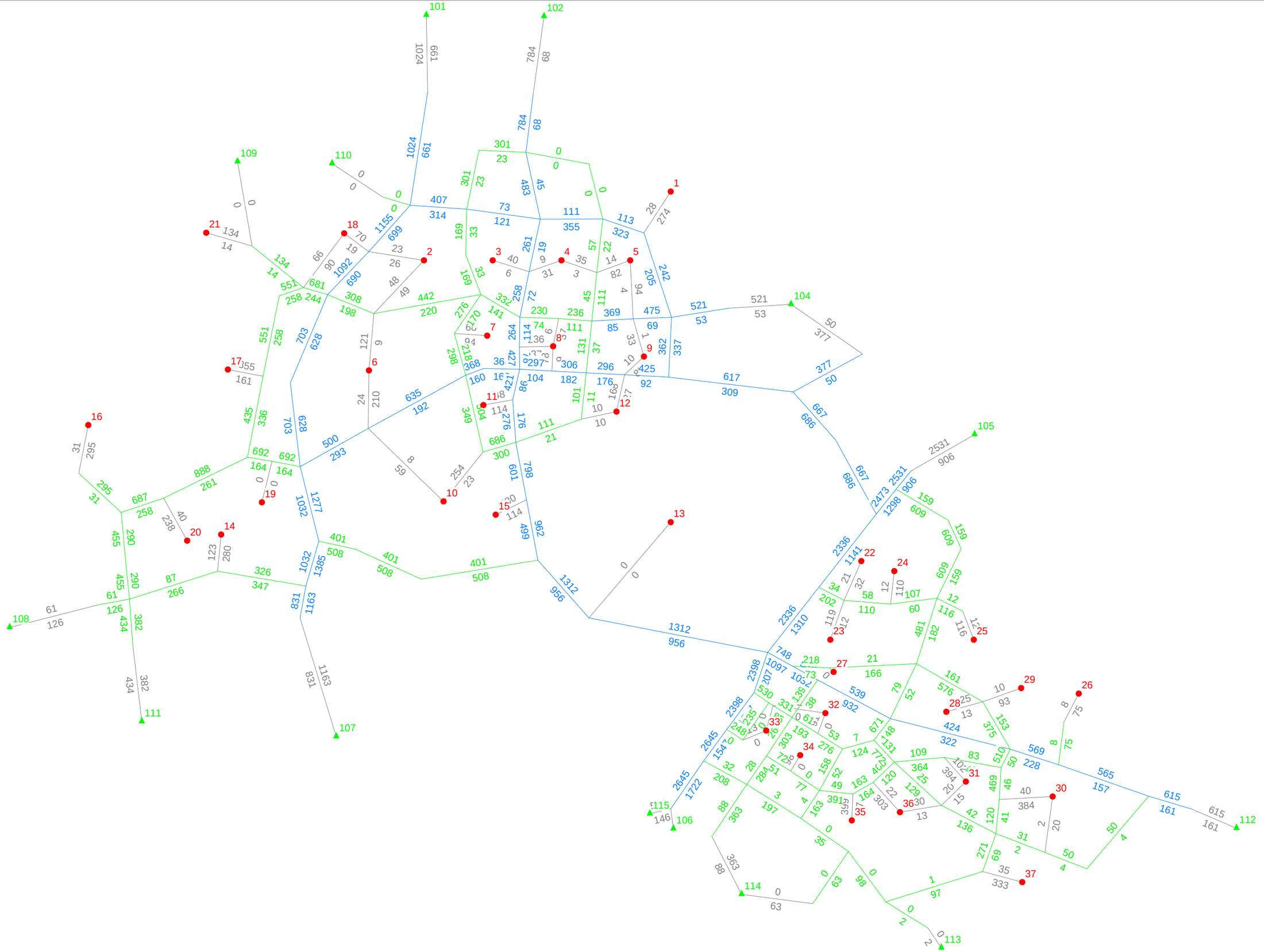
Guidelines for road network hierarchy are discussed in **Section 3.2.2**. In summary, the Growth Centres Commission has identified four categories of road, ranging from arterial roads to local streets. To better serve the needs of the cyclists, Maunsell recommends that two-lane and four-lane sub-arterial roads be provided. Two-lane sub-arterial roads are intended to operate as higher order collector roads with off-street cycleways.

Using the traffic flows shown in **Figures 3.4** to **Figure 3.7**, Annual Average Daily Traffic (AADT) flows have been estimated for links within the precincts using the assumption that daily traffic flows are ten times higher than morning peak hour flows (two-way). Subsequently, road classifications for the two precincts are shown in **Figure 3.8** and **Figure 3.9**.

The Oran Park ILP shows local roads connecting to higher order roads, such as the Oran Park North Spine Road (south of the Oran Park Town Centre). These should be revised to ensure that the hierarchy is maintained. A similar arrangement is seen in the Turner Road precinct, with a Collector Road connecting to Camden Valley Way in the vicinity of the golf course to be reviewed.

Figure 3.4 – Indicative Layout Plan Traffic Flows, 2016, Morning Peak Hour

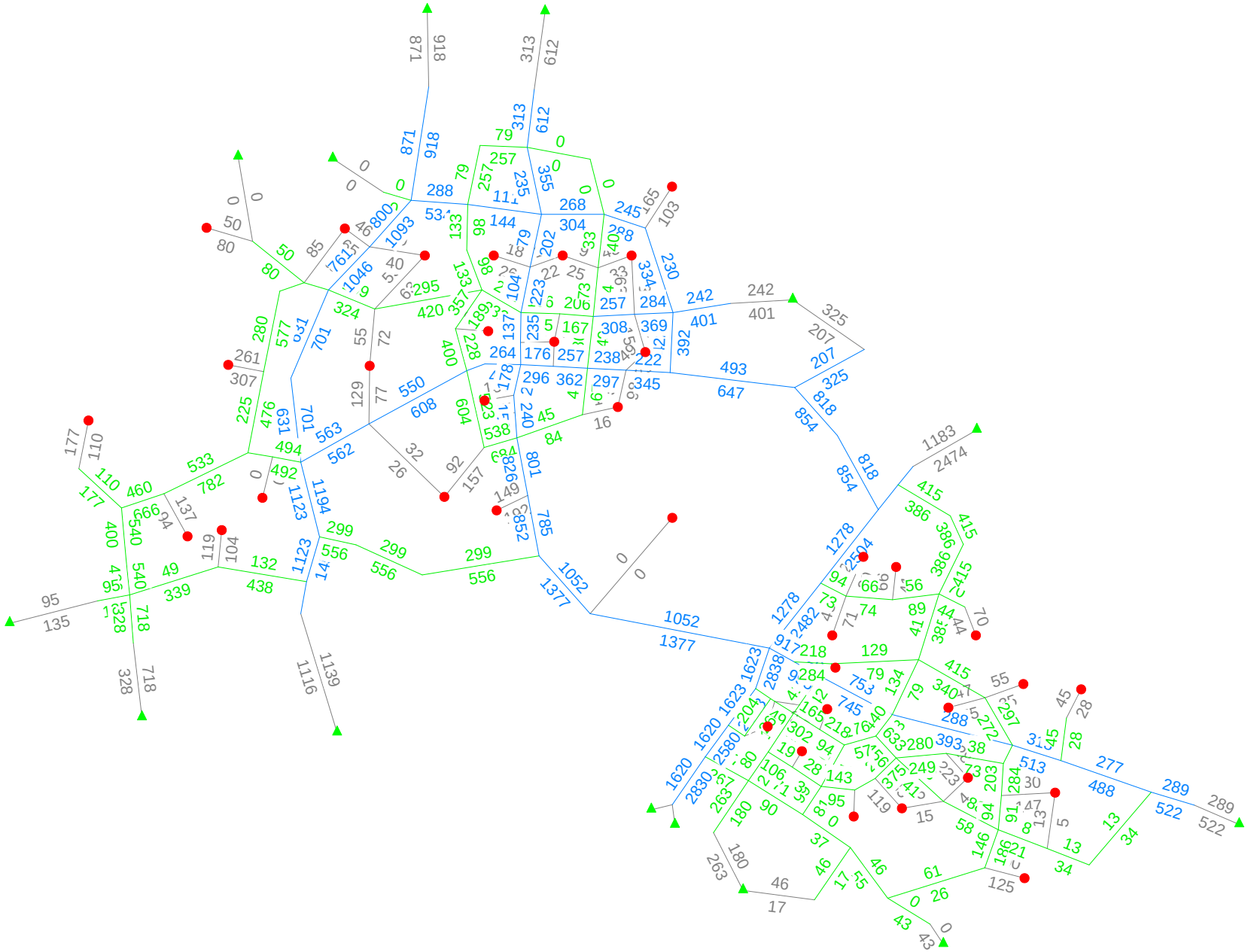
Source: Maunsell, 2007



Oran Park and Turner Road Precinct Model
2016 Future Year Network - G_Sc1
am peak Hour Traffic Flow
24/07/2007

Figure 3.5 – Indicative Layout Plan Traffic Flows, 2016, Evening Peak Hour

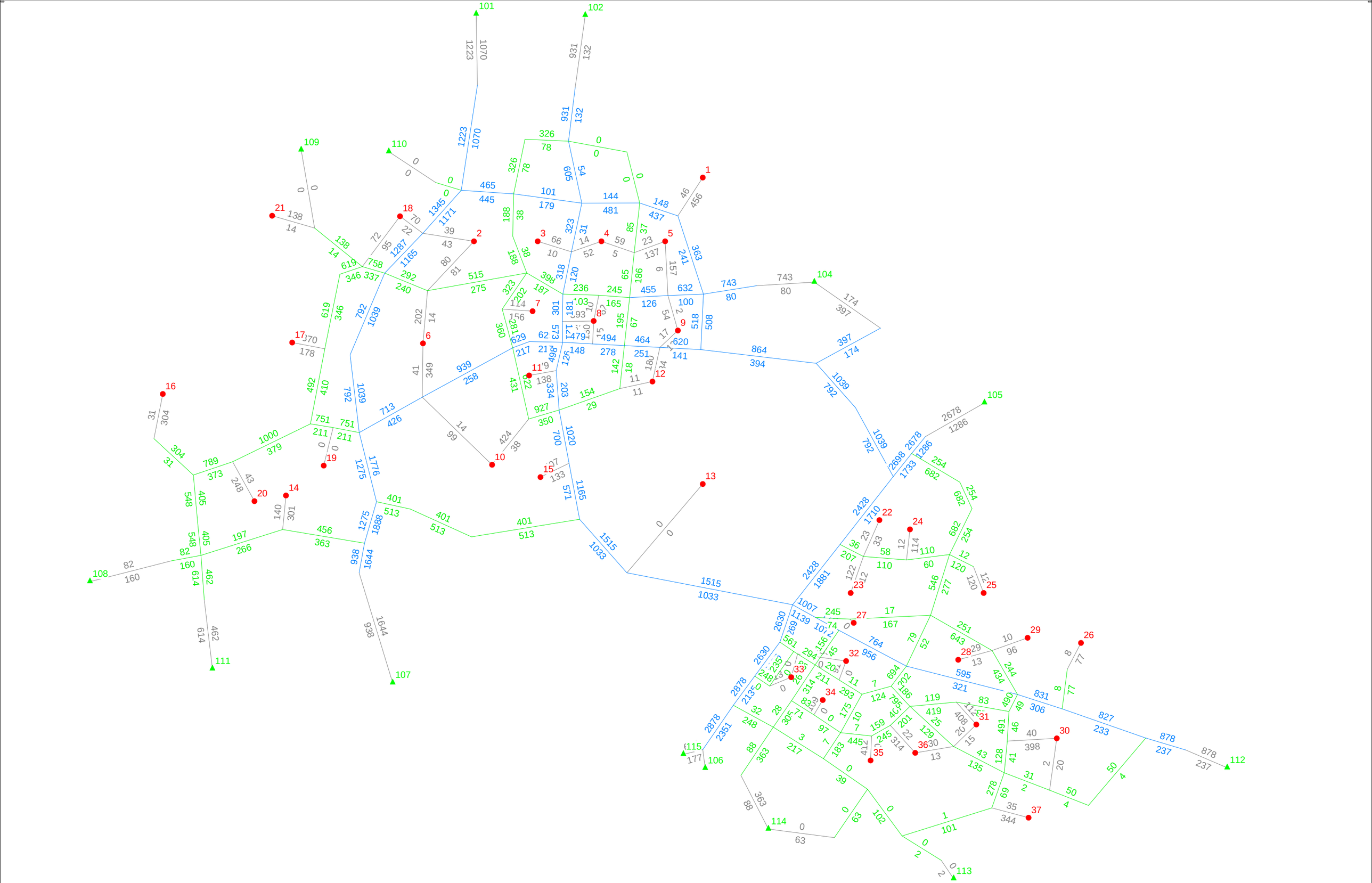
Source: Maunsell, 2007



Oran Park and Turner Road Precinct Model
2016 Future Year Network - G_Sc1pm
pm peak Hour Traffic Flow
26/07/2007

Figure 3.6 – Indicative Layout Plan Traffic Flows, 2026, Morning Peak Hour

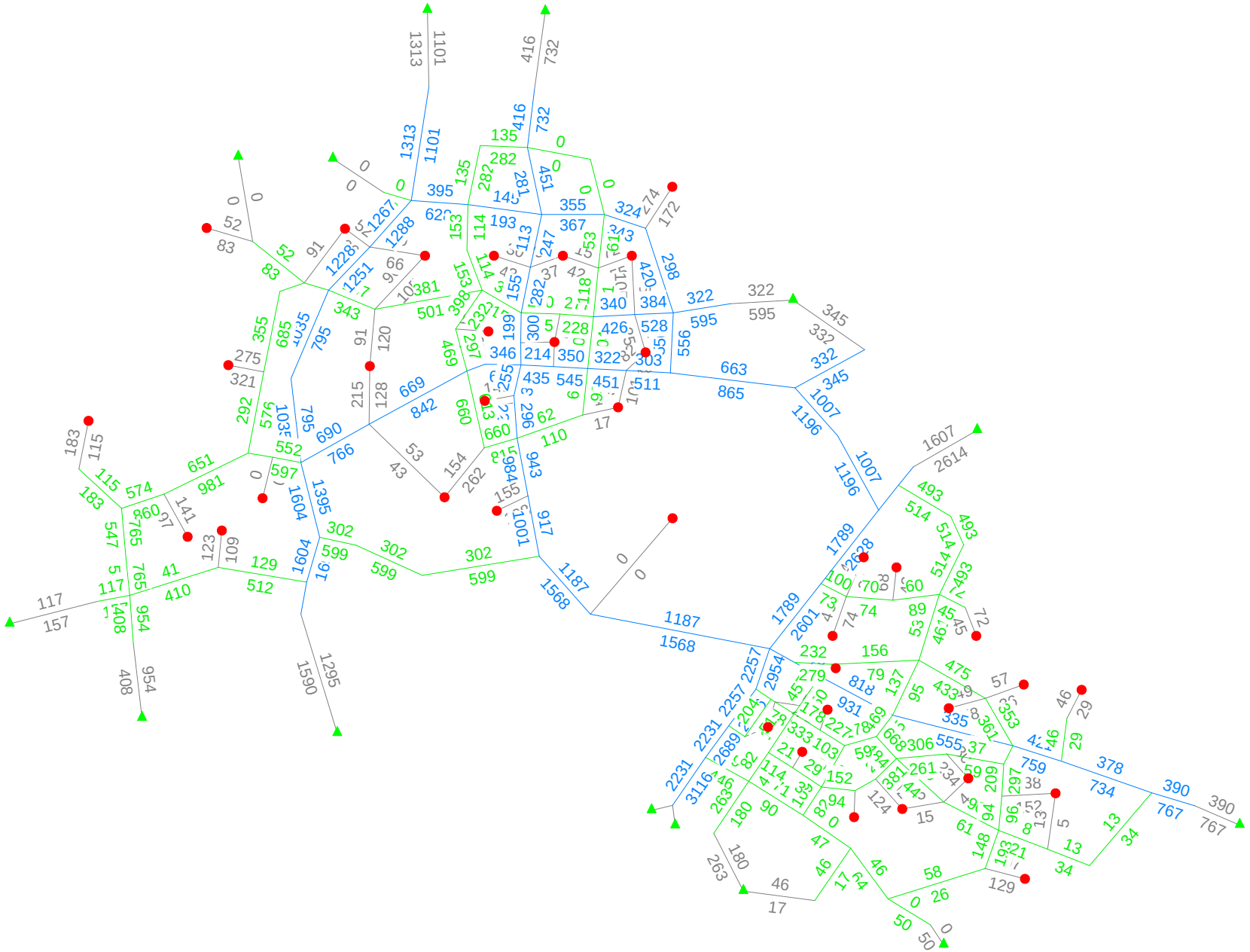
Source: Maunsell, 2007



Oran Park and Turner Road Precinct Model
2026 Future Year Network - G_Sc1
am peak Hour Traffic Flow
24/07/2007

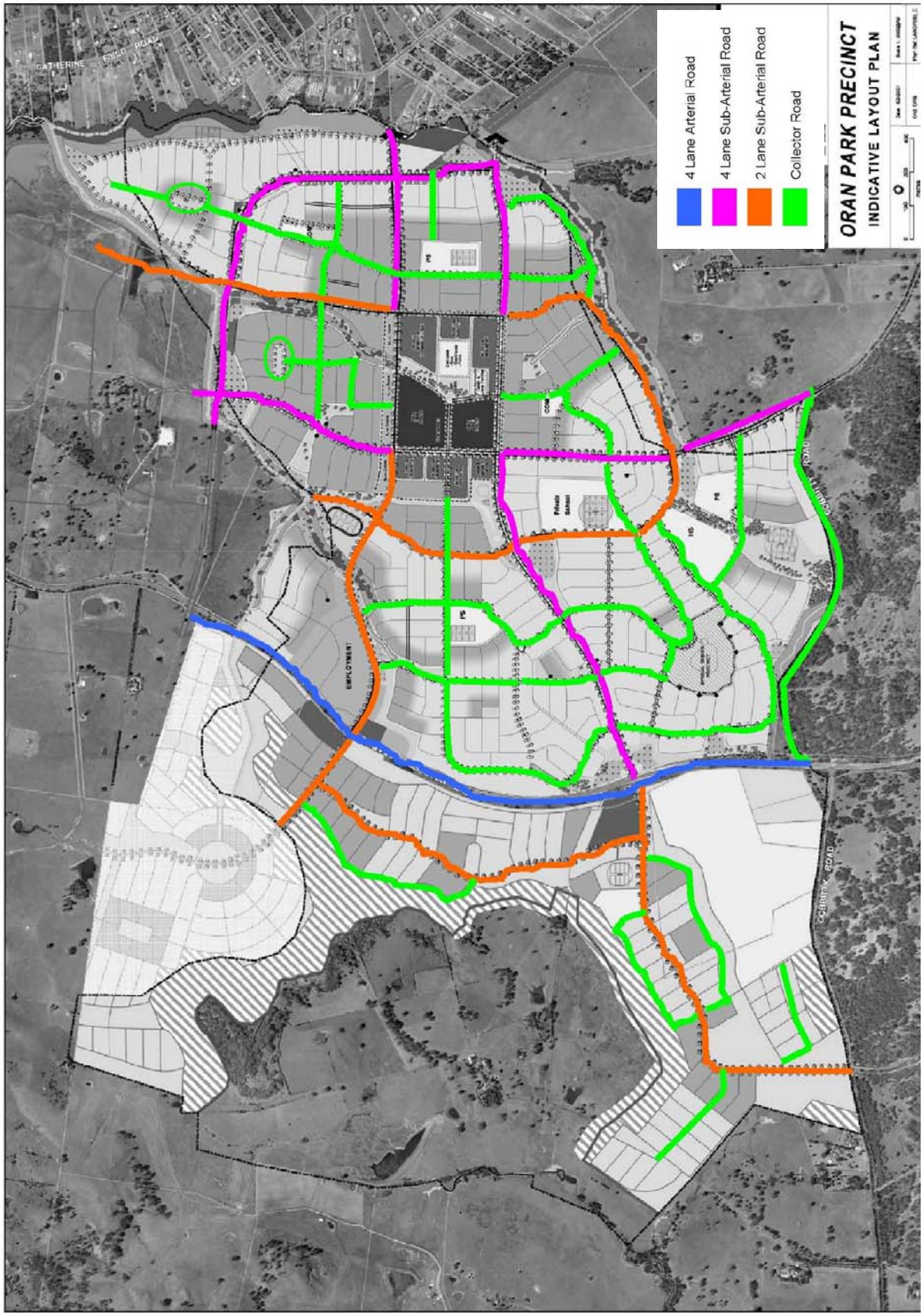
Figure 3.7 – Indicative Layout Plan Traffic Flows, 2026, Evening Peak Hour

Source: Maunsell, 2007



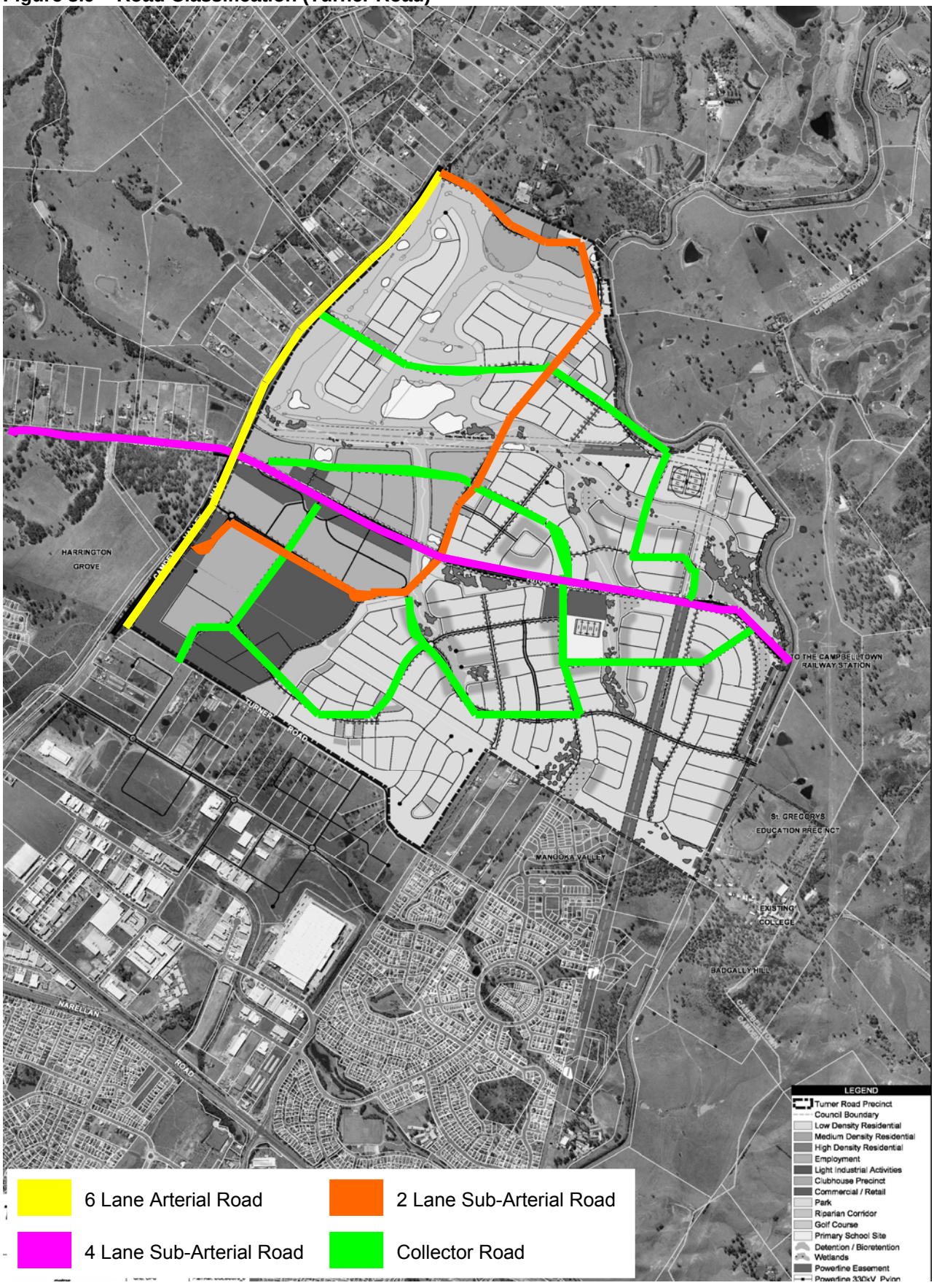
Oran Park and Turner Road Precinct Model
2026 Future Year Network - G_Sc1pm
pm peak Hour Traffic Flow
26/07/2007

Figure 3.8 – Road Classification (Oran Park)



Source: Maunsell, 2007

Figure 3.9 – Road Classification (Turner Road)



Source: Maunsell, 2007

3.4 Intersection Analysis

Maunsell has undertaken intersection analysis of the major intersections into the Precincts from the Regional Road network with the aid of the SIDRA Intersection 3.0 for the AM and PM peak hours. The intersections have been tested for the Base case, being the Indicative Layout Plans provided as input to this study. The results of this analysis are provided at **Table 3.6** for the morning peak hour and **Table 3.7** for the evening peak hour, while intersection layouts and performance details are provided at **Appendix C**.

The intersection of Camden Valley Way/Central Spine Road has been assumed as left-in/left-out only and has therefore not been tested with SIDRA. While traffic volumes on Camden Valley Way will be significant, flows on Central Spine Road are minor and will likely have sufficient gaps from adjacent signalised intersections to enable vehicles to join Camden Valley Way.

Table 3.6 – Intersection Performance, AM Peak Hour

	2016			2026		
Intersection Location	**DoS**	**Av. Delay**	**LoS**	**DoS**	**Av. Delay**	**LoS**
Camden Valley Way / TR North Spine Road	0.854	20.4	B	0.806	18.9	B
Camden Valley Way / Oran Park Link Road	1.000	28.7	C	0.999	38.4	C
Camden Valley Way/Badgally Rd/Cobbitty Rd	1.029	82.9	F	1.151	114.5	F
Camden Valley Way / Industrial Road 1	0.888	22.4	B	0.868	18.3	B
The Northern Road / East-West Road 2	0.920	44.0	D	0.895	50.1	D
The Northern Road / East-West Road 1	0.997	28.7	C	1.000	34.4	C
The Northern Road / Southern Boulevard	0.818	41.2	C	0.869	50.6	D
The Northern Road / Cobbitty Road east	0.809	17.0	B	0.895	19.1	B
The Northern Road / Cobbitty Road west	0.843	21.3	B	0.891	20.7	B

Source: Maunsell, 2007

Table 3.7 – Intersection Performance, PM Peak Hour

	2016			2026		
Intersection Location	**DoS**	**Av. Delay**	**LoS**	**DoS**	**Av. Delay**	**LoS**
Camden Valley Way / TR North Spine Road	0.898	27.6	B	1.000	44.8	D
Camden Valley Way / Oran Park Link Road	0.829	24.2	B	1.000	25.8	B
Camden Valley Way/Badgally Rd/Cobbitty Rd	0.989	67.0	E	1.052	88.6	F
Camden Valley Way / Industrial Road 1	0.900	24.3	B	0.889	21.0	B
The Northern Road / East-	0.730	31.1	C	0.920	40.8	C

West Road 2						
The Northern Road / East-West Road 1	0.772	36.3	C	0.901	45.4	D
The Northern Road / Southern Boulevard	0.857	37.1	C	0.881	47.4	D
The Northern Road / Cobbitty Road east	0.886	19.7	B	0.896	26.1	B
The Northern Road / Cobbitty Road west	0.881	23.8	B	0.893	28.6	C

Source: Maunsell, 2007

The Camden Valley Way/Badgally Road intersection is expected to operate with inappropriate conditions, however increasing the intersection capacity further would result in a poor urban outcome and reduced amenity for pedestrians and cyclists. Providing additional connections in the local road network is essential to alleviate congestion at the Camden Valley Way/Badgally Road intersection, this includes Industrial Road 1 and to a lesser degree Turner Road North Spine Road.

The intersection of Camden Valley Way and the Turner Road North Spine Road has been tested as a four-way intersection, as discussed at **Section 3.3.5**, to maintain the arterial function of Camden Valley Way. The results of this analysis confirm that the intersection would operate satisfactorily.

As discussed in **Section 4**, bus priority facilities (bus jumps) should be provided at all key intersections on bus routes. In future as delays increase for general vehicles, these facilities will enable buses to maintain suitable journey times and will improve the attractiveness of public transport.

3.5 Heavy Goods Vehicles

The Indicative Layout Plans have been reviewed to identify which areas will generate heavy goods vehicles movements and which roads heavy goods vehicles would use to access these areas.

Heavy goods vehicles tend to operate on higher order roads due to the time savings that these routes offer and limited need to stop and start the vehicles at intersections, which increases operating costs. The retail precincts within the Oran Park and Turner Road Precincts will be serviced by heavy goods vehicles. In addition, there are two large employment areas that would generate heavy vehicle movements:

- Oran Park Precinct adjacent to The Northern Road and East-West Road 1; and
- Turner Road precinct adjacent to Camden Valley Way.

The employment areas are well located in terms of proximity to the regional road networks for heavy goods vehicles. B-Double access to the Turner Road Precinct employment area from the M5 Motorway would be via Narellan Road and Camden Valley Way. B-Double access to the employment area in the Oran park precinct would be via Narellan Road and The Northern Road.

These roads all currently carry a high volume of heavy goods vehicles and have a cross-section that reflects their role and function with limited residential exposure. Within the Precincts, the proportions of heavy goods vehicles would be expected to be comparable to existing urban areas. There are no apparent ‘rat-runs’ or roads that would be expected to carry higher than average heavy goods vehicle movements.

B-Doubles are not permitted to travel on sub-arterial roads, such as Cobbitty Road and Raby Road. It is not recommended that Badgally Road be considered as a heavy goods vehicle route due to the topography.

3.6 Findings and Recommendations

3.6.1 Road Network

The strategic network analysis suggests that the majority of the road network has been sized appropriately, although the road network hierarchy should be reviewed to ensure that local streets do not connect to higher order roads in the Indicative Layout Plans.

Camden Valley Way will require widening to three lanes in each direction to support regional traffic growth within the next ten years as demand will exceed capacity on the majority of sections by 2016.

The Northern Road will require widening to two lanes in each direction by 2016 to cater for demands, although this analysis suggests that further widening to three lanes in each direction would not be required until after 2026.

3.6.2 Intersections

The majority of the access intersections will operate with acceptable Levels of Service during the morning peak hour and evening peak hour. However, the Camden Valley Way/Badgally Road intersection will operate poorly.

This analysis has confirmed that it will not be possible to serve a significant proportion of the 4,000 dwellings and more than 60ha of employment land uses within Turner Road precinct from the Camden Valley Way/Badgally Road signalised intersection. This intersection is expected to reach capacity between 2016 and 2021, and it will be important to provide additional links in the network at North Spine Road and Industrial Road 1 to spread demand evenly.

It is recognised that the arterial function of Camden Valley Way should be maintained, and therefore it is recommended that the Camden Valley Way/Central Spine Road, and Camden Valley Way/Turner Road intersections be made left-in/left-out only. The Camden Valley Way/Southern Boulevard and Camden Valley Way/North Spine Road 'T' intersections should be combined to create one four-way intersection.

3.6.3 Heavy Goods Vehicles

The commercial/employment zones are well located in terms of their accessibility to the Regional Road network. B-Double access to the Precincts would be available via The Northern Road and Camden Valley Way from the M5 Motorway (via Narellan Road). There are no apparent rat-runs or areas where heavy goods vehicles would use lower order roads to avoid network problems.

4.0 Public Transport Framework

4.1 Principles and Guidelines

4.1.1 Urban Design Principles

Efficient public transport networks are influenced by four primary factors (TCRP Report 116, TRB, 2006):

- Density – the number of people within a given area. Density directly affects patronage potential. The more people in an area, the more opportunity there is for a service to generate revenue.
- Diversity – the mix of land uses present. A mix of origins and destinations within a service area presents the opportunity for public transport services to collect passengers at different points in the network and at different times of the day;
- Design – the quality of the urban form. The urban form can be considered through the availability of footpaths to enable passengers to easily walk to bus stops and the connectivity of the street network (grid coverage, cul-de-sacs and/or curvilinear road forms). Footpaths should be provided on all roads to enable pedestrians to access public transport services; and
- Driving Deterrents – reasons why people would choose public transport over driving. The major factors in travel choice are travel time and cost of parking. Networks should be designed to provide public transport priority wherever required and possible.

Other factors that influence the use of public transport systems include:

- Building orientation, pedestrian access and provision of free parking between the road frontage and the building entrance;
- Location of bus stops and availability of crossing points;
- Quality of the urban infrastructure, including bus stop facilities (shelters, seating, timetables, etc); and/or
- Streetscapes that discourage walking or limit access to facilities (rear fences, noise walls, etc).

4.1.2 NSW Service Planning Guidelines

In NSW, buses are governed by the NSW Service Planning Guidelines (NSW Ministry of Transport, 2006).

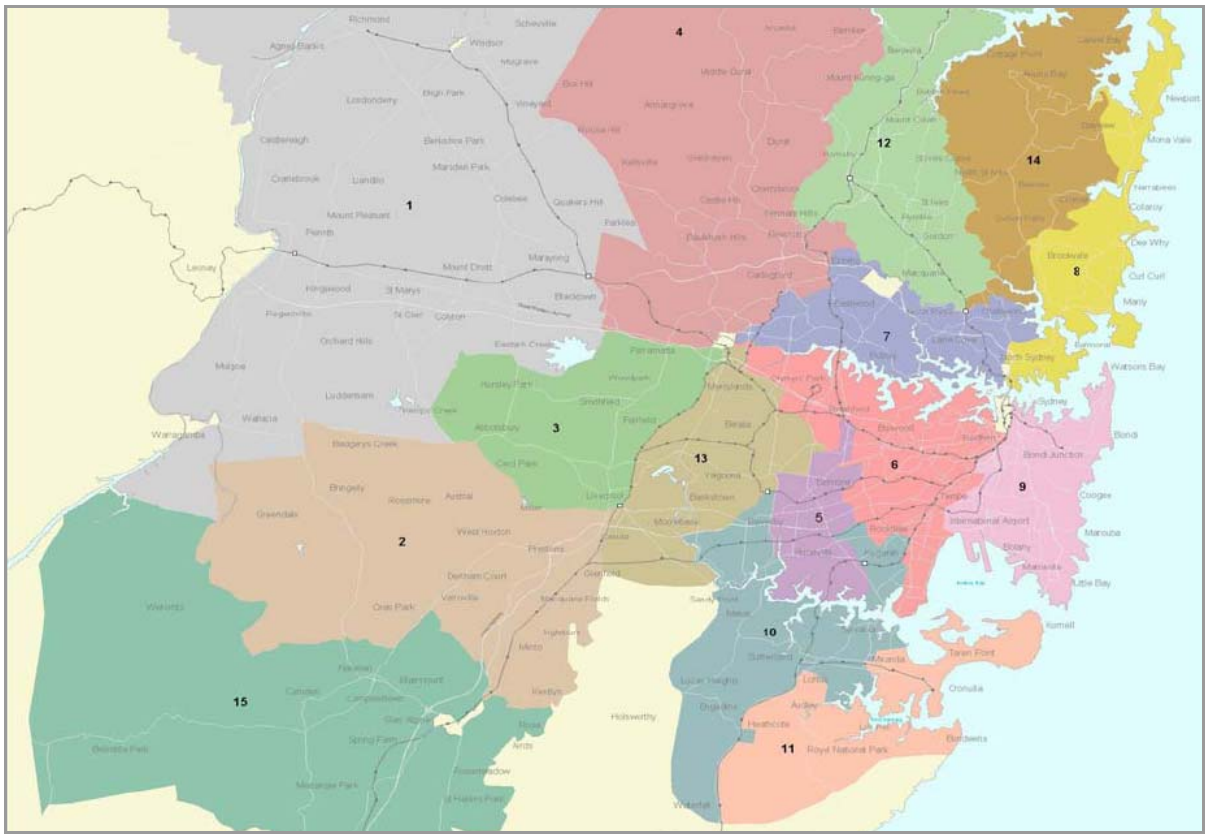
There are currently 15 contract regions within the Sydney metropolitan area, with bus services undertaken on a contract basis by operators on behalf of the NSW Ministry of Transport. Oran Park is located in Contract Region 2, while Turner Road is in Contract Region 15. Cobbitty Road, Camden Valley Way and Raby Road form the boundary between the two Contract Regions as shown in **Figure 4.1**. The Contract Regions are intentionally large enough to include the future urban release areas, including the South West Growth Centre.

Contract Regions 2 and 15 will be amalgamated through the next round of bus contracting in 2012, as shown in **Figure 4.2**.

In addition to the Contract Regions, the NSW Ministry of Transport is implementing 43 Strategic Transport Corridors to link regional centres across Sydney. Of interest to this study is Corridor 32, which connects Camden Town Centre to Campbelltown Town Centre via Camden Valley Way and Narellan Road.

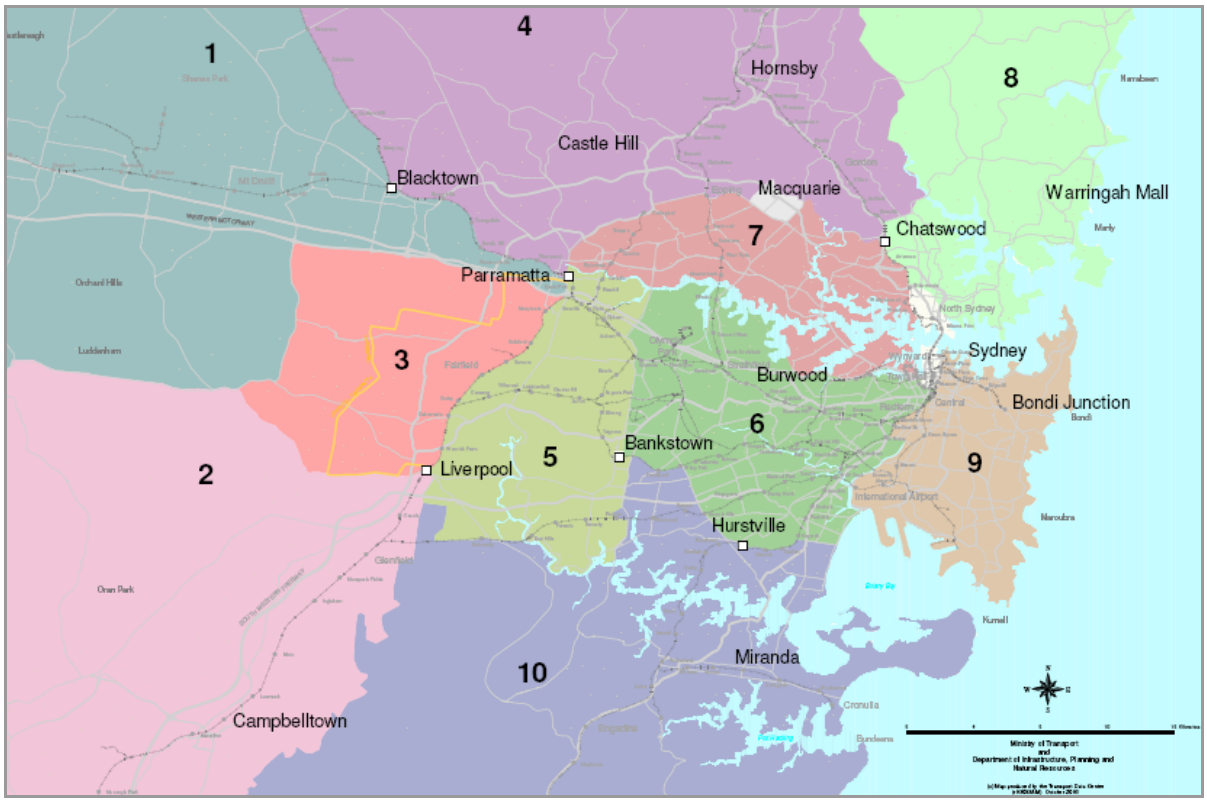
The Service Planning Guidelines also note a “Future Service” between Campbelltown Town Centre and Liverpool City Centre through the South West Growth Centre along Badgally Road, through Catherine Field.

Figure 4.1 – Metropolitan Sydney Contract Regions, 2005



Source: NSW Service Planning Guidelines, NSW Ministry of Transport, 2006

Figure 4.2 – Metropolitan Sydney Contract Regions, 2012



Source: Review of Bus Services in NSW, NSW Ministry of Transport, February 2004

The NSW Ministry of Transport, in consultation with the bus operator, is in the process of developing Integrated Network Plans for each of the Contract Regions. The Plans for Regions 2 and 15 are due to be completed by the end of 2007.

The Integrated Network Plans *"aim to establish Strategic Transport Corridors and a hierarchy of bus route types that:*

- *link to regional centre(s)*
- *pass through patronage generators such as district centres, TAFE colleges, hospitals and universities*
- *connect with other transport modes (trains, ferries and other buses)*
- *are multifunctional (serving journeys to work, education, shopping and recreation)*
- *are direct and frequent; and*
- *meet the network planning principles."*

The Service Planning Guidelines note that Regional Centres include Macarthur and the future centre at Leppington. Oran Park and Narellan are considered District Centres under the Ministry's terminology. These centres will form 'hubs' for bus routes.

It is noted that the early establishment of public transport services is important to achieve a public transport culture from the outset. However, because patronage potential will increase over time, developer contributions would be required to off-set the additional costs incurred during the service establishment and ramp-up period.

A summary of the Service Planning Guidelines planning principles is provided at **Table 4.1**.

Table 4.1 – Service Planning Guidelines Summary

Bus Planning Characteristics	Benchmark/Criteria
Network (Area) Coverage	• 90% of households to be within 400 metres of a rail line and/or a Regional or District bus route during commuter peaks, inter peak and weekend day time. • 90% of households to be within 800m of a rail line and/or a Regional or District bus route at other times.
Network Legibility	• Peak and off-peak services should use the same route wherever possible.
Route Design	• Regional Routes to be between 10 and 25 kilometres in length. • Routes to be between 30 and 60 minutes in duration. • Maximum diversion from the fastest or shortest route (between termini) to be no more than 20%.
Accessible Buses	• Low floor, wheelchair accessible buses to be allocated to Strategic Transport Corridor routes. • Accessible buses to be evenly timetabled on the corridors and advertised as "accessible" trips in the public timetable.
Dedicated School Services	• Dedicated school services should be kept to a minimum in order to maximise the frequency and availability of normal route services. • Average 5 boardings per revenue kilometre. • Students to be delivered to their school within half an hour of school commencement time and picked up within half an hour of school finishing.
Section Points	• The range of section point lengths to be between 1.3 km and 1.9 km. • The average length of section points within each route to be 1.6 km.

Patronage	• Average 1.5 to 2.5 boardings per revenue kilometre (based on an average operating speed of 24 kph). • Peak period patronage to be in the range of 50% (25% at other times) seated capacity and 85% of the legal bus capacity (averaged by the number of trips operated during any 20 minute period) at maximum load point. • Passengers not to stand for more than 30" of a timetabled service.

Source: NSW Service Planning Guidelines, NSW Ministry of Transport, 2006

4.2 Public Transport Framework Analysis

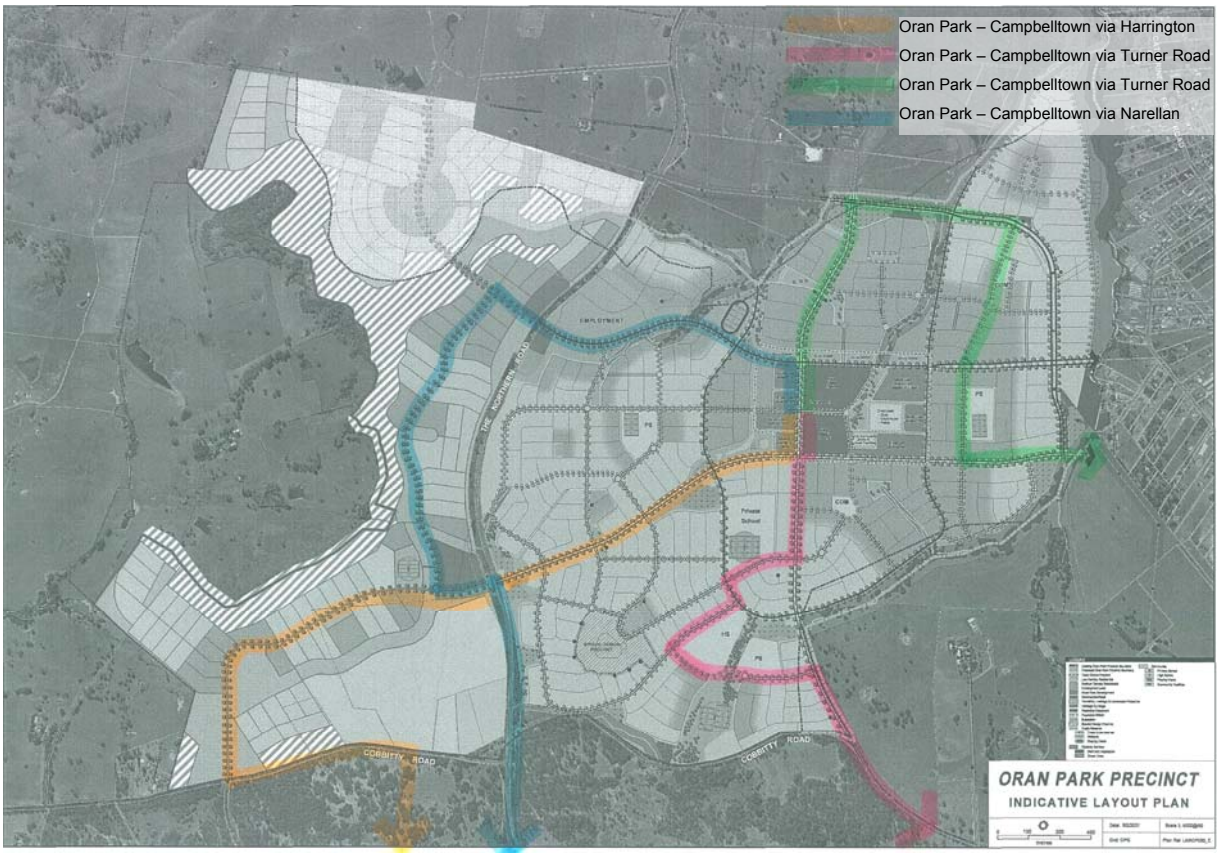
4.2.1 Bus Networks

Public transport services need to be flexible enough to cater for three broad scenarios:

- In the short-term to connect new communities to existing facilities at Harrington Park and Narellan, with access to the rail network at Macarthur and Campbelltown Stations;
- In the medium term, Oran Park will become a destination for public transport services with connecting services to Narellan and Camden via Harrington Park;
- In the long term, Leppington will become a new Regional Centre, with Oran Park, Narellan and Catherine Fields being District Centres.

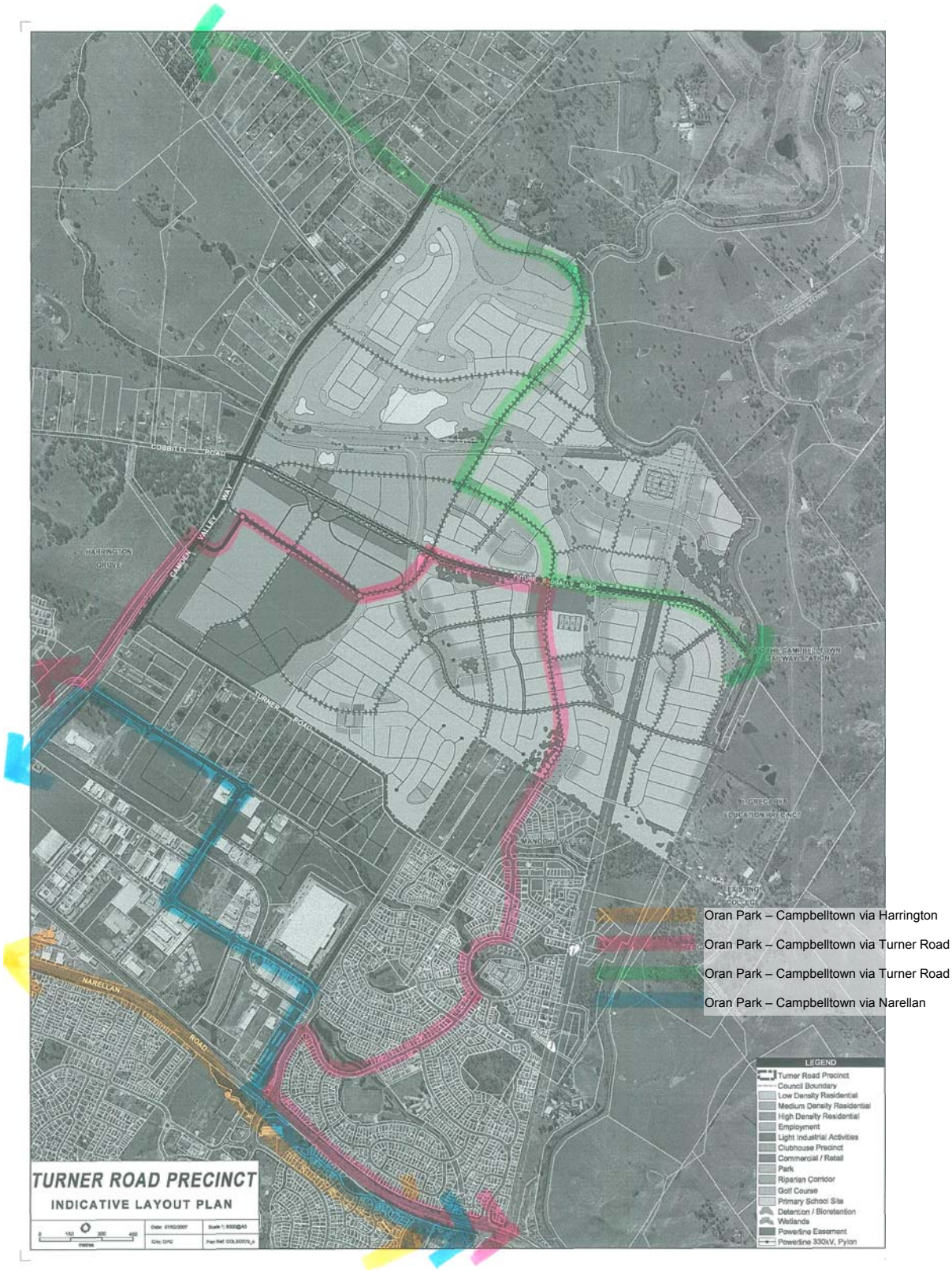
Proposed bus route strategies for the two precincts are shown at **Figure 4.3** and **Figure 4.4** for Oran Park and Turner Road precincts respectively. An evaluation of this network is provided in **Table 4.2**.

Figure 4.3 – Oran Park Bus Servicing Strategy



Source: Maunsell, 2007

Figure 4.4 – Turner Road Bus Servicing Strategy



Source: Maunsell, 2007

Table 4.2 – Short-Term Bus Network Evaluation

Bus Planning Characteristics	Benchmark/Criteria	Met
Network (Area) Coverage	• 90% of households to be within 400 metres of a rail line and/or a Regional or District bus route during commuter peaks, inter peak and weekend day time. • 90% of households to be within 800m of a rail line and/or a Regional or District bus route at other times.	Yes
Network Legibility	• Peak and off-peak services use the same routes.	Yes
Route Design	• Regional Routes to be between 10 and 25 kilometres. • Routes to be between 30 and 60 minutes in duration. • Maximum diversion from the fastest or shortest route (between termini) to be no more than 20%.	Yes
Section Points	• The range of section point lengths to be between 1.3km and 1.9km. • The average length of section points within each route to be 1.6 km.	Yes

Source: Maunsell, 2007

4.2.2 Service Frequencies

Table 4.3 shows the service frequencies required under the Service Planning Guidelines to be provided by the end of the first contract term, being 2012.

Table 4.3 – Service Frequencies by Route Type

Route Type	Frequency (Equal to or better than)
Regional Routes	• Pre peak 30 mins • Peaks 20 mins • Inter Peak 30 mins • Night time 60 mins • Saturday daytime 30 mins • Sunday daytime 30 mins
District Routes	• Peaks 60 mins • Inter Peak 60 mins • Saturday daytime 60 mins • Sunday daytime 60 mins
Local Fixed Routes Local Flexible Transport Services	• Inter Peak 120 mins • As required (Negotiated with the Ministry)

Source: NSW Ministry of Transport, 2006

It is recommended that services are more frequent than 60 minutes to encourage greater use of public transport in this region.

4.2.3 Bus Interchange

The majority of bus services have been allocated to Oran Park Town Centre, providing the opportunity to create a minor bus interchange within the Town Centre. The interchange should be located within the western part of the Oran Park Town Centre, close to the entertainment land uses and toward the geographic centre of the Oran Park precinct.

Stand requirements have been estimated under a shared stop system. Buses share a drop-off stand, move to a short-term layover point and then pick up at a shared lead stop when timetabled.

Under this arrangement drop-off stops would have the capacity to cater for up to thirty buses an hour at the drop-off stop, with two minutes per bus to unload. For an interchange with more than thirty buses per hour, additional drop-off stops would be required.

Short-term layover provision has been estimated by assuming that every bus would run approximately five minutes ahead of schedule and require a layover bay for that time. On this basis one short-term layover bay should be provided for every twelve buses that serve the interchange.

The number of lead stops required has been estimated by assuming that a bus will require three minutes to allow the full capacity of passengers to board. On this basis, each lead stop would have capacity for 20 buses per hour.

With four routes using the interchange and minimum 20 minute frequencies, the interchange should have capacity for 12 buses per direction. In each direction, this would require:

- 1 x drop-off stop (capacity 30 buses);
- 1 x short-term layover space (capacity 12 buses); and
- 1 x lead stop (capacity 20 buses).

To cater for future growth in the region, the interchange should have sufficient roadspace close by to expand into a further three bays in each direction.

4.2.4 School Buses

School bus services would be introduced for each of the schools within the Oran Park and Turner Road precincts. Dedicated routes would be introduced where demand is warranted however in general students would be encouraged to travel on daily services. All schools are located either on a proposed route or in close proximity.

Dedicated bus services would be introduced when the demand leads to maximum passenger loadings being exceeded.

4.2.5 Topography

The Road Design Guide (RTA, varies) specifies that the maximum vertical grade for sealed roads is 6-8% (Table 2.3.1, design speed 60km/h, flat terrain). A review of the proposed bus network has found that the topography may affect the bus services in the following locations:

- East-West Road 1;
- North-South Spine Road (south of Oran Park Town Centre); and
- Badgally Road (east of Turner Road Precinct).

4.2.6 Road Network

Buses can have difficulty negotiating roundabouts in urban areas. Roundabouts on bus routes should be designed to accommodate buses, or amended to an alternate form of intersection to aid bus movements.

4.2.7 Bus Stops

Bus stop locations would be defined during detailed planning as land uses are more defined. However, at this stage any routes identified as bus corridors need to have space within the road reserve to accommodate bus stops or shelters. Stops should be provided at a minimum of 400m spacings to maintain vehicle speeds while providing sufficient access for passengers.

This requires routes to have two lanes in each direction or one lane in each direction with a parking lane that could accommodate a bus stop. Lane widths on bus routes need to be a minimum of 3.5m.

Whilst indented bus stops are a possible solution where a cross-section has one lane in each direction, they do not allow flexibility in bus stop location as land uses and patronage demands change. Therefore, indented bays should be avoided.

4.3 Findings and Recommendations

Draft Network Plans have been prepared for the Oran Park and Turner Road Precincts. Bus routes are proposed to serve the two precincts, linking communities to adjacent employment areas, District Centres and Regional Centres. The network plans provide coverage for the majority of the Oran Park and Turner Road precincts.

The ILP's include roundabouts on bus routes. These intersections need to be managed to accommodate buses during design.

The Road Design Guide (RTA, varies) specifies that the maximum vertical grade for sealed roads is 6-8% (Table 2.3.1, design speed 60km/h, flat terrain). A review of the proposed bus network has found that the topography may affect the bus services on the North-South Spine Road (south of Oran Park Town Centre).

Routes should have two lanes in each direction or one lane in each direction with a parking lane that could accommodate a bus stop. Lane widths need to be a minimum of 3.5m. Whilst indented bus stops are a possible solution where a cross-section has one lane in each direction, they do not allow flexibility in bus stop location as land uses and patronage demands change. Ideally indented bays should be avoided.

5.0 Walking and Cycling Networks

5.1 Introduction

Walking and cycling opportunities are increasing quickly in the Camden area as urban developments are progressed and the Camden Bike Plan is implemented. Walking is a good way of keeping fit and healthy, while reducing the need to travel by car for short journeys. Cycling is an excellent choice for journeys of up to 5km, providing:

- cyclists have safe and amenable routes;
- key locations are connected in an integrated manner; and
- end-of-trip facilities are available.

The outcomes of this Section are high quality walking and cycling networks within the Oran Park and Turner Road Precincts, integrating into adjacent areas (Harrington Grove and Manooka Valley) and regional cycle routes, such as the shared path proposed for Camden Valley Way for longer distance trips.

5.2 Existing conditions

There are no pedestrian footpaths or crossing facilities on Northern Road, Camden Valley Way, Cobbitty Road or Badgally Road in the vicinity of the Oran Park and Turner Road sites. There are no cycle facilities on existing roads that access the site. However, good facilities for walking and cycling are provided in Harrington Grove, to the south of Oran Park, providing an excellent opportunity to connect the two precincts across Cobbitty Road.

The Camden Council Pedestrian Access and Mobility Plan (PAMP, 2003) aims to promote pedestrian routes and facilitate improvements to the network. The PAMP contains recommendations to improve the pedestrian network on Cobbitty Road. In addition, the Preliminary Camden Valley Way Route Development Strategy (NSW Roads and Traffic Authority, 2005) identified the development of a shared pedestrian / cycle path along the western side of Camden Valley Way.

5.3 Principles and Guidelines

Two documents guide the provision of pedestrian and cyclist networks in this area. The Growth Centres Development Code (October 2006) includes guidelines for all aspects of urban design from street layout to open space and water use. The other key document guiding the design of cycle networks is the NSW Bicycle Guidelines (NSW Roads and Traffic Authority, 2003). A review of these documents follows.

5.3.1 Growth Centres Development Code

Salient objectives of the Growth Centres Development Code that relate to pedestrian and cycle planning are to improve:

- facilities at a local level (i.e. walking/cycling distance from residences);
- access to public transport;
- encourage reduction of the reliance of private vehicles;
- walking and cycling connections, especially between residential areas, shops and schools;
- buildings and landscapes to define thoroughfares as civic places; and
- developments to accommodate pedestrians while also adequately accommodating vehicles.

The objectives can be achieved by adhering to the elements of the code that follow. The elements highlighted in bold can be achieved at this stage of planning. The remaining elements will be carried forward for consideration during later planning stages (through DCP's).

It is important to ensure that these 'later' elements are not precluded by design decisions at this stage.

- Pedestrian and cycle routes will be direct, continuous and well lit.
- Cycle routes will be linked to those outside the site
- Grid like street network pattern to facilitate cycling.
- Limit use of cul-de-sacs (cul-de-sacs should be used only where other more permeable options are not available).
- Clearly delineated routes for pedestrian, bicycles and vehicles.
- Public open space should be a design feature, with recreational uses along drainage lines.
- "Recreational trails" will connect public open space using on or off road routes.
- Smaller lots and higher densities should be provided close to centres and public transport.
- Pedestrian movement should not be inhibited by parking areas in town centres.
- Lots will front open space and major streets to provide casual surveillance.
- High level of pedestrian amenity, with active streets and links between parks and plazas.
- Streets and lanes will be shared spaces accommodating all users.

5.3.2 NSW Bicycle Guidelines

The NSW Bicycle Guidelines (NSW Roads and Traffic Authority, 2003) assist in the design of bicycle facilities and the principles of network design are also relevant when designing pedestrian networks. The document provides a step by step process that the design should move through and details factors that should be considered. It is a best practice guide and professional judgement should be used when applying the guidelines.

The NSW Bicycle Guidelines identify five key principles to adopt when designing a cycle network. These are:

- **Coherence**: The cycle network should link popular destinations in a continuous form, with consistent quality across the network. The correct path, especially at intersections, should be clear. There should be adequate density of routes to offer a choice to cyclists.
- **Directness**: Long detours should be avoided, but minor detours to avoid the steepest section of a hill are advisable so that the cyclist can maintain a constant speed throughout the journey. Barriers, such as a crossing, at critical points can disrupt the momentum of the ride.
- **Safety**: Intersections should be designed with bicycles in mind and should include a path for cyclists. Roadway crossings should be safe and easy to negotiate.
- **Attractiveness**: Bicycle infrastructure should fit with the surrounding environment. Routes should be clearly signed, line marked and well lit to offer a sense of security.
- **Comfort**: A smooth surface ensures a safe and comfortable ride. Space should be allocated to cyclists within the road reserve (in either a cycle lane or separated path) on all roads unless speed and traffic volumes are very low.

Other principles to be considered that are not included in the guidelines include:

- **Capacity**: there must be adequate space for waiting or queuing pedestrians, particularly at bus stops.
- **Integration**: walking and cycling should be integrated with other modes (particularly bus and train services) through the provision of obvious, safe and convenient pedestrian/cycle access paths to interchange areas, as well as secure cycle storage facilities.
- **Storage facilities**: appropriate storage facilities should be provided at all key destinations (including train stations, major bus stops and large developments). Storage facilities should

provide for both long and short term storage of cycles and related equipment. Design should be such that storage is not only secure and provides weather protection, but also conveys a sense of high priority for the treatment of cycles and cyclists.

Commuter cyclists would prefer to use direct routes and are not as deterred by gradients and travel within the vehicle carriageway as recreational cyclists. Recreational cyclists are more likely to prefer a longer but flatter route and travel time is less of a consideration than a pleasant ride.

5.4 Network Analysis

Table 5.1 – Assessment of ILPs against planning principles

	Oran Park Precinct	Turner Road Precinct	Turner Road Small Lots
Development Code Principle			
Recreational uses along drainage lines	√	√	√
"Recreational trails" will connect to public open space using on or off road routes	√	√	√
Pedestrian movement should not be inhibited by parking areas in town centres	√	√	√
Net lot density of >15 lots per hectare	√	√	√
Smaller lots/higher densities close to centres/public transport	√	√	√
Lots will front open space and major streets to provide casual surveillance	X	X	X
Link cycle routes to those outside the site	√	√	√
Limit use of cul-de-sacs. Cul-de-sacs should be used only where other options are not available.	√	√	√
High level of pedestrian amenity, with active streets and links between parks and plazas	√	√	√
Streets and lanes will be shared spaces	√	√	√
Grid like street network pattern where possible to facilitate walking and cycling routes	√	√	√
Clearly delineated routes for pedestrians / bicycles / vehicles	√	√	√
Direct, continuous and well lit pedestrian/cycle routes	X	X	X
Other Design Principles			
Coherence	√	√	√
Directness	X	X	X
Safety	√	√	√
Attractiveness	√	√	√
Comfort	X	X	X
Capacity	√	√	√
Integration	√	√	√
Storage	√	√	√

Source: Maunsell, 2007

Table 5.1 suggests that the precinct plans do not adhere to principles in these cases:

- Pedestrian/ cycle connections are not indicated from cul-de-sacs to adjacent streets and/ or green spaces.
- Residential dwellings do not front major streets (Badgally Road, Southern Boulevard, Turner Road, East-West Link Road 1 and 2, Southern Boulevard East).
- Comfort – gradient high on certain links. Can avoid in some cases but some require thought into the alignment of the road. For example, Badgally Road (southeast corner of Turner Road Precinct), North Spine Road (Turner Road Precinct),

Important points to consider when entering next stages of planning that could include lot layout, building sizes:

- Allow 'space' for cycle paths through intersections
- Allow 'space' for pedestrian waiting areas at bus stops/ interchanges
- Space for cycle route to follow line behind bus stop.
- Retain pathways in linear green spaces.

5.4.1 Cycle Network

A hierarchy of routes has been devised as shown in **Table 5.2**. The hierarchy is shown at **Figure 5.1** and **Figure 5.2** for the Oran Park and Turner Road precincts respectively.

Table 5.2 – Cycle Route Hierarchy

Classification	Type of Facility	Requirement
Regional Route	Off-road cycleway and footpath on both sides of the carriageway	Provides direct routes along high speed, high volume arterial roads to link centres.
Sub-Regional Route	Off-road cycleway and footpath on both sides of the carriageway	Connects regional cycle routes to the schools along sub arterial roads.
	Off-road cycleway and footpath on both sides of the carriageway	Connects regional cycle routes to the centres along sub-arterial roads where off-road shared paths are not required.
Collector Routes	On-road cycle lanes. Footpaths on both sides of the carriageway.	Connects residential dwellings and employment zones to sub-regional and regional routes along collector streets.
Local Roads	Cyclists share carriageway with motor vehicles. Footpaths on both sides of the carriageway.	Low speed and traffic volumes on minor residential streets.
Recreational Routes	Off-road shared path	Connects cycle network to green spaces.

Source: Maunsell, 2007

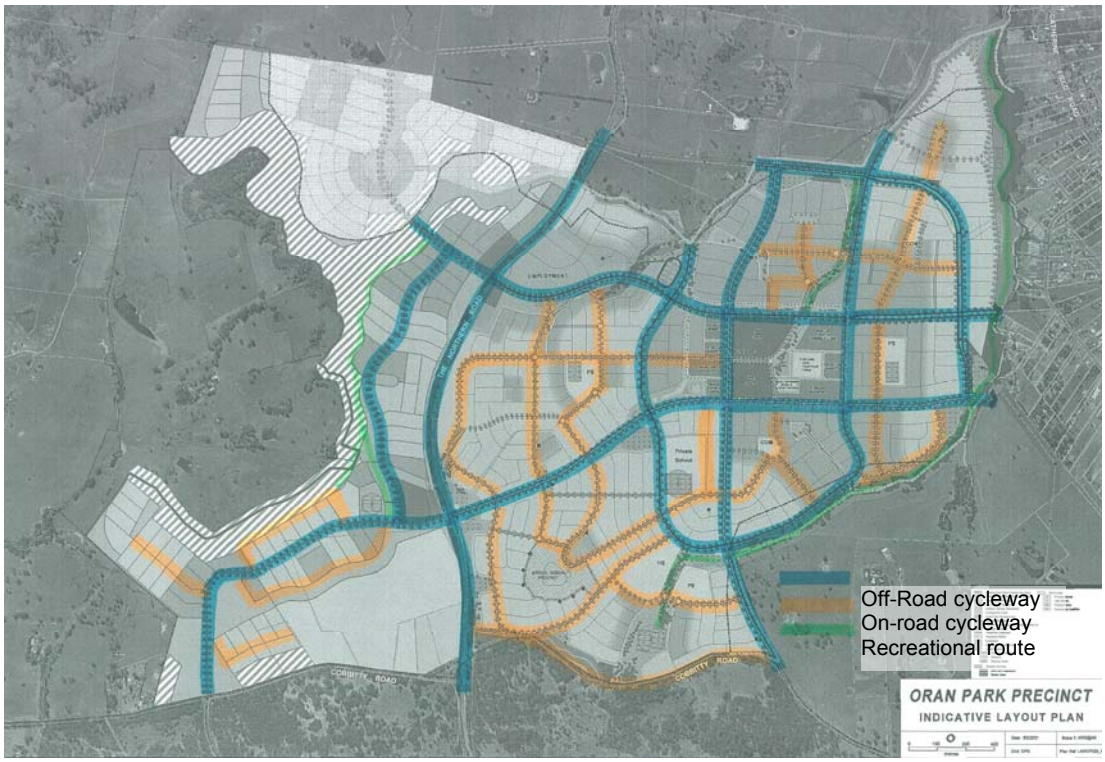
Numbered routes provide opportunities for way-marking along the route, particularly at road crossings. In time, route numbers could be included on cycle maps and information as part of a wider network of numbered routes throughout Sydney. Key cycle routes have been numbered to as follows:

1: Oran Park – Narellan/ Macarthur Square

2: Oran Park – Campbelltown/ Catherine Fields

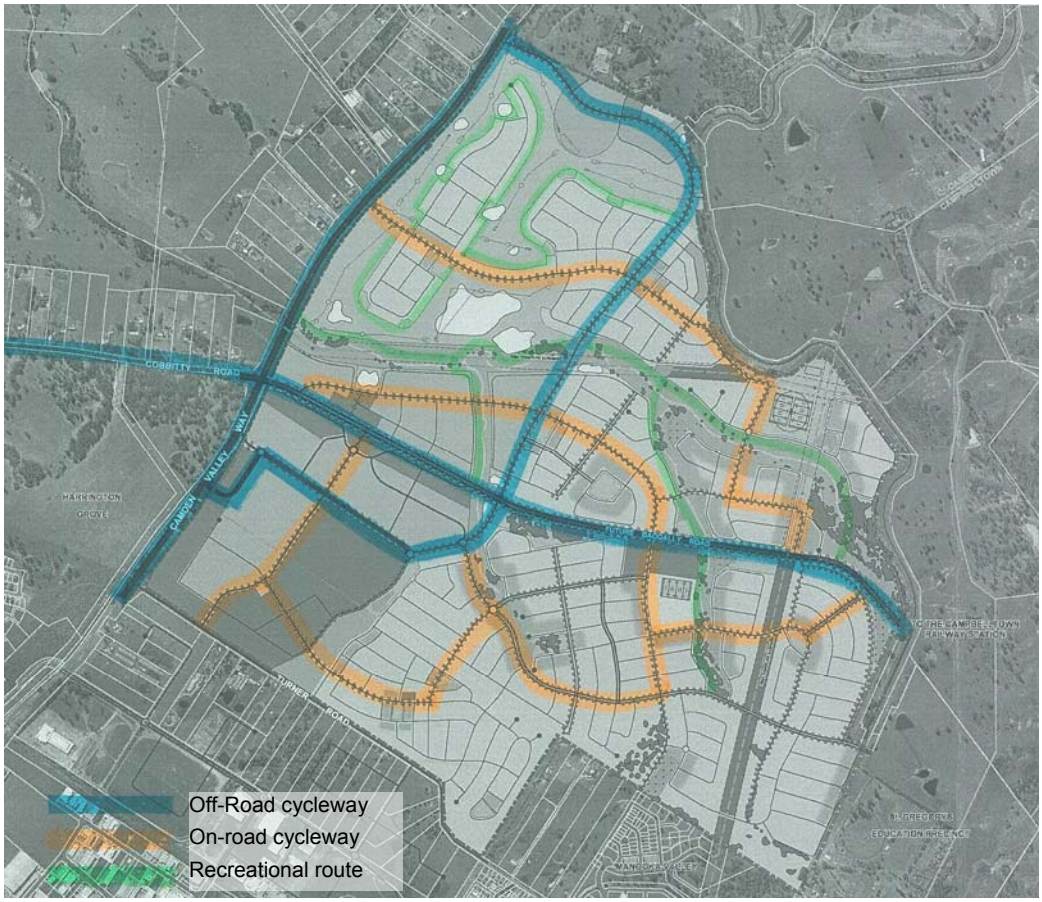
3: Camden – Leppington/ Liverpool/ M7

Figure 5.1 – Oran Park Cycle Network



Source: Maunsell, 2007

Figure 5.2 – Turner Road Cycle Network



Source: Maunsell, 2007

The cycle network provides direct and continuous routes to all regional centres, neighbourhood centres, schools, employment areas and recreational facilities. All high schools and primary schools will be accessible via the proposed cycle network.

Consideration should be given to comfortable cycling gradients in the design of the longitudinal section of the road network. Sections of the cycle network that are affected by the natural topography of the area are:

Oran Park

- Southern Boulevard East, on the approach to The Northern Road;
- Southern Boulevard East, between the North Spine Road and the North-South East Road (alternative routes are available via East West Road 1 and North-South East Road);
- North Spine Road, on the approach to Cobbitty Road;

Turner Road

- Industrial Road 2, on the approach to South Spine Road 2 (alternative routes are available via Camden Valley Way or Industrial Road 1);
- South Spine Road 1, on the approach to the Southern Boulevard (an alternative route is available via Industrial Road 1);
- South Spine Road 2, south of Southern Boulevard;
- Central Spine Road, in the vicinity of the Clubhouse Precinct.

It is important that the realignment does not increase journey distance to the extent that it counteracts the effect of reducing the gradient. As a rule of thumb, the increase in distance should be less than 50 per cent of the original route.

5.5 Findings and Recommendations

Some minor amendments are recommended to ensure that the precinct plans adhere to principles:

- Footpaths should be provided on each side of every street.
- Provide pedestrian/ cycle connections from cul-de-sacs to adjacent streets and/ or green space(s). These links should be well designed to avoid unsociable activity and crime.
- Activate the street-frontage on Badgally Road and the Southern Boulevard to achieve passive surveillance.
- Pathways are shown on the precinct plans that run along linear green space. Connections should be made to adjacent streets.
- In accordance with NSW Roads and Traffic Authority guidelines, pedestrian crossings should be provided on all arms of all intersections.

It is recommended that travel plans be established for all schools within the Oran Park and Turner Road precincts. These should be integrated into the curriculum for the school and encourage parents and children to walk, cycle or catch public transport for their journey to school. Reducing the number of children travelling to school by car is likely to result in better health, better social interaction at the community level, air quality improvements and road safety benefits.

6.0 Cross-Sections

6.1 Introduction

Cross-sections for roads within the Oran Park and Turner Road Precincts are defined in the Growth Centres Development Code (NSW Growth Centres Commission, October 2006). These cross-sections have been discussed with the design team to ensure that they meet the objectives of the Precinct Planning process, including:

- Density and urban form;
- Pedestrian and cycle network connectivity;
- Parking provision;
- Landscape strategy;
- Public transport; and
- Environmental engineering.

In some instances, amendments have been proposed to the Growth Centres Development Code cross-sections as discussed in the following sections. The suggested cross-sections are minimum widths and wider facilities may be provided.

The recommended cross-sections have been developed in accordance with the following guidance:

- Road Design Guide, Section 3 (NSW Roads and Traffic Authority, 2000);
- NSW Bicycle Guidelines (NSW Roads and Traffic Authority, 2003);
- Guide to Traffic Engineering Practice Part 13: Pedestrians (Austroads, 1995);
- Guide to Traffic Engineering Practice Part 14: Cyclists (Austroads, 1999);
- AS 2890.5 On-Street Parking (Australian Standards, 2004); and
- Planning Guidelines for Walking and Cycling (DIPNR, 2004).

6.2 Transit Boulevard

Transit Boulevards are intended to provide an arterial transport function, with the capacity to (in future) provide dedicated transit lanes for buses or other public transport modes in the median. One Transit Boulevard is proposed in Oran Park Precinct, connecting the Oran Park Town Centre to the future Leppington Regional Centre.

The Development Code cross-section for Transit Boulevards includes a shared path for pedestrians and cyclists on both sides of the road, and two 3.5m wide vehicle lanes. As shown in **Table 6.1**, it is proposed to amend this cross-section to separate pedestrians and cyclists into dedicated off-road lanes on these arterial links. Shared paths are considered less appropriate for these roads due to the volume of cyclists, the speed differential between pedestrians and cyclists and the potential for conflict between cyclists and pedestrians waiting at bus stops.

Kerbside lanes should be 3.5m wide for buses, with slightly narrower outside lanes for general traffic. The opportunity to widen into the median has been retained. No on-road parking would be provided.

Table 6.1 – Transit Boulevard Cross Section

Transit Boulevard	Foot Path	Planting	Cycle Path	Vehicle Lanes	Median	Vehicle Lanes	Cycle Path	Planting	Foot Path	Total Width
GCC Code	4.5m		2.5m**	7.0m	13.0m	7.0m	2.5m**	4.5m		41.0m
Recommended	1.2m	2.5m	1.2m	6.7m	10.6m	6.7m	1.2m	2.5m	1.2m	35.0m*

* includes 0.6m kerb in each direction

**shared path

6.3 Sub-Arterial Road

Sub-arterial roads are focussed towards traffic efficiency and will have two lanes in each direction. Sub-arterial roads are proposed within the Oran Park and Turner Road Precincts at approximately 2km spacings to support the adjacent The Northern Road and Camden Valley Way arterial roads.

The Development Code suggests two 3.5 metre traffic lanes, a 1.8 metre cycle lane in each direction and a median of 7.2 metres. As shown in **Table 6.2**, it is proposed to locate cyclist in dedicated off-road paths. Off-road cycle paths are proposed to separate vehicles and cyclists on these higher order roads due to traffic volumes and vehicle speeds.

Kerbside lanes have been retained at 3.5m for buses, with 3.2m general traffic lanes. Planting and medians are retained. On-road parking would not be provided.

Table 6.2 – Sub-Arterial Road Cross Section

Sub Arterial Road 4 Lanes	Foot Path	Planting	Cycle Path	Vehicle Lanes	Median	Vehicle Lanes	Cycle Path	Planting	Foot Path	Total Width
GCC Code	5.0m		1.8m	7.0m	7.2m	7.0m	1.8m	5.0m		34.8m
Recommended	1.2m	2.5m	1.2m	6.7m	4.2m	6.7m	1.2m	2.5m	1.2m	28.6m*

* includes 0.6m kerb in each direction

6.4 Distributor Road

Distributor Roads are not included in the Growth Centres Development Code. However, it is recommended that Distributor Roads with one-lane in each direction be provided where traffic efficiency needs to be maintained but traffic volumes do not warrant a sub-arterial road with two-lanes in each direction.

The proposed cross section for a Distributor is shown in **Table 6.3**. Separate off-road pedestrian paths and cycle paths are provided in both directions, with medians and verge planting. On-road parking would generally be provided. However, in short-sections of road adjacent to mixed-use developments such as the Turner Road town centre, on-street parking may be appropriate.

Table 6.3 – Distributor Road Cross Section

Distributor	Foot Path	Planting	Cycle Path	Vehicle Lane	Median	Vehicle Lane	Cycle Path	Planting	Foot Path	Total Width
GCC Code	-	-	-	-	-	-	-	-	-	-
Recommended	1.2m	2.5m	1.2m	5.5m	4.2m	5.5m	1.2m	2.5m	1.2m	26.2m*

* includes 0.6m kerb in each direction

6.5 Collector Road

Collector Roads have a balance of traffic and urban functions, connecting local streets to the higher order road network.

As shown in **Table 6.4**, it is recommended that off-road shared paths be provided in both directions on Collector Roads, with the option to provide on-road cycleways and separate footpaths on routes to schools or other areas that may see a higher number of cyclists. Vehicle lanes should be 3.5m wide to accommodate the potential for buses, with parking to be provided within planting areas on a discretionary basis.

Table 6.4 – Collector Road Cross Section

Collector Street	Service Corridor	Planting	Shared Path	Vehicle Lane	Vehicle Lane	Shared Path	Planting	Service Corridor	Total Width
GCC Code		3.5m		3.0m	3.0m		3.5m		18.0m*
Recommended	0.6m	2.5m	2.5m	3.5m	3.5m	2.5m	2.5m	0.6m	19.4m**

*includes 2.5m parking lane in each direction

** includes 0.6m kerb in each direction

6.6 Local Street

Local streets provide an urban function and are intended to carry low volumes of traffic and have a high level of amenity. As shown in **Table 6.5** it is recommended that cyclists ride on-road and mix with traffic in low speed environments. Parking areas can be provided in planting areas on a discretionary basis.

Table 6.5 – Local Street Cross Section

Local Street	Service Corridor	Foot Path	Planting	Vehicle Lane	Vehicle Lane	Planting	Foot Path	Service Corridor	Total Width
GCC Code		3.5m		3.0m	3.0m		4.0m		16.0m*
Recommended	0.6m	1.2m	2.2m	3.0m	3.0m	2.2m	1.2m	0.6m	14.0m

* includes 2.5m parking lane

7.0 Conclusions and Recommendations

7.1 Road Network

The following changes are proposed to the Indicative Layout Plans to improve traffic efficiency:

- Realign Southern Boulevard to minimise intersections on Camden Valley Way;
- Reduce speed limits to 50km/h on local streets within residential areas to the west of The Northern Road (Western Boulevard).

The intersection of The Northern Road/Southern Boulevard should have reasonable layout (including double right turn lanes, left slip lanes and pedestrian crossings on all arms). The analysis in this report suggests that the intersection will not have sufficient capacity to cater for projected traffic movements and that some redistribution of vehicles will occur. It is not recommended to provide further capacity at this intersection as this would affect other road users, such as pedestrians and cyclists by increasing crossing times.

7.2 Heavy Goods Vehicles

The commercial/employment zones are well located in terms of their accessibility to the Regional Road network. B-Double access to the Precincts would be available via The Northern Road and Camden Valley Way from the M5 Motorway (via Narellan Road).

There are no apparent rat-runs or areas where heavy goods vehicles would use lower order roads to avoid network problems.

7.3 Public Transport Network

A network of bus routes is proposed to serve the areas, linking the communities to adjacent District Centres and Regional Centres. The network plans provide coverage of the majority of the Turner Road and Oran Park Precincts.

Lane widths need to be a minimum of 3.5m on bus routes and indented bays should be avoided. A number of roundabouts are noted for further review as they are located along bus routes. These intersections should be designed to aid bus movements.

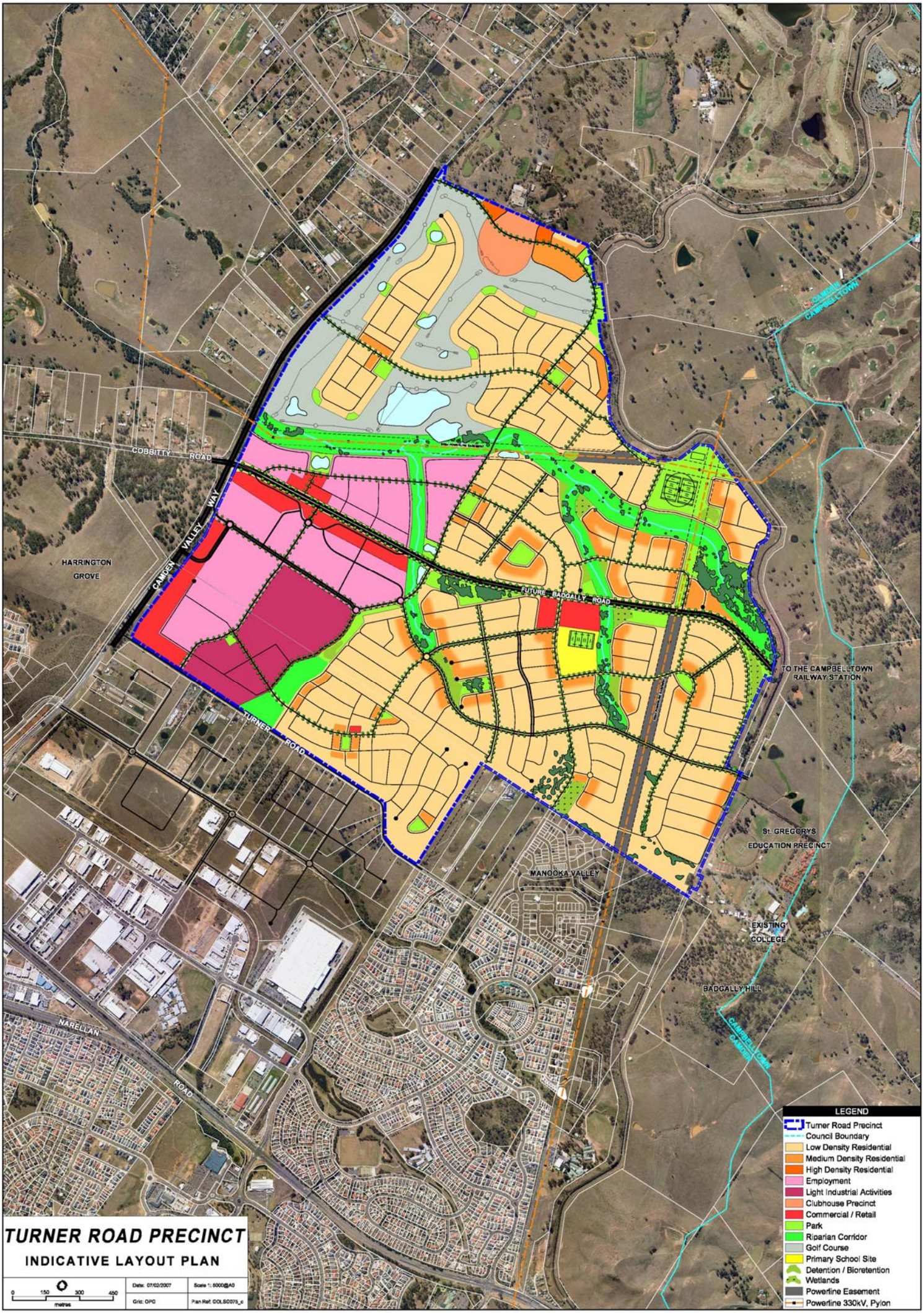
The Road Design Guide (RTA, varies) specifies that the maximum vertical grade for sealed roads is 6-8% (Table 2.3.1, design speed 60km/h, flat terrain). A review of the proposed bus network has found that the topography may affect the bus services on the North-South Spine Road (south of Oran Park Town Centre).

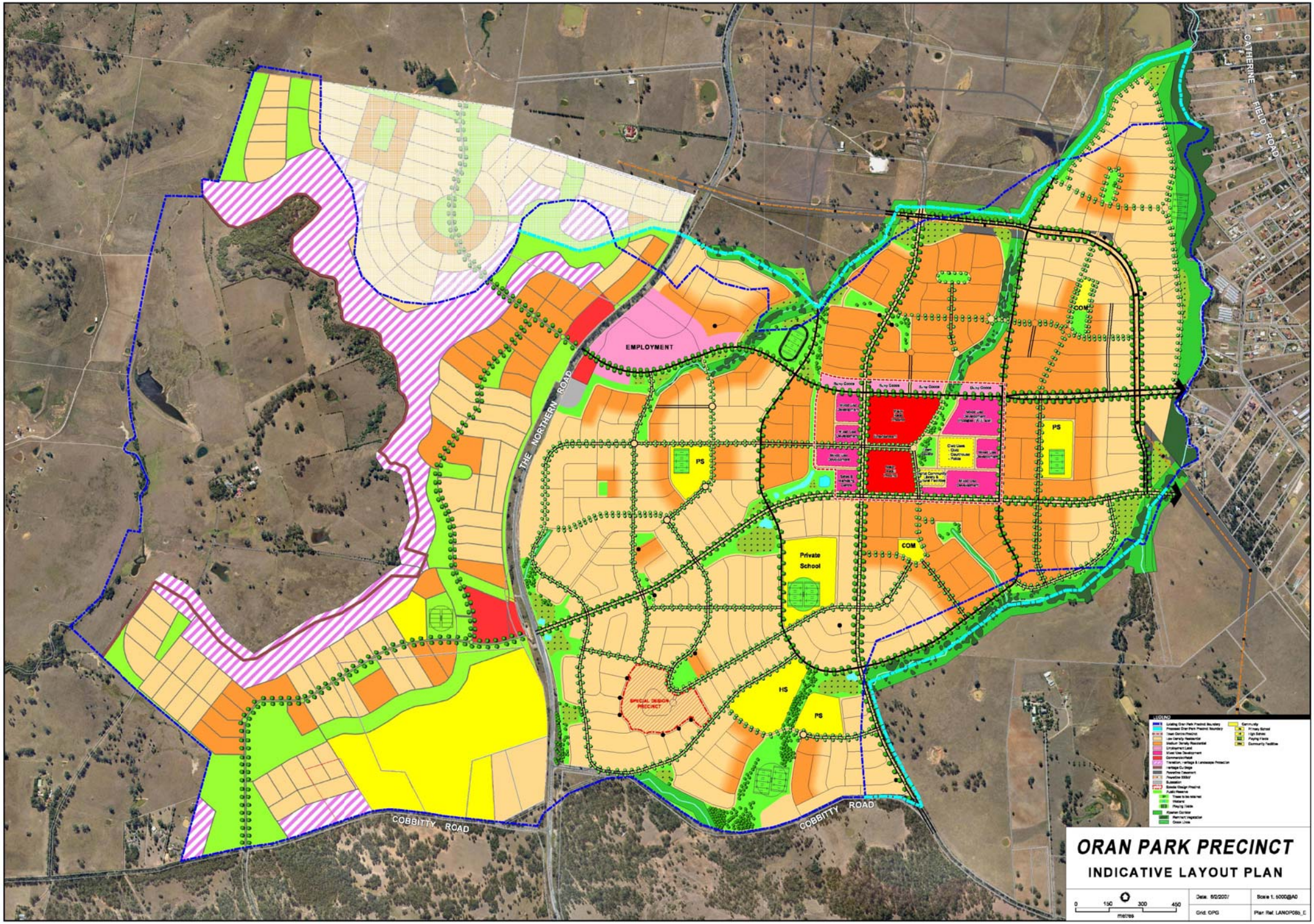
7.4 Walking and Cycling

Some minor amendments are recommended to ensure that the precinct plans adhere to principles:

- Provide pedestrian/ cycle connections from cul-de-sacs to adjacent streets and/ or green space(s). These links should be well designed to avoid unsociable activity and crime.
- Activate the street-frontage on Badgally Road and the Southern Boulevard to achieve passive surveillance. The ILP suggests that there would be little street activity which would create an uncomfortable walking environment during quiet times of the day or after dark.
- Shared cycleway/footpaths are shown on the precinct plans along linear green space, with connections to adjacent streets.

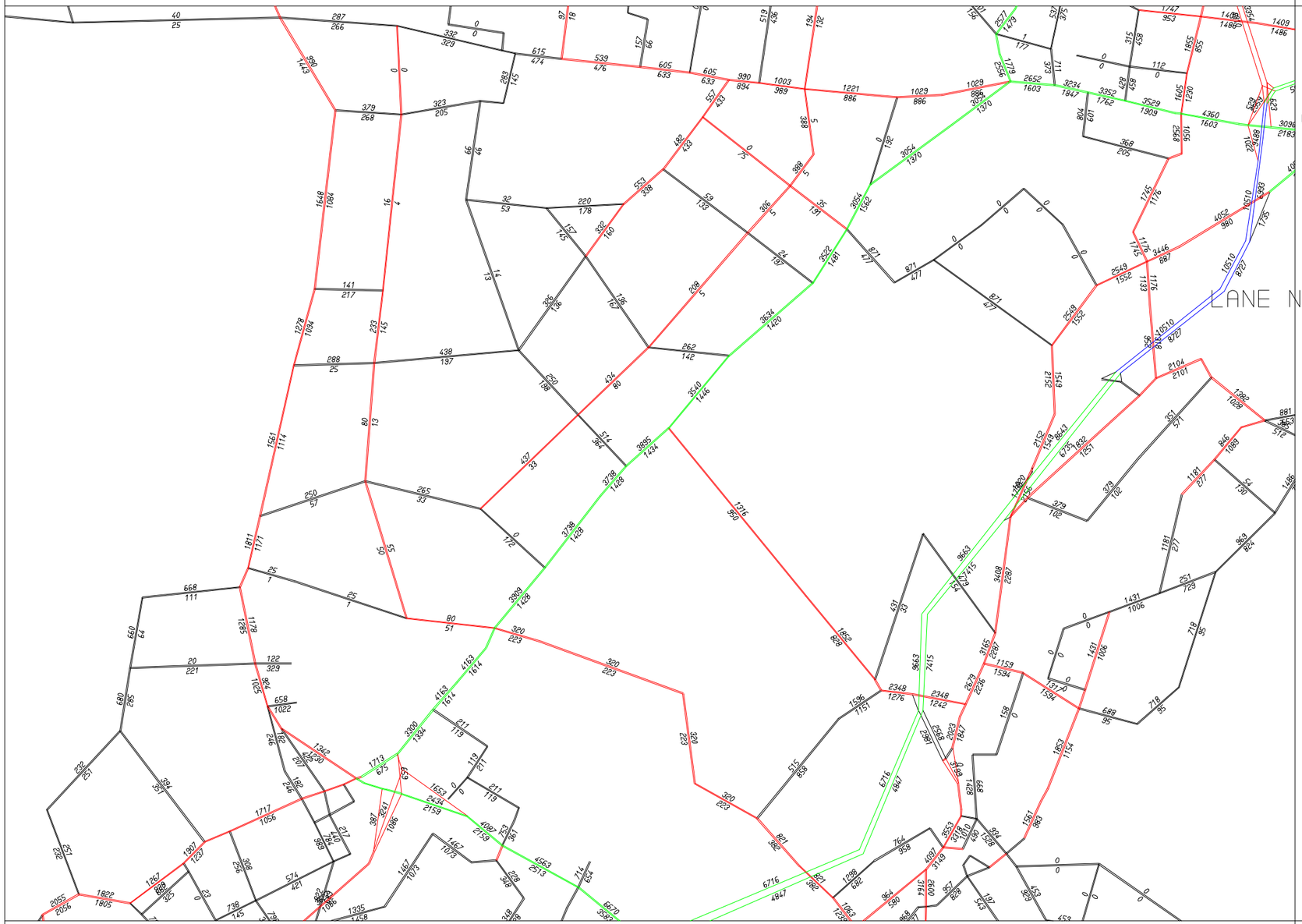
Appendix A: Indicative Layout Plans


COBBITTY ROAD
CAMDEN VALLEY WAY
HARRINGTON GROVE
FUTURE BADGALLY ROAD
TURNER ROAD
TO THE CAMPBELLTOWN RAILWAY STATION
St. GREGORYS EDUCATION PRECINCT
MANOOKA VALLEY
EXISTING COLLEGE
BADGALLY HILL
NARELLAN ROAD
CAMPBELLTOWN
CAMDEN
LEGEND
Turner Road Precinct
Council Boundary
Low Density Residential
Medium Density Residential
High Density Residential
Employment
Light Industrial Activities
Clubhouse Precinct
Commercial / Retail
Park
Riparian Corridor
Golf Course
Primary School Site
Detention / Bioretention
Wetlands
Powerline Easement
Powerline 330kV, Pylon
TURNER ROAD PRECINCT
INDICATIVE LAYOUT PLAN
0 150 300 450
metres
Date: 07/02/2007
Scale 1: 6000@A0
Grid: GPO
Plan Ref: GOLSC079_c


THE NORTHERN ROAD
CATHERINE FIELD ROAD
COBBITTY ROAD
COBBITTY ROAD
EMPLOYMENT
COM
COM
PS
PS
PS
PS
Private School
HS
SPECIAL DESIGN PRECINCT
LEGEND
ORAN PARK PRECINCT
INDICATIVE LAYOUT PLAN
0 150 300 450
metres
Date: 6/2/2007
Scale 1: 5000@A0
Grid: GPG
Plan Ref: LANOP08b_E

Appendix B: Model Input Data

TRAFFIC VOLUMES



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THRESHOLD:
LOWER: -
UPPER: 9999
COL-IND: @lan

LANE NUMBER:
1
2
3
>3

WINDOW:
286506/62289
304095/62421

EMME/2 PROJECT: SYDNEY ROAD NETWORK MODEL
SCENARIO 555: 2031SYDRDNET 7-9am: 2016trips (No ORAN/TURNERDEVS) mf36

07-06-22 08:
MODULE: 6.
RTA-NSW.....

TRAFFIC VOLUMES

emme/2

LINKS:
type=1, 15
THRESHOLD:
LOWER: -
UPPER: 9999
COL-IND: @lan

LANE NUMBER:
1
2
3
>3

WINDOW:
286506/62289
304095/62421

EMME/2 PROJECT: SYDNEY ROAD NETWORK MODEL
SCENARIO 444: 2031SYDRDNET 7-9am: 2026trips (No ORAN/TURNERDEVs) mf37

07-06-22 08:
MODULE: 6.
RTA-NSW.....

Oran Park Precinct - Land Use Summary

Weekday PM Peak Hour Vehicle Trip Generation Rate

PM Peak Trip Adj F	88%
Low Density	0.75
Medium Density	0.46
High Density	0.26

Evening Peak Trip by Purpose

HTS Trip Purpo	Porportior	Private Veh Mode		Adj Trip Pr	Model Trip Purpose
Commuting	27%	73%	19.8%	36%	HBW
Work Related Bu	8%	89%	7.1%	13%	HBO
Education/Childc	5%	54%	2.7%		HBS
Shopping	12%	66%	7.9%	14%	HBO
personal busines	5%	72%	3.5%	6%	HBO
Social/Recreatio	24%	64%	15.4%	28%	HBO
Serve Passenge	17%	88%	15.0%		
Other	2%	100%	2.0%	4%	HBO
Total (Excl Serve	**83%**		**56%**	**100%**	

Source: 2004 Household Travel Survey Summary Report 2006 Release

HBW	36%	Work-to-Home (100%)
HBS		
HBO	64%	Home-to-Other (50%), Other-to-Home (50%)

Model Zone	Old Model Zone	Number of Dwellings			Employment					No of School Pupils		Peak Hour Vehicle Trips			
		Low Den	Med Den	Hi Den	Retail	Commercial	Industrial	Education	Total	Primary	Secondary	HBW	HBS	HBO	Total
1	16	538	94	0	0	0	0	0	0	0	0	159	0	288	447
2	17	134	47	0	0	182	182	0	364	0	0	44	0	79	123
3	18	0	141	0	0	7	7	0	14	0	0	23	0	42	65
4	19	0	235	0	0	14	14	0	28	0	0	39	0	70	109
5	20	269	188	0	0	0	0	0	0	0	0	103	0	186	289
6	21	672	94	0	0	0	0	40	40	400	0	195	0	353	548
7	22	0	141	348	140	56	42	0	237.5	0	0	55	0	100	155
8	23	0	0	348	1014	161	79.8	0	1254.5	0	0	32	0	57	89
9	24	134	188	0	0	0	0	0	0	0	0	67	0	121	188
10	25	672	19	0	0	0	0	0	0	0	0	183	0	331	513
11	26	269	188	0	0	0	0	140	140	400	1000	103	0	186	289
12	27	134	141	0	0	0	0	40	40	400	0	59	0	107	166
13	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	29	269	0	0	0	0	0	140	140	400	1000	72	0	130	202
15	30	403	47	0	0	0	0	140	140	400	1000	115	0	209	325
16	61	271	205	0	0	0	0	0	0	0	0	106	0	192	298
17	62	361	205	0	260	19.6	0	40	320	400	0	130	0	236	366
18	63	90	205	0	149	11.2	0	0	160	0	0	58	0	105	163
19	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	65	180	205	0	0	0	0	40	40	400	0	82	0	149	230
21	66	180	0	0	0	0	0	0	0	0	0	48	0	87	135
22	41	5	25	62	37	2.8	0	0	40	0	0	11	0	20	31
23	42	145	25	0	0	0	0	0	0	0	0	43	0	78	120
24	43	145	5	0	0	0	0	0	0	0	0	40	0	72	111
25	44	145	20	0	0	0	0	0	0	0	0	42	0	76	118
26	45	70	50	0	0	0	0	0	0	0	0	27	0	49	76
27	46	0	0	0	298	302.4	280	0	880	0	0	0	0	0	0
28	47	145	38	0	0	0	0	0	0	0	0	45	0	82	126
29	48	70	88	0	0	0	0	0	0	0	0	33	0	60	93
30	49	376	235	70	0	0	0	0	0	0	0	146	0	264	409
31	50	376	235	71	149	11.2	0	40	200	400	0	146	0	264	409
32	51	0	0	0	446	229.6	196	0	872	0	0	0	0	0	0
33	52	0	0	0	446	215.6	182	0	844	0	0	0	0	0	0
34	53	0	0	0	0	56	504	0	560	0	0	0	0	0	0
35	54	509	50	0	37	2.8	0	0	40	0	0	144	0	261	405
36	55	376	118	0	0	0	0	0	0	0	0	120	0	217	337
37	56	376	118	0	0	0	0	0	0	0	0	120	0	217	337
	Total	7315	3351	899	2976	1271	1487	620	6354	3200	3000	2587	0	4689	7277

Notes:
The size of employment areas, number of pupils, etc has been used to estimate the distribution of trips within the precincts (not for trip generation).

Oran Park Precinct - Land Use Summary

Weekday AM Peak Hour Vehicle Trip Generation Rate

Low Density	0.85
Medium Density	0.53
High Density	0.29

Source: RTA Guide to Traffic Generating Developments (Oct 2002), Section 3

Morning Peak Trip by Purpose

HTS Trip Purpose	Porportior	Private Veh Mode		Adj Trip Pr	Model Trip Purpose
Commuting	27%	73%	19.8%	37%	HBW
Work Related Business	9%	89%	8.4%	16%	HBO
Education/Childcare	18%	54%	9.6%	18%	HBS
Shopping	8%	66%	5.0%	9%	HBO
personal business	5%	72%	3.5%	7%	HBO
Social/Recreation	10%	64%	6.3%	12%	HBO
Serve Passenger	23%	88%	20.3%		
Other	1%	100%	0.5%	1%	HBO
Total (Excl Serve Passe	**77%**		**53%**	**100%**	

Source: 2004 Household Travel Survey Summary Report 2006 Release

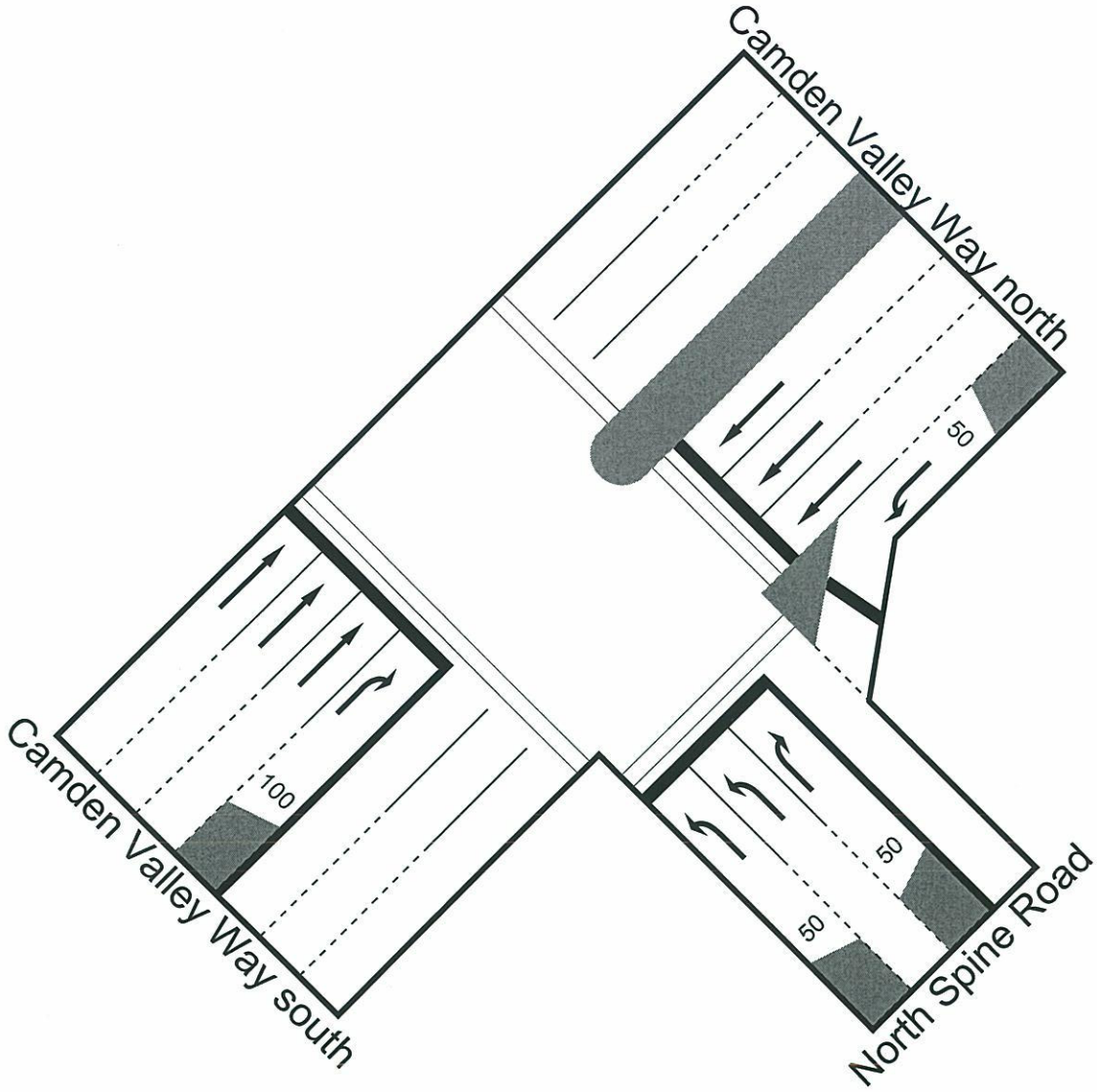
HBW	37%	
HBS	18%	
HBO	45%	35%

Model Zone	Old Model Zone	Number of Dwellings			Employment					No of School Pupils	
		Low Den	Med Den	Hi Den	Retail	Commercial	Industrial	Education	Total	Primary	Secondary
1	16	538	94	0	0	0	0	0	0	0	0
2	17	134	47	0	0	182	182	0	364	0	0
3	18	0	141	0	0	7	7	0	14	0	0
4	19	0	235	0	0	14	14	0	28	0	0
5	20	269	188	0	0	0	0	0	0	0	0
6	21	672	94	0	0	0	0	40	40	400	0
7	22	0	141	348	140	56	42	0	237.5	0	0
8	23	0	0	348	1014	161	79.8	0	1254.5	0	0
9	24	134	188	0	0	0	0	0	0	0	0
10	25	672	19	0	0	0	0	0	0	0	0
11	26	269	188	0	0	0	0	140	140	400	1000
12	27	134	141	0	0	0	0	40	40	400	0
13	28	0	0	0	0	0	0	0	0	0	0
14	29	269	0	0	0	0	0	140	140	400	1000
15	30	403	47	0	0	0	0	140	140	400	1000
16	61	271	205	0	0	0	0	0	0	0	0
17	62	361	205	0	260	19.6	0	40	320	400	0
18	63	90	205	0	149	11.2	0	0	160	0	0
19	64	0	0	0	0	0	0	0	0	0	0
20	65	180	205	0	0	0	0	40	40	400	0
21	66	180	0	0	0	0	0	0	0	0	0
22	41	5	25	62	37	2.8	0	0	40	0	0
23	42	145	25	0	0	0	0	0	0	0	0
24	43	145	5	0	0	0	0	0	0	0	0
25	44	145	20	0	0	0	0	0	0	0	0
26	45	70	50	0	0	0	0	0	0	0	0
27	46	0	0	0	298	302.4	280	0	880	0	0
28	47	145	38	0	0	0	0	0	0	0	0
29	48	70	88	0	0	0	0	0	0	0	0
30	49	376	235	70	0	0	0	0	0	0	0
31	50	376	235	71	149	11.2	0	40	200	400	0
32	51	0	0	0	446	229.6	196	0	872	0	0
33	52	0	0	0	446	215.6	182	0	844	0	0
34	53	0	0	0	0	56	504	0	560	0	0
35	54	509	50	0	37	2.8	0	0	40	0	0
36	55	376	118	0	0	0	0	0	0	0	0
37	56	376	118	0	0	0	0	0	0	0	0
	Total	7315	3351	899	2976	1271	1487	620	6354	3200	3000

Peak Hour Vehicle Trips			
HBW	HBS	HBO	Total
189	92	226	506
52	25	62	139
28	13	33	74
46	22	55	123
122	59	146	327
232	113	276	621
65	32	78	175
38	18	45	101
80	39	95	213
217	105	259	581
122	59	146	327
70	34	84	188
0	0	0	0
85	41	102	229
137	67	164	367
126	61	150	338
155	75	184	414
69	33	82	184
0	0	0	0
97	47	116	261
57	28	68	153
13	6	16	35
51	25	61	136
47	23	56	126
50	24	60	134
32	16	38	86
0	0	0	0
53	26	64	143
39	19	47	106
173	84	206	463
173	84	206	464
0	0	0	0
0	0	0	0
0	0	0	0
171	83	204	459
142	69	170	382
142	69	170	382
3075	1494	3669	8238

Notes:
The size of employment areas, number of pupils, etc has been used to estimate the distribution of trips within the precincts (not for trip generation).

Appendix C: Intersection Layouts and Performance Summaries


Camden Valley Way north
50
Camden Valley Way south
100
50
50
North Spine Road

SIDRA INTERSECTION

Movement Summary

Camden Valley Way / TR North Spine Road

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 70 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
North Spine Road										
21	L	423	5.0	0.284	16.9	LOS B	49	0.56	0.76	37.9
23	R	185	4.9	0.488	26.7	LOS B	46	0.79	0.77	32.8
Approach		**608**	**4.9**	**0.488**	**19.9**	**LOS B**	**49**	**0.63**	**0.76**	**36.2**
Camden Valley Way north										
24	L	32	9.4	0.026	9.2	LOS A	1	0.07	0.62	52.7
25	T	875	10.0	0.558	23.4	LOS B	74	0.83	0.70	41.1
Approach		**908**	**10.0**	**0.558**	**22.9**	**LOS B**	**74**	**0.81**	**0.70**	**41.4**
Camden Valley Way south										
31	T	2346	10.0	0.854	18.4	LOS B	188	0.84	0.85	45.1
32	R	127	10.2	0.571	41.9	LOS C	44	0.96	0.80	28.9
Approach		**2473**	**10.0**	**0.854**	**19.6**	**LOS B**	**188**	**0.84**	**0.85**	**43.9**
All Vehicles		**3989**	**9.3**	**0.854**	**20.4**	**LOS B**	**188**	**0.80**	**0.80**	**42.0**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	24.0	LOS C	0	0.83	0.83
P11	50	29.3	LOS C	0	0.91	0.91
P15	50	29.3	LOS C	0	0.91	0.91
All Peds	**150**	**27.5**	**LOS B**	**0**	**0.89**	**0.89**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR1_AM_2016
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / TR North Spine Road

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 120 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
North Spine Road										
21	L	288	4.9	0.275	31.2	LOS C	70	0.68	0.77	30.7
23	R	98	5.1	0.475	52.6	LOS D	48	0.90	0.77	24.0
Approach		**386**	**4.9**	**0.475**	**36.6**	**LOS C**	**70**	**0.73**	**0.77**	**28.6**
Camden Valley Way north										
24	L	131	9.9	0.111	9.4	LOS A	5	0.06	0.63	52.4
25	T	2343	10.0	0.898	34.0	LOS C	331	0.92	0.93	34.6
Approach		**2474**	**10.0**	**0.898**	**32.7**	**LOS C**	**331**	**0.87**	**0.92**	**35.2**
Camden Valley Way south										
31	T	1085	10.0	0.279	1.5	LOS A	18	0.08	0.07	67.0
32	R	284	9.9	0.893	71.2	LOS F	146	1.00	0.99	20.6
Approach		**1370**	**10.0**	**0.893**	**15.9**	**LOS B**	**146**	**0.27**	**0.26**	**46.9**
All Vehicles		**4230**	**9.5**	**0.898**	**27.6**	**LOS B**	**331**	**0.67**	**0.69**	**37.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	21.0	LOS C	0	0.59	0.59
P11	50	54.2	LOS E	0	0.95	0.95
P15	50	54.2	LOS E	0	0.95	0.95
All Peds	**150**	**43.1**	**LOS D**	**0**	**0.83**	**0.83**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / TR North Spine Road

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
North Spine Road										
21	L	494	5.1	0.346	18.7	LOS B	66	0.58	0.77	36.8
23	R	188	4.8	0.579	32.3	LOS C	55	0.84	0.79	30.4
Approach		**682**	**5.0**	**0.579**	**22.5**	**LOS B**	**66**	**0.66**	**0.77**	**34.8**
Camden Valley Way north										
24	L	46	10.9	0.043	9.9	LOS A	2	0.11	0.63	51.7
25	T	1239	10.0	0.722	26.9	LOS B	116	0.89	0.79	38.7
Approach		**1285**	**10.0**	**0.722**	**26.3**	**LOS B**	**116**	**0.86**	**0.79**	**39.0**
Camden Valley Way south										
31	T	2491	10.0	0.806	12.0	LOS A	171	0.68	0.66	51.5
32	R	208	10.1	0.686	44.4	LOS D	73	0.96	0.85	27.9
Approach		**2699**	**10.0**	**0.806**	**14.5**	**LOS A**	**171**	**0.71**	**0.67**	**48.6**
All Vehicles		**4666**	**9.3**	**0.806**	**18.9**	**LOS B**	**171**	**0.74**	**0.72**	**43.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	24.8	LOS C	0	0.79	0.79
P11	50	34.2	LOS D	0	0.93	0.93
P15	50	34.2	LOS D	0	0.93	0.93
All Peds	**150**	**31.1**	**LOS C**	**0**	**0.88**	**0.88**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / TR North Spine Road

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
North Spine Road										
21	L	375	5.1	0.349	34.6	LOS C	107	0.67	0.78	29.3
23	R	139	5.0	0.859	83.1	LOS F	89	0.97	0.99	18.2
Approach		**514**	**5.1**	**0.859**	**47.7**	**LOS D**	**107**	**0.75**	**0.84**	**25.2**
Camden Valley Way north										
24	L	133	9.8	0.193	12.7	LOS A	15	0.15	0.65	48.5
25	T	2481	10.0	0.982	69.1	LOS E	566	1.00	1.16	22.7
Approach		**2614**	**10.0**	**0.982**	**66.2**	**LOS E**	**566**	**0.96**	**1.14**	**23.3**
Camden Valley Way south										
31	T	1468	9.9	0.354	1.4	LOS A	29	0.08	0.07	67.1
32	R	360	10.7	1.000#	66.4	LOS E	167	0.99	0.86	21.6
Approach		**1805**	**10.0**	**1.000**	**13.6**	**LOS A**	**167**	**0.25**	**0.22**	**49.5**
All Vehicles		**4956**	**9.4**	**1.000**	**44.8**	**LOS D**	**566**	**0.67**	**0.77**	**29.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	26.4	LOS C	0	0.59	0.59
P11	50	69.1	LOS F	0	0.96	0.96
P15	50	69.1	LOS F	0	0.96	0.96
All Peds	**150**	**54.9**	**LOS D**	**0**	**0.84**	**0.84**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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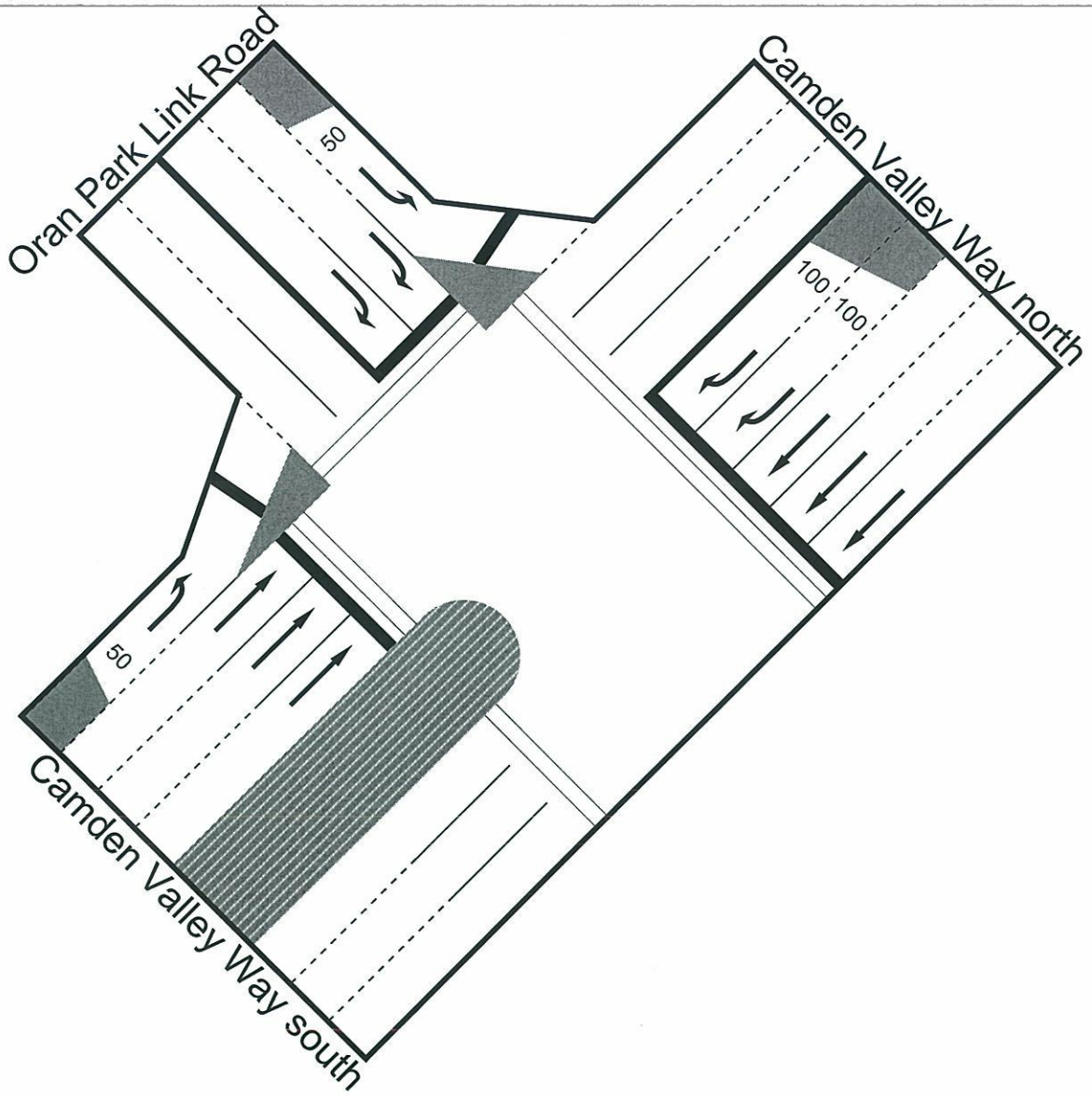
Oran Park Link Road
Camden Valley Way north
Camden Valley Way south
50
100
100
50

SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Oran Park Link Road

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 110 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Camden Valley Way north										
25	T	835	10.0	0.229	3.1	LOS A	23	0.15	0.13	64.1
26	R	463	9.9	0.864	66.2	LOS E	112	1.00	0.95	22.4
Approach		**1299**	**10.0**	**0.864**	**25.6**	**LOS B**	**112**	**0.46**	**0.43**	**39.1**
Oran Park Link Road										
27	L	360	5.8	1.000#	39.6	LOS C	93	1.00	0.85	30.2
29	R	307	4.2	0.440	48.7	LOS D	73	0.91	0.81	26.8
Approach		**615**	**4.9**	**1.000**	**48.2**	**LOS D**	**93**	**1.03**	**0.90**	**28.3**
Camden Valley Way south										
30	L	223	9.9	0.185	9.9	LOS A	8	0.07	0.64	52.7
31	T	2113	10.0	0.846	27.7	LOS B	248	0.87	0.84	38.2
Approach		**2336**	**10.0**	**0.846**	**26.0**	**LOS B**	**248**	**0.80**	**0.82**	**39.1**
All Vehicles		**4302**	**9.1**	**1.000**	**28.7**	**LOS C**	**248**	**0.72**	**0.70**	**36.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P11	50	49.2	LOS E	0	0.95	0.95
P13	50	21.0	LOS C	0	0.62	0.62
P15	50	44.5	LOS E	0	0.90	0.90
All Peds	**150**	**38.2**	**LOS C**	**0**	**0.82**	**0.82**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Oran Park Link Road

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 70 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Camden Valley Way north										
25	T	2146	10.0	0.829	18.1	LOS B	168	0.84	0.82	45.3
26	R	486	10.1	0.818	44.6	LOS D	81	1.00	0.93	28.7
Approach		**2632**	**10.0**	**0.829**	**23.0**	**LOS B**	**168**	**0.87**	**0.84**	**41.1**
Oran Park Link Road										
27	L	460	5.0	0.798	25.8	LOS B	91	0.73	0.92	36.8
29	R	358	5.0	0.280	26.4	LOS B	43	0.75	0.78	36.2
Approach		**818**	**5.0**	**0.798**	**26.1**	**LOS B**	**91**	**0.74**	**0.86**	**36.5**
Camden Valley Way south										
30	L	368	10.1	0.371	11.4	LOS A	24	0.20	0.68	50.9
31	T	910	10.0	0.773	31.2	LOS C	91	0.97	0.88	36.1
Approach		**1278**	**10.0**	**0.773**	**25.5**	**LOS B**	**91**	**0.75**	**0.82**	**39.3**
All Vehicles		**4728**	**9.2**	**0.829**	**24.2**	**LOS B**	**168**	**0.81**	**0.84**	**39.8**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P11	50	29.3	LOS C	0	0.91	0.91
P13	50	28.4	LOS C	0	0.90	0.90
P15	50	24.9	LOS C	0	0.84	0.84
All Peds	**150**	**27.5**	**LOS B**	**0**	**0.89**	**0.89**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Oran Park Link Road

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 130 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Camden Valley Way north										
25	T	1183	10.0	0.322	3.6	LOS A	39	0.16	0.14	63.2
26	R	550	10.0	0.897	77.0	LOS F	152	1.00	0.99	20.1
Approach		**1733**	**10.0**	**0.897**	**26.9**	**LOS B**	**152**	**0.43**	**0.41**	**38.3**
Oran Park Link Road										
27	L	511	9.3	0.999#	43.6	LOS D	93	1.00	0.84	28.7
29	R	527	3.4	0.886	72.6	LOS F	196	1.00	1.03	21.0
Approach		**807**	**5.0**	**1.000**	**83.3**	**LOS E**	**196**	**1.29**	**1.26**	**22.7**
Camden Valley Way south										
30	L	241	10.0	0.212	10.5	LOS A	11	0.09	0.65	52.0
31	T	2187	10.0	0.893	38.0	LOS C	332	0.93	0.93	32.6
Approach		**2428**	**10.0**	**0.892**	**35.3**	**LOS C**	**332**	**0.85**	**0.91**	**33.8**
All Vehicles		**5199**	**8.8**	**0.999**	**38.4**	**LOS C**	**332**	**0.74**	**0.76**	**31.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P11	50	53.6	LOS E	0	0.91	0.91
P13	50	24.6	LOS C	0	0.62	0.62
P15	50	49.1	LOS E	0	0.87	0.87
All Peds	**150**	**42.4**	**LOS C**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Oran Park Link Road

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Camden Valley Way north										
25	T	2217	10.0	0.751	11.1	LOS A	143	0.66	0.60	52.4
26	R	639	10.0	0.868	49.9	LOS D	115	1.00	0.99	26.8
Approach		**2856**	**10.0**	**0.868**	**19.8**	**LOS B**	**143**	**0.74**	**0.69**	**43.6**
Oran Park Link Road										
27	L	596	5.8	1.000#	24.6	LOS B	93	1.00	0.88	37.5
29	R	412	4.2	0.442	32.9	LOS C	69	0.85	0.81	32.9
Approach		**925**	**5.1**	**1.000**	**31.2**	**LOS C**	**93**	**1.01**	**0.92**	**35.1**
Camden Valley Way south										
30	L	557	10.1	0.682	16.3	LOS B	56	0.53	0.77	45.7
31	T	1232	10.0	0.897	41.7	LOS C	146	1.00	1.03	31.1
Approach		**1789**	**10.0**	**0.897**	**33.8**	**LOS C**	**146**	**0.85**	**0.95**	**34.4**
All Vehicles		**5653**	**9.1**	**1.000**	**25.8**	**LOS B**	**146**	**0.81**	**0.80**	**38.6**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P11	50	34.2	LOS D	0	0.93	0.93
P13	50	28.9	LOS C	0	0.85	0.85
P15	50	29.8	LOS C	0	0.86	0.86
All Peds	**150**	**31.0**	**LOS C**	**0**	**0.88**	**0.88**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR2_PM_2026
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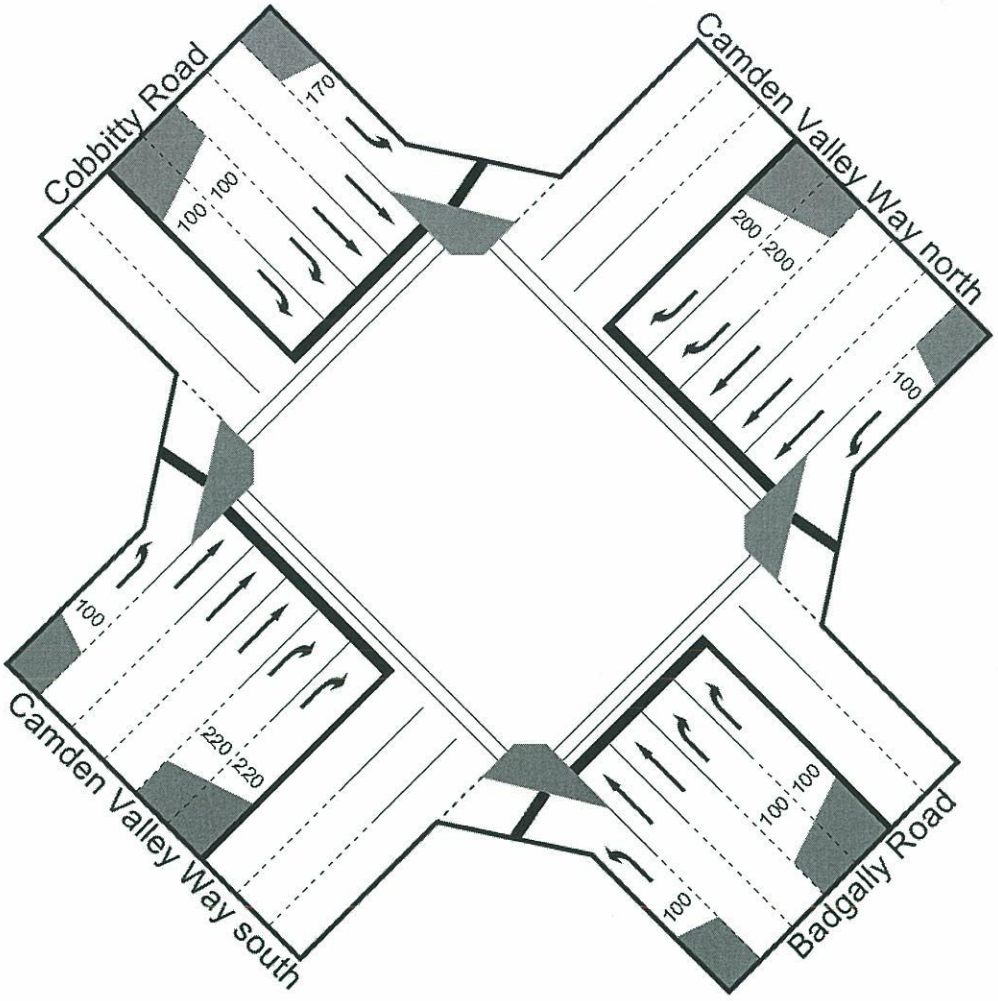
Cobbitty Road
Camden Valley Way north
Camden Valley Way south
Badgally Road
170
100
100
100
200
200
100
100
220
220
100
100
100
100

SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Badgally Road / Cobbitty Road

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Badgally Road										
21	L	162	4.9	0.458	51.7	LOS D	78	0.81	0.79	26.1
22	T	807	5.0	1.001	112.8	LOS F	293	1.00	1.26	14.6
23	R	129	4.7	0.206	63.1	LOS E	39	0.88	0.76	23.1
Approach		**1098**	**4.9**	**1.001**	**97.9**	**LOS F**	**293**	**0.96**	**1.13**	**16.5**
Camden Valley Way north										
24	L	63	9.5	0.073	15.0	LOS B	9	0.19	0.66	47.0
25	T	1145	10.0	0.540	34.4	LOS C	147	0.72	0.63	34.4
26	R	102	9.8	0.630	90.5	LOS F	40	1.00	0.77	18.0
Approach		**1311**	**10.0**	**0.630**	**37.9**	**LOS C**	**147**	**0.72**	**0.64**	**32.6**
Cobbitty Road										
27	L	23	4.3	0.043	47.8	LOS D	13	0.74	0.71	27.3
28	T	520	3.9	0.844	67.7	LOS E	189	1.00	0.96	21.0
29	R	770	6.3	1.000#	72.9	LOS F	166	1.00	0.85	21.0
Approach		**1162**	**5.0**	**1.000**	**78.9**	**LOS E**	**189**	**1.13**	**1.02**	**21.1**
Camden Valley Way south										
30	L	48	10.4	0.056	15.0	LOS B	7	0.19	0.66	47.0
31	T	2185	10.0	1.029	107.6	LOS F	577	1.00	1.31	16.5
32	R	165	10.2	1.028	138.8	LOS F	76	1.00	1.03	12.9
Approach		**2400**	**10.0**	**1.029**	**107.9**	**LOS F**	**577**	**0.98**	**1.28**	**16.4**
All Vehicles		**6123**	**7.9**	**1.029**	**82.9**	**LOS F**	**577**	**0.92**	**1.03**	**19.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	37.5	LOS D	0	0.71	0.71
P11	50	62.6	LOS F	0	0.91	0.91
P13	50	37.5	LOS D	0	0.71	0.71

P15	50	62.6	LOS F	0	0.91	0.91
All Peds	**200**	**50.0**	**LOS D**	**0**	**0.81**	**0.81**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR3_AM_2016
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Badgally Road / Cobbitty Road

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Badgally Road										
21	L	94	5.3	0.257	46.7	LOS D	47	0.75	0.75	27.7
22	T	848	5.0	0.962	91.9	LOS F	280	1.00	1.16	17.0
23	R	310	5.1	0.685	78.5	LOS F	93	1.00	0.84	20.0
Approach		**1253**	**5.0**	**0.962**	**85.2**	**LOS F**	**280**	**0.98**	**1.05**	**18.3**
Camden Valley Way north										
24	L	123	9.8	0.158	17.1	LOS B	22	0.24	0.68	45.0
25	T	2316	10.0	0.988	77.0	LOS F	543	1.00	1.18	21.1
26	R	43	9.3	0.231	86.0	LOS F	18	0.98	0.71	18.7
Approach		**2482**	**10.0**	**0.988**	**74.2**	**LOS F**	**543**	**0.96**	**1.15**	**21.6**
Cobbitty Road										
27	L	13	7.7	0.024	44.6	LOS D	7	0.70	0.69	28.4
28	T	611	5.1	0.694	56.7	LOS E	154	0.97	0.83	23.5
29	R	428	4.9	0.941	101.9	LOS F	143	1.00	1.09	16.7
Approach		**1052**	**5.0**	**0.942**	**74.9**	**LOS F**	**154**	**0.98**	**0.93**	**20.1**
Camden Valley Way south										
30	L	486	10.1	0.670	25.4	LOS B	100	0.55	0.78	38.5
31	T	954	10.0	0.407	27.3	LOS B	108	0.60	0.52	38.4
32	R	183	9.8	0.989	117.3	LOS F	77	1.00	1.00	14.8
Approach		**1623**	**10.0**	**0.989**	**36.9**	**LOS C**	**108**	**0.63**	**0.65**	**32.7**
All Vehicles		**6410**	**8.2**	**0.989**	**67.0**	**LOS E**	**543**	**0.89**	**0.97**	**22.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	33.3	LOS D	0	0.67	0.67
P11	50	59.9	LOS E	0	0.89	0.89
P13	50	33.3	LOS D	0	0.67	0.67

P15	50	59.9	LOS E	0	0.89	0.89
All Peds	**200**	**46.6**	**LOS D**	**0**	**0.78**	**0.78**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR3_PM_2016
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Badgally Road / Cobbitty Road

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Badgally Road										
21	L	149	4.7	0.397	45.6	LOS D	68	0.75	0.77	28.0
22	T	861	5.0	1.006	114.5	LOS F	316	1.00	1.27	14.5
23	R	129	4.7	0.245	70.3	LOS E	41	0.93	0.76	21.6
Approach		**1139**	**4.9**	**1.006**	**100.5**	**LOS F**	**316**	**0.96**	**1.15**	**16.2**
Camden Valley Way north										
24	L	89	10.1	0.122	18.4	LOS B	18	0.27	0.68	43.8
25	T	1685	10.0	0.794	39.7	LOS C	253	0.88	0.80	31.9
26	R	107	10.3	0.387	82.3	LOS F	39	0.97	0.75	19.3
Approach		**1882**	**10.0**	**0.794**	**41.1**	**LOS C**	**253**	**0.86**	**0.79**	**31.2**
Cobbitty Road										
27	L	23	4.3	0.041	42.7	LOS D	12	0.69	0.70	29.1
28	T	631	3.3	1.151	224.2	LOS F	499	1.00	1.70	8.4
29	R	862	8.2	1.000#	97.9	LOS F	166	1.00	0.99	17.2
Approach		**1180**	**5.0**	**1.151**	**228.2**	**LOS F**	**499**	**1.28**	**1.85**	**10.4**
Camden Valley Way south										
30	L	66	10.6	0.091	18.3	LOS B	13	0.26	0.67	43.9
31	T	2277	10.0	1.072	139.3	LOS F	669	1.00	1.46	13.5
32	R	287	10.1	1.036	143.6	LOS F	122	1.00	1.12	12.5
Approach		**2630**	**10.0**	**1.072**	**136.8**	**LOS F**	**669**	**0.98**	**1.40**	**13.6**
All Vehicles		**7167**	**7.9**	**1.151**	**114.5**	**LOS F**	**669**	**0.95**	**1.21**	**15.3**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	37.5	LOS D	0	0.71	0.71
P11	50	60.8	LOS F	0	0.90	0.90
P13	50	37.5	LOS D	0	0.71	0.71

P15	50	60.8	LOS F	0	0.90	0.90
All Peds	**200**	**49.1**	**LOS D**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR3_AM_2026
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Badgally Road / Cobbitty Road

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 150 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Badgally Road										
21	L	64	4.7	0.171	44.4	LOS D	32	0.72	0.74	28.4
22	T	946	5.0	1.043	138.2	LOS F	380	1.00	1.39	12.5
23	R	312	5.1	0.687	78.5	LOS F	94	1.00	0.84	20.0
Approach		**1322**	**5.0**	**1.043**	**119.6**	**LOS F**	**380**	**0.99**	**1.23**	**14.2**
Camden Valley Way north										
24	L	172	9.9	0.234	18.4	LOS B	34	0.28	0.69	43.8
25	T	2388	10.0	1.052	120.6	LOS F	668	1.00	1.40	15.1
26	R	41	9.8	0.197	84.4	LOS F	17	0.97	0.71	18.9
Approach		**2601**	**10.0**	**1.052**	**113.3**	**LOS F**	**668**	**0.95**	**1.34**	**15.8**
Cobbitty Road										
27	L	13	7.7	0.024	43.1	LOS D	7	0.69	0.69	28.9
28	T	671	4.7	0.797	60.6	LOS E	189	1.00	0.91	22.5
29	R	503	5.5	1.000#	124.4	LOS F	166	1.00	1.18	14.3
Approach		**1138**	**5.1**	**1.000**	**88.5**	**LOS F**	**189**	**1.04**	**1.06**	**18.4**
Camden Valley Way south										
30	L	582	10.0	0.866	41.1	LOS C	165	0.82	0.91	30.2
31	T	1464	10.0	0.645	32.9	LOS C	189	0.75	0.67	35.2
32	R	211	10.0	1.014	130.2	LOS F	90	1.00	1.05	13.6
Approach		**2257**	**10.0**	**1.014**	**44.1**	**LOS D**	**189**	**0.79**	**0.77**	**29.7**
All Vehicles		**7367**	**8.3**	**1.052**	**88.6**	**LOS F**	**668**	**0.92**	**1.09**	**18.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	34.7	LOS D	0	0.68	0.68
P11	50	59.0	LOS E	0	0.89	0.89
P13	50	34.7	LOS D	0	0.68	0.68

P15	50	59.0	LOS E	0	0.89	0.89
All Peds	**200**	**46.8**	**LOS D**	**0**	**0.78**	**0.78**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR3_PM_2026
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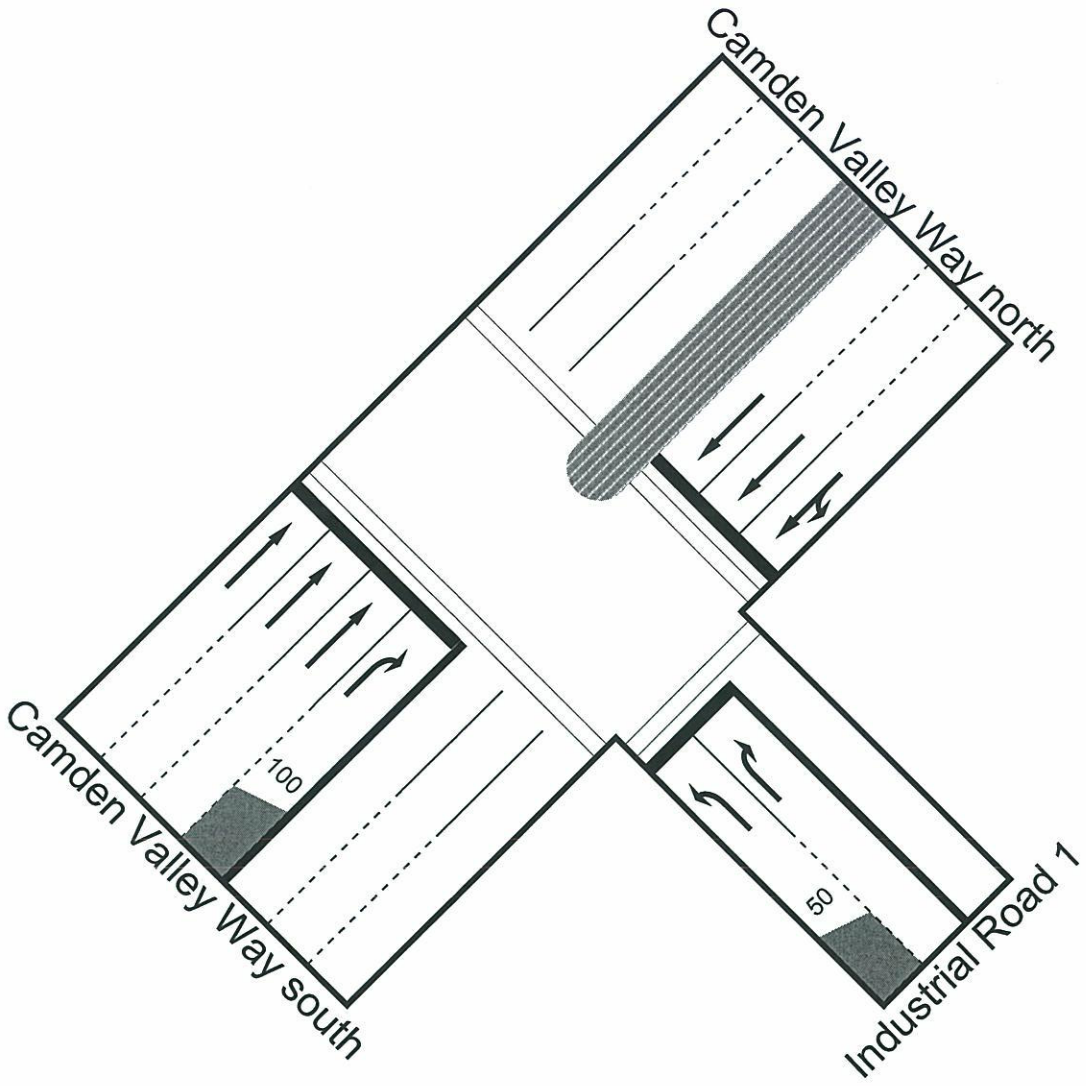
Camden Valley Way north
Camden Valley Way south
Industrial Road 1
100
50

SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Industrial Road 1

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Industrial Road 1										
21	L	45	4.4	0.098	17.6	LOS B	9	0.51	0.71	37.5
23	R	40	5.0	0.078	30.2	LOS C	13	0.76	0.73	31.1
Approach		**85**	**4.7**	**0.098**	**23.6**	**LOS B**	**13**	**0.63**	**0.72**	**34.2**
Camden Valley Way north										
24	L	30	10.0	0.888	44.7	LOS D	174	0.98	1.02	27.8
25	T	1547	10.0	0.884	35.6	LOS C	174	0.98	1.01	33.8
Approach		**1577**	**10.0**	**0.884**	**35.8**	**LOS C**	**174**	**0.98**	**1.01**	**33.7**
Camden Valley Way south										
31	T	2398	10.0	0.776	10.4	LOS A	152	0.65	0.60	53.3
32	R	248	10.1	0.881	53.2	LOS D	96	1.00	0.99	25.0
Approach		**2646**	**10.0**	**0.881**	**14.4**	**LOS A**	**152**	**0.68**	**0.64**	**48.6**
All Vehicles		**4308**	**9.9**	**0.888**	**22.4**	**LOS B**	**174**	**0.79**	**0.78**	**41.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	22.5	LOS C	0	0.75	0.75
P11	50	31.5	LOS D	0	0.89	0.89
P15	50	34.2	LOS D	0	0.93	0.93
All Peds	**150**	**29.4**	**LOS C**	**0**	**0.85**	**0.85**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR4_AM_2016
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Industrial Road 1

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 120 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Industrial Road 1										
21	L	67	4.5	0.249	33.0	LOS C	26	0.67	0.73	30.0
23	R	224	4.9	0.651	56.9	LOS E	100	0.98	0.83	22.8
Approach		**291**	**4.8**	**0.651**	**51.4**	**LOS D**	**100**	**0.91**	**0.81**	**24.2**
Camden Valley Way north										
24	L	30	10.0	0.893	38.2	LOS C	342	0.88	0.98	30.4
25	T	2513	10.0	0.897	29.1	LOS C	342	0.88	0.90	37.3
Approach		**2543**	**10.0**	**0.897**	**29.2**	**LOS C**	**342**	**0.88**	**0.90**	**37.2**
Camden Valley Way south										
31	T	1399	10.0	0.360	1.6	LOS A	25	0.09	0.08	66.8
32	R	221	10.0	0.900	75.1	LOS F	120	1.00	0.99	19.8
Approach		**1620**	**10.0**	**0.900**	**11.6**	**LOS A**	**120**	**0.22**	**0.20**	**51.6**
All Vehicles		**4454**	**9.7**	**0.900**	**24.3**	**LOS B**	**342**	**0.64**	**0.64**	**39.8**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	17.1	LOS B	0	0.53	0.53
P11	50	51.3	LOS E	0	0.93	0.93
P15	50	54.2	LOS E	0	0.95	0.95
All Peds	**150**	**40.9**	**LOS C**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR4_PM_2016
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Industrial Road 1

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 110 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Industrial Road 1										
21	L	45	4.4	0.144	26.8	LOS B	15	0.60	0.71	32.6
23	R	40	5.0	0.107	45.8	LOS D	19	0.84	0.74	25.7
Approach		**85**	**4.7**	**0.144**	**35.7**	**LOS C**	**19**	**0.72**	**0.72**	**28.9**
Camden Valley Way north										
24	L	30	10.0	0.868	39.2	LOS C	268	0.90	0.96	30.0
25	T	2135	10.0	0.868	30.1	LOS C	268	0.90	0.89	36.7
Approach		**2166**	**10.0**	**0.868**	**30.2**	**LOS C**	**268**	**0.90**	**0.89**	**36.6**
Camden Valley Way south										
31	T	2630	10.0	0.702	3.7	LOS A	100	0.27	0.25	62.9
32	R	248	10.1	0.829	62.0	LOS E	115	1.00	0.93	22.6
Approach		**2878**	**10.0**	**0.829**	**8.8**	**LOS A**	**115**	**0.34**	**0.31**	**55.2**
All Vehicles		**5129**	**9.9**	**0.868**	**18.3**	**LOS B**	**268**	**0.58**	**0.56**	**44.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	19.8	LOS B	0	0.60	0.60
P11	50	46.4	LOS E	0	0.92	0.92
P15	50	49.2	LOS E	0	0.95	0.95
All Peds	**150**	**38.4**	**LOS C**	**0**	**0.82**	**0.82**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR4_AM_2026
K:\60020921_ORANPKPREC\05_Eng_Plan\Analysis\SIDRA Intersection\July Report models\AM 2026 Scenario 1.aap
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SIDRA INTERSECTION

Movement Summary

Camden Valley Way / Industrial Road 1

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 130 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Industrial Road 1										
21	L	93	5.4	0.381	36.8	LOS C	39	0.70	0.75	28.5
23	R	246	4.9	0.775	66.6	LOS E	123	1.00	0.92	20.8
Approach		**339**	**5.0**	**0.775**	**58.5**	**LOS E**	**123**	**0.92**	**0.87**	**22.5**
Camden Valley Way north										
24	L	30	10.0	0.884	35.2	LOS C	353	0.85	0.95	31.8
25	T	2596	10.0	0.889	26.2	LOS B	354	0.85	0.84	39.2
Approach		**2626**	**10.0**	**0.888**	**26.3**	**LOS B**	**354**	**0.85**	**0.84**	**39.1**
Camden Valley Way south										
31	T	2011	10.0	0.501	1.7	LOS A	41	0.10	0.09	66.7
32	R	221	10.0	0.872	76.3	LOS F	124	1.00	0.95	19.5
Approach		**2232**	**10.0**	**0.872**	**9.1**	**LOS A**	**124**	**0.19**	**0.18**	**54.8**
All Vehicles		**5197**	**9.7**	**0.889**	**21.0**	**LOS B**	**354**	**0.57**	**0.56**	**42.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P9	50	16.8	LOS B	0	0.51	0.51
P11	50	56.3	LOS E	0	0.93	0.93
P15	50	59.1	LOS E	0	0.95	0.95
All Peds	**150**	**44.1**	**LOS D**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: TR4_PM_2026
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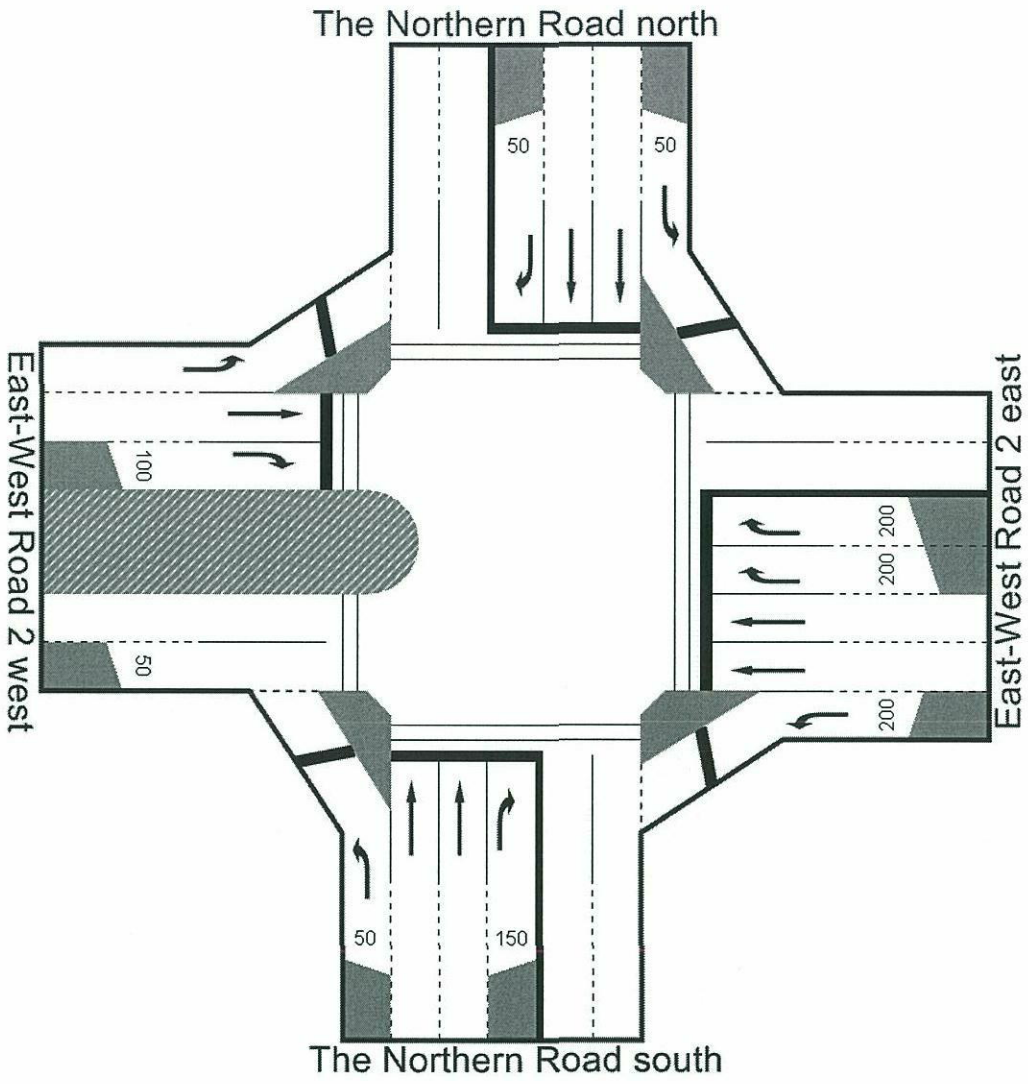
The Northern Road north
50
50
East-West Road 2 west
100
50
East-West Road 2 east
200
200
200
50
150
The Northern Road south

SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 2

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 90 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	20	10.0	0.052	26.1	LOS B	5	0.52	0.68	38.1
2	T	804	10.0	0.898	46.1	LOS D	157	1.00	1.02	29.3
3	R	351	10.0	0.868	52.8	LOS D	135	1.00	0.98	26.0
Approach		**1175**	**10.0**	**0.898**	**47.8**	**LOS D**	**157**	**0.99**	**1.01**	**28.4**
East-West Road 2 east										
4	L	94	5.3	0.107	21.8	LOS B	23	0.57	0.73	39.3
5	T	20	5.0	0.041	32.2	LOS C	6	0.84	0.58	31.8
6	R	220	5.0	0.920	68.6	LOS E	55	1.00	1.04	21.8
Approach		**334**	**5.1**	**0.920**	**53.3**	**LOS D**	**55**	**0.87**	**0.92**	**25.5**
The Northern Road north										
7	L	56	10.7	0.147	26.5	LOS B	15	0.54	0.70	37.7
8	T	606	10.1	0.677	34.2	LOS C	101	0.92	0.79	34.5
9	R	20	5.0	0.066	38.1	LOS C	7	0.72	0.71	31.3
Approach		**682**	**10.0**	**0.677**	**33.7**	**LOS C**	**101**	**0.88**	**0.78**	**34.6**
East-West Road 2 west										
10	L	20	5.0	0.023	21.1	LOS B	5	0.54	0.68	39.7
11	T	20	5.0	0.056	32.5	LOS C	8	0.85	0.61	31.7
12	R	20	5.0	0.167	54.4	LOS D	10	0.97	0.70	25.2
Approach		**60**	**5.0**	**0.167**	**36.0**	**LOS C**	**10**	**0.79**	**0.66**	**31.1**
All Vehicles		**2251**	**9.1**	**0.920**	**44.0**	**LOS D**	**157**	**0.93**	**0.92**	**29.6**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	39.2	LOS D	0	0.93	0.93
P3	50	37.4	LOS D	0	0.91	0.91
P5	50	39.2	LOS D	0	0.93	0.93

P7	50	32.1	LOS D	0	0.84	0.84
All Peds	**200**	**37.0**	**LOS C**	**0**	**0.91**	**0.91**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP1_AM_2016
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SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 2

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	20	10.0	0.040	19.7	LOS B	4	0.42	0.67	42.7
2	T	662	10.0	0.629	27.1	LOS B	93	0.86	0.74	38.6
3	R	138	10.1	0.708	49.5	LOS D	55	1.00	0.84	27.0
Approach		**820**	**10.0**	**0.708**	**30.7**	**LOS C**	**93**	**0.88**	**0.75**	**36.2**
East-West Road 2 east										
4	L	324	4.9	0.452	27.7	LOS B	80	0.78	0.81	35.7
5	T	20	5.0	0.037	27.0	LOS B	5	0.82	0.57	34.5
6	R	210	5.2	0.673	51.0	LOS D	43	1.00	0.84	26.2
Approach		**555**	**5.0**	**0.673**	**36.5**	**LOS C**	**80**	**0.87**	**0.81**	**31.4**
The Northern Road north										
7	L	150	10.0	0.312	20.8	LOS B	29	0.48	0.72	41.9
8	T	769	10.0	0.730	29.2	LOS C	113	0.91	0.81	37.3
9	R	20	5.0	0.099	44.9	LOS D	8	0.89	0.70	28.5
Approach		**939**	**9.9**	**0.730**	**28.2**	**LOS B**	**113**	**0.84**	**0.80**	**37.7**
East-West Road 2 west										
10	L	20	5.0	0.028	24.1	LOS B	5	0.63	0.69	37.8
11	T	20	5.0	0.050	27.2	LOS B	7	0.82	0.59	34.3
12	R	20	5.0	0.127	47.2	LOS D	9	0.95	0.70	27.3
Approach		**60**	**5.0**	**0.127**	**32.8**	**LOS C**	**9**	**0.80**	**0.66**	**32.5**
All Vehicles		**2374**	**8.7**	**0.730**	**31.1**	**LOS C**	**113**	**0.86**	**0.78**	**35.3**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	34.2	LOS D	0	0.93	0.93
P3	50	31.5	LOS D	0	0.89	0.89
P5	50	34.2	LOS D	0	0.93	0.93

P7	50	26.4	LOS C	0	0.81	0.81
All Peds	**200**	**31.6**	**LOS C**	**0**	**0.89**	**0.89**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 2

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 110 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	20	10.0	0.053	24.7	LOS B	5	0.44	0.67	38.9
2	T	967	10.0	0.880	47.3	LOS D	208	0.99	0.98	28.9
3	R	379	10.0	0.891	62.7	LOS E	173	1.00	1.00	23.2
Approach		**1366**	**10.0**	**0.891**	**51.3**	**LOS D**	**208**	**0.99**	**0.99**	**27.2**
East-West Road 2 east										
4	L	188	4.8	0.230	28.0	LOS B	56	0.65	0.76	35.5
5	T	20	5.0	0.051	42.8	LOS D	8	0.88	0.61	27.6
6	R	256	5.1	0.873	73.4	LOS F	69	1.00	0.98	20.8
Approach		**464**	**5.0**	**0.873**	**53.7**	**LOS D**	**69**	**0.85**	**0.88**	**25.4**
The Northern Road north										
7	L	87	10.3	0.233	25.5	LOS B	23	0.47	0.70	38.4
8	T	983	10.0	0.895	49.3	LOS D	216	1.00	1.01	28.2
9	R	20	5.0	0.076	43.1	LOS D	8	0.71	0.71	29.2
Approach		**1090**	**9.9**	**0.895**	**47.3**	**LOS D**	**216**	**0.95**	**0.98**	**28.8**
East-West Road 2 west										
10	L	20	5.0	0.025	26.0	LOS B	7	0.57	0.69	36.7
11	T	20	5.0	0.069	43.1	LOS D	10	0.88	0.63	27.5
12	R	20	5.0	0.136	61.5	LOS E	12	0.96	0.71	23.4
Approach		**60**	**5.0**	**0.136**	**43.5**	**LOS D**	**12**	**0.81**	**0.68**	**28.2**
All Vehicles		**2980**	**9.1**	**0.895**	**50.1**	**LOS D**	**216**	**0.95**	**0.96**	**27.5**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	49.2	LOS E	0	0.95	0.95
P3	50	37.6	LOS D	0	0.83	0.83
P5	50	49.2	LOS E	0	0.95	0.95

P7	50	32.8	LOS D	0	0.77	0.77
All Peds	**200**	**42.2**	**LOS C**	**0**	**0.87**	**0.87**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP1_AM_2026
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SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 2

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 90 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	20	10.0	0.042	20.0	LOS B	4	0.40	0.67	42.5
2	T	1048	10.0	0.920	45.7	LOS D	206	1.00	1.07	29.5
3	R	220	10.0	0.879	58.7	LOS E	94	1.00	0.97	24.3
Approach		**1288**	**10.0**	**0.920**	**47.5**	**LOS D**	**206**	**0.99**	**1.05**	**28.6**
East-West Road 2 east										
4	L	362	5.0	0.505	30.5	LOS C	98	0.80	0.82	34.2
5	T	20	5.0	0.041	32.2	LOS C	6	0.84	0.58	31.8
6	R	265	4.9	0.831	60.0	LOS E	60	1.00	0.95	23.7
Approach		**647**	**4.9**	**0.831**	**42.6**	**LOS D**	**98**	**0.88**	**0.86**	**28.9**
The Northern Road north										
7	L	175	10.2	0.383	21.3	LOS B	35	0.46	0.72	41.5
8	T	926	10.0	0.813	33.9	LOS C	154	0.94	0.89	34.7
9	R	20	5.0	0.077	45.8	LOS D	8	0.85	0.71	28.1
Approach		**1122**	**10.0**	**0.813**	**32.1**	**LOS C**	**154**	**0.87**	**0.86**	**35.4**
East-West Road 2 west										
10	L	20	5.0	0.028	26.0	LOS B	6	0.63	0.69	36.7
11	T	20	5.0	0.056	32.5	LOS C	8	0.85	0.61	31.7
12	R	20	5.0	0.125	51.5	LOS D	9	0.95	0.70	26.0
Approach		**60**	**5.0**	**0.125**	**36.7**	**LOS C**	**9**	**0.81**	**0.67**	**30.8**
All Vehicles		**3117**	**8.9**	**0.920**	**40.8**	**LOS C**	**206**	**0.92**	**0.93**	**30.8**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	39.2	LOS D	0	0.93	0.93
P3	50	32.1	LOS D	0	0.84	0.84
P5	50	39.2	LOS D	0	0.93	0.93

P7	50	27.2	LOS C	0	0.78	0.78
All Peds	**200**	**34.4**	**LOS C**	**0**	**0.87**	**0.87**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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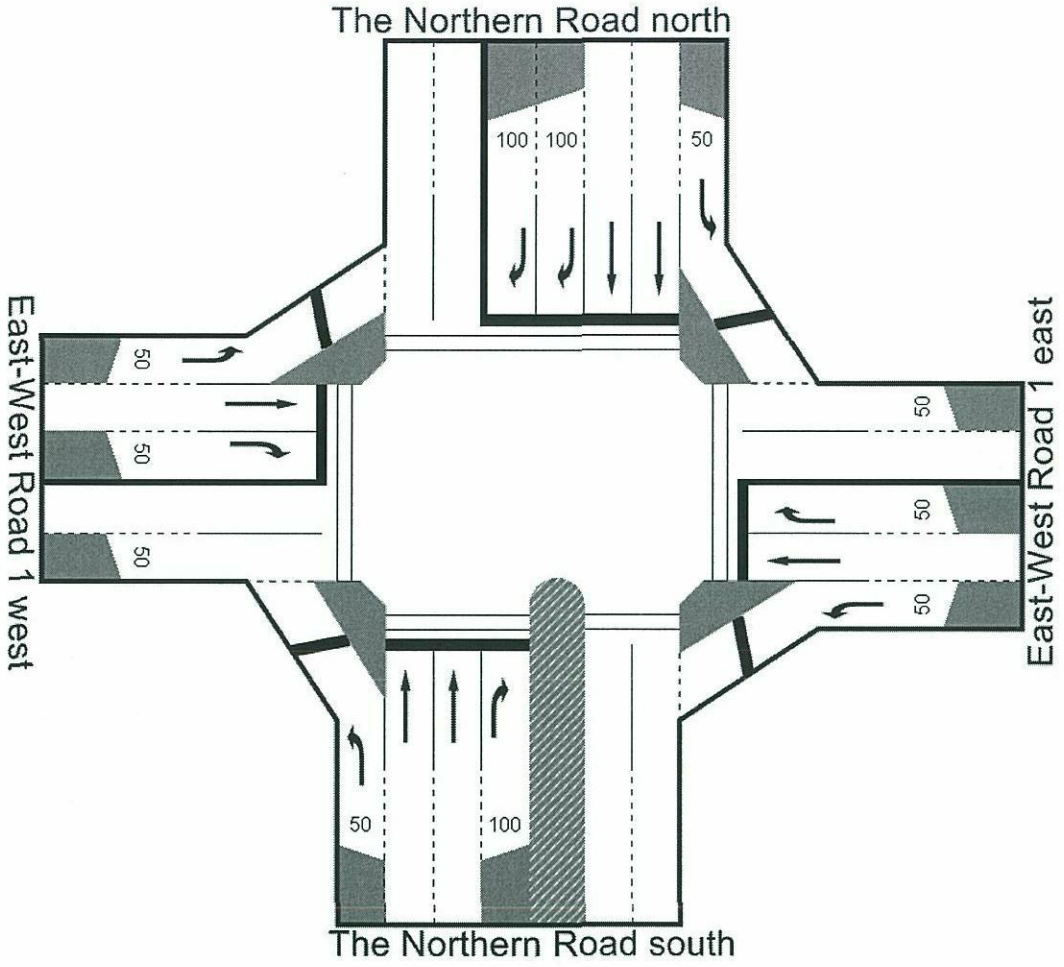
The Northern Road north
100
100
50
East-West Road 1 west
50
50
50
East-West Road 1 east
50
50
50
50
100
The Northern Road south

SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 1

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	12	8.3	0.024	19.6	LOS B	2	0.42	0.66	42.8
2	T	703	10.0	0.640	26.2	LOS B	97	0.86	0.74	39.1
3	R	20	10.0	0.154	49.2	LOS D	9	0.94	0.70	27.0
Approach		**735**	**9.9**	**0.640**	**26.8**	**LOS B**	**97**	**0.85**	**0.73**	**38.7**
East-West Road 1 east										
4	L	20	5.0	0.053	24.1	LOS B	5	0.63	0.68	37.8
5	T	182	4.9	0.385	27.3	LOS B	56	0.88	0.72	34.3
6	R	16	6.2	0.120	48.4	LOS D	7	0.96	0.69	27.0
Approach		**218**	**5.0**	**0.385**	**28.6**	**LOS C**	**56**	**0.86**	**0.71**	**33.9**
The Northern Road north										
7	L	20	10.0	0.040	19.7	LOS B	4	0.42	0.67	42.7
8	T	628	10.0	0.572	25.6	LOS B	86	0.83	0.70	39.6
9	R	62	9.7	0.357	50.0	LOS D	20	0.96	0.73	26.8
Approach		**710**	**10.0**	**0.572**	**27.5**	**LOS B**	**86**	**0.83**	**0.70**	**38.1**
East-West Road 1 west										
10	L	373	5.1	0.997	32.7	LOS C	93	0.98	0.85	33.2
11	T	307	4.9	0.650	29.7	LOS C	92	0.95	0.81	33.0
12	R	20	5.0	0.149	48.6	LOS D	9	0.97	0.70	26.9
Approach		**700**	**5.0**	**0.997**	**31.9**	**LOS C**	**93**	**0.97**	**0.83**	**32.9**
All Vehicles		**2363**	**8.0**	**0.997**	**28.7**	**LOS C**	**97**	**0.88**	**0.75**	**36.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	31.5	LOS D	0	0.89	0.89
P3	50	25.6	LOS C	0	0.80	0.80
P5	50	34.2	LOS D	0	0.93	0.93

P7	50	25.6	LOS C	0	0.80	0.80
All Peds	**200**	**29.2**	**LOS C**	**0**	**0.85**	**0.85**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 1

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 90 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	12	8.3	0.030	25.1	LOS B	3	0.50	0.66	38.7
2	T	631	10.0	0.674	33.3	LOS C	103	0.91	0.78	35.0
3	R	20	10.0	0.061	42.0	LOS C	8	0.79	0.71	29.7
Approach		**663**	**10.0**	**0.674**	**33.4**	**LOS C**	**103**	**0.90**	**0.78**	**34.8**
East-West Road 1 east										
4	L	20	5.0	0.051	21.7	LOS B	5	0.55	0.68	39.3
5	T	313	5.1	0.746	37.9	LOS C	109	0.99	0.89	29.4
6	R	10	9.1	0.095	53.8	LOS D	6	0.97	0.68	25.4
Approach		**344**	**5.2**	**0.746**	**37.5**	**LOS C**	**109**	**0.96**	**0.88**	**29.7**
The Northern Road north										
7	L	20	10.0	0.051	25.2	LOS B	5	0.51	0.68	38.6
8	T	701	10.0	0.749	35.3	LOS C	118	0.94	0.84	33.9
9	R	337	10.1	0.772	48.7	LOS D	96	0.95	0.86	27.2
Approach		**1058**	**10.0**	**0.772**	**39.4**	**LOS C**	**118**	**0.94**	**0.85**	**31.6**
East-West Road 1 west										
10	L	120	5.0	0.311	22.6	LOS B	30	0.59	0.73	38.7
11	T	200	5.0	0.476	33.5	LOS C	69	0.92	0.76	31.3
12	R	20	5.0	0.167	54.4	LOS D	10	0.97	0.70	25.2
Approach		**340**	**5.0**	**0.477**	**30.9**	**LOS C**	**69**	**0.81**	**0.74**	**33.1**
All Vehicles		**2405**	**8.6**	**0.772**	**36.3**	**LOS C**	**118**	**0.91**	**0.82**	**32.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	36.5	LOS D	0	0.90	0.90
P3	50	31.2	LOS D	0	0.83	0.83
P5	50	39.2	LOS D	0	0.93	0.93

P7	50	31.2	LOS D	0	0.83	0.83
All Peds	**200**	**34.5**	**LOS C**	**0**	**0.88**	**0.88**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP2_PM_2016
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SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 1

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 90 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	12	8.3	0.025	19.9	LOS B	2	0.39	0.66	42.5
2	T	791	10.0	0.648	26.6	LOS B	114	0.83	0.72	38.9
3	R	20	10.0	0.173	55.0	LOS D	10	0.95	0.70	25.2
Approach		**823**	**10.0**	**0.648**	**27.2**	**LOS B**	**114**	**0.83**	**0.72**	**38.4**
East-West Road 1 east										
4	L	20	5.0	0.058	26.0	LOS B	6	0.63	0.68	36.7
5	T	213	5.2	0.423	29.8	LOS C	70	0.87	0.73	33.0
6	R	28	3.6	0.232	54.7	LOS D	14	0.98	0.72	25.2
Approach		**261**	**5.0**	**0.423**	**32.1**	**LOS C**	**70**	**0.87**	**0.72**	**32.1**
The Northern Road north										
7	L	20	10.0	0.042	20.0	LOS B	4	0.40	0.67	42.5
8	T	1039	10.0	0.851	34.7	LOS C	177	0.96	0.94	34.2
9	R	124	9.7	0.803	59.2	LOS E	46	0.99	0.83	24.1
Approach		**1183**	**10.0**	**0.851**	**37.0**	**LOS C**	**177**	**0.95**	**0.92**	**32.9**
East-West Road 1 west										
10	L	468	6.7	1.000#	35.6	LOS C	93	0.99	0.85	31.9
11	T	290	3.6	0.841	40.6	LOS C	149	1.00	1.00	28.3
12	R	20	5.0	0.167	54.4	LOS D	10	0.97	0.70	25.2
Approach		**653**	**5.0**	**1.000**	**46.2**	**LOS C**	**149**	**1.19**	**1.10**	**29.7**
All Vehicles		**3046**	**8.1**	**1.000**	**34.4**	**LOS C**	**177**	**0.92**	**0.85**	**33.3**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	32.9	LOS D	0	0.86	0.86
P3	50	25.7	LOS C	0	0.76	0.76
P5	50	35.6	LOS D	0	0.89	0.89

P7	50	25.7	LOS C	0	0.76	0.76
All Peds	**200**	**30.0**	**LOS C**	**0**	**0.81**	**0.81**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

The Northern Road / East-West Road 1

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 110 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	12	8.3	0.032	25.4	LOS B	3	0.45	0.66	38.5
2	T	1035	10.0	0.889	46.7	LOS D	223	0.99	1.00	29.1
3	R	20	10.0	0.053	46.0	LOS D	9	0.75	0.71	28.2
Approach		**1068**	**10.0**	**0.889**	**46.5**	**LOS D**	**223**	**0.98**	**0.99**	**29.1**
East-West Road 1 east										
4	L	20	5.0	0.061	25.4	LOS B	6	0.56	0.68	37.0
5	T	325	4.9	0.901	60.7	LOS E	153	1.00	1.07	22.5
6	R	17	5.9	0.175	65.7	LOS E	10	0.98	0.70	22.5
Approach		**362**	**5.0**	**0.901**	**59.0**	**LOS E**	**153**	**0.98**	**1.03**	**23.0**
The Northern Road north										
7	L	20	10.0	0.054	25.5	LOS B	5	0.45	0.67	38.4
8	T	795	10.1	0.683	34.3	LOS C	139	0.87	0.75	34.4
9	R	441	10.0	0.874	59.2	LOS E	151	0.95	0.93	24.1
Approach		**1257**	**10.0**	**0.874**	**42.9**	**LOS D**	**151**	**0.89**	**0.81**	**30.1**
East-West Road 1 west										
10	L	176	5.1	0.546	27.2	LOS B	52	0.63	0.75	36.0
11	T	222	5.0	0.616	44.8	LOS D	92	0.97	0.81	26.9
12	R	20	5.0	0.204	66.0	LOS E	12	0.99	0.70	22.3
Approach		**418**	**5.0**	**0.616**	**38.4**	**LOS C**	**92**	**0.83**	**0.78**	**29.9**
All Vehicles		**3105**	**8.8**	**0.901**	**45.4**	**LOS D**	**223**	**0.92**	**0.89**	**28.8**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	45.5	LOS E	0	0.91	0.91
P3	50	31.3	LOS D	0	0.75	0.75
P5	50	48.2	LOS E	0	0.94	0.94

P7	50	31.3	LOS D	0	0.75	0.75
All Peds	**200**	**39.1**	**LOS C**	**0**	**0.84**	**0.84**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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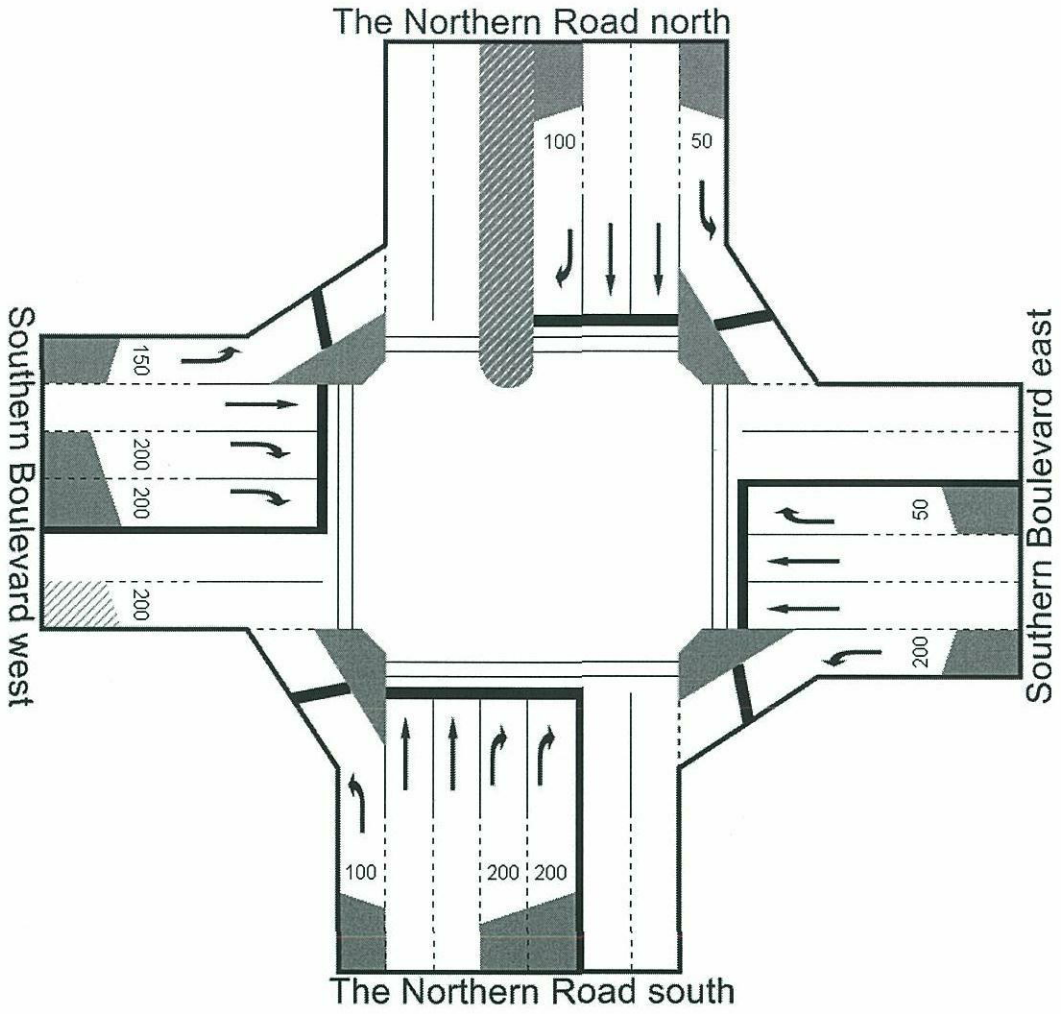
The Northern Road north
100
50
Southern Boulevard west
150
200
200
200
Southern Boulevard east
50
200
100
200
200
The Northern Road south

SIDRA INTERSECTION

Movement Summary

The Northern Road / Southern Boulevard

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 90 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	32	9.4	0.043	20.1	LOS B	6	0.40	0.68	42.4
2	T	703	10.0	0.814	39.5	LOS C	127	0.98	0.91	32.0
3	R	297	10.1	0.772	55.8	LOS D	65	1.00	0.87	25.1
Approach		**1032**	**10.0**	**0.814**	**43.6**	**LOS D**	**127**	**0.97**	**0.90**	**29.9**
Southern Boulevard east										
4	L	161	5.0	0.224	27.7	LOS B	45	0.70	0.77	35.7
5	T	132	5.3	0.156	30.7	LOS C	25	0.84	0.65	32.6
6	R	20	5.0	0.078	43.5	LOS D	8	0.87	0.71	28.6
Approach		**313**	**5.1**	**0.224**	**30.0**	**LOS C**	**45**	**0.77**	**0.71**	**33.8**
The Northern Road north										
7	L	20	10.0	0.042	20.0	LOS B	4	0.40	0.67	42.5
8	T	628	10.0	0.728	36.2	LOS C	108	0.95	0.83	33.5
9	R	20	10.0	0.104	49.4	LOS D	9	0.89	0.71	27.0
Approach		**668**	**10.0**	**0.728**	**36.1**	**LOS C**	**108**	**0.93**	**0.82**	**33.5**
Southern Boulevard west										
10	L	20	5.0	0.028	26.0	LOS B	6	0.63	0.69	36.7
11	T	203	4.9	0.479	33.5	LOS C	70	0.92	0.76	31.3
12	R	489	4.9	0.818	54.1	LOS D	96	1.00	0.96	25.3
Approach		**712**	**4.9**	**0.818**	**47.4**	**LOS D**	**96**	**0.97**	**0.90**	**27.0**
All Vehicles		**2725**	**8.1**	**0.818**	**41.2**	**LOS C**	**127**	**0.94**	**0.86**	**30.3**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	39.2	LOS D	0	0.93	0.93
P3	50	36.5	LOS D	0	0.90	0.90
P5	50	37.4	LOS D	0	0.91	0.91

P7	50	35.6	LOS D	0	0.89	0.89
All Peds	**200**	**37.1**	**LOS C**	**0**	**0.91**	**0.91**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

The Northern Road / Southern Boulevard

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	69	10.1	0.095	21.7	LOS B	14	0.48	0.70	41.2
2	T	703	10.0	0.844	37.9	LOS C	120	1.00	0.96	32.7
3	R	297	10.1	0.857	54.9	LOS D	62	1.00	0.93	25.3
Approach		**1069**	**10.0**	**0.857**	**41.6**	**LOS C**	**120**	**0.96**	**0.93**	**30.7**
Southern Boulevard east										
4	L	139	5.0	0.182	24.0	LOS B	34	0.66	0.75	37.8
5	T	424	5.0	0.444	27.8	LOS B	64	0.89	0.74	34.0
6	R	20	5.0	0.089	43.4	LOS D	8	0.91	0.71	28.6
Approach		**583**	**5.0**	**0.444**	**27.4**	**LOS B**	**64**	**0.84**	**0.74**	**34.7**
The Northern Road north										
7	L	20	10.0	0.043	21.2	LOS B	4	0.46	0.67	41.5
8	T	628	10.0	0.755	33.8	LOS C	101	0.96	0.86	34.7
9	R	20	10.0	0.115	46.3	LOS D	8	0.91	0.70	28.1
Approach		**668**	**10.0**	**0.755**	**33.8**	**LOS C**	**101**	**0.94**	**0.85**	**34.6**
Southern Boulevard west										
10	L	20	5.0	0.026	22.8	LOS B	5	0.60	0.69	38.6
11	T	139	5.0	0.291	26.6	LOS B	44	0.85	0.69	34.7
12	R	355	5.1	0.792	51.0	LOS D	68	1.00	0.93	26.2
Approach		**514**	**5.1**	**0.792**	**43.3**	**LOS D**	**68**	**0.94**	**0.86**	**28.4**
All Vehicles		**2834**	**8.1**	**0.857**	**37.1**	**LOS C**	**120**	**0.93**	**0.86**	**31.8**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	34.2	LOS D	0	0.93	0.93
P3	50	34.2	LOS D	0	0.93	0.93
P5	50	32.4	LOS D	0	0.90	0.90

P7	50	33.3	LOS D	0	0.91	0.91
All Peds	**200**	**33.5**	**LOS C**	**0**	**0.92**	**0.92**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

The Northern Road / Southern Boulevard

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 120 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	32	9.4	0.043	18.8	LOS B	6	0.31	0.67	43.5
2	T	792	10.0	0.659	36.2	LOS C	146	0.85	0.74	33.5
3	R	452	10.0	0.869	71.5	LOS F	118	1.00	0.95	21.2
Approach		**1276**	**10.0**	**0.869**	**48.2**	**LOS D**	**146**	**0.89**	**0.81**	**28.1**
Southern Boulevard east										
4	L	247	4.9	0.375	38.5	LOS C	88	0.78	0.80	30.7
5	T	179	5.0	0.282	47.7	LOS D	45	0.92	0.72	26.0
6	R	20	5.0	0.100	55.5	LOS D	11	0.88	0.71	24.9
Approach		**446**	**4.9**	**0.375**	**42.9**	**LOS D**	**88**	**0.84**	**0.76**	**28.4**
The Northern Road north										
7	L	20	10.0	0.042	18.7	LOS B	4	0.31	0.66	43.6
8	T	1039	10.0	0.864	45.8	LOS D	229	0.97	0.94	29.4
9	R	20	10.0	0.077	56.9	LOS E	11	0.84	0.71	24.7
Approach		**1079**	**10.0**	**0.864**	**45.5**	**LOS D**	**229**	**0.96**	**0.93**	**29.5**
Southern Boulevard west										
10	L	20	5.0	0.033	34.3	LOS C	8	0.67	0.70	32.5
11	T	261	5.0	0.821	58.0	LOS E	125	1.00	0.95	23.1
12	R	490	4.9	0.862	71.5	LOS F	123	1.00	1.00	21.3
Approach		**771**	**4.9**	**0.862**	**66.0**	**LOS E**	**125**	**0.99**	**0.97**	**22.1**
All Vehicles		**3572**	**8.3**	**0.869**	**50.6**	**LOS D**	**229**	**0.93**	**0.88**	**26.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	54.2	LOS E	0	0.95	0.95
P3	50	36.0	LOS D	0	0.77	0.77
P5	50	52.3	LOS E	0	0.93	0.93

P7	50	35.3	LOS D	0	0.77	0.77
All Peds	**200**	**44.4**	**LOS D**	**0**	**0.86**	**0.86**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

The Northern Road / Southern Boulevard

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 110 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	69	10.1	0.099	21.1	LOS B	15	0.38	0.69	41.6
2	T	1035	10.0	0.880	45.4	LOS D	219	0.99	0.98	29.6
3	R	500	10.0	0.881	67.2	LOS E	121	1.00	0.98	22.2
Approach		**1605**	**10.0**	**0.881**	**51.1**	**LOS D**	**219**	**0.96**	**0.97**	**27.2**
Southern Boulevard east										
4	L	238	5.0	0.332	33.0	LOS C	76	0.74	0.79	33.0
5	T	528	4.9	0.761	49.3	LOS D	113	1.00	0.90	25.5
6	R	20	5.0	0.094	56.5	LOS D	11	0.92	0.71	24.6
Approach		**786**	**5.0**	**0.761**	**44.6**	**LOS D**	**113**	**0.92**	**0.86**	**27.4**
The Northern Road north										
7	L	20	10.0	0.045	20.7	LOS B	4	0.36	0.66	41.9
8	T	795	10.1	0.676	34.2	LOS C	139	0.86	0.75	34.5
9	R	20	10.0	0.071	51.6	LOS D	10	0.82	0.71	26.3
Approach		**836**	**10.0**	**0.676**	**34.3**	**LOS C**	**139**	**0.85**	**0.75**	**34.4**
Southern Boulevard west										
10	L	20	5.0	0.030	29.7	LOS C	7	0.63	0.69	34.6
11	T	190	5.2	0.551	44.9	LOS D	81	0.96	0.79	26.9
12	R	362	5.0	0.854	69.1	LOS E	90	1.00	0.98	21.7
Approach		**573**	**5.1**	**0.854**	**59.7**	**LOS E**	**90**	**0.97**	**0.91**	**23.5**
All Vehicles		**3800**	**8.2**	**0.881**	**47.4**	**LOS D**	**219**	**0.93**	**0.89**	**27.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	49.2	LOS E	0	0.95	0.95
P3	50	34.4	LOS D	0	0.79	0.79
P5	50	47.3	LOS E	0	0.93	0.93

P7	50	33.6	LOS D	0	0.78	0.78
All Peds	**200**	**41.1**	**LOS C**	**0**	**0.86**	**0.86**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP3_PM_2026
K:\60020921_ORANPKPREC\05_Eng_Plan\Analysis\SIDRA Intersection\July Report models\PM 2026 Scenario 1.aap
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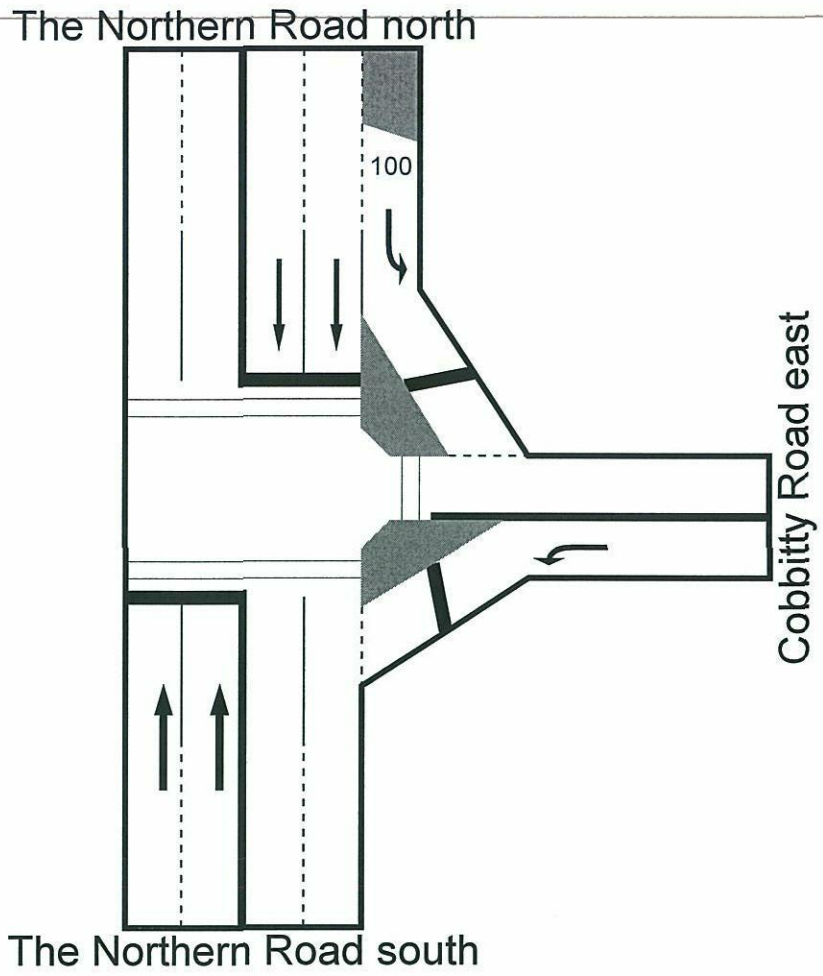
The Northern Road north
100
Cobbitty Road east
The Northern Road south

SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road east

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 40 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
2	T	1032	10.0	0.805	15.6	LOS B	90	0.91	0.89	47.6
Approach		**1032**	**10.0**	**0.805**	**15.6**	**LOS B**	**90**	**0.91**	**0.89**	**47.6**
Cobbitty Road east										
4	L	508	4.9	0.809	24.9	LOS B	92	0.97	1.04	33.8
Approach		**508**	**4.9**	**0.809**	**24.9**	**LOS B**	**92**	**0.97**	**1.04**	**33.8**
The Northern Road north										
7	L	401	10.0	0.661	20.6	LOS B	62	0.82	0.84	41.0
8	T	877	10.0	0.684	12.6	LOS A	68	0.83	0.75	50.8
Approach		**1278**	**10.0**	**0.684**	**15.1**	**LOS B**	**68**	**0.83**	**0.78**	**47.5**
All Vehicles		**2818**	**9.1**	**0.809**	**17.0**	**LOS B**	**92**	**0.88**	**0.86**	**44.2**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	53	14.4	LOS B	0	0.85	0.85
P3	53	9.8	LOS A	0	0.70	0.70
P5	53	14.4	LOS B	0	0.85	0.85
All Peds	**159**	**12.9**	**LOS A**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue

- Density for continuous movement

SIDRA SOLUTIONS

Site: OP4_AM_2016
K:\60020921_ORANPKPREC\05_Eng_Plan\Analysis\SIDRA Intersection\July Report models\AM 2016 Scenario 1.aap
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SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road east

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 40 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
2	T	1123	10.0	0.876	19.7	LOS B	109	0.96	1.02	43.9
Approach		**1123**	**10.0**	**0.876**	**19.7**	**LOS B**	**109**	**0.96**	**1.02**	**43.9**
Cobbitty Road east										
4	L	556	5.0	0.886	31.1	LOS C	115	1.00	1.21	31.0
Approach		**556**	**5.0**	**0.886**	**31.1**	**LOS C**	**115**	**1.00**	**1.21**	**31.0**
The Northern Road north										
7	L	299	10.0	0.493	19.2	LOS B	43	0.73	0.78	42.2
8	T	895	10.0	0.699	12.8	LOS A	71	0.84	0.76	50.5
Approach		**1195**	**10.0**	**0.699**	**14.4**	**LOS A**	**71**	**0.82**	**0.77**	**48.3**
All Vehicles		**2874**	**9.0**	**0.886**	**19.7**	**LOS B**	**115**	**0.91**	**0.95**	**42.1**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	53	14.4	LOS B	0	0.85	0.85
P3	53	9.8	LOS A	0	0.70	0.70
P5	53	14.4	LOS B	0	0.85	0.85
All Peds	**159**	**12.9**	**LOS A**	**0**	**0.80**	**0.80**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue

- Density for continuous movement

SIDRA SOLUTIONS

Site: OP4_PM_2016
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SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road east

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 50 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
2	T	1275	10.0	0.792	14.0	LOS A	114	0.83	0.80	49.3
Approach		**1276**	**10.0**	**0.792**	**14.0**	**LOS A**	**114**	**0.83**	**0.80**	**49.3**
Cobbitty Road east										
4	L	513	5.1	0.895	36.9	LOS C	127	1.00	1.20	28.8
Approach		**513**	**5.1**	**0.894**	**36.9**	**LOS C**	**127**	**1.00**	**1.20**	**28.8**
The Northern Road north										
7	L	401	10.0	0.526	17.9	LOS B	58	0.64	0.77	43.3
8	T	1375	10.0	0.854	17.6	LOS B	138	0.89	0.92	45.8
Approach		**1777**	**10.0**	**0.854**	**17.6**	**LOS B**	**138**	**0.83**	**0.89**	**45.3**
All Vehicles		**3566**	**9.3**	**0.895**	**19.1**	**LOS B**	**138**	**0.85**	**0.90**	**42.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	53	17.6	LOS B	0	0.84	0.84
P3	53	9.0	LOS A	0	0.60	0.60
P5	53	17.6	LOS B	0	0.84	0.84
All Peds	**159**	**14.8**	**LOS B**	**0**	**0.76**	**0.76**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue

- Density for continuous movement

SIDRA SOLUTIONS

Site: OP4_AM_2026
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SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road east

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 90 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
2	T	1604	10.0	0.896	27.5	LOS B	267	0.90	0.95	38.3
Approach		**1604**	**10.0**	**0.896**	**27.5**	**LOS B**	**267**	**0.90**	**0.95**	**38.3**
Cobbitty Road east										
4	L	599	5.0	0.884	47.1	LOS D	218	1.00	1.10	25.6
Approach		**599**	**5.0**	**0.884**	**47.1**	**LOS D**	**218**	**1.00**	**1.10**	**25.6**
The Northern Road north										
7	L	302	9.9	0.405	20.3	LOS B	58	0.48	0.73	41.3
8	T	1093	10.0	0.610	14.1	LOS A	115	0.62	0.55	49.1
Approach		**1395**	**10.0**	**0.610**	**15.5**	**LOS B**	**115**	**0.59**	**0.59**	**47.3**
All Vehicles		**3598**	**9.1**	**0.896**	**26.1**	**LOS B**	**267**	**0.80**	**0.83**	**37.9**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	53	22.8	LOS C	0	0.71	0.71
P3	53	12.8	LOS B	0	0.53	0.53
P5	53	22.8	LOS C	0	0.71	0.71
All Peds	**159**	**19.4**	**LOS B**	**0**	**0.65**	**0.65**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue

- Density for continuous movement

SIDRA SOLUTIONS

Site: OP4_PM_2026
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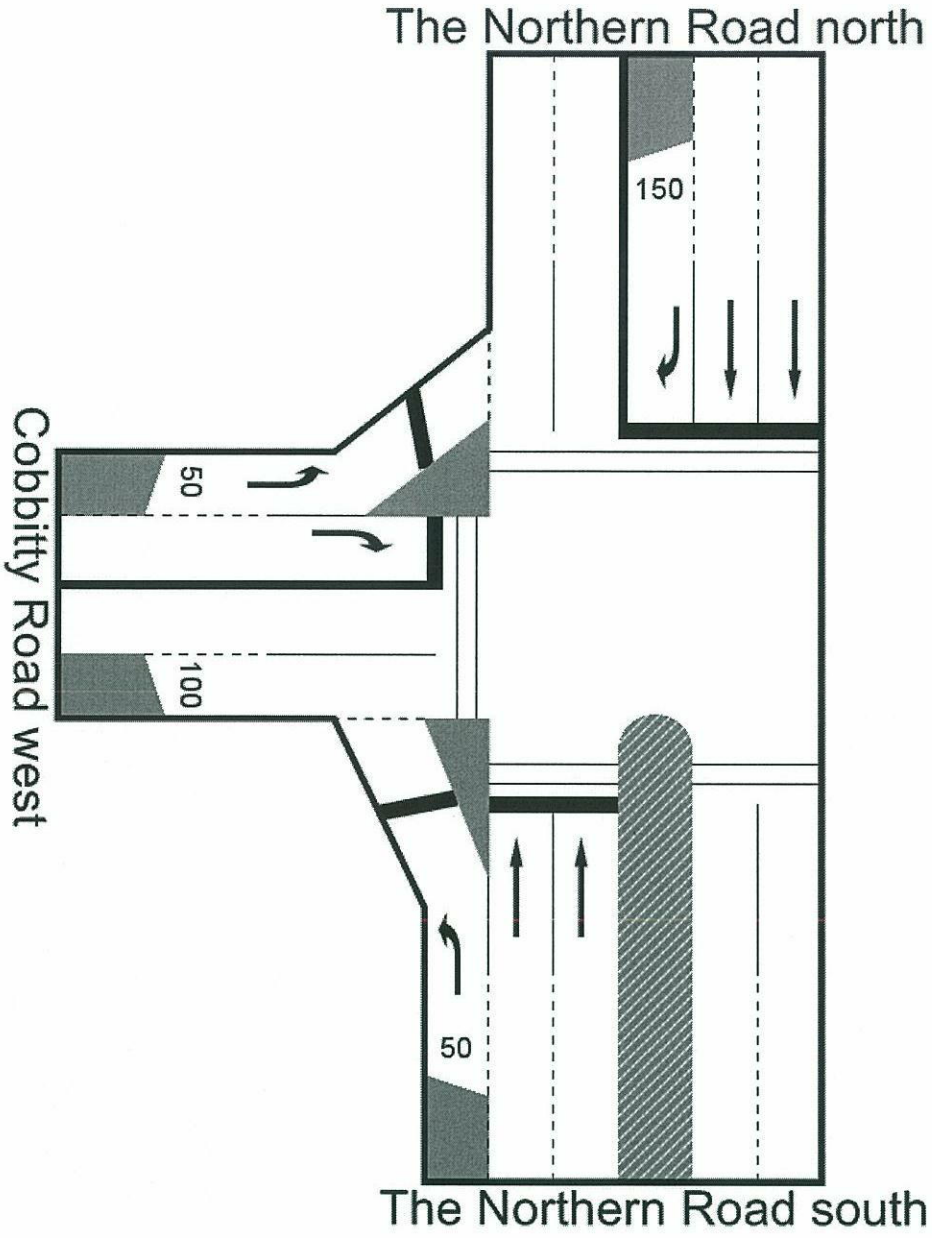
The Northern Road north
150
Cobbitty Road west
50
100
50
The Northern Road south

SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road west

AM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	35	8.6	0.101	31.5	LOS C	10	0.68	0.70	33.8
2	T	1042	10.0	0.843	30.7	LOS C	160	0.95	0.93	36.4
Approach		**1077**	**9.9**	**0.843**	**30.7**	**LOS C**	**160**	**0.94**	**0.92**	**36.3**
The Northern Road north										
8	T	1073	10.0	0.459	3.8	LOS A	51	0.27	0.24	62.8
9	R	312	9.9	0.800	44.8	LOS D	105	0.98	0.92	27.7
Approach		**1385**	**10.0**	**0.800**	**13.0**	**LOS A**	**105**	**0.43**	**0.39**	**49.8**
Cobbitty Road west										
10	L	236	5.1	0.532	19.0	LOS B	49	0.60	0.73	37.0
12	R	90	5.5	0.339	41.9	LOS C	34	0.94	0.77	26.9
Approach		**327**	**5.2**	**0.532**	**25.3**	**LOS B**	**49**	**0.69**	**0.74**	**33.5**
All Vehicles		**2789**	**9.4**	**0.843**	**21.3**	**LOS B**	**160**	**0.66**	**0.64**	**41.4**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	31.5	LOS D	0	0.89	0.89
P5	50	34.2	LOS D	0	0.93	0.93
P7	50	21.8	LOS C	0	0.74	0.74
All Peds	**150**	**29.2**	**LOS C**	**0**	**0.85**	**0.85**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP5_AM_2016
K:\60020921_ORANPKPREC\05_Eng_Plan\Analysis\SIDRA Intersection\July Report models\AM 2016 Scenario 1.aap
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SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road west

PM 2016 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 80 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	74	9.5	0.222	33.1	LOS C	22	0.72	0.73	33.0
2	T	1042	10.0	0.876	34.6	LOS C	170	0.98	0.99	34.3
Approach		**1116**	**9.9**	**0.875**	**34.5**	**LOS C**	**170**	**0.96**	**0.97**	**34.2**
The Northern Road north										
8	T	1087	10.0	0.466	3.8	LOS A	52	0.27	0.24	62.8
9	R	363	9.9	0.881	49.9	LOS D	129	1.00	1.01	26.0
Approach		**1450**	**10.0**	**0.881**	**15.3**	**LOS B**	**129**	**0.45**	**0.43**	**47.4**
Cobbitty Road west										
10	L	81	4.9	0.178	17.3	LOS B	17	0.52	0.69	38.0
12	R	52	5.8	0.194	40.9	LOS C	20	0.91	0.74	27.2
Approach		**133**	**5.3**	**0.194**	**26.5**	**LOS B**	**20**	**0.67**	**0.71**	**32.9**
All Vehicles		**2699**	**9.7**	**0.881**	**23.8**	**LOS B**	**170**	**0.67**	**0.67**	**40.1**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	31.5	LOS D	0	0.89	0.89
P5	50	34.2	LOS D	0	0.93	0.93
P7	50	22.5	LOS C	0	0.75	0.75
All Peds	**150**	**29.4**	**LOS C**	**0**	**0.85**	**0.85**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP5_PM_2016
K:\60020921_ORANPKPREC\05_Eng_Plan\Analysis\SIDRA Intersection\July Report models\PM 2016 Scenario 1.aap
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SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road west

AM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 70 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	32	9.4	0.093	32.5	LOS C	9	0.76	0.71	33.3
2	T	907	10.0	0.867	32.8	LOS C	136	0.99	0.99	35.2
Approach		**939**	**10.0**	**0.867**	**32.8**	**LOS C**	**136**	**0.98**	**0.98**	**35.1**
The Northern Road north										
8	T	1557	10.0	0.726	6.9	LOS A	113	0.55	0.50	58.0
9	R	331	10.0	0.891	47.6	LOS D	111	1.00	1.02	26.7
Approach		**1888**	**10.0**	**0.891**	**14.0**	**LOS A**	**113**	**0.63**	**0.59**	**48.9**
Cobbitty Road west										
10	L	368	4.9	0.720	20.2	LOS B	71	0.64	0.82	36.3
12	R	88	4.5	0.285	36.0	LOS C	28	0.91	0.77	28.9
Approach		**456**	**4.8**	**0.720**	**23.2**	**LOS B**	**71**	**0.69**	**0.81**	**34.6**
All Vehicles		**3283**	**9.3**	**0.891**	**20.7**	**LOS B**	**136**	**0.74**	**0.73**	**41.7**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	26.6	LOS C	0	0.87	0.87
P5	50	29.3	LOS C	0	0.91	0.91
P7	50	22.4	LOS C	0	0.80	0.80
All Peds	**150**	**26.1**	**LOS B**	**0**	**0.86**	**0.86**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP5_AM_2026
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SIDRA INTERSECTION

Movement Summary

The Northern Road / Cobbitty Road west

PM 2026 Intersection Analysis - Scenario 1

Signalised - Fixed time **Cycle Time = 140 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
The Northern Road south										
1	L	72	9.7	0.236	30.0	LOS C	24	0.48	0.69	34.7
2	T	1518	10.0	0.893	37.4	LOS C	361	0.92	0.91	32.9
Approach		**1590**	**10.0**	**0.893**	**37.1**	**LOS C**	**361**	**0.90**	**0.90**	**33.0**
The Northern Road north										
8	T	1251	10.0	0.431	1.3	LOS A	37	0.09	0.08	67.3
9	R	441	10.0	0.890	70.4	LOS E	238	1.00	0.99	20.7
Approach		**1692**	**10.0**	**0.890**	**19.3**	**LOS B**	**238**	**0.33**	**0.32**	**43.7**
Cobbitty Road west										
10	L	86	4.7	0.330	30.6	LOS C	34	0.61	0.71	31.2
12	R	44	4.5	0.285	74.5	LOS F	30	0.97	0.74	19.5
Approach		**130**	**4.6**	**0.330**	**45.5**	**LOS D**	**34**	**0.73**	**0.72**	**26.0**
All Vehicles		**3412**	**9.8**	**0.893**	**28.6**	**LOS C**	**361**	**0.61**	**0.61**	**37.0**

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P1	50	61.3	LOS F	0	0.94	0.94
P5	50	64.1	LOS F	0	0.96	0.96
P7	50	23.4	LOS C	0	0.58	0.58
All Peds	**150**	**49.6**	**LOS D**	**0**	**0.82**	**0.82**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS

- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OP5_PM_2026
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Processed Jul 27, 2007 03:33:10PM

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