APPENDIX I

Traffic and Transport

Volume 6

Port Kembla Port Corporation

4 February 2010

Port Kembla Outer Harbour Development

Traffic Impact Assessment

Port Kembla Outer Harbour Development

Traffic Impact Assessment

Prepared for

Port Kembla Port Corporation

Prepared by

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Executive Summary

Port Kembla Port Corporation (PKPC) proposes to develop additional landside facilities in the Outer Harbour of Port Kembla to attract new trades and to increase the volume of existing cargoes. This report has been prepared on behalf of PKPC to present a Traffic Impact Assessment of the proposed development to support an Environmental Assessment (EA) submission.

The assessment is undertaken to consider the impact of the following two phases of development:

- Concept Plan Approval for the entire development; and
- Major Project Approval for the first stage of development along with the majority of dredging and reclamation activities for the entire development.

Surface access would play a key role in linking the Outer Harbour to the rest of its supply chain. Ensuring that surface transport links to the Outer Harbour are adequate, through both road and rail modes, will be crucial in ensuring the efficiency of the overall supply network.

The Southern Freeway and the Illawarra Rail Line currently provide the primary road and rail links between Sydney and Wollongong. There also exists a number of east-west transport links that provide, or have the potential to provide, access between Port Kembla Outer Harbour, the Sydney Metropolitan area and wider areas.

The focus of this report is to determine the level of traffic generation associated with the Outer Harbour Development (OHD), its impact on the road network and to consider mitigation measures to minimise any impacts. Detailed investigation of rail infrastructure impacts and opportunities are considered in a separate report to the EA submission.

Following completion of the Major Project works, all traffic movements associated with the development are expected to join the road network via a new road link to Christy Drive. Upon completion of the full development for the Concept Plan, an extension of the new link from Christy Drive will also provide access to the container terminal. This will allow the connection between Old Port Road and Foreshore Road to be closed at the existing level crossing. Consequently, all port related traffic is expected to use Flinders Street and Five Islands Road to provide access to the strategic road network.

Ultimately, the level of traffic created by the Outer Harbour development will be determined by the level and type of trade handled at the berths. The traffic generation analysis indicates that for the current trade forecast scenarios, which have an emphasis on container trade (which would be increasingly transported by rail), there is unlikely to be a significant increase in the number of vehicles accessing the Outer Harbour.

The analysis indicates that road freight traffic to the Outer Harbour is likely to grow over time reaching 505 trucks per day by 2036. This equates to 64 trucks per peak hour.

The traffic impact analysis shows that these truck movements, together with employee vehicles, will only comprise a very small (1%) proportion of the total trips at nearby intersections and therefore there is unlikely to be a significant impact on the local road network as a result of the number of vehicles accessing the Outer Harbour.

Although peak hour traffic volumes generated by the proposal are unlikely to be significant, the main roads currently accessing the Outer Harbour, namely Flinders Street and Old Port Road, may require enhancement to cater for increased levels of heavy traffic. Augmentation might include improvements to pavement strength and improved turning radii for long vehicles; however, this is unlikely to be required in the short to medium term (i.e. for the major project approval).

Intersection modelling results indicate that the wider road network will experience negligible impacts following development of the proposed Outer Harbour development. With the exception of the Springhill Road / Masters Road intersection, which is forecast to have insufficient capacity regardless of the proposed development, all of the intersections are capable of supporting the effect of traffic that may occur as a result of the OHD. Consequently, no mitigation measures are deemed necessary to ameliorate the impacts of the proposed development.

Construction traffic movements are unlikely to pose a greater impact than operational vehicles, however suitable traffic management will be required to minimise construction impacts on pedestrian and vehicle movements and it is recommended that a Traffic Management Plan (TMP) would be included in CEMPs prepared for each discrete package of construction works. The TMPs would address work practices on site, haulage routes to and from the site, driver protocols, financial penalties and hours of construction as a minimum.

1.0 Introduction

1.1 Background

Port Kembla Port Corporation (PKPC) proposes to develop additional landside facilities in the Outer Harbour of Port Kembla to attract new trades and to increase the volume of existing cargoes. AECOM has been engaged to undertake an Environmental Assessment (EA) for the proposed port expansion on behalf of PKPC. The purpose of the EA is to anticipate environmental impacts that future developments may incur, and suggest mitigation measures, if necessary.

PKPC is seeking concurrent:

- Concept Plan Approval for the entire development; and
- Major Project Approval for the first stage of development along with the majority of dredging and reclamation activities for the entire development.

A description of the Concept Plan and Major Project works are provided in Section 4.2.

Concept Plan approval would provide certainty for government stakeholders and the community about the long term plans for development of the Outer Harbour. It would also provide PKPC with a greater level of certainty and confidence in securing trades and future customers for components of the development in later stages, while retaining flexibility for refinement of the design.

Major Project Approval is being sought to construct and operate the first stage of the Concept Plan. As such, the application for Major Project approval sits within, and is part of, the overarching Concept Plan. The Major Project application provides a comprehensive and quantified assessment of the first stage of the project, including the impacts and mitigation and management measures.

Subsequent stages of the Concept Plan (Stages 2 and 3) will be subject to separate applications for approval.

1.2 Purpose and Scope

This report presents a Traffic Impact Assessment (TIA) of the proposed Outer Harbour Development (OHD) to support the EA submission. This report provides an assessment of the road network only. Rail impacts of the proposed development are covered in a separate report for the EA submission.

The assessment involves determining the level of trip generation associated with the OHD, its impact on the road network and provides recommendations for mitigation measures to minimise any impacts.

The TIA includes:

- Assessment of the existing and future road conditions and the available capacity;
- An evaluation of potential impacts associated with the Concept Plan and Major Project works;
- A review of the impacts of construction traffic; and
- Consideration of measures to mitigate development impacts.

The report has been prepared in accordance with the Guide to Traffic Generating Developments (New South Wales Roads and Traffic Authority, 2002). It takes into regard the Director General's Requirements for the OHD that were issued by the Department of Planning on 27 January 2009 and responses to the Adequacy Review comments dated 2 November 2009.

1.3 Report Structure

This report is structured as follows:

- Section 2 summarises the existing transport conditions in the area surrounding the development site;
- Section 3 considers the likely future transport conditions in the area without development of the Outer Harbour;
- Section 4 provides a description of the OHD in terms of its development extent, operations and access. Assessment of the trip generation and distribution associated with the OHD is given, together with a review of its impact on the transportation networks and consideration of mitigation measures to minimise any impacts; and
- Section 5 summarises the findings and recommendations for the transportation requirements of the OHD.

2.0 Existing Transport Conditions

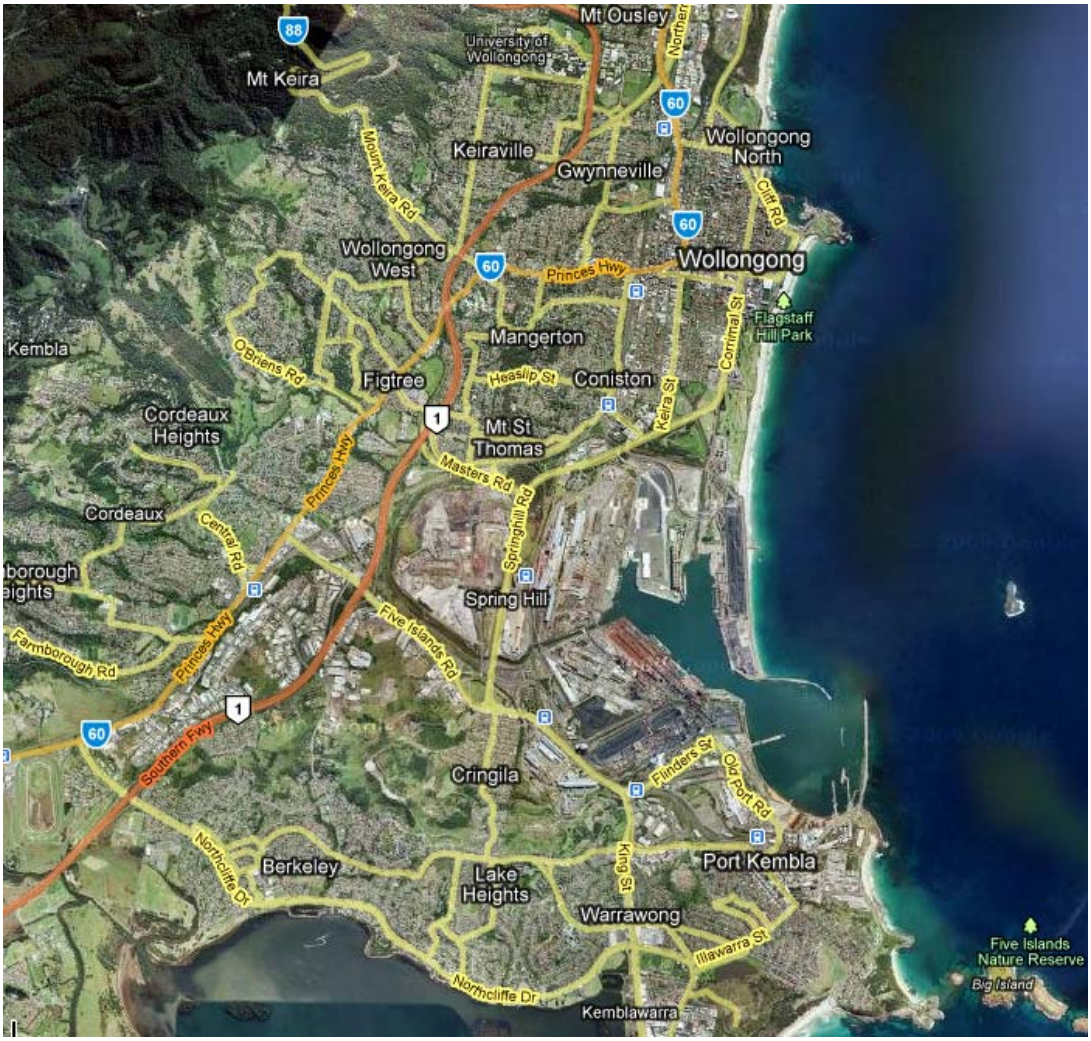
2.1 Introduction

This section provides an overview of the existing strategic and local road network surrounding Port Kembla together with details of the access arrangements to the study site.

2.2 Site Location

The Port Kembla Outer Harbour (Outer Harbour), shown in **Figure 2.1**, is located in the south eastern extent of Port Kembla. The Outer Harbour lies approximately 6km south of Wollongong CBD and approximately 80km south of Sydney CBD.

Figure 2.1 Location of Port Kembla Outer Harbour



Source: AECOM, July 2009, adapted from Google Maps

2.3 Transport Access Overview

Surface access will play a key role in linking the Outer Harbour to the rest of its supply chain. Ensuring that surface transport links to the Outer Harbour are adequate, through both road and rail modes, will be crucial in ensuring the efficiency of the overall supply network.

The Southern Freeway and the Illawarra Rail Line currently provide the primary road and rail links between Sydney and Wollongong. There also exists a number of east-west transport links, such as Picton Road and Appin Road, that provide, or have the potential to provide, viable alternatives that bypass significant tracts of the Sydney metropolitan area.

The focus of this report is to consider the road infrastructure requirements on the network in the vicinity of the port to ensure that suitable access is provided to the strategic network. Detailed investigation of rail infrastructure impacts and opportunities are considered in an accompanying study to the EA submission.

The following sections provide a summary of the existing road infrastructure in the vicinity of the Port and, in particular, to the Outer Harbour.

2.4 Strategic Road Network

2.4.1 Southern Freeway

The Southern Freeway currently provides the primary road link between Sydney and Wollongong and is an authorised B-double route. The Southern Freeway is split into two sections, with the northern section running between Waterfall and Bulli Tops along the ridge of the Illawarra Escarpment, whilst the southern section runs between Gwynneville and Yallah, after which it rejoins the Princes Highway.

After recommencing at the foothills of Mount Keira, the Southern Freeway is the primary freight route to Port Kembla. Although the Southern Freeway is a high quality road link, its ability to serve as an arterial connection between Wollongong and Sydney Airport / Port Botany and the Sydney motorway network is undermined by the lack of similar standard roads through Southern Sydney.

2.4.2 Princes Highway

The Princes Highway runs parallel with the Southern Freeway between Waterfall and Bulli Tops, where it deviates through Bulli Pass and follows the coastline to Wollongong. Bulli Pass is characterised by difficult road geometry including tight curvatures and steep grades which makes its use difficult for heavy vehicle traffic.

Historically, the Princes Highway was the major link between Sydney and Wollongong. The development of the Southern Freeway in the 1970s saw the highway's role diminish, as the Freeway provides a quicker and arguably superior route. Between Waterfall and Thirroul, the highway is a two-lane undivided carriageway, which is below the standard required to cater for efficient and safe motoring given the current levels of demand in the corridor. It is only south of Yallah where the Princes Highway re-establishes itself as the primary north-south road. South of Port Kembla, the highway predominantly consists of one lane in each direction with limited overtaking opportunities.

2.4.3 Mount Ousley Road

Mount Ousley Road is the major route up and down the Illawarra Escarpment and serves as the gateway to Wollongong. Developed to provide an alternative connection to the Bulli and Mount Keira Passes through the escarpment, Mount Ousley Road provides a connecting link between the two sections of the Southern Freeway to form a continuous road link from the southern fringes of Sydney into the heart of the Illawarra. The southern end of Mount Ousley Road is characterised by a gradient (ranging from 6-9%) and the incline near Mount Keira reduces the speed of heavy vehicle traffic. These constraints combine to create a potential pinch-point in the corridor between Sydney and Wollongong.

2.4.4 Northern Distributor

The Northern Distributor runs parallel and to the east of the Princes Highway between North Wollongong and Bellambi. It links the Southern Freeway south of the University of Wollongong and the Princes Highway via Bellambi Lane at its northern end. The distributor consists of a four lane divided carriageway.

The primary function of the distributor is to bypass the Wollongong CBD and facilitate more efficient journeys to areas to the north of the City. The distributor is also a permitted B-double route. The RTA is currently progressing plans to extend the road north from Bellambi to join the Princes Highway and Lawrence Hargrave Drive at Thirroul.

2.4.5 Picton Road

Picton Road provides a key connection between Western Sydney and Wollongong connecting Mount Ousley Road and the Hume Highway. As congestion on the Sydney road network increases and as significant population and employment centres become established in Western Sydney, this route will increase in importance as an alternative inland corridor for freight traffic between Sydney and Wollongong. The importance of this road corridor has been enhanced by the opening of the M7 Motorway in Western Sydney.

The NSW State Government announced a $12 million program of safety improvements for Picton Road in February 2009. This two and a half year program will address the most common types of crashes along this busy road. On top of this, the Federal Government has committed $3.7 million to help upgrade Picton Road. This will cover seven projects including junction improvements, median treatments and improvements to clear zones such as vegetation removal and shoulder widening.

The $12 million Picton Road safety program includes:

- upgrading sections of the road to reduce the risk of vehicles losing control in the wet;
- improving line marking and medians to better separate opposing traffic and reduce the potential for head-on crashes;
- improvements to the road shoulders and a number of curves to reduce the severity of crashes caused by cars running off the road; and
- new warning signs to advise drivers of the appropriate speeds they should be taking around curves; and new enforcement bays to provide police with more opportunities to catch dangerous drivers.

2.4.6 Appin Road

Appin Road connects the Southern Freeway just north of Bulli with Campbelltown and the Hume Highway, running parallel and to the north of Picton Road. Significant volumes of trucks use this route (approximately 15% of total traffic) for hauling export coal from the West Cliff Colliery through to Port Kembla or to coke works as feedstock. The route provides a good connection to serve the Minto industrial area whilst avoiding the Hume Highway (unlike Picton Road to the south).

2.5 Local Road Network

The main access and haulage route to the Outer Harbour from the Southern Freeway is via Five Islands Road. From Five Islands Road, the most direct access to the Outer Harbour would be via Flinders Street and Old Port Road with local connections via Christy Drive and Foreshore Road. This is shown in **Figure 2.2**.

Due to a decline in operations of the existing jetties, these local roads are not widely used as they do not cater for any through traffic. The roads would predominantly be used for access to the industrial properties and recreational visitors to the boat harbour and breakwater at the end of Foreshore Road.

Figure 2.2 Existing Local Roads and Primary Haulage Routes

Source: AECOM, July 2009, adapted from Google Maps

2.5.1 Masters Road

Masters Road connects Springhill Road to the Southern Freeway and is the main access route from Port Kembla Inner Harbour to northern and southern destinations. The route runs along the northern boundary of the BlueScope Steel Spring Hill site and has a speed limit of 80 km/h. It consists of a divided carriageway with 3 lanes in each direction and additional flares exist for left and right turning vehicles at the intersection with Springhill Road. There is no off-ramp to Masters Road for vehicles travelling from the south on the Southern Freeway.

2.5.2 Springhill Road

Springhill Road forms the western boundary of the Inner Harbour and the majority of freight accessing the Inner Harbour must use or cross this road. As there is no southern access to Masters Road (the main entrance to the Inner Harbour) from the Southern Freeway, Springhill Road (via Five Islands Road) is used by all trucks, travelling from the south, wishing to access the Inner Harbour. Through its connections to Five Islands Road, which is the main access route to the Outer Harbour, and Kiera Street and Corrimal Street to the north, Springhill Road provides a major north-south arterial link in the study area.

Springhill Road has a speed limit of 80 km/h and comprises a divided carriageway with three lanes in each direction. Provision of flare lanes is made for right turning vehicles at the majority of its intersections.

2.5.3 Five Islands Road

Five Islands Road is also a major link to Port Kembla from the Southern Freeway and Princes Highway. The road links to Springhill Road and Flinders Street and thus links to both the Inner and Outer Harbours. This road consists of a divided carriageway with three lanes in each direction and widening to accommodate turning lanes on the approach to major intersections. The speed limit of Five Islands Road is 80 km/h.

2.5.4 Flinders Street and Old Port Road

Flinders Street and Old Port Road provide a loop off Five Islands Road to give access to the Outer Harbour area as well as Port Kembla North and the Orica, Incitec and Port Kembla Copper sites. The road is a two lane undivided carriageway with one lane in each direction however the lanes are wide and overtaking is permitted. The speed limit on this route is 60km/h. The Port Kembla North rail loop crosses Old Port Road via a low bridge which has a height restriction of 4.5m.

2.5.5 Foreshore Road

Foreshore Road provides access to the Outer Harbour and the recreational boat harbour (adjacent to the Eastern Breakwater) from Old Port Road. The road is a two lane undivided carriageway with one lane in each direction however the lanes are wide and overtaking is permitted. The road has two at-grade rail crossings however the rail connection to Jetty No. 3 is not currently operational.

2.5.6 Christy Drive

Christy Drive leads to Jetty No. 6 (Gateway) and continues northwards to the tug berth. It is a wide two lane undivided carriageway and it crosses a rail line at an at-grade crossing 130m north of Old Port Road.

3.0 Future Transport Conditions without Development

3.1 Introduction

This section considers the ability of the surrounding road network to cope with future traffic volumes, regardless of the proposed development of the Outer Harbour. The purpose of this exercise is to identify the future performance and remaining capacity of the roads and intersections to provide a base case for the traffic impact assessment.

The assessment is undertaken for the future years of 2016 and 2036. This is to coincide with the anticipated operation of the Major Project approval by 2016, and the Concept Plan approval by 2036. Further details of the proposed development are provided in **Section 4**.

The assessment focuses on the morning and evening peak hours. These are the periods when traffic movements on the surrounding network are highest and the greatest demand is placed on road infrastructure.

3.2 Strategic Traffic Modelling Outputs

In order to assess the vehicular traffic impacts of the Outer Harbour development, AECOM has used traffic modelling outputs provided by Gabites Porter for the future years of 2016 and 2026. Gabites Porter has been commissioned by the NSW RTA to prepare an update of the Wollongong Shellharbour (WOLSH) Transportation model using TRACKS software.

The WOLSH model encompasses the area contained within the Statistical Local Areas of Wollongong and Shellharbour. The area stretches from Dunmore in the south to Sutherland in the north and also includes the major strategic roads that run into southern Sydney. It is bounded by the coast on the east and the mountains in the west which contain the escarpment.

The WOLSH model comprises three discrete models covering an average weekday:

- Morning Peak: 0700 - 0900
- Inter Peak: 0900 - 1600
- Evening Peak: 1600 - 1800

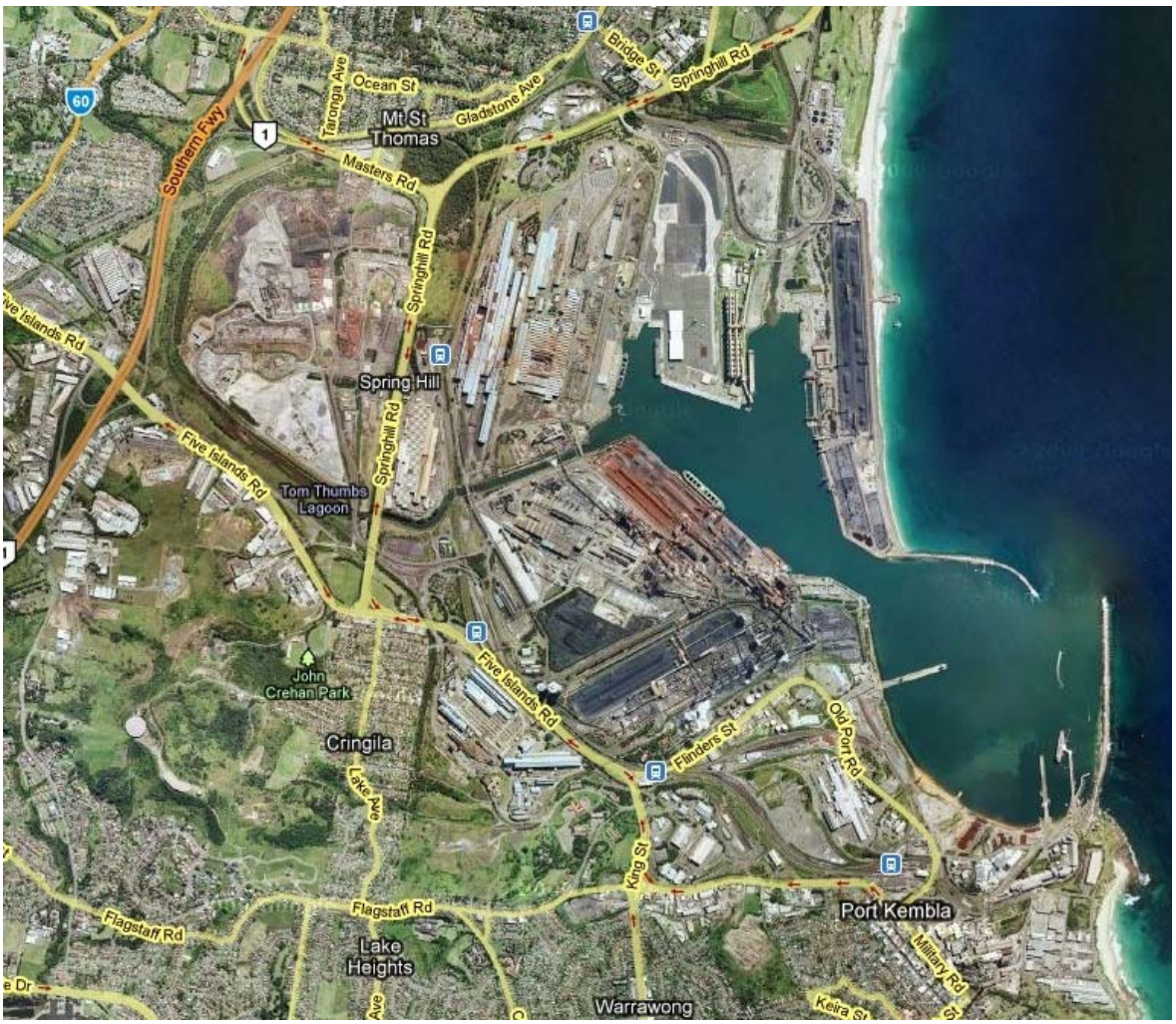
Gabites Porter has provided AECOM, in August 2009, with traffic volumes from its latest 2016 and 2026 models for the road network surrounding the Outer Harbour and environs. Traffic for the morning and evening peak period models is reported in hourly traffic volumes and these are presented in Appendix A for reference.

The existing WOLSH model has been calibrated against the 2001 road network and land use data in the study area. For the purposes of the EA submission, the RTA requested that the base model be updated to include land use data for 2006. However, 2006 data remains unavailable for use at the time of assessment. As a result the RTA has agreed that, due to the extensive delays of the availability of data from the Transport Data Centre to update the TRACKS models, the RTA would accept the traffic analysis using the existing available TRACKS modelling forecast (2016 and 2026). This is the latest modelling available to the proponent for the assessment of the Outer Harbour development.

3.3 Road Network Performance – 2016

To consider the future road network performance, AECOM has reviewed the mid-block lane capacities on key links as well as utilising intersection modelling software to assess the performance of individual intersections. **Figure 3.1** presents the locations where this network review has been undertaken which should be used as reference for analyses in the following sections (refer to Tables 3.1 and 3.3 for details of the mid-block and intersection locations.

Figure 3.1 Existing Local Roads and Primary Haulage Routes



Source: AECOM, July 2009, adapted from Google Maps

3.3.1 Mid-block Capacity

The traffic modelling outputs provided by Gabites Porter give an indication of peak hour traffic volumes on key links in the study area. This enables identification of road links that may require capacity improvements over time.

Table 3.1 summarises the capacity and traffic volumes on the on/off ramps and travel lanes associated with the Southern Freeway. These links have been assessed as the Southern Freeway is the nearest strategic corridor to the Outer Harbour and is likely to be used by the majority of heavy vehicles accessing the site. Mid-block lane capacities on the local roads have not been considered as network capacity in urban areas is generally governed by the capacity of its intersections. Intersection capacity is considered in more detail in **Section 3.3.2**.

Lane capacities used in **Table 3.1** have been determined from the Guide to Traffic Engineering Practice – Part 2: Roadway Capacity (AUSTROADS, 1999). The capacity of freeway ramps has been determined as 1,500 vehicles per hour per lane while the capacity for the freeway itself has been determined as 2,000 vehicles per hour per lane (for a design speed of 100km/h).

The data for each link is used to derive the Degree of Saturation, which is a measure of the ratio between traffic volumes and road capacity. Where the degree of saturation is greater than 1.0, this indicates that traffic volumes are higher than the road's capacity. For the purposes of this assessment, links where the degree of saturation is greater than 0.9 and therefore nearing capacity are highlighted to indicate future capacity constraints.

Table 3.1 Summary of average weekday AM & PM mid-block traffic flows on key links in 2016

Location	Peak Hour	Lanes	Capacity	Peak Hour Flow	Degree of Saturation
A. Southern Freeway on-ramp (northbound) from Masters Road	AM	1	1,500	785	0.52
	PM			475	0.32
B. Southern Freeway off-ramp (southbound) to Masters Road	AM	1	1,500	834	0.56
	PM			988	0.66
C. Southern Freeway on-ramp (southbound) from Masters Road	AM	1	1,500	361	0.24
	PM			863	0.58
D. Southern Freeway (northbound)	AM	2	4,000	3,839	0.96
	PM			2,105	0.53
E. Southern Freeway (southbound)	AM	2	4,000	1,866	0.47
	PM			4,266	1.07
F. Southern Freeway off-ramp (southbound) to Five Islands Road	AM	2	3,000	458	0.15
	PM			653	0.22
G. Southern Freeway on-ramp (northbound) from Five Islands Road	AM	1	1,500	628	0.42
	PM			704	0.47
H. Southern Freeway off-ramp (northbound) to Five Islands Road	AM	1	1,500	199	0.13
	PM			523	0.35
I. Southern Freeway on-ramp (southbound) from Five Islands Road	AM	1	1,500	834	0.56
	PM			387	0.26

Source: AECOM, August 2009 (from data provided by Gabites Porter, 2009)

The mid-block lane capacities shown in **Table 3.1** indicate that by 2016, traffic volumes on the Southern Freeway are likely to exceed the theoretical capacity for a two-lane freeway. This implies that augmentation to the freeway in the vicinity of Port Kembla will be required to accommodate the 2016 forecast volumes.

The analysis also shows that the on/off ramps associated with the freeway (to / from Masters Road and Five Islands Road) will have sufficient capacity to accommodate the forecast 2016 traffic volumes.

3.3.2 Intersection Performance

Using details of the geometry of nearby intersections and the traffic data provided by Gabites Porter, AECOM has undertaken intersection modelling using SIDRA Intersection 3.2. SIDRA is a proven and advanced software product that can evaluate signalised and unsignalised intersections in one package. SIDRA is a widely accepted analytical tool for evaluation of alternative intersection designs in terms of capacity, level of service and a wide range of performance measures including delay, queue length, stops, fuel consumption, pollutant emissions and operating cost.

SIDRA output data used in this study includes:

- Degree of Saturation – a measure of the ratio between traffic volumes and the capacity of the intersection;
- Level of Service – a measure of the overall performance of the intersection; and
- Average Delay – the average time in seconds that vehicles wait at the intersection.

Table 3.2 details the Level of Service performance criteria and how it relates to different traffic control devices.

Table 3.2 Performance Criteria for Intersections

Level of Service	Average Delay (sec / vehicle)	Traffic Signals, Roundabout	Give Way andStop 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, Roads and Traffic Authority, 2002

As shown in **Figure 3.1**, four intersections, which are all signalised, have been identified for detailed analysis as part of this TIA. **Table 3.3** defines the approach designations for the individual turning movements at each of these intersections. This information should be used as reference when reviewing the SIDRA 3.2 output tables in the following sections.

Table 3.3 Approach Descriptions for Intersection Performance Results

Intersection	Approach Description	Approach Name
1. Five Islands Road / King Street / Wattle Street	Major Approach (SB)	Five Islands Road / King Street
	Minor Approach (WB)	Five Islands Road
	Major Approach (NB)	King Street
	Minor Approach (EB)	Wattle Street
2. Five Islands Road / Flinders Street	Major Approach (NB)	Five Islands Road
	Minor Approach (WB)	Flinders Street
	Major Approach (SB)	Five Islands Road
3. Five Islands Road / Springhill Road	Major Approach (EB)	Five Islands Road
	Minor Approach (SB)	Springhill Road
	Major Approach (WB)	Five Islands Road
4. Springhill Road / Masters Road	Major Approach (SB)	Springhill Road
	Major Approach (NB)	Springhill Road
	Minor Approach (EB)	Masters Road

Source: AECOM, August 2009

Table 3.4 and **Table 3.5** summarise the SIDRA 3.2 performance results for the 2016 morning and evening peak hours respectively. The results include the Level of Service, Degree of Saturation and the Average Delay for the major and minor traffic movements to represent the range of performance taking place. Detailed intersection analysis results are provided in **Appendix B**.

Table 3.4 Intersection Performance, 2016 AM Peak Hour

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.75	D (WB) D (EB)	B (SB) B (NB)	B	27.3
2. Five Islands Road / Flinders Street	0.46	F (WB)	A (NB) A (SB)	A	6.9
3. Five Islands Road / Springhill Road	1.00	D (SB)	C (EB) A (WB)	B	18.7
4. Springhill Road / Masters Road	0.82	D (EB)	C (SB) C (NB)	C	34.5

Source: AECOM, August 2009

During the AM peak hour for 2016, the results in **Table 3.4** show that all of the intersections report a satisfactory level of service. The majority of delays occur on the minor approach movements, particularly for traffic on Flinders Street, however the detailed results in **Appendix B** show that these vehicles only comprise a small (3%)

proportion of the total traffic at this intersection. The degree of saturation results indicate that the Five Islands Road / Springhill Road intersection is operating at capacity.

Table 3.5 Intersection Performance, 2016 PM Peak Hour

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach		Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.76	D (WB) D (EB)	B (SB) B (NB)	C	29.2
2. Five Islands Road / Flinders Street	0.60	F (WB)	A (NB) A (SB)	A	9.9
3. Five Islands Road / Springhill Road	0.98	E (SB)	D (EB) A (WB)	B	26.4
4. Springhill Road / Masters Road	0.80	C (EB)	C (SB) C (NB)	C	35.9

Source: AECOM, August 2009

The 2016 PM peak hour results in **Table 3.5** report similar performance results as those shown for the AM peak. Delays are most prevalent for traffic on the minor approaches although it is noted that Springhill Road is an important arterial link. The Five Islands Road / Springhill Road intersection is again operating near capacity in the PM peak in 2016.

3.4 Road Network Performance – 2036

AECOM has used the WOLSH model outputs from 2016 and 2026 to derive annual growth factors for the road network. These factors, which have been determined for each assessment link and intersection, have been applied to the 2026 data to estimate traffic volumes for 2036.

The 2026 WOLSH modelling includes additional through lanes (to three lanes in each direction) on the Southern Freeway. This change to the modelled network has been included as the modelled volumes far exceed the capacity of a two-lane freeway, as shown in **Table 3.1**. Without the inclusion of additional lanes on the Southern Freeway, high volumes of traffic would redistribute to other corridors, resulting in congestion on lower order roads.

3.4.1 Mid-block Capacity

Similarly to the assessment provided in **Section 3.3.1**, AECOM has reviewed the estimated 2036 traffic volumes in comparison to the link capacities. The results of this review are provided in **Table 3.6**.

Table 3.6 Summary of average weekday AM & PM mid-block traffic flows on key links in 2036

Location	Peak Hour	Lanes	Capacity	Peak Hour Flow	Degree of Saturation
A. Southern Freeway on-ramp (northbound) from Masters Road	AM	1	1,500	863	0.58
	PM			349	0.23
B. Southern Freeway off-ramp (southbound) to Masters Road	AM	1	1,500	950	0.63
	PM			1,004	0.67
C. Southern Freeway on-ramp (southbound) from Masters Road	AM	1	1,500	413	0.28
	PM			1,147	0.76
D. Southern Freeway (northbound)	AM	3	6,000	4,610	0.77
	PM			2,485	0.41
E. Southern Freeway (southbound)	AM	3	6,000	1,929	0.32
	PM			5,601	0.93
F. Southern Freeway off-ramp (southbound) to Five Islands Road	AM	2	3,000	577	0.19
	PM			1,162	0.39
G. Southern Freeway on-ramp (northbound) from Five Islands Road	AM	1	1,500	959	0.64
	PM			1,019	0.68
H. Southern Freeway off-ramp (northbound) to Five Islands Road	AM	1	1,500	183	0.12
	PM			593	0.40
I. Southern Freeway on-ramp (southbound) from Five Islands Road	AM	1	1,500	1,138	0.76
	PM			439	0.29

Source: AECOM, August 2009 (from data provided by Gabites Porter, 2009)

As shown in **Section 3.3.1**, mid-block traffic volumes in 2016 were exceeding the theoretical capacity on the Southern Freeway. By 2036, with three lanes in each direction, the degree of saturation improves, however the volumes remain near capacity for the southbound movements in the PM peak hour.

This analysis also shows that the on/off ramps associated with the freeway will have sufficient capacity to accommodate the forecast 2036 traffic volumes.

3.4.2 Intersection Performance

Table 3.7 and **Table 3.8** summarise the SIDRA results for the 2036 traffic flows for the AM and PM peak hours respectively. Detailed results are provided in Appendix C.

Table 3.7 Intersection Performance, 2036 AM Peak Hour

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.82	E (WB) F (EB)	B (SB) C (NB)	C	32.6
2. Five Islands Road / Flinders Street	0.54	F (WB)	A (NB) A (SB)	A	7.5
3. Five Islands Road / Springhill Road	1.00	E (SB)	C (EB) A (WB)	B	21.4
4. Springhill Road / Masters Road	0.99	F (EB)	D (SB) F (NB)	F	80.0

Source: AECOM, August 2009

Table 3.8 Intersection Performance, 2036 PM Peak Hour

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.78	D (WB) E (EB)	B (SB) B (NB)	C	32.2
2. Five Islands Road / Flinders Street	0.70	F (WB)	A (NB) A (SB)	A	11.1
3. Five Islands Road / Springhill Road	1.00	E (SB)	E (EB) A (WB)	C	30.2
4. Springhill Road / Masters Road	0.87	D (EB)	C (SB) D (NB)	D	43.8

Source: AECOM, August 2009

By 2036, the Five Islands Road / King Street / Wattle Street intersection reports satisfactory level of service in both time periods although poor level of service is reported for the minor approaches.

Delays occur for traffic on Flinders Street at the intersection with Five Islands Road which was also evident in the 2016 analysis. This traffic only comprises a small percentage (3-4%) of total traffic at this intersection. Overall the intersection reports good performance in both time periods.

The degree of saturation results show that the Five Islands Road / Springhill Road intersection is operating at capacity, primarily due to the high volume of right-turning traffic from Five Islands Road into Springhill Road. In both time periods however the level of service results are satisfactory. Delays occur for traffic from Springhill Road as this traffic is given less green-time than the right-turning traffic from Five Islands Road.

The levels of service results for the Springhill Road / Masters Road intersection are unsatisfactory, particularly in the AM peak hour. This is due to the high volumes of traffic from each approach arm competing for green-time at the intersection.

3.5 Summary

The mid-block capacity analysis in this section has shown that, without the inclusion of traffic generated by development of the Outer Harbour, the on/off ramps associated with the Southern Freeway will have sufficient capacity to accommodate the forecast 2036 traffic volumes. Augmentation to the Southern Freeway (with one extra lane in each direction) will be required to accommodate the forecast traffic volumes regardless of future development of the Outer Harbour.

As a result of the increase in traffic volumes over the next 25 years, the AM and PM peak hour results presented in **Table 3.7** and **Table 3.8** show that the intersection performance will worsen in comparison to that shown in the 2016 analysis. For the current modelled traffic volumes, all of the intersections, with the exception of the Springhill Road / Masters Road intersection, report satisfactory level of service by 2036.

As well as the Springhill Road / Masters Road intersection, capacity issues are evident at the intersection of Five Islands Road / Springhill Road despite the satisfactory level of service result. Potential solutions to the capacity issues might include:

- Grade separation of the right-turn movement from Five Islands Road into Springhill Road; and
- Grade separation of the Springhill Road / Masters Road intersection.

It is likely that the performance of these intersections will need to be addressed at some time in the future regardless of the proposed OHD.

4.0 Transport Implications of Development Options

4.1 Introduction

This section provides a description of the OHD in terms of its development extent, operations and access. Assessment of the trip generation and distribution associated with the development is given, together with a review of the performance of the transportation networks once development traffic has been added.

4.2 Proposed Development

The development of the Outer Harbour is intended to maximise available land area and to provide the maximum number of berths suitable for container handling, bulk trades and general cargo. As such, the development must be appropriately staged to meet the needs of prospective customers, to cater for growing port needs and regional development, and to increase the potential to address the needs of new industry for 30 years into the future.

Physical features of the proposed development include:

- At least 42 hectares of reclamation, carried out in stages;
- 1,770 metres total of new berth length;
- A total of seven berths including:
  - Four container berths with a total berth length of 1,150 metres;
  - Two new multi-purpose berths with a total berth length of 620 metres; and
  - A new multi-purpose berth at the site of the existing Jetty 6.
- Retention of the existing oil berth;
- Berthing basins and approaches with up to 15m water depth below lowest astronomical tide (LAT) for new berths; and
- Road and rail infrastructure to support the expansion.

PKPC is seeking concurrent Concept Plan Approval for the entire development and Major Project Approval for the first stage of development which includes the majority of dredging and reclamation activities for the entire development and operation of one multi-purpose berth.

Concept Plan Approval for the total development will allow PKPC a level of certainty in defining the key components of the full development, while allowing flexibility to refine discrete stages in parallel with port growth. The application for Concept Plan approval outlines the project scope and staging for the entire development and identifies the potential environmental impacts and the broad mitigation and management measures to address these impacts. This is in contrast to a Major Project approval which provides more detail and will allow PKPC to construct and operate the first stage of the development.

Major Project Approval is being sought to construct and operate the first stage of the Concept Plan. As such, the application for Major Project approval sits within, and is part of, the overarching Concept Plan. The Major Project application provides a comprehensive and quantified assessment of the first stage of the project, including the impacts and mitigation and management measures.

Figure 4.1 provides an artist's impression of the concept plan. The yellow dotted line represents the existing mean high water mark.

Figure 4.1 Artist's Impression of Concept Plan

4.3 Staged Development

While development of the Outer Harbour is envisaged to occur in discrete programmes of works, it is acknowledged that actual staging of construction and reclamation may vary, subject to the rate of trade growth and driven by market demand over a 20 to 30 year time frame. Activities involved with the Major Project Approval are programmed to commence mid 2010, subject to approval, and to be completed by 2018. Project timing for activities associated with the Concept Plan has been determined based on current market projections outlined in the Port Kembla Outer Harbour Master Plan (Maunsell AECOM, 2008), and are anticipated to be completed by 2037.

4.3.1 Concept Plan Approval

Concept Approval for the development (refer **Figure 4.2**) involves completion of the multi-purpose and container terminals and their associated berths.

Key features from a traffic and transport perspective are summarised in **Table 4.1**.

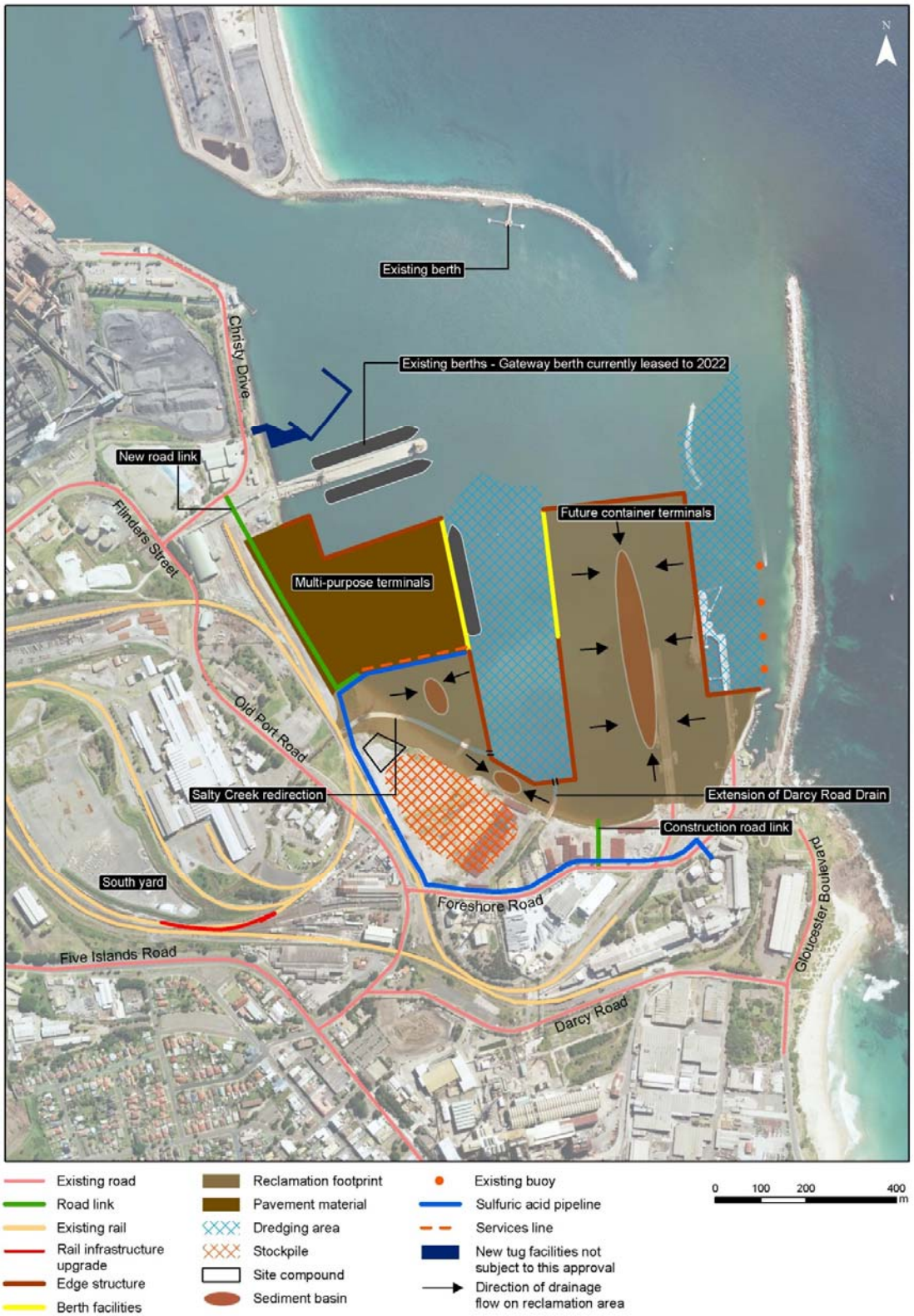
4.3.2 Major Project Approval

Major Project Approval (refer **Figure 4.3**) involves the majority of Outer Harbour dredging activities; land reclamation and construction for part of the multi-purpose terminal; construction and operation of the first multi-purpose berth; and construction of the first container berth. Construction activities for the Major Project Approval are anticipated to be finalised by 2018 although the intent is for part of the multi-purpose terminal to be in operation by 2016.

Figure 4.2 Concept Approval Development Plan

Source: AECOM, December 2009

Figure 4.3 Major Project Approval Plan



Source: AECOM, December 2009

Table 4.1 provides details of the proposed transport infrastructure components associated with the Major Project Approval and Concept Plan Approval works.

Table 4.1 Proposed Transport Infrastructure Development

Stage	Proposed development
Major Project Works	• New road from Christy Drive to the multi-purpose terminal • New access road from Foreshore Road to the container terminal to be utilised for reclamation activities
Concept Plan Works	• Extension of the new road from Christy Drive to link to Foreshore Road • Rail link to and on the container terminal • A new rail overbridge to provide grade separation between the rail lines to the container terminal and road traffic on Foreshore Road • A new road along the old rail corridor at the southern end of the eastern breakwater to serve Port offices and the public facilities area and to separate this traffic from the port traffic • A truck loading and unloading area facility located at the southern end of the reclamation, on the eastern side of the rail line

Source: AECOM, August 2009

4.4 Port Capacity

The Port Kembla Outer Harbour Master Plan (Maunsell AECOM, 2008) assessed the potential throughput of cargo from PKPC trade forecasts to determine the required capacity to service likely demand into the future.

The capacity of the stages of development has been calculated using the following throughputs:

- Dry bulk products assumed at 4.25 million tonnes per annum (mtpa) per berth;
- General cargo assumed at 1 mtpa per berth; and
- Containers assumed at 300,000 twenty-foot equivalent units (TEU) per annum per berth.

The anticipated capacity for Major Project Approval and Concept Approval of the Outer Harbour are shown in **Table 4.2**.

Table 4.2 Preferred Option Capacity for Major Project Approval and Concept Approval

Stage	Bulk / General Cargo		Containers		Total Number of Berths in Outer Harbour[1]
	No. Berths	Capacity (mtpa) Bulk / General Cargo	No. Berths	Capacity ('000 TEU)	
Major Project Approval	1	4.25	0	0	4
Concept Approval	3	4.25 / 2.0	4	1,200	8

Note: [1] inclusive of existing Gateway Jetty and Berth 201

Source: PKPC, July 2009

4.5 Trip Generation

In order to undertake the traffic assessment, various assumptions have been made to determine peak hour traffic generation levels. These include the modal split between road and rail, the average payload of trucks and the hours of operation of the proposed terminal. The assumptions used are outlined in the following sections together with details of how the traffic generation numbers have been calculated.

4.5.1 Mode Share

The mode split of cargo to and from the Outer Harbour will be determined to a large extent by the types of products hauled. As the volume and type of products are not exactly known at present, a number of assumptions have been applied to consider the level of road traffic movements associated with each development stage.

In the long-term it is envisaged that the majority of trade handled at the Outer Harbour will be transported to and from the port by rail. Rail infrastructure upgrades (details provided in a separate report for the EA submission), in the locality of the Outer Harbour would offer a viable transport option and use of rail would reduce the impact on the local community in terms of noise, air quality and congestion on the local road network.

Based on PKPC's previous experience with port related activities, including the Inner Harbour, it has been assumed that 50% of all dry bulk trade, 80% of general cargo and 10% of containers will be transported by road for the Concept Plan.

4.5.2 Average Payloads

Average payloads for road vehicles (based on typical road transport) are summarised in **Table 4.3**.

Table 4.3 Average Loading Assumptions

Per Truck	Quantity	Unit
Bulk	35	Tonnes
General Cargo	25	Tonnes
Containers	2	TEU

4.5.3 Operational Hours

For the purposes of this assessment it has been assumed that the terminals will operate for 24 hours per day, 7 days per week (365 days per year).

4.5.4 Truck Volumes

To determine the traffic movements associated with the Major Project and Concept Plan, the mode split and average truck loading assumptions were applied to the port capacity volumes defined in **Table 4.2** to derive truck movements per year. This information is presented in **Table 4.4**.

To consider the road network impacts, truck movements have been determined for a peak hour situation which assumes that the number of truck movements in the busiest hour is 50% greater than the average hour during the remainder of a typical day. To consider a worst case, it has been assumed that this peak hour will coincide with the peak movements on the wider network (i.e. during the AM and PM peaks) however, in reality, this may not necessarily be the case.

4.5.5 Employee Traffic

Employee vehicle movements associated with Major Project Approval and Concept Approval Works also require consideration in order to assess road network impacts. Precise details of employee numbers expected to work at Port Kembla Outer Harbour is currently unknown, but it is envisaged that upon full development (2036), there will be approximately 200 employees and that there will be 75 employees by 2016.

To determine volumes on the road network, it has been assumed that 10% of employee movements will occur during the peak hours. This is on the basis that employees are likely to work a shift pattern with start / finish times occurring outside the peak hours experienced on the wider road network. Assuming vehicle occupancy of one vehicle per employee, this equates to eight peak hour movements in 2016 and 20 peak hour movements in 2036, as shown in **Table 4.4**.

4.5.6 Traffic Generation Summary

The calculation process to derive the truck and employee traffic volumes and the resultant number of vehicles for each development stage is summarised in **Table 4.4**.

Table 4.4 Summary of vehicles serving the Outer Harbour

	Bulk	General Cargo	Containers
Volume per year	4.25mtpa	2mtpa	1,200,000 teu
Proportion by road	50%	80%	10%
Volume by road	2.125mtpa	1.6mtpa	120,000 teu
Truck loading (per truck)	35 tonnes	25 tonnes	2 containers
Trucks per year	60,714	64,000	60,000
Working days per year	365	365	365
Trucks per day (average)	166	175	164
Hours of operation	24	24	24
Trucks per hour (average)	7	7	7
Peak hour factor	1.5	1.5	1.5
Trucks per hour (peak)	10	11	10
Two-way peak hour truck movements	21	22	21
Total for Major Project (2016)	29 (bulk only + 8 employee vehicles)		
Total for Concept Plan (2036)	84 (bulk, general cargo and containers + 20 employee vehicles)		

Source: AECOM, January 2010

The analysis in **Table 4.4** shows that peak hour traffic movements will equate to 29 vehicles per hour (72% trucks) following development of the Major Project and 84 vehicles per hour (76% trucks) upon completion of the Concept Plan.

4.6 Traffic Distribution

Traffic movements associated with the proposed development have been distributed to the wider road network using gravity model principles whereby drivers would choose the shortest route to reach their destination.

Following completion of the Major Project, all traffic movements associated with the development are expected to join the road network via the new link to Christy Drive. Upon completion of the full development for the Concept Plan, an extension of the new road link from Christy Drive will also provide access to the container terminals. This will allow the connection between Old Port Road and Foreshore Road to be closed at the existing level crossing. Consequently, all port related traffic is expected to use Flinders Street and Five Islands Road to provide access to the strategic road network.

Based on the trade forecasts received from PKPC, **Table 4.5** details where these trades are to be distributed and the intersections to be used.

Table 4.5: Major Project truck distribution

Trade	From/ to location	Distribution Split	Intersections to be used
300,000 tonnes bulk	Local area	100%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road
1,200,000 tonnes bulk	Sydney (north)	80%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road - Springhill Road / Masters Road - Masters Road / Southern Freeway
	Southern NSW (south)	20%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road - Five Islands Road / Southern Freeway
50,000 tonnes raw materials	Blue Scope Steel (local area)	100%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road
250,000 tonnes coke export	Blue Scope Steel (local area)	100%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road
350,000 tonnes fertilizer	Southern / South Western NSW (south)	100%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road - Five Islands Road / Southern Freeway
Containers	Local Illawarra (local)	50%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road
	Princes Highway	25%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road
	Picton Road (north)	25%	- Five Islands Road / Flinders Road - Springhill Road / Five Islands Road - Springhill Road / Masters Road - Masters Road / Southern Freeway

Source: PKPC, 2009

The residential location of employees is currently unknown. To consider a worst case, it has been assumed that all employee generated traffic will access the Outer Harbour via the intersections of Five Islands Road / Flinders Road, Springhill Road / Five Islands Road and Springhill Road / Masters Road.

Based on the traffic routes that have been described, it is considered unlikely that port related vehicles will travel via the intersection of Five Islands Road / King Street / Wattle Street and so no impact will be seen at this intersection.

4.7 Traffic Proportions

Following development, the operational trips shown in **Table 4.4** will comprise a proportion of the total trips on the wider network. The impact of these trips, once added to the 'without development' trips appraised in **Section 3**, is reviewed in the following sections.

Consideration of the proportion of trips generated by the proposal confirms the extent to which the development will impact on infrastructure requirements.

Table 4.6 and **Table 4.7** show the proportion of Outer Harbour related traffic in comparison to the total traffic on the network in 2016.

Table 4.6 Traffic Proportions, 2016 AM Peak Hour, with Major Project Approval

Intersection	Total Trips	Outer Harbour Trips	
		Volume	%
1. Five Islands Road / King Street / Wattle Street	3,877	0	0%
2. Five Islands Road / Flinders Street	3,893	29	1%
3. Five Islands Road / Springhill Road	4,310	29	1%
4. Springhill Road / Masters Road	5,140	18	0%

Source: AECOM, January 2010

Table 4.7 Traffic Proportions, 2016 PM Peak Hour, with Major Project Approval

Intersection	Total Trips	Outer Harbour Trips	
		Volume	%
1. Five Islands Road / King Street / Wattle Street	4,181	0	0%
2. Five Islands Road / Flinders Street	4,110	29	1%
3. Five Islands Road / Springhill Road	3,586	29	1%
4. Springhill Road / Masters Road	5,021	18	0%

Source: AECOM, January 2010

The data in **Table 4.6** and **Table 4.7** show that development related trips for the Major Project Approval will only comprise up to one percent of total peak hour trips at the surrounding intersections.

4.8 Road Network Performance – Major Project, 2016

To consider the impact of development related traffic on the local road network, AECOM has applied the generated traffic volumes to the intersection models reviewed in **Section 3**. Review of the mid-block capacity on the links associated with the Southern Freeway is not undertaken. The analysis found that spare capacity exists on each of the on/off ramps associated with the Southern Freeway and therefore it is reasonable to assume that they can accommodate the volume of peak hour traffic generated by the Major Project.

4.8.1 Intersection Performance

Intersection performance following development of the Major Project Approval has been assessed in SIDRA 3.2. Total traffic volumes assessed for this scenario are the sum of the 2016 'without development' trips detailed in **Section 3** and the trips associated with the Major Project Approval, shown in **Table 4.4**.

The 2016 intersection performance with the Major Project Approval traffic is presented in **Table 4.8** and **Table 4.9**. Detailed intersection performance results are provided in **Appendix D**.

Table 4.8 Intersection Performance, 2016 AM Peak Hour, with Major Project Approval

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.75	D (WB) D (EB)	B (SB) B (NB)	B	27.3
2. Five Islands Road / Flinders Street	0.46	F (WB)	A (NB) A (SB)	A	7.6
3. Five Islands Road / Springhill Road	1.00	D (SB)	C (EB) A (WB)	B	19.3
4. Springhill Road / Masters Road	0.82	D (EB)	C (SB) C (NB)	C	34.7

Source: AECOM, January 2010

Table 4.9 Intersection Performance, 2016 PM Peak Hour, with Major Project Approval

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.76	D (WB) D (EB)	B (SB) B (NB)	C	29.2
2. Five Islands Road / Flinders Street	0.61	F (WB)	A (NB) A (SB)	A	10.8
3. Five Islands Road / Springhill Road	1.00	E (SB)	D (EB) A (WB)	B	26.6
4. Springhill Road / Masters Road	0.80	C (EB)	C (SB) C (NB)	C	36.1

Source: AECOM, January 2010

The intersection performance results in **Table 4.8** and **Table 4.9** shows that each of the intersections report satisfactory performance in the 2016 'with development' scenario for both time periods. As was reported in **Section 3.3.2**, the degree of saturation results indicate that the Five Islands Road / Springhill Road intersection is already operating at capacity in both modelled periods.

Comparison of the 'with development' and 'without development' performance results for 2016 is given in **Section 5**.

4.9 Road Network Performance – Concept Plan, 2036

As per the analysis for 2016, AECOM has applied the generated traffic volumes from 2036 to the modelled intersections. Review of the mid-block capacity on the links associated with the Southern Freeway is again not undertaken as it is considered reasonable that they can accommodate the volume of peak hour traffic generated by full development of the Concept Plan.

4.9.1 Intersection Performance

Intersection performance upon completion of the full development has been assessed in SIDRA 3.2. Total traffic volumes assessed for this scenario are the sum of the 2036 'without development' trips used in **Section 3** and the trips generated from the Concept Plan given in **Table 4.4**.

The 2036 intersection performance with full development traffic for the AM and PM peak hours is presented in **Table 4.10** and **Table 4.11**. Detailed intersection performance results are provided in **Appendix E**.

Table 4.10 Intersection Performance, 2036 AM Peak Hour, with Concept Plan Approval

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.82	E (WB) F (EB)	B (SB) C (NB)	C	32.6
2. Five Islands Road / Flinders Street	0.58	F (WB)	A (NB) A (SB)	A	8.9
3. Five Islands Road / Springhill Road	1.00	E (SB)	C (EB) A (WB)	B	19.9
4. Springhill Road / Masters Road	1.00	F (EB)	D (SB) F (NB)	F	84.7

Source: AECOM, January 2010

Table 4.11 Intersection Performance, 2036 PM Peak Hour, with Concept Plan Approval

Intersection Location	Degree of Saturation	Level of Service (LOS)			Ave Delay (Sec / Vehicle)
	Whole Intersection	Minor Approach	Major Approach	Whole Intersection	Whole Intersection
1. Five Islands Road / King Street / Wattle Street	0.78	D (WB) E (EB)	B (SB) B (NB)	C	32.2
2. Five Islands Road / Flinders Street	0.78	F (WB)	A (NB) A (SB)	A	13.5
3. Five Islands Road / Springhill Road	1.00	E (SB)	F (EB) A (WB)	C	31.9
4. Springhill Road / Masters Road	0.89	D (EB)	C (SB) D (NB)	D	45.0

Source: AECOM, January 2010

As per the analysis in **Section 3.4.2**, intersection performance in 2036 will worsen as a result of the increase in background (non-Outer Harbour development related) traffic. All of the intersections, with the exception of the Springhill Road / Masters Road intersection, report satisfactory level of service for the whole intersection.

As well as the Springhill Road / Masters Road intersection, capacity issues are evident at the intersection of Five Islands Road / Springhill Road despite the satisfactory level of service result.

The inclusion of development related traffic does not significantly exacerbate the forecast 'without development' problems. Comparison of the 'with development' and 'without development' performance results for 2036 are provided in **Section 5**.

4.10 Construction Traffic Movements

Construction traffic will be generated by the various construction activities associated with the Major Project and Concept Plan. Broadly, construction activities include:

- Reclamation and dredging; and
- General construction activities.

The majority of the Concept Plan reclamation and dredging activities would take place during Stage 1. Approximately 3,410,799m^3 of fill is required for reclamation works and will be sourced as follows:

- 650,000m^3 of blast furnace slag sourced locally from Mt Prosser (100% transported by road);
- 150,000m^3 of coal wash sourced locally from BlueScope Steel or from West Cliff Colliery on Appin Road, approximately 30km north west of the Outer Harbour (100% transported by road);
- 1,612,401m^3 from major infrastructure projects such as Sydney Metro Stage 1 and other infrastructure projects within Sydney and the greater Sydney region (0% transported by road);
- Potential for a further 1,000,000m^3 of coal wash from local sources including BlueScope Steel and West Cliff Colliery etc) (100% transported by road).

Of the total fill required, it is assumed that 53% (650,000 m^3 of blast furnace slag and 1,150,000 m^3 of coal wash) will be transported by road. The remaining fill will be transported by rail and barge.

Figure 4.4 shows the location of the construction materials that will be transported by road.

Figure 4.4: Location of locally sourced construction materials

Source: AECOM, January 2010, adapted from Google Maps

Table 4.12 describes the general construction activities for the Concept Plan and Major Project Approval in more detail.

Table 4.12: General Construction Activities

	Stage	Activity to be undertaken
Concept Plan	Stage 1 (Major Project application)	**General construction** • Erection of site compound approximately 100m south east of Salty Creek outlet • Delineation of a temporary stockpiling/surcharge area south of the proposed multi-purpose terminal, capable of storing up to 100,000m^3 of material at any one time. • New access road from Christy Drive to the multi-purpose terminals. • Temporary construction access road from Foreshore Road to the container terminals to be utilised for reclamation and dredging activities. • Relocation of utilities for import of sulphuric acid (currently at Berth 206) to the operational central area of the multi-purpose terminal, including developing a dedicated pipeline/services corridor. • Extension of Darcy Road Drain to the extent of the reclamation. Drain to remain an open drain, u-shaped, with wing walls at the harbour entrance. • Redirection of Salty Creek from the foreshore, through the multi-purpose terminal reclamation area, to the harbour. Salty Creek to remain an open channel through the reclamation area.
		Reclamation • Land reclamation for central and southern areas of the multi-purpose and container terminals. (capping fill of a few meter deep to be disposed off over sea while remaining to be disposed off by end tipping, wick drain and surcharge and/or other ground improvement works) • Land reclamation for container terminals and southern portion of multi-purpose terminals (capping fill of a few meter deep to be disposed off over sea while remaining to be disposed off by end tipping, wick drain and surcharge and/or other ground improvement works) • Construction of temporary revetment structures. • Construction of permanent revetment structures along the northern edge of the container terminals and reclaimed area between container terminals and multi-purpose terminals. • A series of discrete bunded fill areas, to be constructed within the reclamation footprint, for encapsulation of contaminated dredged material. Bund size and location would reflect dredging phases.
		Terminal and berth construction • Construction of the central part of the multi-purpose terminal, partly paved for common users, including drainage systems. • Construction of one new multi-purpose berth. • Installation of utilities to service the central (operational) portion of the multi-purpose terminals (i.e. water, hydrant mains, power 240V and 415V, telecommunications, and sewer). • Construction of first container berth with permanent edge structure (western container facility). Structure may be of the form pile supported deck of caisson/blockwork gravity structure. Berth not operational.
		Dredging • Dredging for approach channel and berth boxes for eastern area of multi-purpose terminals. • Dredging for all container berth boxes and approach channels. • Dredging for basins between multi-purpose terminal and container terminal, and basin east of the container terminal.
		Demolition • Demolition of No. 3 Jetty (currently used to accommodate tug boats) and No. 4 Jetty (currently used for import and export of non flammable liquids including sulphuric acid).
		Rail infrastructure upgrade • Rail infrastructure upgrade in the South Yard. including extension of No. 13 siding.

	Stage	Activity to be undertaken
	Stage 2	**General construction** • Decking/enclosure of Darcy Road Drain under hardstand of container terminal for rational movement in this area. • Salty Creek open channel through multi-purpose terminal to be enclosed under hardstand for operational movement in this area. • An extended new road link to connect the new container terminal with Christy Drive. • Closure of the road at the existing level crossing between Old Port Road and Foreshore Road. • Potential for a new road link along an existing disused rail corridor off Darcy Road to service the PKPC office and public access area and to separate this traffic from Port traffic.
		Reclamation • Commence land reclamation for the northern area of the multi-purpose terminal.
		Terminal and berth construction • Construction of second multi-purpose berth and terminal facilities. • Construction of second container berth (western container facility) • Pavements
		Rail infrastructure upgrade • Rail link to the container terminals and new rail siding on the terminal area.
		Road • A new rail overbridge to provide grade separation between the rail and road traffic servicing the container terminal.
	Stage 3	**Demolition** • Demolition of No. 6 Jetty (Port Kembla Gateway)
		Dredging • Dredging for northern area multi-purpose berth boxes. • Dredging for basin north of the multi-purpose terminal. • Dredging in northern portion of Outer Harbour to accommodate altered location of turning circle
		Reclamation • Complete land reclamation for the northern area of the multi-purpose terminal. • Complete reclamation for container terminals (eastern container facility)
		Terminal and berth construction • Construction of the third multi-purpose berth and terminal (formerly Port Kembla Gateway). • Construction of third container berth (eastern container facility) • Construction of fourth container berth (eastern container facility) • Construction of the northern portion of the container terminal (piled structure). • Construction of pavement material between extent of reclamation and boundary of development (i.e. landside area to the rail line along the south western edge of the Outer Harbour, and to Foreshore Road in the south).

Table 4.13 highlights the amount of trucks that will be generated by each construction activity during each stage of the project.

The following assumptions have been made with regards to the generation of construction traffic.

- Construction hours based on a 5 day week (260 days per year) and 11 hour days (7am to 6pm);
- Truck loading assumption of 15m^3 per truck for fill;
- Construction workforce – 1 vehicle per worker; and
- No peak hour loading for network peak (it is assumed the busiest hour for construction vehicles will occur at off-peak times)

Table 4.13: Construction Traffic Generation

Stage / Phase		Activity	Trucks per year	Trucks per weekday	Trucks per weekday hour (average)	Workforce Vehicles per weekday hour (average)	Duration of activity	Years of works	Comments
Stage 1 (Major Project Approval)	1a	**Fill** – blast furnace slag	35,484	136	12	-	18 months	2010 - 2011	798,398m^3 of blast furnace slag
	1b	**Fill** – coal wash	11,000	42	4	-	4 years	2010 - 2014	666,666m^3 of coal wash
	1c	**Fill** - coal wash	11,000	42	4	-	2 years	2015 - 2017	333,333m^3 of coal wash
	-	General construction	-	17	2	1	6 months	2010	
		Reclamation	-	10	1	1	18 months	2010 - 2011	
		Terminal and Berth construction	-	50	5	8	18 months	2012 - 2013	
		Dredging	-	5	1	2	12 months	2010	
		Demolition	-	10	1	2	12 months	2010	
		Rail infrastructure upgrade	-	5	1	1	6 weeks	2010	
Stage 2		General construction	-	10	1	1	6 months	2014	
		Reclamation	-	10	1	1	12 months	2022	
		Terminal and berth construction	-	10	1	5	6 ½ years	2014 - 2021	
		Rail infrastructure upgrade	-	5	1	2	8 weeks	2014	
		Road	-	5	1	3	12 months	2014	
Stage 3		Demolition	-	10	1	2	12 months	2026	
		Dredging	-	5	1	2	6 months	2026	
		Reclamation	-	10	1	1	12 months	2026	
		Terminal and berth construction	-	10	1	5	8 years	2030 - 2037	

Source: AECOM, January 2010

Based on the information presented in **Table 4.13**, **Table 4.14** indicates the amount of construction trucks / vehicles that will be generated per weekday average hour in each year of the project.

Table 4.14: Construction Traffic per weekday average hour per year

Year	Fill construction trucks per weekday average hour	General construction trucks per weekday average hour	Workforce vehicles per weekday average hour	Total traffic per weekday average hour	% trucks
2010	17	6	8	**31**	**74%**
2011	17	1	2	**20**	**90%**
2012	4	10	8	**22**	**64%**
2013	4	5	5	**14**	**64%**
2014	4	4	11	**19**	**42%**
2015	4	1	5	**10**	**50%**
2016	4	1	5	**10**	**50%**
2017	4	1	5	**10**	**50%**
2018	0	1	5	**6**	**17%**
2019	0	1	5	**6**	**17%**
2020	0	1	5	**6**	**17%**
2021	0	1	5	**6**	**17%**
2022	0	1	2	**3**	**33%**
2023	0	0	0	**0**	**-**
2024	0	0	0	**0**	**-**
2025	0	0	0	**0**	**-**
2026	0	3	6	**9**	**33%**
2027	0	0	0	**0**	**-**
2028	0	0	0	**0**	**-**
2029	0	0	0	**0**	**-**
2030	0	1	5	**6**	**17%**
2031	0	1	5	**6**	**17%**
2032	0	1	5	**6**	**17%**
2033	0	1	5	**6**	**17%**
2034	0	1	5	**6**	**17%**
2035	0	1	5	**6**	**17%**
2036	0	1	5	**6**	**17%**

Source: AECOM, January 2010

Table 4.14 indicates that the highest volume of construction related vehicles will be generated in 2010, with 23 trucks and eight other workforce vehicles expected per weekday average hour. These volumes are comparable to the number of vehicles generated by the operational phase of the development in 2016 (outlined in **Section 4.5**). In 2016, the operational development will generate 29 vehicles, consisting of 21 trucks and 8 employee vehicles.

By 2016, the volume of traffic on the wider road network will have increased, therefore placing greater demands on road infrastructure provision. At the same time, this operational traffic is expected to use the strategic road network while the construction vehicles (which are predominantly trucks) are envisaged to remain largely on the local network i.e. Mt Prosser / BlueScope Steel, as described previously. Consequently, review of intersection performance in 2010, to assess the impact of construction related traffic is considered unwarranted and has not been undertaken.

4.11 Cumulative Construction and Operational Traffic Movements

It is also noted that the number of weekday average hour construction vehicles in any one year after 2016, when added with the 2016 operational traffic, will not exceed the total forecast operational vehicle movements in 2036. Therefore, assessment of cumulative traffic impacts (construction and operation) for an interim year, between 2016 and 2036 is also not considered to be warranted as operational vehicle movements in 2036 effectively represents the worst case traffic generation scenario.

5.0 Findings and Recommendations

5.1 Road Access

The strategic road network, which includes the Southern Freeway, enables direct access between Port Kembla Outer Harbour, the Sydney Metropolitan area and wider areas. The near presence of the Southern Freeway, together with the main arterial of Five Islands Road, ensures that the interaction of heavy vehicles and local traffic is minimised.

Flinders Street and Old Port Road provide a loop off Five Islands Road to give access to the Outer Harbour area. Due to a decline in operations of the existing jetties, these roads are not widely used as they do not cater for any through traffic. However, they have wide lanes, limited on-street parking, few intersections and good visibility and therefore offer spare capacity for increased traffic use.

There is currently an at-grade rail crossing on Old Port Road between Christy Drive and Foreshore Road; however, this section of road is unlikely to be used for traffic accessing the Outer Harbour from the wider network. Other at-grade rail crossings exist on Foreshore Road.

Following completion of the Major Project, it is expected that all operational traffic will use Flinders Street and Christy Drive, via a new road link, to access the multi-purpose terminal. A new link from Foreshore Road, which connects to Old Port Road, will provide construction access for reclamation activities.

Under the Concept Plan, Foreshore Road will be closed at the existing level crossing closest to Old Port Road. Traffic accessing the container terminal will link to the wider network through an extension of the new road link from Christy Drive. Consequently, all port related traffic will use Christy Drive and Flinders Street for port access.

Access to the Port offices and public facilities at the southern end of the eastern breakwater will be provided via a new road, running from Darcy Road, along the disused rail corridor. The inclusion of this link will allow general public and port-related vehicles to be kept separate.

The level of traffic created by the Outer Harbour development will be determined by the level of trade handled at the berths. The traffic generation analysis used in this report indicates that for the trade forecast scenarios provided by Port Kembla Port Corporation, which has an emphasis on container trade (which would be increasingly transported by rail), there is unlikely to be a significant increase in the number of trucks accessing the Outer Harbour. The analysis indicates that road freight traffic to the Outer Harbour is likely to grow over time reaching 166 trucks per day by 2016 and 505 trucks per day by 2036. This equates to 29 and 84 trucks per peak hour respectively.

5.2 Road Network Performance

To consider the future road network performance, AECOM has reviewed the mid-block lane capacities on key links as well as utilising intersection modelling software to assess the performance of individual intersections both with and without the OHD. Intersection analyses were undertaken using SIDRA Intersection 3.2 for key intersections surrounding the proposed development for the following scenarios:

Table 5.1 Summary of Intersection Performance Modelling Scenarios

Intersection	Year	Development Traffic	Scenario
Existing Intersections in current form	2016	No	Capacity Review
	2036	No	Capacity Review
	2016	Yes	Impact Assessment
	2036	Yes	Impact Assessment

Source: AECOM, January 2010

5.2.1 'Without' Development Performance - 2016

The mid-block capacity analysis found that, without the inclusion of traffic generated by the Major Project, the on/off ramps associated with the Southern Freeway will have sufficient capacity to accommodate the forecast 2016 traffic volumes. Augmentation to the Southern Freeway will be required to accommodate the forecast traffic volumes regardless of future development of the Outer Harbour.

All of the intersections report a satisfactory level of service for the forecast traffic volumes in 2016. Delays are most prevalent for traffic on the 'minor' approaches although it is noted that Springhill Road is an important arterial link. The degree of saturation results indicate that the Five Islands Road / Springhill Road intersection is operating at capacity.

5.2.2 'Without' Development Performance - 2036

The mid-block capacity analysis found that, without the inclusion of traffic generated by the Concept Plan, the on/off ramps associated with the Southern Freeway will have sufficient capacity to accommodate the forecast 2036 traffic volumes. Widening of the Southern Freeway, to three lanes in each direction, has been included in the WOLSH traffic model in order to accommodate the forecast traffic volumes which do not include future development of the Outer Harbour.

For the 2036 'without development' scenario, all of the intersections, with the exception of the Springhill Road / Masters Road intersection, report satisfactory level of service.

Capacity issues are evident at the intersections of Five Islands Road / Springhill Road and Springhill Road / Masters Road, which also reports unsatisfactory level of service. Potential solutions to the capacity issues might include:

- Grade separation of the right-turn movement from Five Islands Road into Springhill Road; and
- Grade separation of the Springhill Road / Masters Road intersection.

These works should be considered regardless of the proposed development of the Outer Harbour and are therefore not recommended as a mitigation measure to the development proposal.

5.2.3 'With' Development Performance – Major Project, 2016

The 2016 'with development' intersection performance results are compared to the 2016 base performance in **Table 5.2** and **Table 5.3** for the AM and PM peak hours respectively. These tables summarise the Degree of Saturation (DOS), Level of Service (LOS) and Average Vehicle Delay (AVD) results for each intersection.

Table 5.2 2016 Intersection Performance Results, AM Peak Hour

Intersection	2016 Base Case			2016 With Development		
	DOS	LOS	AVD	DOS	LOS	AVD
1. Five Islands Road / King Street / Wattle Street	0.75	B	27.3	0.75	B	27.3
2. Five Islands Road / Flinders Street	0.46	A	6.9	0.46	A	7.6
3. Five Islands Road / Springhill Road	1.00	B	18.7	1.00	B	19.3
4. Springhill Road / Masters Road	0.82	C	34.5	0.82	C	34.7

Source: AECOM, January 2010

Table 5.3 2016 Intersection Performance Results, PM Peak Hour

Intersection	2016 Base Case			2016 With Development		
	DOS	LOS	AVD	DOS	LOS	AVD
1. Five Islands Road / King Street / Wattle Street	0.76	C	29.2	0.76	C	29.2
2. Five Islands Road / Flinders Street	0.60	A	9.9	0.61	A	10.8
3. Five Islands Road / Springhill Road	0.98	B	26.4	1.00	B	26.6
4. Springhill Road / Masters Road	0.80	C	35.9	0.80	C	36.1

Source: AECOM, January 2010

Table 5.2 and **Table 5.3** show that the Major Project will have a negligible impact on intersections with increases in the Degree of Saturation and Average Delay per Vehicle being minimal and no change to the Level of Service results.

5.2.4 'With' Development Performance – Concept Plan, 2036

The 2036 'with development' intersection performance results are compared to the 2036 base performance in **Table 5.4** and **Table 5.5** for the AM and PM peak hours respectively. These tables summarise the Degree of Saturation (DOS), Level of Service (LOS) and Average Vehicle Delay (AVD) results for each intersection.

Table 5.4 2036 Intersection Performance Results, AM Peak Hour

Intersection	2036 Base Case			2036 With Development		
	DOS	LOS	AVD	DOS	LOS	AVD
1. Five Islands Road / King Street / Wattle Street	0.82	C	32.6	0.82	C	32.6
2. Five Islands Road / Flinders Street	0.54	A	7.5	0.58	A	8.9
3. Five Islands Road / Springhill Road	1.00	B	21.4	1.00	B	19.9
4. Springhill Road / Masters Road	0.99	F	80.0	1.00	F	84.7

Source: AECOM, January 2010

Table 5.5 2036 Intersection Performance Results, PM Peak Hour

Intersection	2036 Base Case			2036 With Development		
	DOS	LOS	AVD	DOS	LOS	AVD
1. Five Islands Road / King Street / Wattle Street	0.78	C	32.2	0.78	C	32.2
2. Five Islands Road / Flinders Street	0.70	A	11.1	0.78	A	13.5
3. Five Islands Road / Springhill Road	1.00	C	30.2	1.00	C	31.9
4. Springhill Road / Masters Road	0.87	D	43.8	0.89	D	45.0

Source: AECOM, January 2010

Table 5.4 and **Table 5.5** show that the Concept Plan will have a negligible impact on intersections with increases in the Degree of Saturation and Average Delay per Vehicle being minimal and no change to the Level of Service results.

5.2.5 Construction Impacts

Analysis of construction activities indicates that the estimated peak hour construction movements will be very similar to the level of operational traffic following completion of the Major Project. The impacts of this operational traffic found that the surrounding road network will experience negligible impacts and therefore it is reasonable to expect a similar result with the inclusion of construction traffic.

5.2.6 Cumulative Construction and Operational Traffic Movements

The number of weekday average hour construction vehicles in any one year after 2016, when added with the 2016 operational traffic, would not exceed the total forecast operational vehicle movements in 2036. Therefore, assessment of cumulative traffic impacts (construction and operation) for an interim year, between 2016 and 2036 is also not considered to be warranted as operational vehicle movements in 2036 effectively represents the worst case traffic generation scenario.

5.3 Recommendations

The traffic impact analysis indicates that there is unlikely to be a significant impact on the local road network as a result of the number of trucks accessing the Outer Harbour during both construction and operation of the development.

5.3.1 Major Project

All of the nearby intersections are capable of supporting the impact of traffic that may occur as a result of the activities associated with the Major Project Approval. Consequently, no mitigation measures are deemed necessary on the wider network to ameliorate the impacts of the proposed Outer Harbour development.

Although peak hour traffic volumes generated by the proposal are unlikely to be significant, the main roads currently accessing the Outer Harbour, namely Flinders Street and Old Port Road, may require enhancement to cater for increased levels of heavy traffic. Augmentation might include improvements to pavement strength and improved turning radii for long vehicles; however, this is unlikely to be required in the short to medium term for the Major Project Approval.

5.3.2 Concept Plan

Intersection modelling results indicate that the wider road network will experience negligible impacts as a result of the activities associated with the three stages of development in accordance with the Concept Plan. With the exception of the Springhill Road / Masters Road intersection, which is forecast to have insufficient capacity regardless of the proposed development, all of the intersections are capable of supporting the impact of traffic that may occur as a result of the Concept Plan. Consequently, no mitigation measures are deemed necessary to ameliorate the impacts of the proposed development.

Flinders Street may require enhancement to cater for increased levels of heavy traffic accessing the Outer Harbour. Augmentation might include improvements to pavement strength and improved turning radii for long vehicles. The need for these works could be assessed in more detail as part of subsequent project approvals for Stages 2 and 3 of the Concept Plan.

5.3.3 Construction Traffic

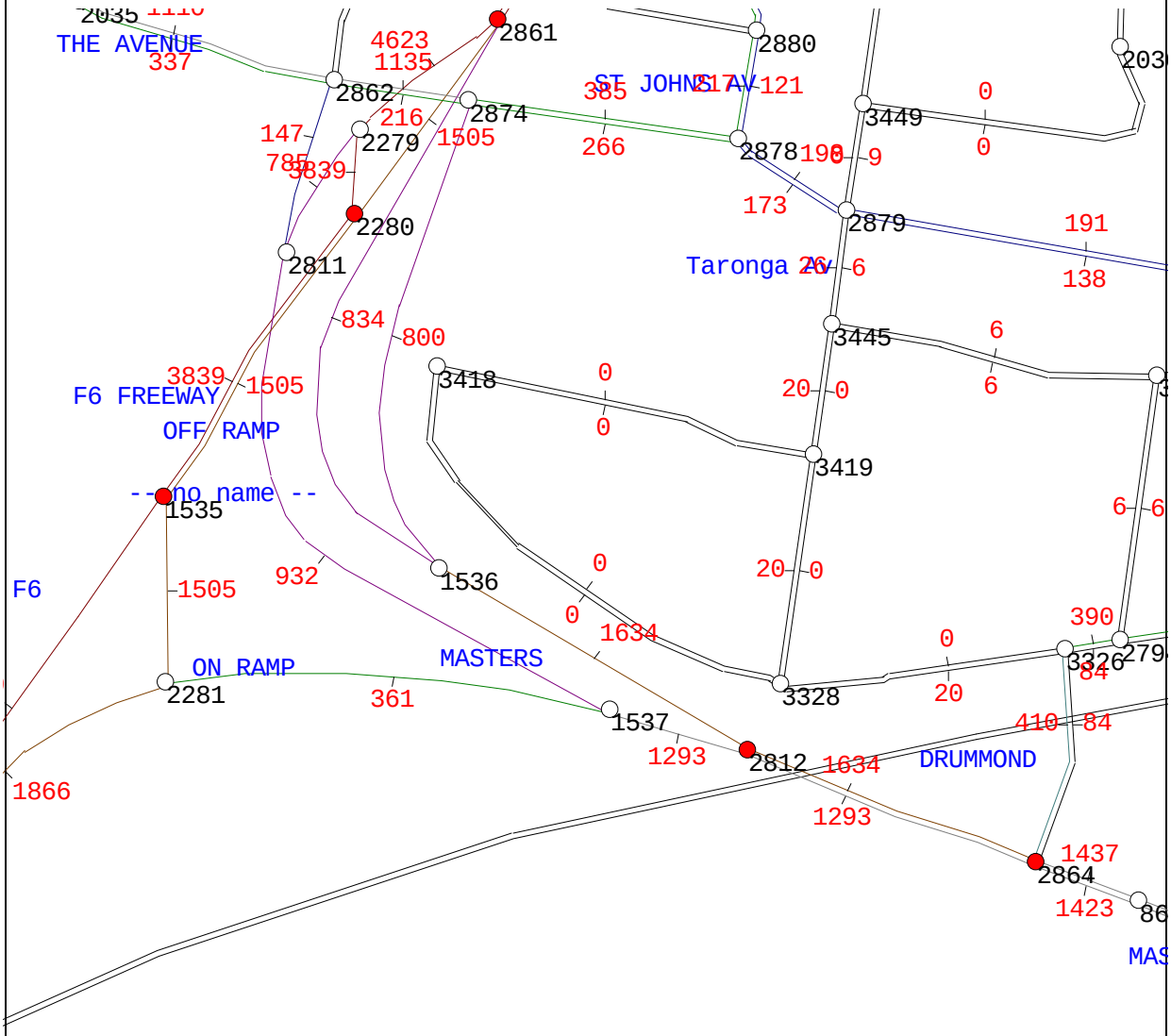
The final dredging depth for multi-purpose and container berth basins and boxes would be determined by the type of ships that visit the Outer Harbour, and their required draft, and would be between -15m and -16.5m.

Assessments for construction traffic has been undertaken to address the worst case scenario for transportation of fill material. That is, if the actual and final depth of dredging is -15m there would be less material available for reclamation and more fill material would need to be imported from external sources.

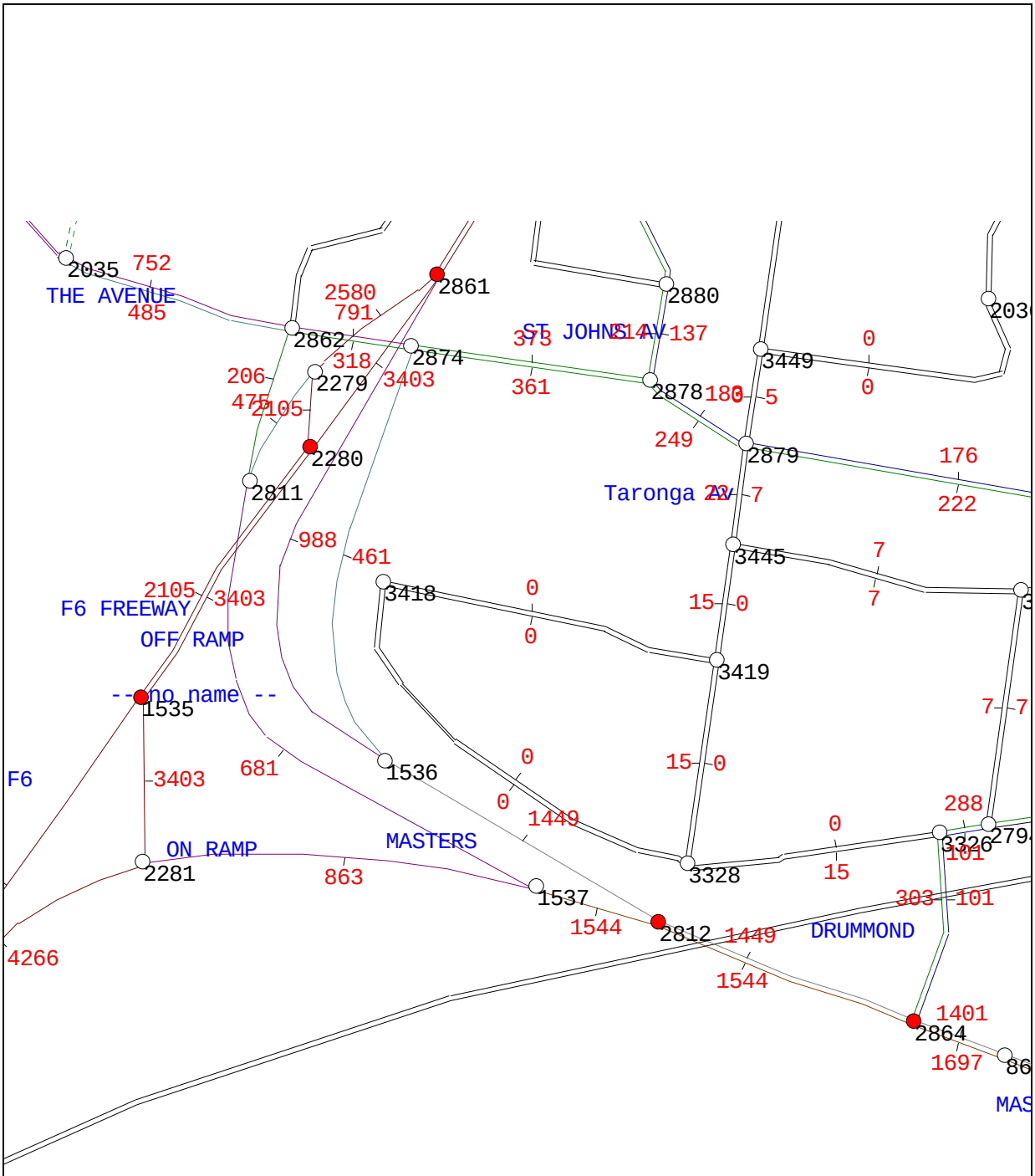
Despite considering a worst case scenario, construction traffic movements are unlikely to pose a greater impact than operational vehicles under either the Major Project or Concept Plan scenarios. However, suitable traffic

management will be required to minimise construction impacts on pedestrian and vehicle movements and it is understood that a Traffic Management Plan would be included in CEMPs prepared for each discrete package of construction works. The TMPs would address work practices on site, haulage routes to and from the site, driver protocols, financial penalties and hours of construction as a minimum.

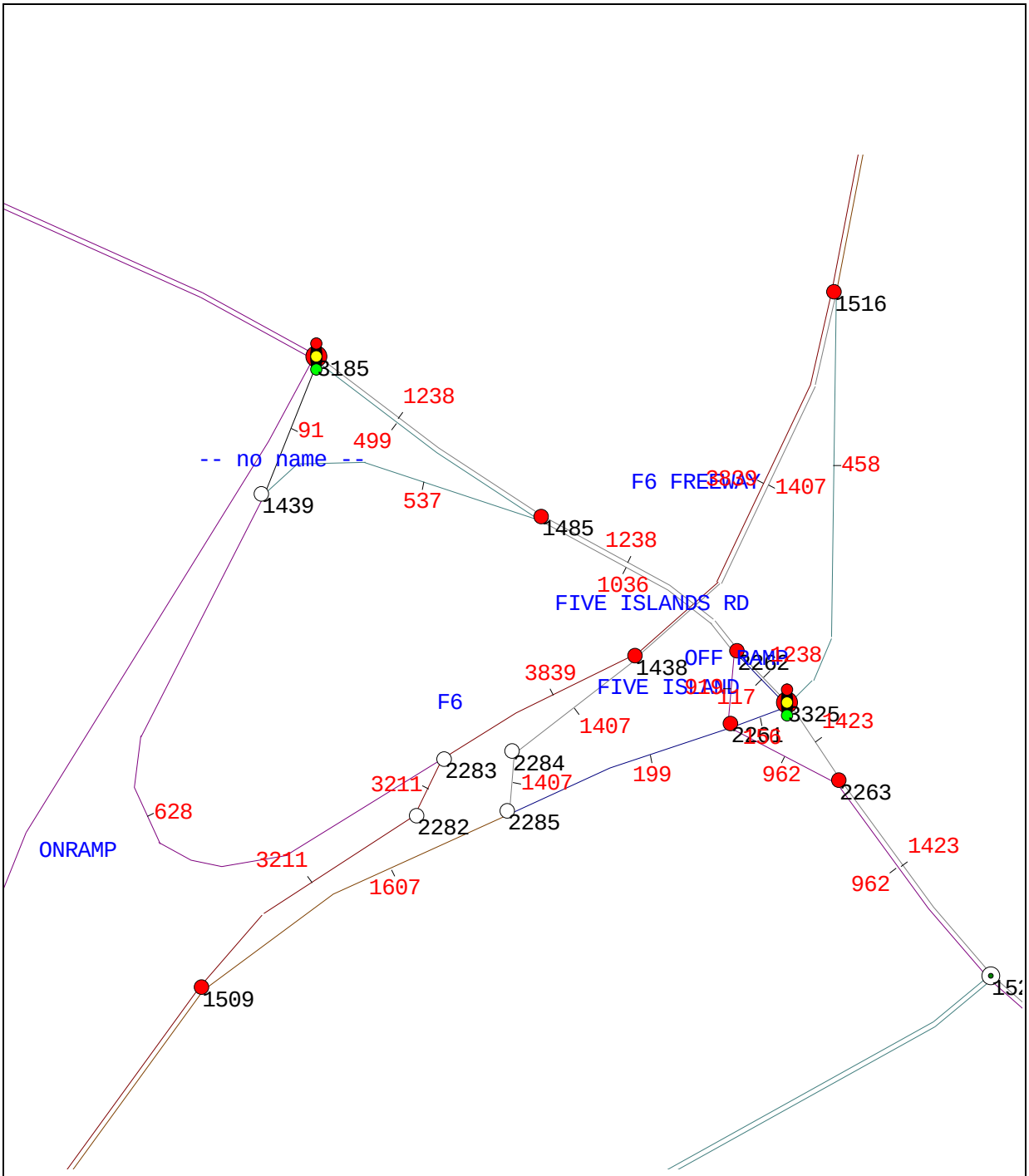
Appendix A WOLSH Modelling Outputs



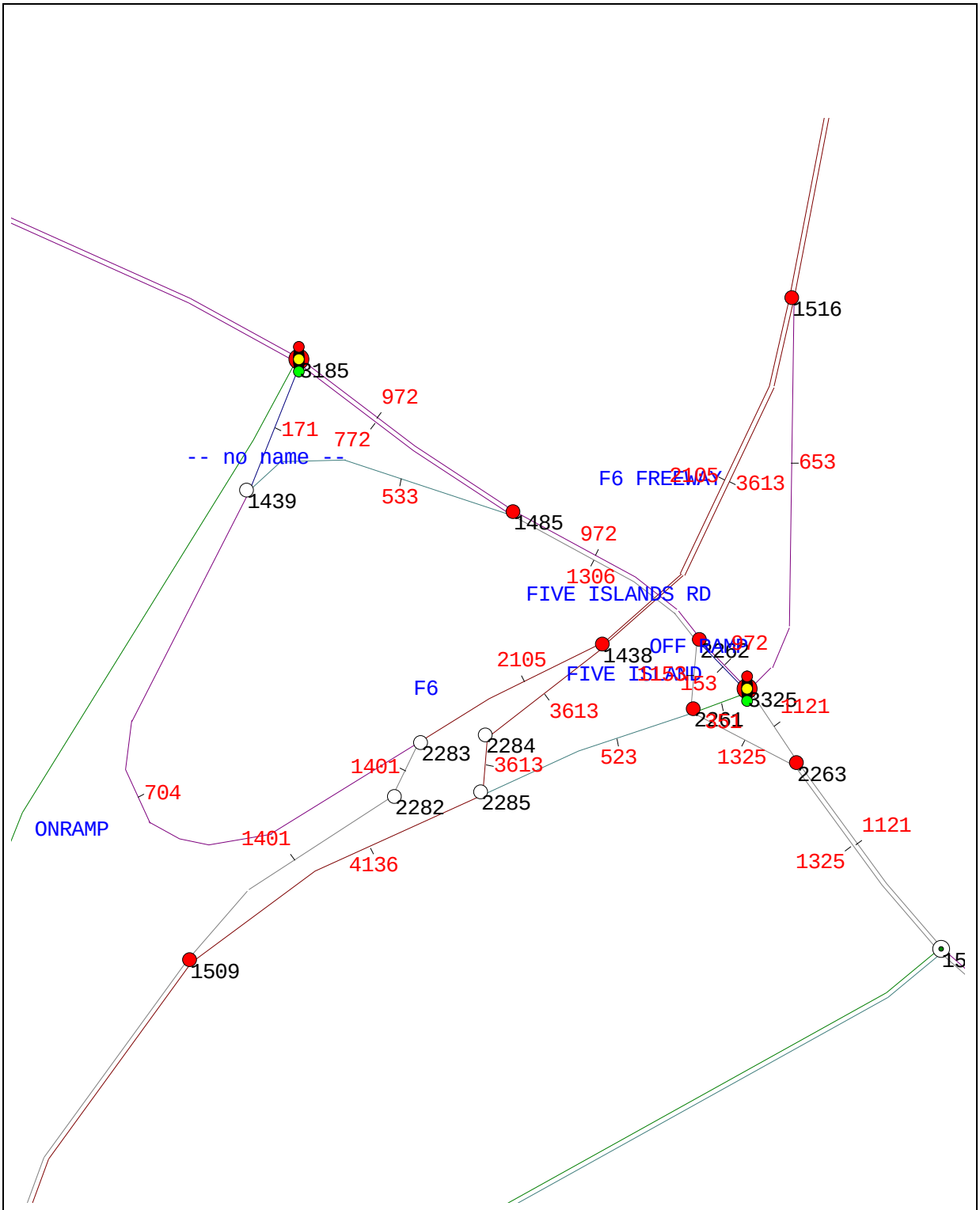
Wolsh Transportation Model	**Traffic Volumes** **The Southern Freeway/Masters Road** **2016 AM Peak**	**Figure 1**
Gabites Porter Consultants		



Wolsh Transportation Model Gabites Porter Consultants	**Traffic Volumes** **The Southern Freeway/Masters Road** **2016 PM Peak**	**Figure 2**

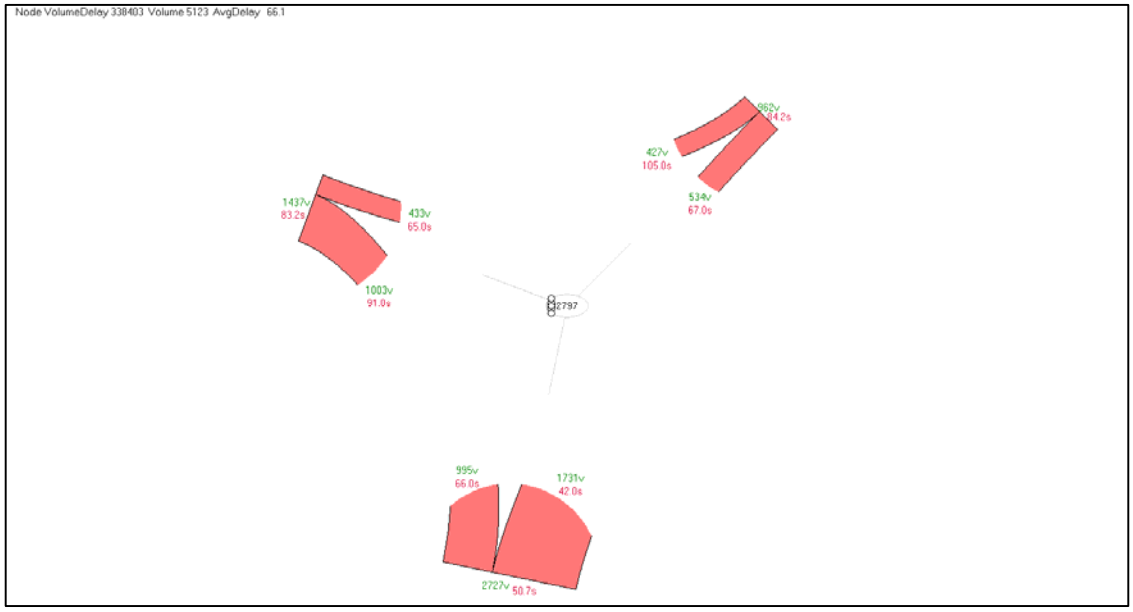


Wolsh Transportation Model	**Traffic Volumes** **The Southern Freeway/Five Islands Road** **2016 AM Peak**	**Figure 3**
Gabites Porter Consultants		

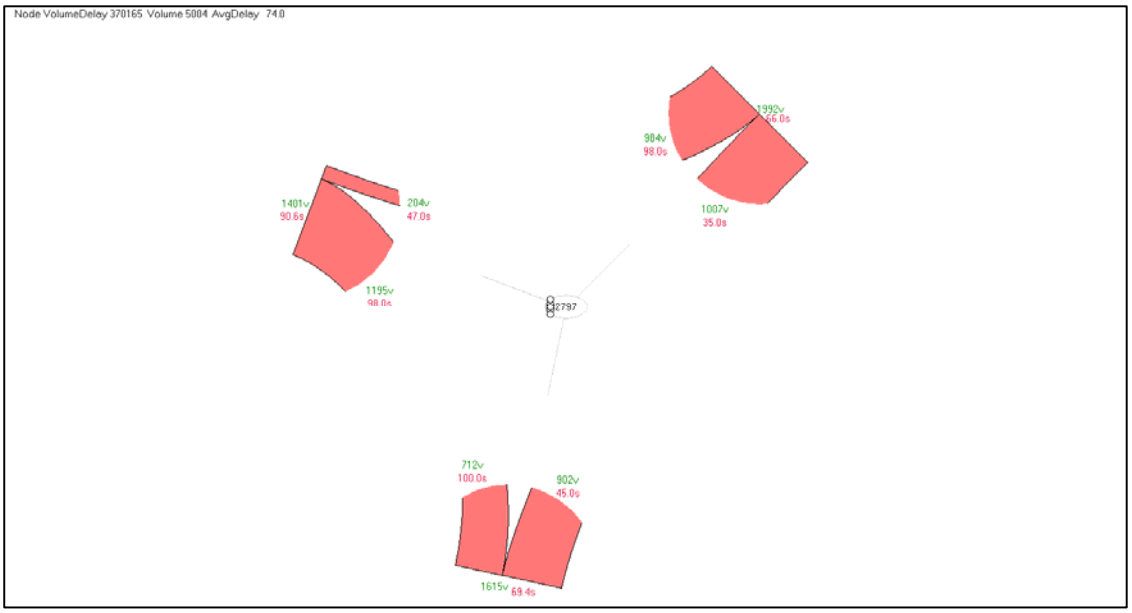


Wolsh Transportation Model Gabites Porter Consultants	**Traffic Volumes** **The Southern Freeway/Five Islands Road** **2016 PM Peak**	**Figure 4**

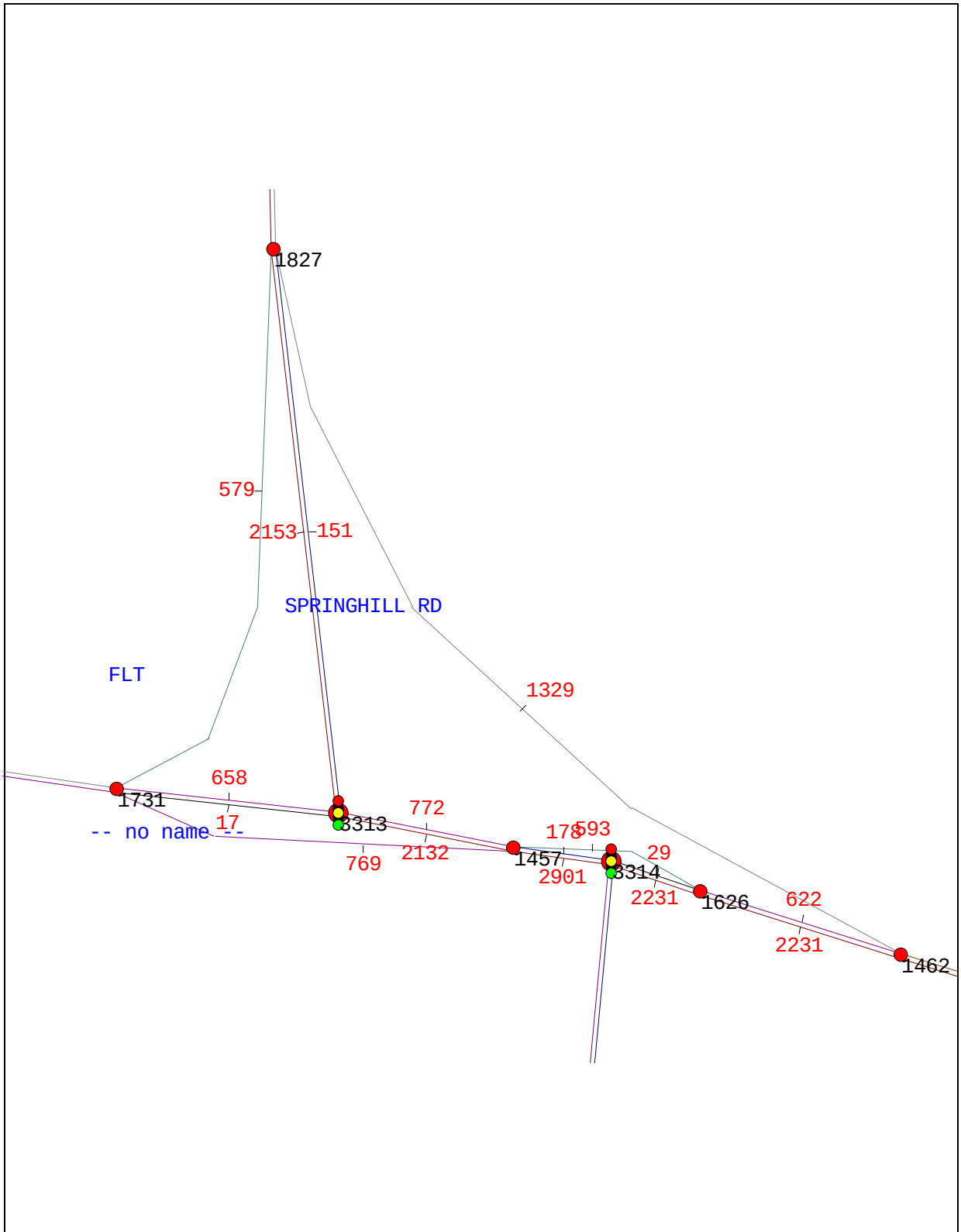
AM Peak



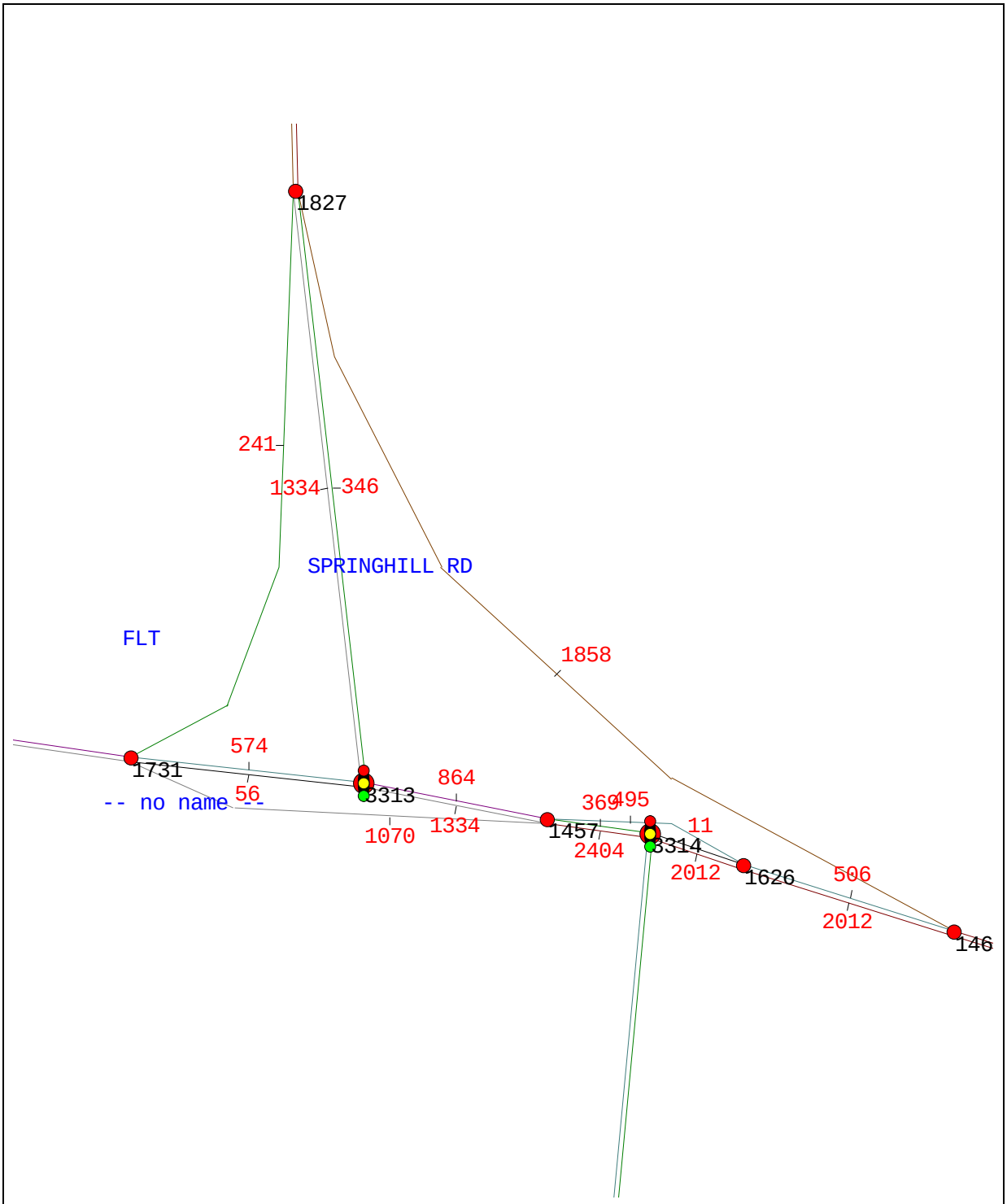
PM Peak



Wolsh Transportation Model	**Turning Movement Plot** **Masters Road/Spring Hill Road** **2016**	**Figure 5**
Gabites Porter Consultants		

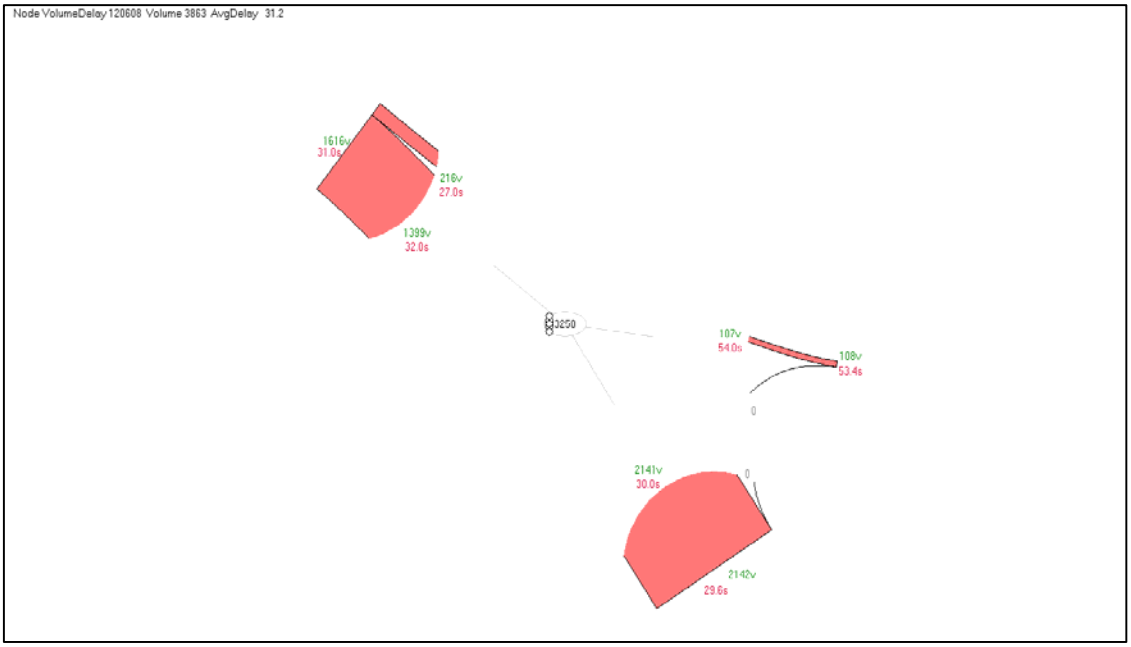


Wolsh Transportation Model	**Traffic Volumes** **Five Islands Road/Springhill Road** **2016 AM Peak**	**Figure 6**
Gabites Porter Consultants		

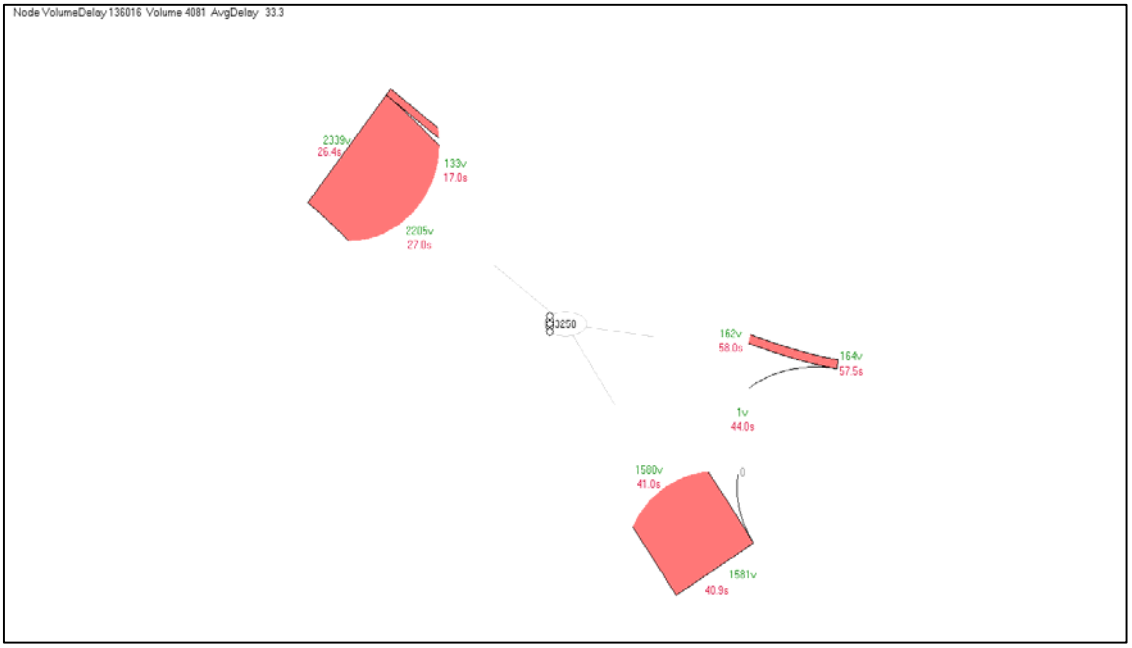


Wolsh Transportation Model	**Traffic Volumes** **Five Islands Road/Springhill Road** **2016 PM Peak**	**Figure 7**
Gabites Porter Consultants		

AM Peak

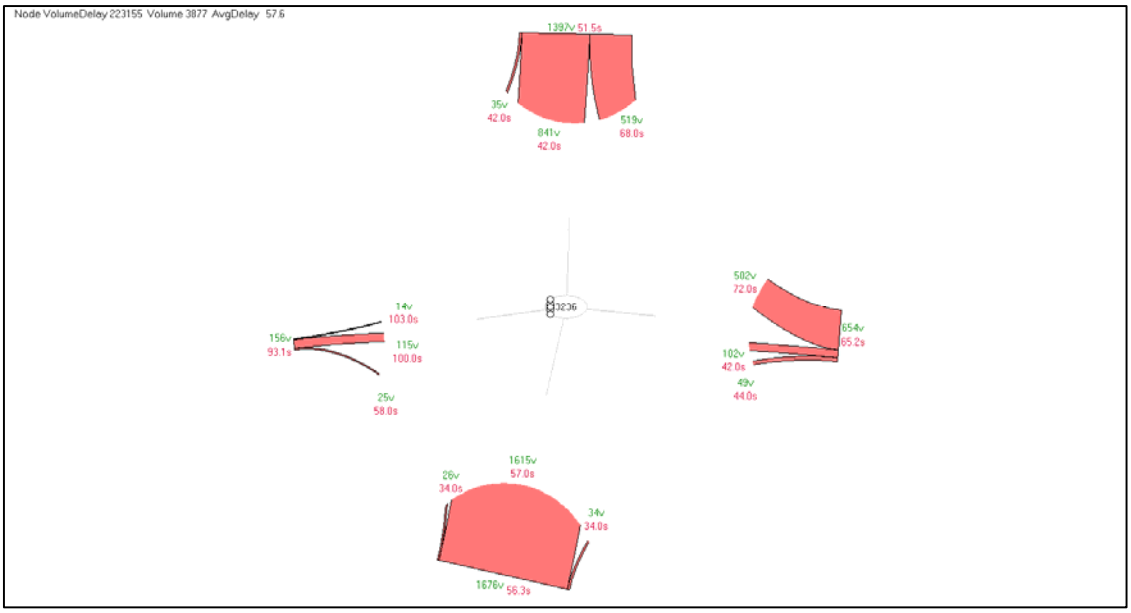


PM Peak

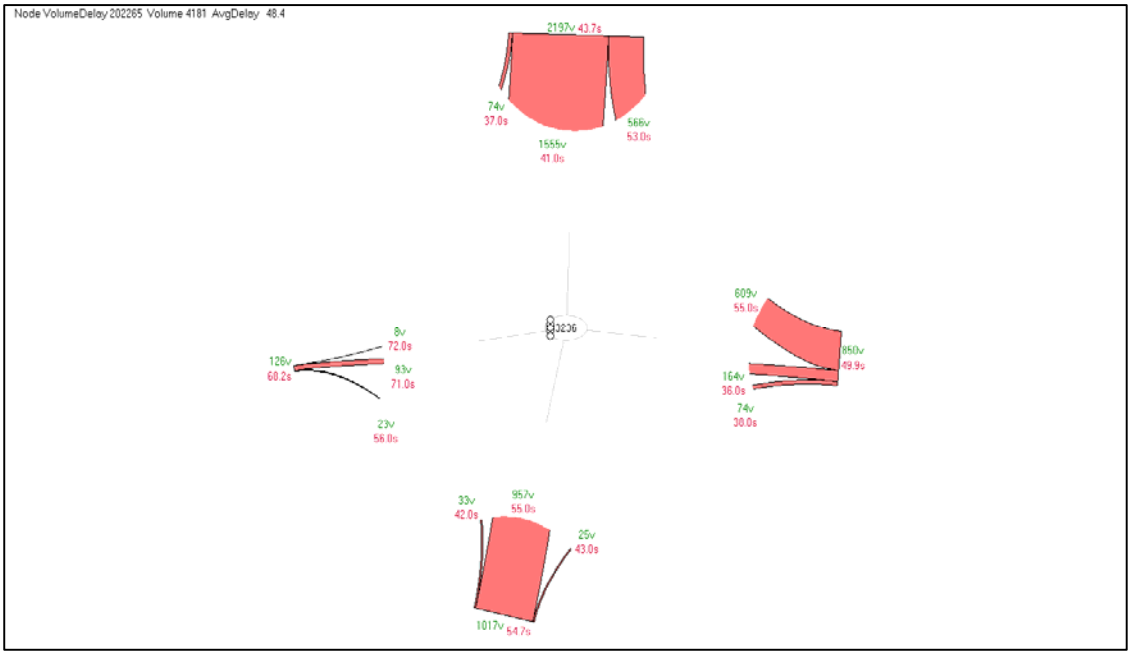


Wolsh Transportation Model	**Turning Movement Plots** **Five Islands Road/Flinders Street** **2016**	**Figure 8**
Gabites Porter Consultants		

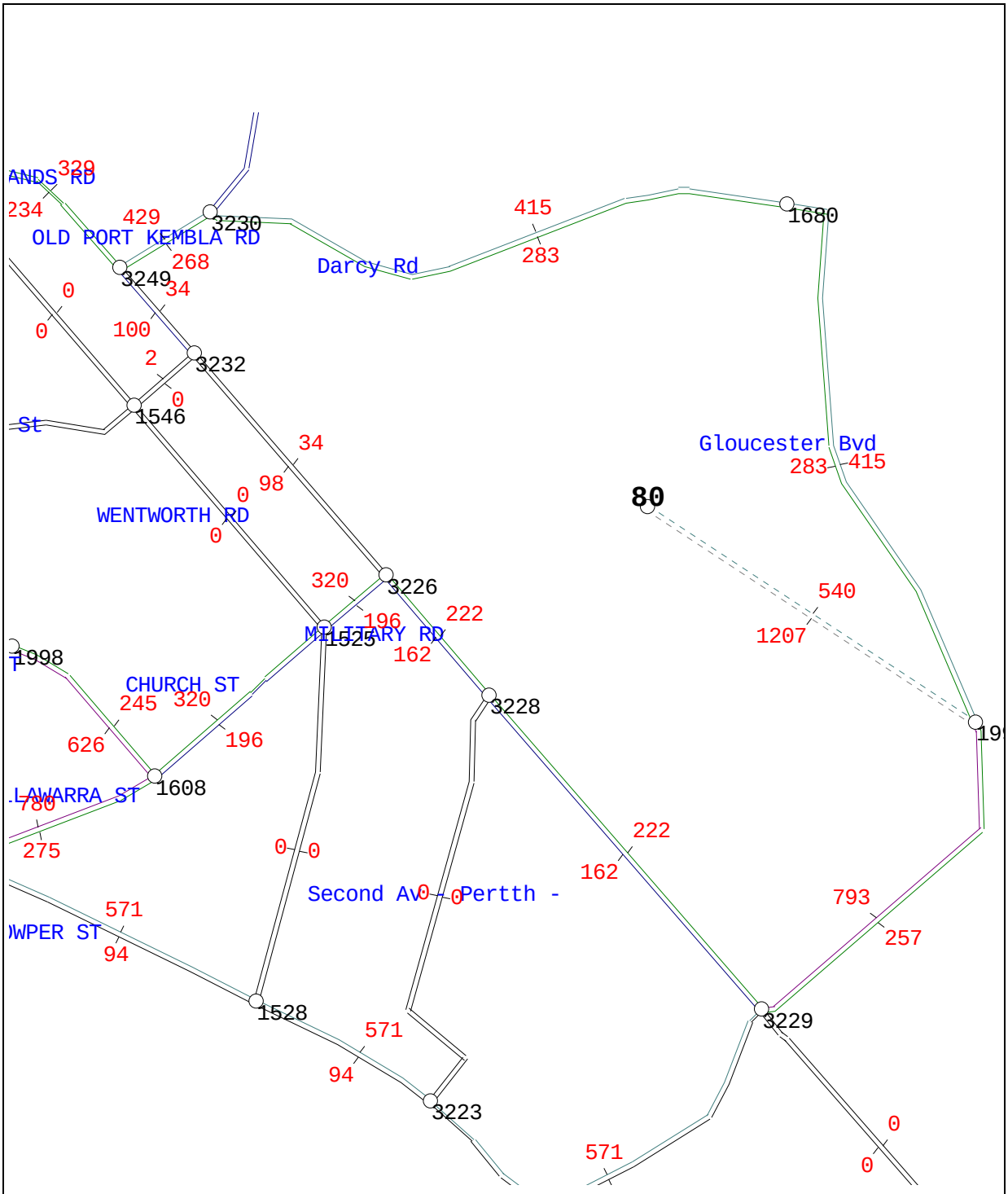
AM Peak



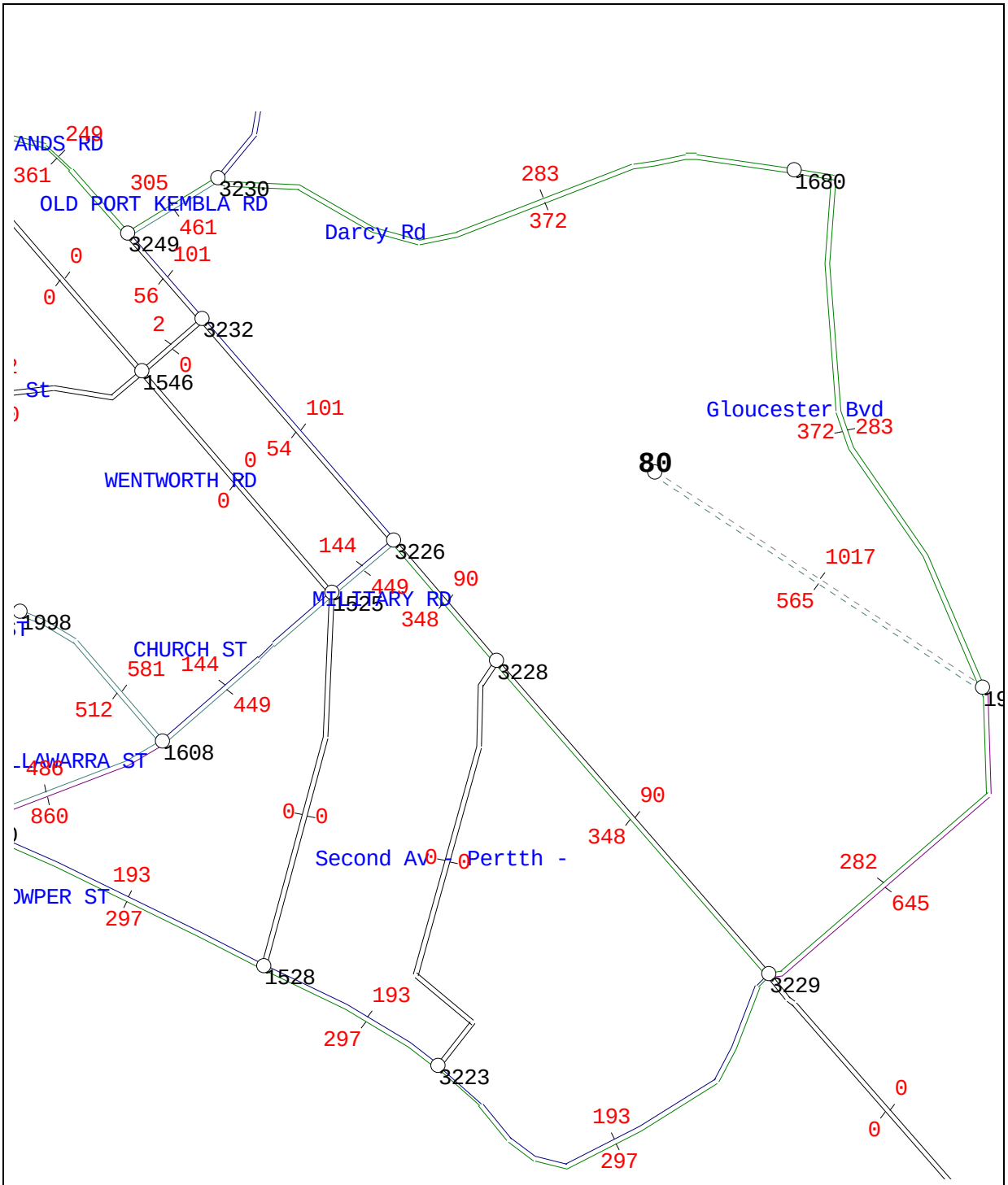
PM Peak



Wolsh Transportation Model	**Turning Movement Plots** **Five Islands Road/King Street** **2016**	**Figure 9**
Gabites Porter Consultants		

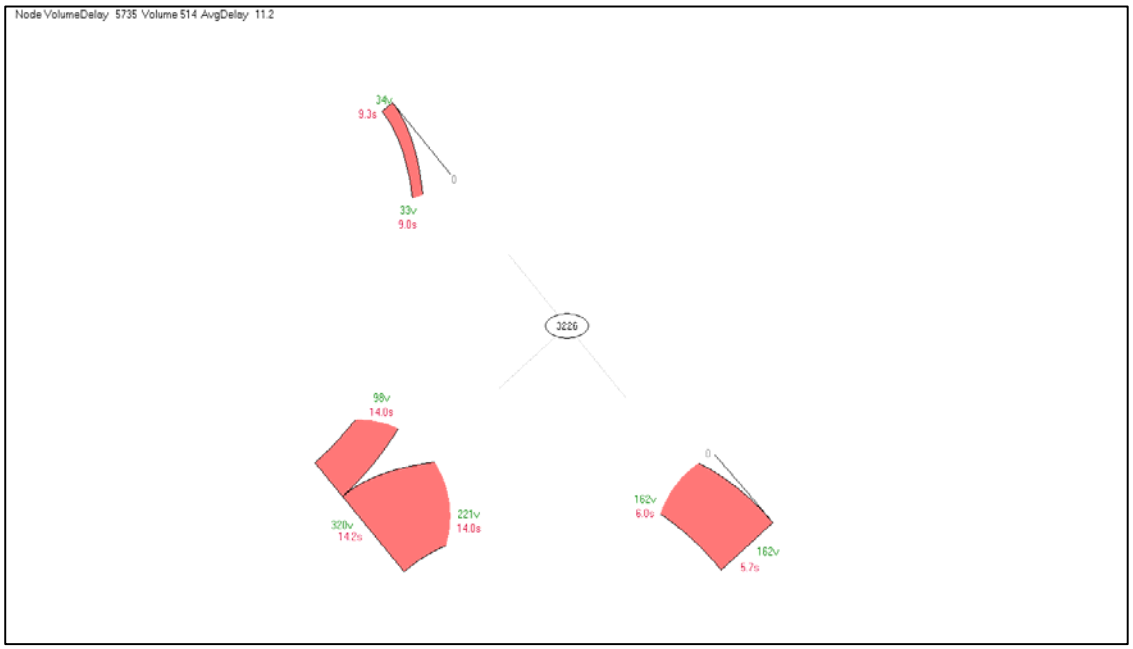


Wolsh Transportation Model	**Traffic Volumes** **Old Port Road/Foreshore Road** **2016 AM Peak**	**Figure 10**
Gabites Porter Consultants		

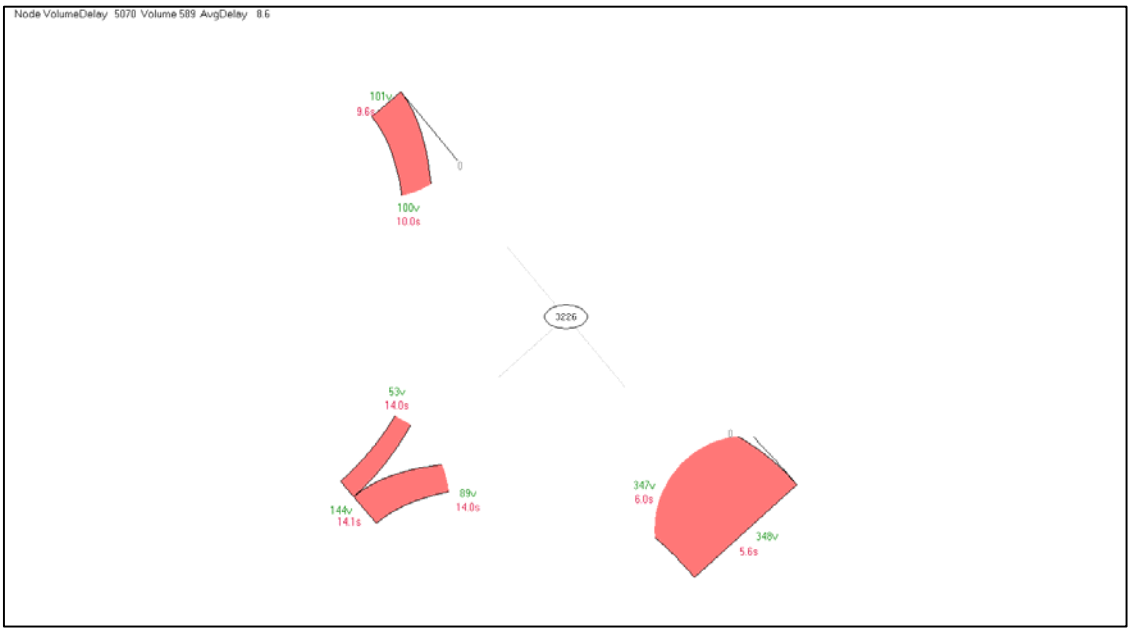


Wolsh Transportation Model	**Traffic Volumes** **Old Port Road/Foreshore Road** **2016 PM Peak**	**Figure 11**
Gabites Porter Consultants		

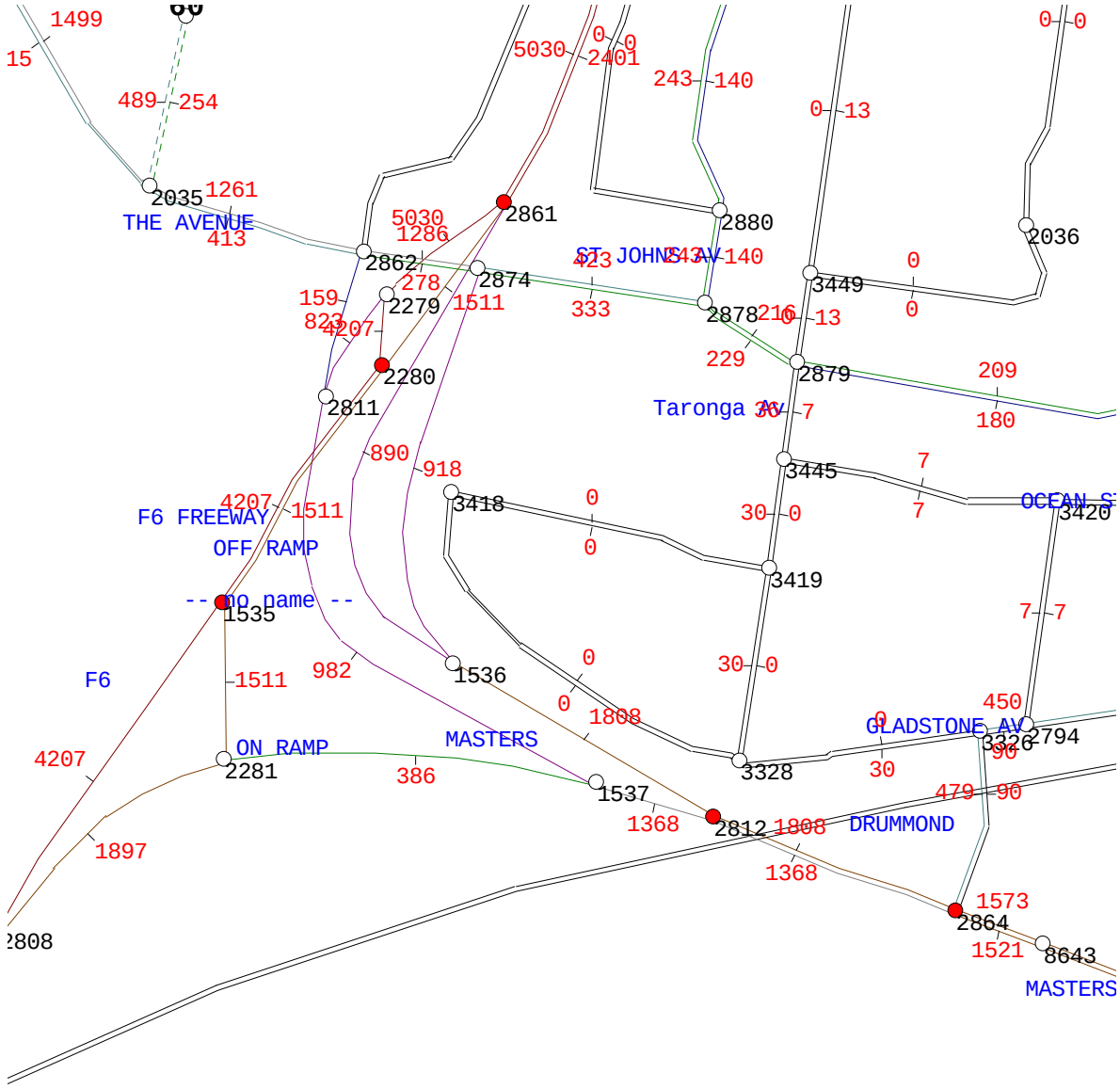
AM Peak



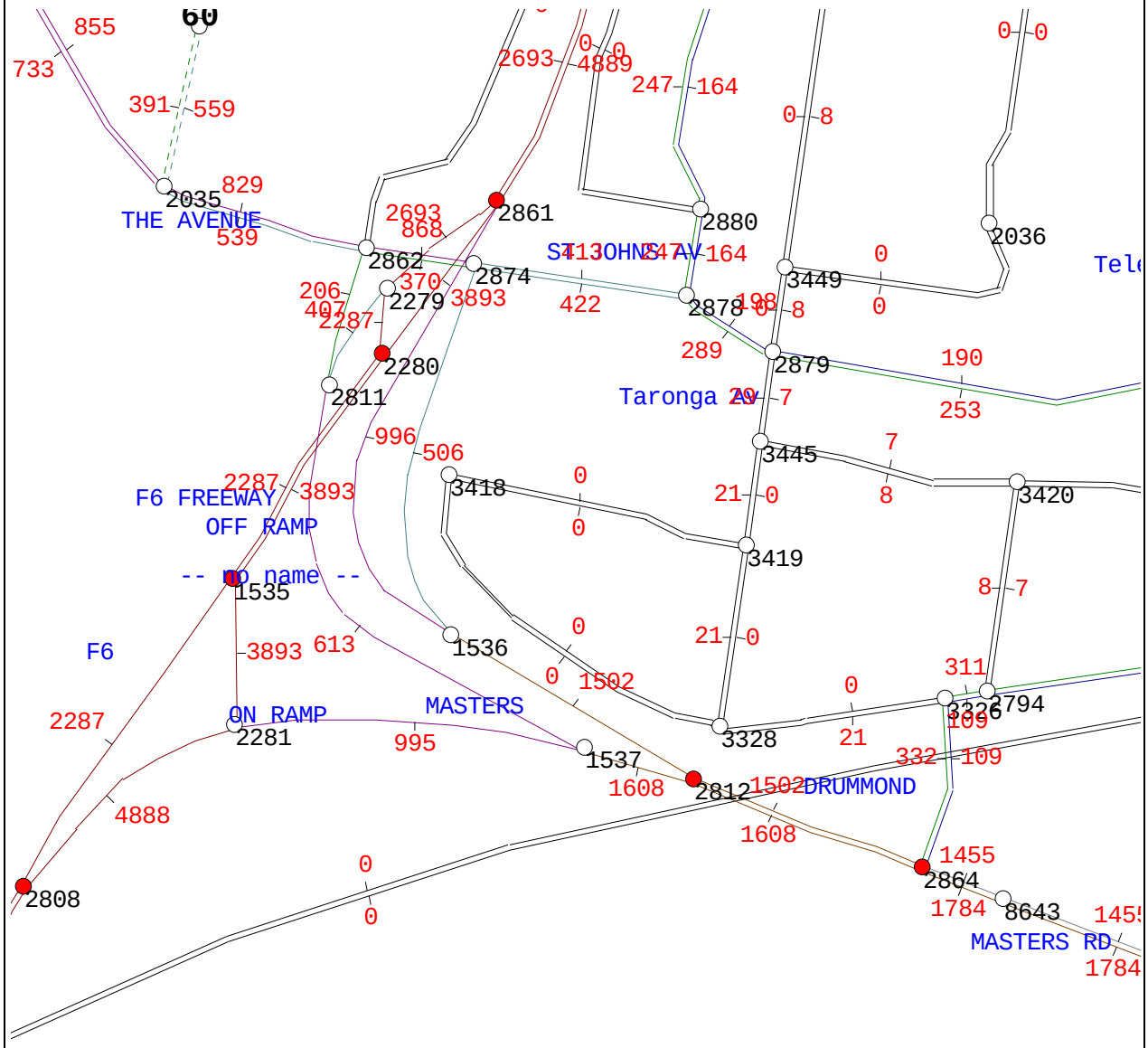
PM peak



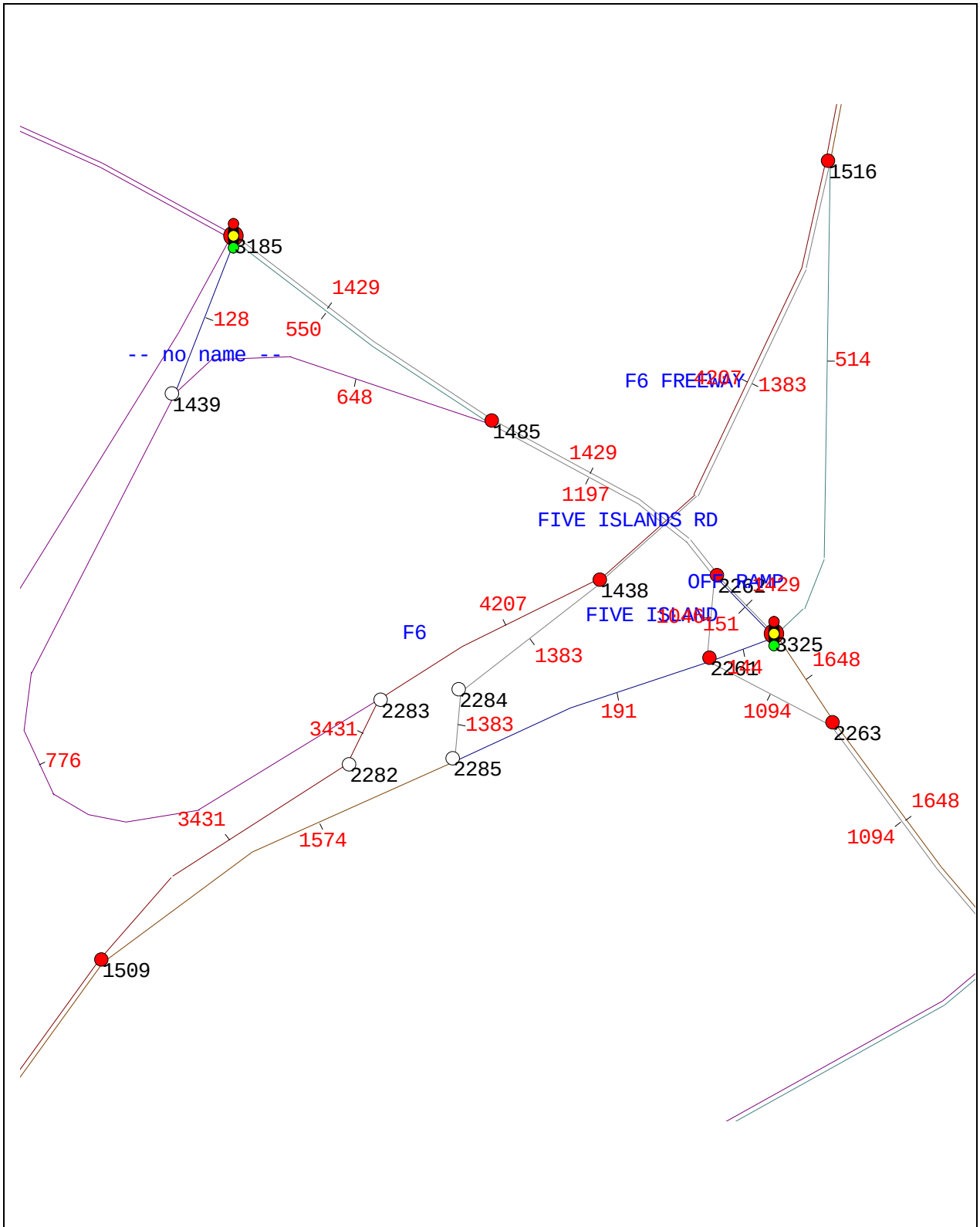
Wolsh Transportation Model	**Turning Movement Plots Old Port Road/Military Road 2016**	**Figure 12**
Gabites Porter Consultants		



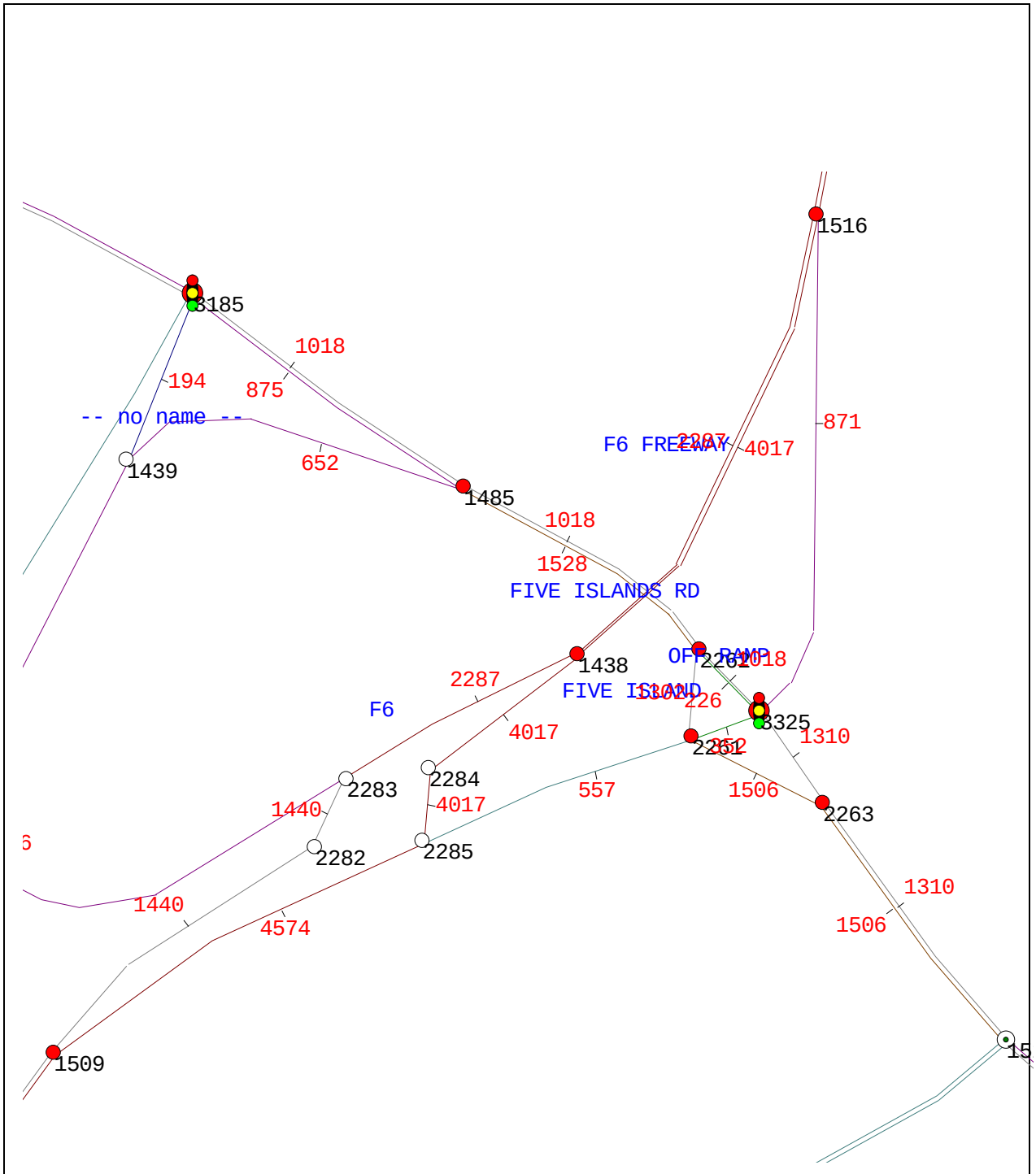
Wolsh Transportation Model	**Traffic Volumes** **The Southern Freeway/Masters Road** **2026 AM Peak**	**Figure 1**
Gabites Porter Consultants		



Wolsh Transportation Model	**Traffic Volumes** **The Southern Freeway/Masters Road** **2026 PM Peak**	**Figure 2**
Gabites Porter Consultants		

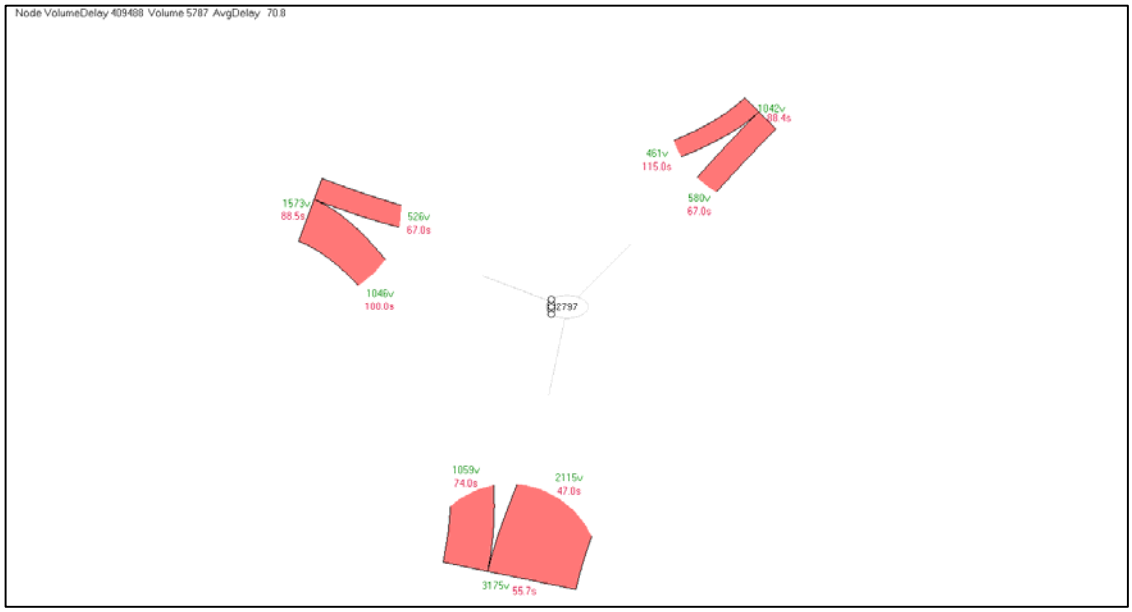


Wolsh Transportation Model	**Traffic Volumes** **The Southern Freeway/Five Islands Road** **2026 AM Peak**	**Figure 3**
Gabites Porter Consultants		

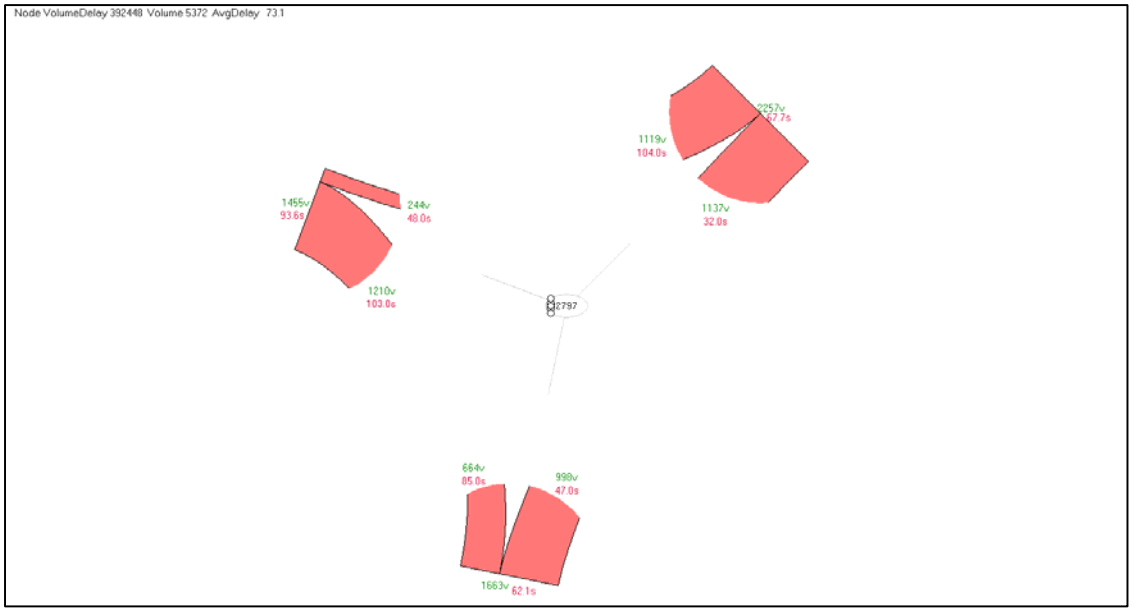


Wolsh Transportation Model	**Traffic Volumes** **The Southern Freeway/Five Islands Road** **2026 PM Peak**	**Figure 4**
Gabites Porter Consultants		

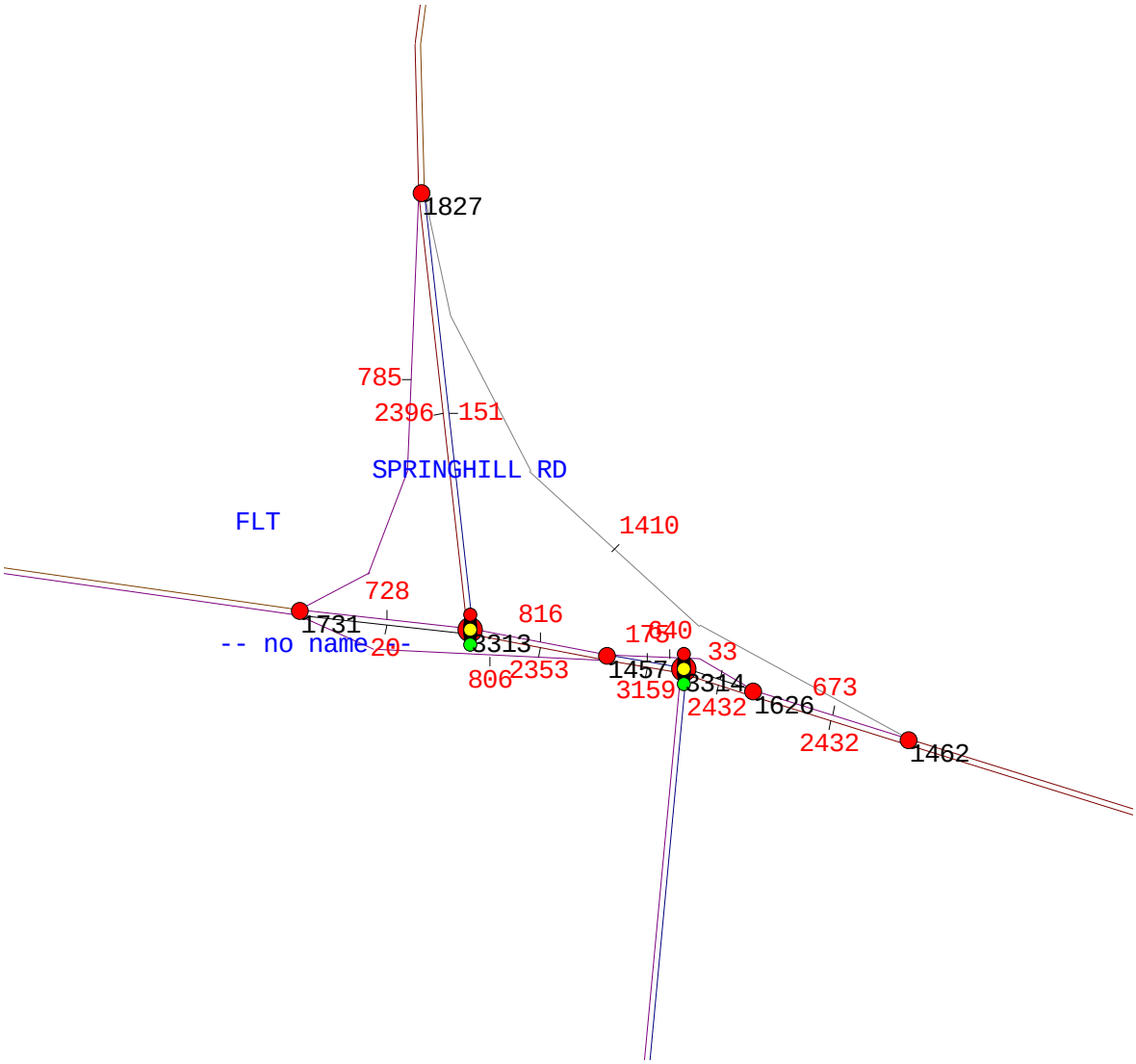
AM Peak



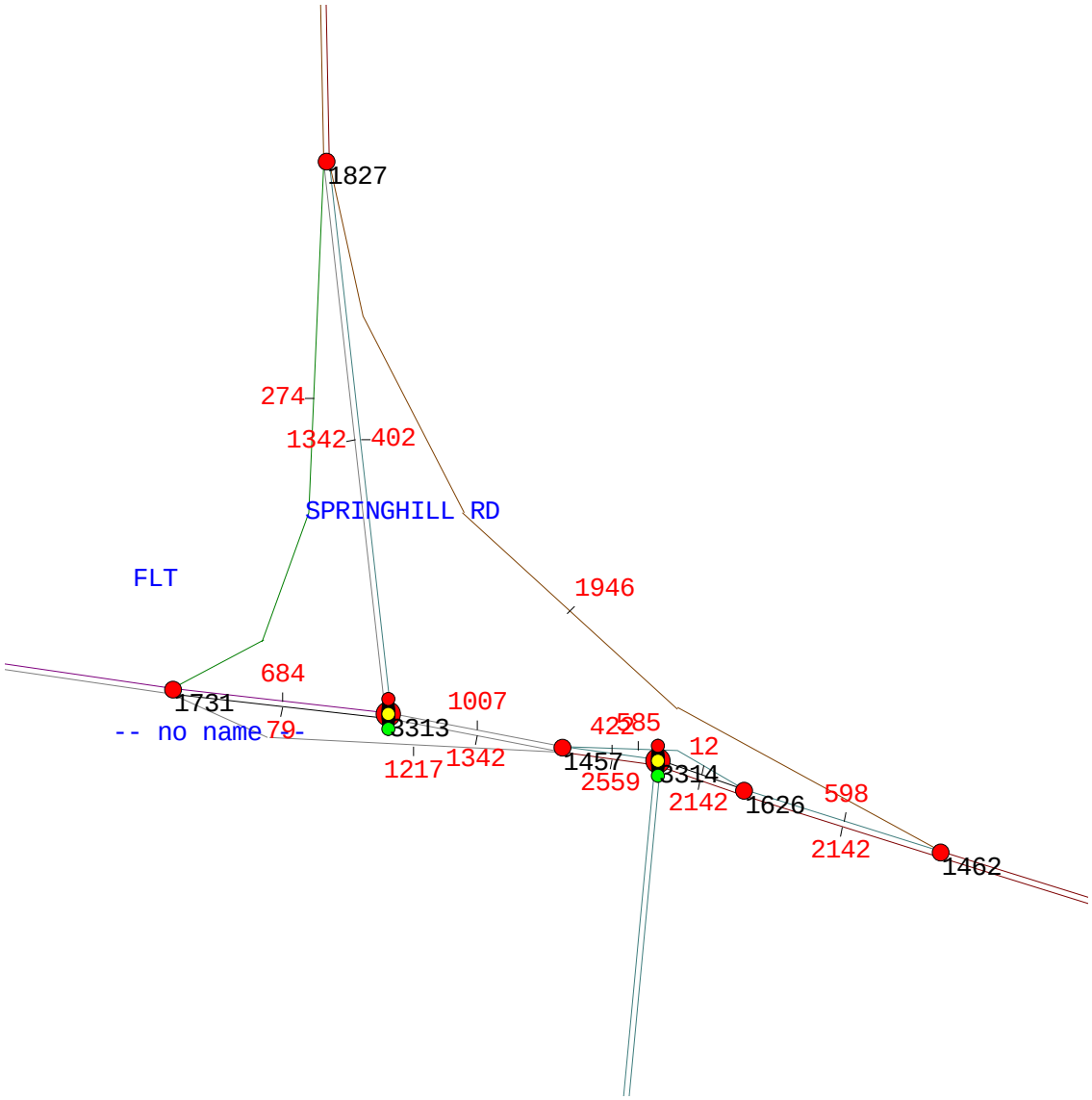
PM Peak



Wolsh Transportation Model	**Turning Movement Plot** **Masters Road/Spring Hill Road** **2026**	**Figure 5**
Gabites Porter Consultants		

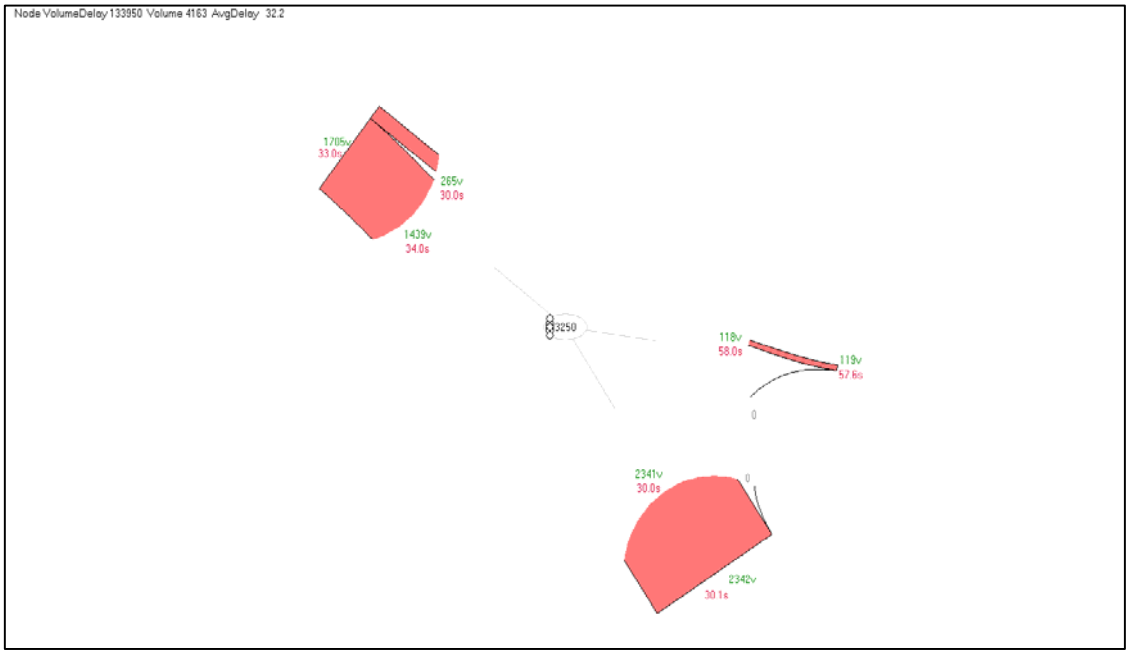


Wolsh Transportation Model	**Traffic Volumes** **Five Islands Road/Springhill Road** **2026 AM Peak**	**Figure 6**
Gabites Porter Consultants		

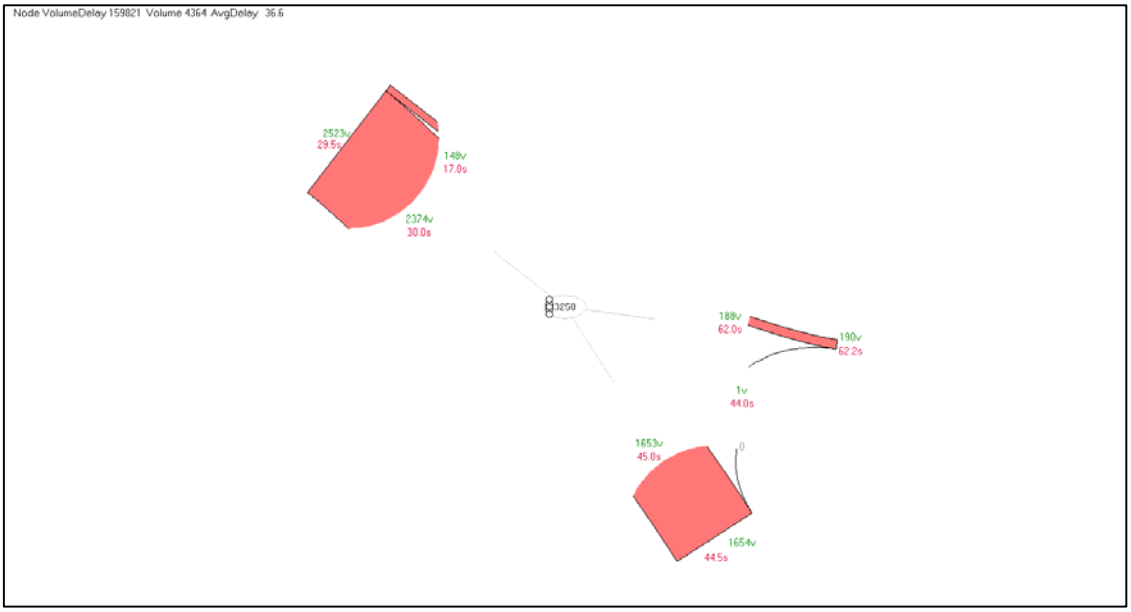


Wolsh Transportation Model	**Traffic Volumes** **Five Islands Road/Springhill Road** **2026 PM Peak**	**Figure 7**
Gabites Porter Consultants		

AM Peak

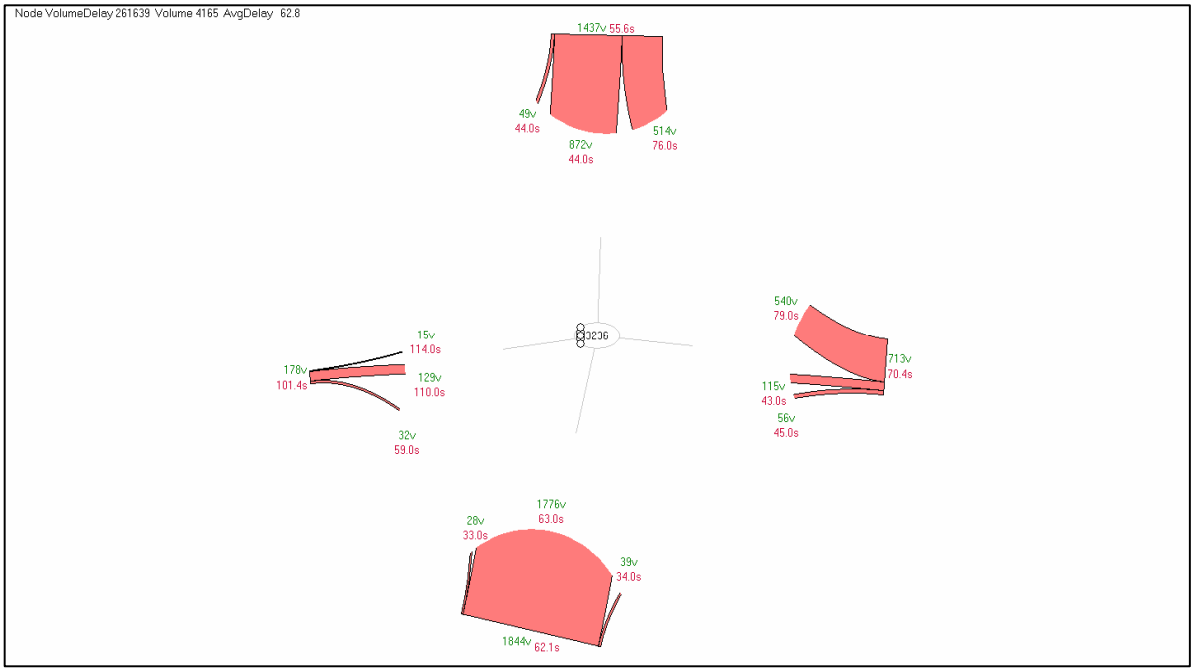


PM Peak

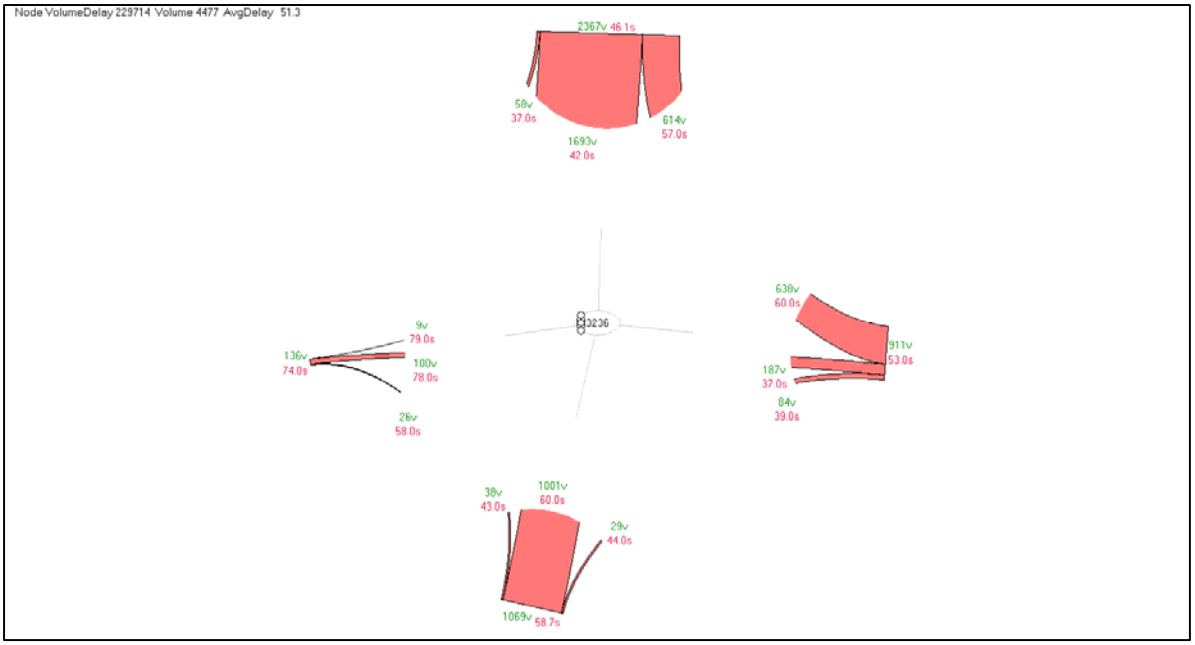


Wolsh Transportation Model	**Turning Movement Plots** **Five Islands Road/Flinders Street** **2026**	**Figure 8**
Gabites Porter Consultants		

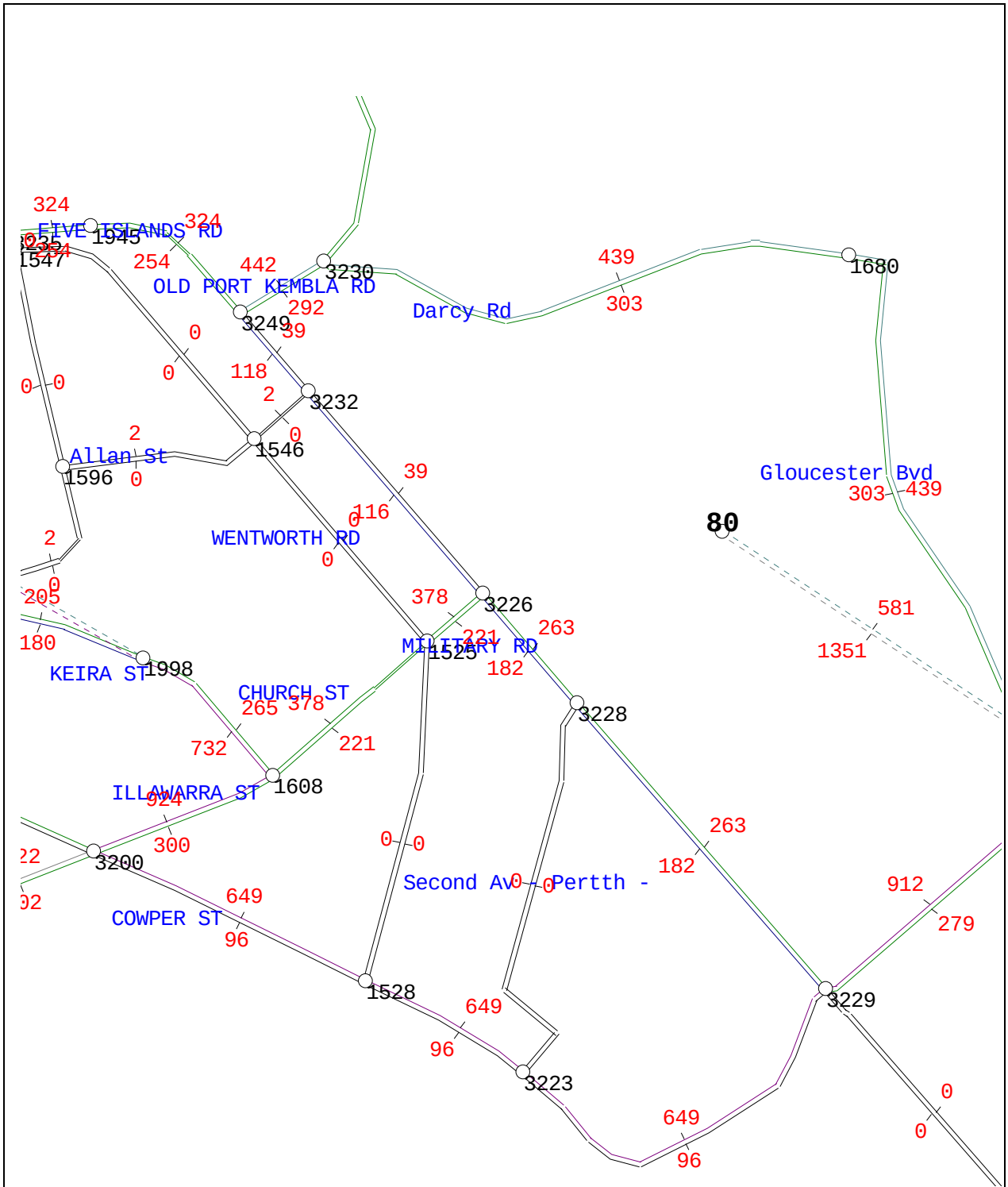
AM Peak



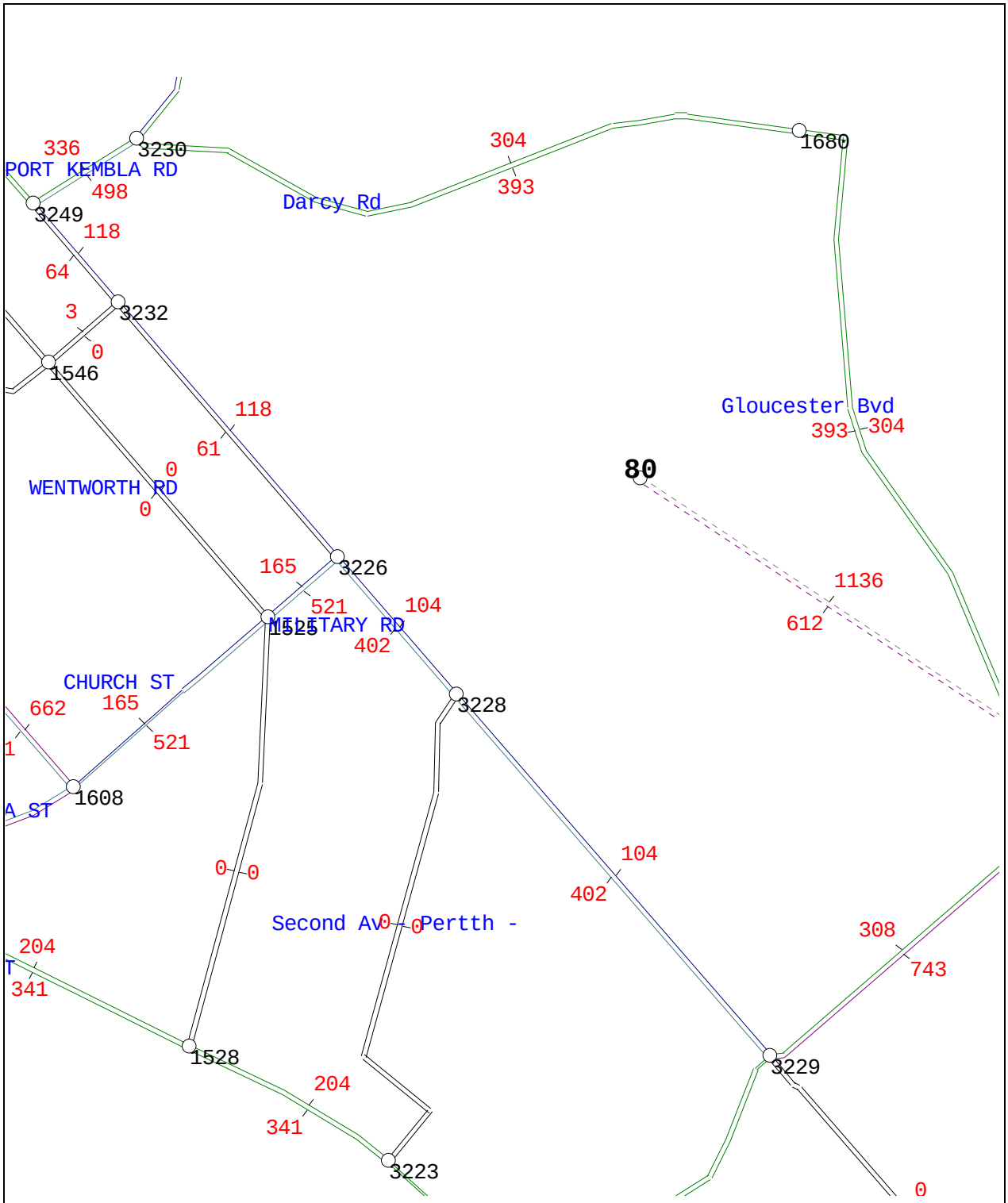
PM Peak



Wolsh Transportation Model	**Turning Movement Plots** **Five Islands Road/King Street** **2026**	**Figure 9**
Gabites Porter Consultants		

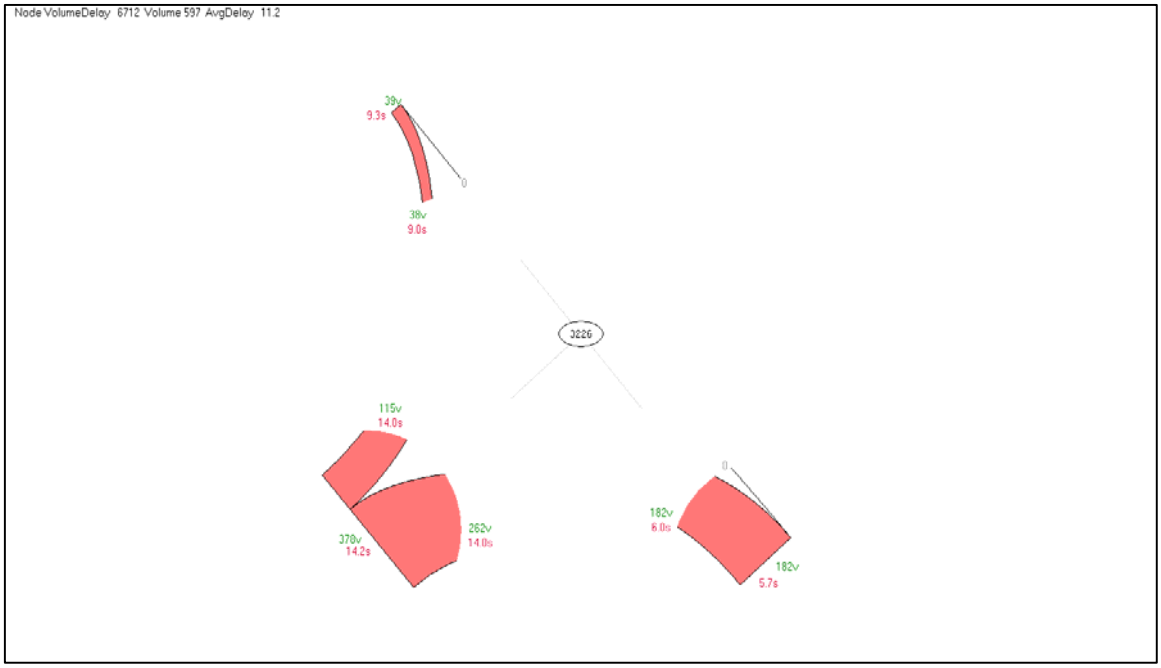


Wolsh Transportation Model	**Traffic Volumes** **Old Port Road/Foreshore Road** **2026 AM Peak**	**Figure 10**
Gabites Porter Consultants		

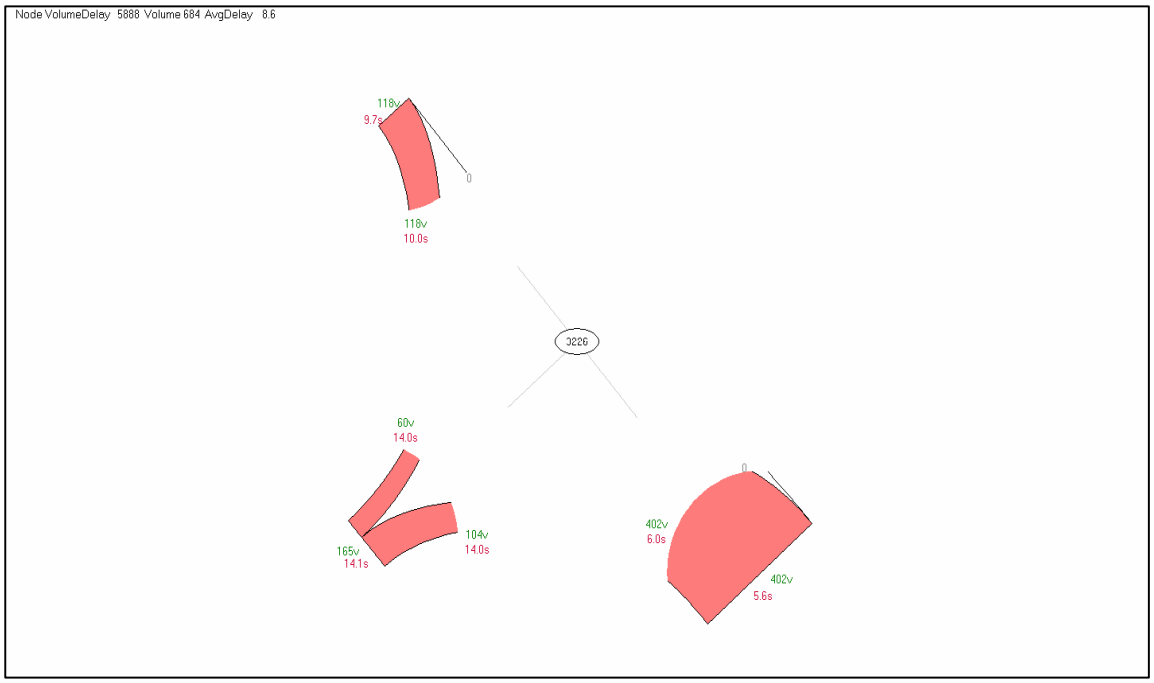


Wolsh Transportation Model	**Traffic Volumes** **Old Port Road/Foreshore Road** **2026 PM Peak**	**Figure 11**
Gabites Porter Consultants		

AM Peak



PM peak



Wolsh Transportation Model	**Turning Movement Plots** **Old Port Road/Military Road** **2026**	**Figure 12**
Gabites Porter Consultants		

Appendix B 2016 Intersection Modelling (SIDRA 3.2) Results - without development

SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2016 AM peak

Signalised - Fixed time Cycle Time = 100 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)
King St (S)										
1	L	26	7.7	0.740	31.3	LOS C	114	0.75	0.85	32.4
2	T	1615	7.0	0.739	24.1	LOS B	187	0.86	0.77	39.7
3	R	34	5.9	0.318	61.5	LOS E	19	0.99	0.72	24.5
Approach		1675	7.0	0.739	25.0	LOS B	187	0.86	0.77	39.1
Five Islands Rd										
4	L	49	6.1	0.411	39.0	LOS C	54	0.92	0.81	29.1
5	T	102	6.9	0.412	31.0	LOS C	54	0.92	0.75	32.4
6	R	502	7.0	0.747	53.9	LOS D	102	1.00	0.90	26.5
Approach		653	6.9	0.747	49.2	LOS D	102	0.98	0.87	27.4
King St (N)										
7	L	519	6.9	0.373	10.4	LOS A	40	0.25	0.70	50.1
8	T	841	7.0	0.334	19.0	LOS B	78	0.69	0.59	39.4
9	R	35	5.7	0.327	60.3	LOS E	19	0.99	0.73	22.7
Approach		1395	7.0	0.372	16.8	LOS B	78	0.53	0.63	42.3
Wattle St										
10	L	14	7.1	0.532	64.4	LOS E	32	1.00	0.83	23.8
11	T	115	7.0	0.535	54.0	LOS D	32	1.00	0.79	26.9
12	R	25	8.0	0.237	59.9	LOS E	14	0.99	0.71	22.8
Approach		154	7.1	0.535	55.9	LOS D	32	1.00	0.78	25.9
All Vehicles		3877	7.0	0.747	27.3	LOS B	187	0.77	0.74	36.7

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

Site: 2016 AM
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2016 AM peak

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)
Five Islands Rd (SE)										
22	T	2141	7.0	0.456	2.9	LOS A	97	0.28	0.26	73.2
23	R	1	0.0	0.012	75.5	LOS F	1	0.97	0.59	21.0
Approach		2142	7.0	0.456	2.9	LOS A	97	0.28	0.26	73.2
Flinders Street										
24	L	1	0.0	0.387	83.2	LOS F	35	0.99	0.77	20.1
26	R	107	6.5	0.438	79.4	LOS F	35	1.00	0.76	20.7
Approach		108	6.5	0.438	79.4	LOS F	35	1.00	0.76	20.7
Five Islands Rd (NW)										
27	L	216	6.9	0.386	15.5	LOS B	84	0.35	0.78	50.4
28	T	1399	7.0	0.386	6.0	LOS A	99	0.38	0.34	67.1
Approach		1615	7.0	0.386	7.2	LOS A	99	0.37	0.40	64.5
All Vehicles		3865	7.0	0.456	6.9	LOS A	99	0.34	0.33	65.0

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

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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Springhill Road

2016 AM peak

Signalised - Fixed time Cycle Time = 60 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)
Five Islands Rd (E)										
5	T	769	3.7	0.406	0.1	LOS B#	10#	0.00	0.00	79.8
6	R	2132	10.5	1.000#	21.3	LOS B	152	1.00	0.90	47.5
Approach		2901	7.0	1.000	10.5	LOS A	152	0.49	0.44	60.0
Springhill Road										
7	L	134	6.7	0.756	44.3	LOS D	43	1.00	0.88	32.8
9	R	17	5.9	0.048	39.1	LOS C	3	0.93	0.67	35.2
Approach		151	6.6	0.756	43.8	LOS D	43	0.99	0.86	33.0
Five Islands Rd (W)										
10	L	579	7.1	0.327	11.4	LOS B#	8#	0.00	0.69	58.8
11	T	658	7.0	0.962	55.6	LOS D	123	1.00	1.29	28.7
Approach		1237	7.0	0.962	34.9	LOS C	123	0.53	1.01	37.7
All Vehicles		4289	7.0	1.000	18.7	LOS B	152	0.52	0.62	50.0

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

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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

AM 2016 peak

Signalised - Fixed time Cycle Time = 100 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)
Springhill Road S										
1	L	995	7.0	0.815	35.9	LOS C	228	0.89	0.93	30.3
2	T	1731	7.0	0.815	27.4	LOS B	234	0.93	0.89	34.2
Approach		2726	7.0	0.815	30.5	LOS C	234	0.91	0.90	32.7
Springhill Road N										
8	T	534	6.9	0.227	8.4	LOS A	53	0.46	0.40	48.7
9	R	427	7.0	0.805	62.2	LOS E	69	1.00	0.93	22.3
Approach		961	7.0	0.805	32.3	LOS C	69	0.70	0.63	31.9
Masters Road										
10	L	433	6.9	0.597	33.3	LOS C	130	0.84	0.84	31.4
12	R	1003	7.0	0.756	48.3	LOS D	127	0.98	0.91	25.9
Approach		1436	7.0	0.756	43.8	LOS D	130	0.94	0.89	27.4
All Vehicles		5123	7.0	0.815	34.5	LOS C	234	0.88	0.85	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
P5	50	44.2	LOS E	0	0.94	0.94
All Peds	50	44.2	LOS D	0	0.94	0.94

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

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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2016 PM peak

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)
King St (S)										
1	L	33	6.1	0.520	31.2	LOS C	77	0.79	0.81	32.5
2	T	957	7.0	0.522	23.9	LOS B	102	0.82	0.71	39.8
3	R	25	8.0	0.213	55.3	LOS D	13	0.98	0.71	26.1
Approach		1015	7.0	0.522	24.9	LOS B	102	0.83	0.71	39.0
Five Islands Rd										
4	L	74	6.8	0.588	40.0	LOS C	76	0.93	0.87	28.7
5	T	164	6.7	0.588	32.0	LOS C	76	0.93	0.82	31.9
6	R	609	7.1	0.738	46.5	LOS D	108	0.98	0.90	28.8
Approach		847	7.0	0.738	43.1	LOS D	108	0.97	0.88	29.3
King St (N)										
7	L	566	7.1	0.398	10.3	LOS A	40	0.27	0.70	50.1
8	T	1555	7.0	0.758	28.6	LOS C	159	0.94	0.86	33.6
9	R	74	6.8	0.626	56.6	LOS E	36	1.00	0.80	23.6
Approach		2195	7.0	0.758	24.8	LOS B	159	0.77	0.82	36.5
Wattle St										
10	L	8	12.5	0.388	55.5	LOS D	22	0.99	0.79	26.1
11	T	93	7.5	0.388	46.2	LOS D	23	0.99	0.76	29.4
12	R	23	8.7	0.197	54.0	LOS D	12	0.98	0.71	24.3
Approach		124	8.1	0.388	48.3	LOS D	23	0.99	0.75	28.1
All Vehicles		4181	7.0	0.758	29.2	LOS C	159	0.83	0.80	35.0

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

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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2016 PM peak

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)
Five Islands Rd (SE)										
22	T	1580	7.0	0.349	2.9	LOS A	67	0.29	0.26	73.1
23	R	1	0.0	0.010	64.5	LOS E	1	0.96	0.59	23.6
Approach		1581	7.0	0.349	3.0	LOS A	67	0.29	0.26	73.0
Flinders Street										
24	L	1	0.0	0.495	91.6	LOS F	67	1.00	0.79	18.8
26	R	162	6.8	0.561	78.4	LOS F	67	1.00	0.79	20.9
Approach		163	6.7	0.561	78.5	LOS F	67	1.00	0.79	20.9
Five Islands Rd (NW)										
27	L	133	6.8	0.597	20.1	LOS B	155	0.54	0.83	45.5
28	T	2205	7.0	0.597	9.3	LOS A	161	0.55	0.51	61.7
Approach		2338	7.0	0.597	9.9	LOS A	161	0.55	0.53	60.6
All Vehicles		4082	7.0	0.597	9.9	LOS A	161	0.47	0.44	60.1

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

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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Springhill Road

2016 PM peak

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)
Five Islands Rd (E)										
5	T	1070	7.0	0.287	0.0	LOS B#	7#	0.00	0.00	79.9
6	R	1334	7.0	0.980	25.9	LOS B	152	0.96	0.90	43.5
Approach		2404	7.0	0.980	14.4	LOS A	152	0.53	0.50	54.8
Springhill Road										
7	L	290	6.9	0.936	68.6	LOS E	123	1.00	1.16	24.7
9	R	56	7.1	0.091	41.9	LOS C	11	0.87	0.73	33.9
Approach		346	6.9	0.936	64.3	LOS E	123	0.98	1.09	25.8
Five Islands Rd (W)										
10	L	241	7.1	0.136	11.4	LOS A#	3#	0.00	0.69	58.9
11	T	574	7.0	0.947	60.4	LOS E	124	1.00	1.19	27.2
Approach		815	7.0	0.947	45.9	LOS D	124	0.70	1.04	32.3
All Vehicles		3565	7.0	0.980	26.4	LOS B	152	0.61	0.68	43.2

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

Masters Road / Springhill Road

PM 2016 peak

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)
Springhill Road S										
1	L	712	7.0	0.798	45.5	LOS D	138	0.99	0.95	26.7
2	T	902	7.0	0.798	36.7	LOS C	143	0.99	0.94	29.9
Approach		1614	7.0	0.798	40.6	LOS C	143	0.99	0.95	28.4
Springhill Road N										
8	T	1007	7.0	0.467	11.7	LOS A	104	0.62	0.55	45.4
9	R	984	7.0	0.795	47.9	LOS D	120	1.00	0.95	26.1
Approach		1991	7.0	0.795	29.6	LOS C	120	0.81	0.75	33.2
Masters Road										
10	L	204	6.9	0.225	17.6	LOS B	41	0.49	0.75	40.6
12	R	1195	7.0	0.780	43.3	LOS D	136	0.98	0.93	27.5
Approach		1399	7.0	0.780	39.6	LOS C	136	0.91	0.91	28.9
All Vehicles		5004	7.0	0.798	35.9	LOS C	143	0.89	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
P5	50	38.3	LOS D	0	0.92	0.92
All Peds	50	38.3	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

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Appendix C 2036 Intersection Modelling (SIDRA 3.2) Results - without development

SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2036 AM peak

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)
King St (S)										
1	L	30	6.7	0.816	37.6	LOS C	141	0.69	0.89	29.7
2	T	1908	7.0	0.816	28.5	LOS C	279	0.87	0.82	37.1
3	R	42	7.1	0.475	73.8	LOS F	27	1.00	0.73	21.8
Approach		1980	7.0	0.816	29.6	LOS C	279	0.87	0.82	36.4
Five Islands Rd										
4	L	60	6.7	0.483	48.1	LOS D	77	0.93	0.83	26.0
5	T	124	7.3	0.483	40.0	LOS C	77	0.93	0.78	28.6
6	R	581	7.1	0.822	65.2	LOS E	139	1.00	0.96	23.6
Approach		765	7.1	0.822	59.8	LOS E	139	0.98	0.92	24.4
King St (N)										
7	L	553	7.1	0.409	10.5	LOS A	52	0.24	0.70	49.9
8	T	937	7.0	0.335	19.1	LOS B	92	0.64	0.56	39.3
9	R	53	7.5	0.602	73.6	LOS F	34	1.00	0.78	19.9
Approach		1543	7.1	0.602	17.9	LOS B	92	0.51	0.61	41.4
Wattle St										
10	L	16	6.2	0.773	86.8	LOS F	50	1.00	0.95	19.5
11	T	139	7.2	0.776	72.5	LOS F	50	1.00	0.91	22.4
12	R	34	5.9	0.382	72.0	LOS F	22	1.00	0.73	20.2
Approach		189	6.9	0.776	73.6	LOS F	50	1.00	0.88	21.8
All Vehicles		4477	7.0	0.822	32.6	LOS C	279	0.77	0.77	33.9

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: 2036 AM
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2036 AM peak

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)
Five Islands Rd (SE)										
22	T	2522	7.0	0.538	3.2	LOS A	122	0.32	0.30	72.5
23	R	1	0.0	0.010	74.0	LOS F	1	0.96	0.59	21.4
Approach		2523	7.0	0.538	3.3	LOS A	122	0.32	0.30	72.4
Flinders Street										
24	L	1	0.0	0.433	88.6	LOS F	43	1.00	0.77	19.2
26	R	127	7.1	0.521	82.4	LOS F	43	1.00	0.77	20.2
Approach		128	7.0	0.521	82.4	LOS F	43	1.00	0.77	20.2
Five Islands Rd (NW)										
27	L	285	7.0	0.442	15.8	LOS B	98	0.38	0.79	50.1
28	T	1549	7.0	0.442	6.6	LOS A	118	0.41	0.38	65.9
Approach		1834	7.0	0.442	8.1	LOS A	118	0.41	0.44	63.2
All Vehicles		4485	7.0	0.538	7.5	LOS A	122	0.38	0.37	64.0

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: 2036 AM
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Springhill Road

2036 AM peak

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)
Five Islands Rd (E)										
5	T	906	3.0	0.688	0.0	LOS D#	16#	0.00	0.00	79.7
6	R	2646	12.9	1.000#	23.3	LOS B	152	0.99	0.90	45.7
Approach		3552	7.0	1.000	9.4	LOS A	152	0.40	0.36	54.9
Springhill Road										
7	L	147	6.8	0.949	72.6	LOS F	70	1.00	1.13	23.7
9	R	23	8.7	0.075	49.4	LOS D	5	0.95	0.68	30.7
Approach		170	7.1	0.949	69.5	LOS E	70	0.99	1.07	24.5
Five Islands Rd (W)										
10	L	883	7.0	0.499	11.5	LOS C#	12#	0.00	0.69	58.7
11	T	818	7.0	0.974	74.5	LOS F	194	1.00	1.32	23.6
Approach		1701	7.0	0.974	41.8	LOS C	194	0.48	0.99	34.1
All Vehicles		5423	7.0	1.000	21.4	LOS B	194	0.44	0.58	42.3

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: 2036 AM
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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

AM 2036 peak

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)
Springhill Road S										
1	L	1197	7.0	0.989	63.2	LOS E	650	1.00	1.14	21.9
2	T	2389	7.0	0.989	90.4	LOS F	664	1.00	1.46	17.2
Approach		3586	7.0	0.989	81.3	LOS F	664	1.00	1.36	18.5
Springhill Road N										
8	T	655	7.0	0.260	8.1	LOS A	67	0.42	0.37	49.1
9	R	520	6.9	0.979	108.8	LOS F	116	1.00	1.28	15.1
Approach		1175	7.0	0.979	52.7	LOS D	116	0.68	0.77	24.6
Masters Road										
10	L	595	7.1	0.992	47.8	LOS D	272	1.00	0.91	26.0
12	R	1182	7.0	0.992	119.4	LOS F	272	1.00	1.44	14.1
Approach		1777	7.0	0.992	95.4	LOS F	272	1.00	1.26	16.6
All Vehicles		6538	7.0	0.992	80.0	LOS F	664	0.94	1.23	18.8

Pedestrian Movements

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

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

Site: 2036 AM
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2036 PM peak

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)
King St (S)										
1	L	41	7.3	0.543	31.4	LOS C	81	0.72	0.80	32.4
2	T	1072	7.0	0.543	25.3	LOS B	133	0.79	0.69	38.9
3	R	31	6.5	0.320	67.2	LOS E	19	1.00	0.72	23.1
Approach		1144	7.0	0.543	26.6	LOS B	133	0.79	0.70	38.0
Five Islands Rd										
4	L	90	6.7	0.696	49.4	LOS D	111	0.96	0.91	25.6
5	T	200	7.0	0.698	41.3	LOS C	111	0.96	0.88	28.1
6	R	683	7.0	0.759	52.8	LOS D	139	0.98	0.90	26.8
Approach		973	7.0	0.759	50.2	LOS D	139	0.98	0.90	26.9
King St (N)										
7	L	657	7.0	0.471	10.4	LOS A	55	0.26	0.70	50.1
8	T	1813	7.0	0.775	30.4	LOS C	210	0.93	0.84	32.7
9	R	62	6.5	0.640	68.2	LOS E	36	1.00	0.80	20.9
Approach		2532	7.0	0.775	26.1	LOS B	210	0.76	0.81	35.7
Wattle St										
10	L	10	10.0	0.546	69.0	LOS E	32	1.00	0.81	22.8
11	T	107	6.5	0.543	59.2	LOS E	32	1.00	0.78	25.5
12	R	28	7.1	0.291	65.8	LOS E	17	0.99	0.72	21.4
Approach		145	6.9	0.543	61.1	LOS E	32	1.00	0.77	24.5
All Vehicles		4794	7.0	0.775	32.2	LOS C	210	0.82	0.80	33.5

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: 2036 PM
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2036 PM peak

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)
Five Islands Rd (SE)										
22	T	1768	7.0	0.391	3.1	LOS A	76	0.30	0.27	72.8
23	R	1	0.0	0.010	64.5	LOS E	1	0.96	0.59	23.6
Approach		1769	7.0	0.391	3.1	LOS A	76	0.30	0.27	72.7
Flinders Street										
24	L	2	0.0	0.688	94.9	LOS F	78	1.00	0.87	18.3
26	R	201	7.0	0.698	81.0	LOS F	78	1.00	0.85	20.4
Approach		203	6.9	0.698	81.2	LOS F	78	1.00	0.85	20.4
Five Islands Rd (NW)										
27	L	158	7.0	0.687	21.2	LOS B	197	0.61	0.85	44.5
28	T	2539	7.0	0.688	10.4	LOS A	204	0.62	0.58	60.0
Approach		2697	7.0	0.688	11.0	LOS A	204	0.62	0.60	59.0
All Vehicles		4669	7.0	0.698	11.1	LOS A	204	0.52	0.49	58.5

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

Five Islands Road / Springhill Road

2036 PM peak

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)
Five Islands Rd (E)										
5	T	1318	5.7	0.450	0.1	LOS C#	11#	0.00	0.00	79.8
6	R	1475	9.1	1.000#	33.3	LOS C	152	1.00	0.89	38.5
Approach		2793	7.1	1.000	13.6	LOS A	152	0.41	0.36	55.7
Springhill Road										
7	L	355	7.0	0.960	58.7	LOS E	149	1.00	0.86	27.4
9	R	87	6.9	0.118	49.6	LOS D	21	0.85	0.75	30.6
Approach		442	7.0	0.960	56.9	LOS E	149	0.97	0.84	28.0
Five Islands Rd (W)										
10	L	301	7.0	0.170	11.4	LOS A#	4#	0.00	0.69	58.8
11	T	752	7.0	0.964	83.6	LOS F	213	1.00	1.22	21.7
Approach		1053	7.0	0.964	63.0	LOS E	213	0.71	1.07	26.4
All Vehicles		4288	7.0	1.000	30.2	LOS C	213	0.54	0.58	40.6

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: 2036 PM
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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

PM 2036 peak

Signalised - Fixed time Cycle Time = 100 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)
Springhill Road S										
1	L	713	7.0	0.873	56.2	LOS D	182	1.00	1.05	23.6
2	T	1071	7.0	0.873	47.3	LOS D	186	1.00	1.05	26.1
Approach		1784	7.0	0.873	50.9	LOS D	186	1.00	1.05	25.0
Springhill Road N										
8	T	1220	7.0	0.545	12.6	LOS A	137	0.64	0.58	44.5
9	R	1201	7.0	0.871	56.9	LOS E	167	1.00	1.05	23.5
Approach		2421	7.0	0.871	34.6	LOS C	167	0.82	0.81	30.8
Masters Road										
10	L	242	7.4	0.279	18.3	LOS B	52	0.49	0.76	40.1
12	R	1299	7.0	0.874	56.2	LOS D	180	1.00	1.06	23.7
Approach		1541	7.1	0.874	50.2	LOS D	180	0.92	1.01	25.3
All Vehicles		5746	7.0	0.874	43.8	LOS D	186	0.90	0.94	27.3

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	50	41.4	LOS E	0	0.91	0.91
All Peds	50	41.4	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

Site: 2036 PM
Q:\60039301_PKOHD\4. Tech work area\4.5. Planning\Transport 0709\SIDRA\Springhill_Masters.aap
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Appendix D 2016 Intersection Modelling (SIDRA 3.2) Results - with Major Project Approval development

SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

AM 2016 peak with Stage 1 Development Traffic

Signalised - Fixed time Cycle Time = 100 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
King St (S)										
1	L	26	7.7	0.740	31.3	LOS C	64	0.75	0.85	32.4
2	T	1615	7.0	0.739	24.1	LOS B	113	0.86	0.77	39.7
3	R	34	5.9	0.318	61.5	LOS E	8	0.99	0.72	24.5
Approach		1675	7.0	0.739	25.0	LOS B	113	0.86	0.77	39.1
Five Islands Rd										
4	L	49	6.1	0.411	39.0	LOS C	26	0.92	0.81	29.1
5	T	102	6.9	0.412	31.0	LOS C	26	0.92	0.75	32.4
6	R	502	7.0	0.747	53.9	LOS D	56	1.00	0.90	26.5
Approach		653	6.9	0.747	49.2	LOS D	56	0.98	0.87	27.4
King St (N)										
7	L	519	6.9	0.373	10.4	LOS A	18	0.25	0.70	50.1
8	T	841	7.0	0.334	19.0	LOS B	40	0.69	0.59	39.4
9	R	35	5.7	0.327	60.3	LOS E	8	0.99	0.73	22.7
Approach		1395	7.0	0.372	16.8	LOS B	40	0.53	0.63	42.3
Wattle St										
10	L	14	7.1	0.532	64.4	LOS E	14	1.00	0.83	23.8
11	T	115	7.0	0.535	54.0	LOS D	14	1.00	0.79	26.9
12	R	25	8.0	0.237	59.9	LOS E	6	0.99	0.71	22.8
Approach		154	7.1	0.535	55.9	LOS D	14	1.00	0.78	25.9
All Vehicles		3877	7.0	0.747	27.3	LOS B	113	0.77	0.74	36.7

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: 2016 AM + Stage 1 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2016 AM peak with Stage 1 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Five Islands Rd (SE)										
22	T	2141	7.0	0.458	3.2	LOS A	57	0.29	0.27	72.5
23	R	1	0.0	0.013	81.1	LOS F	0	0.97	0.59	20.0
Approach		2142	7.0	0.458	3.2	LOS A	57	0.29	0.27	72.5
Flinders Street										
24	L	1	0.0	0.381	87.6	LOS F	20	0.99	0.77	19.4
26	R	118	15.3	0.450	83.8	LOS F	20	0.99	0.77	20.0
Approach		119	15.1	0.450	83.8	LOS F	20	0.99	0.77	20.0
Five Islands Rd (NW)										
27	L	227	11.5	0.389	16.0	LOS B	47	0.35	0.78	50.0
28	T	1399	7.0	0.389	6.3	LOS A	58	0.37	0.34	66.6
Approach		1626	7.6	0.389	7.6	LOS A	58	0.37	0.40	63.9
All Vehicles		3887	7.5	0.458	7.5	LOS A	58	0.34	0.34	63.9

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: 2016 AM + Stage 1 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Springhill Road

2016 AM peak with Stage 1 Development Traffic

Signalised - Fixed time Cycle Time = 60 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Five Islands Rd (E)										
5	T	772	3.8	0.411	0.1	LOS B#	10#	0.00	0.00	79.8
6	R	2140	11.1	1.000#	21.3	LOS B	90	1.00	0.90	47.5
Approach		2912	7.3	1.000	10.4	LOS A	90	0.49	0.44	60.1
Springhill Road										
7	L	134	6.7	0.756	44.3	LOS D	20	1.00	0.88	32.8
9	R	17	5.9	0.048	39.1	LOS C	1	0.93	0.67	35.2
Approach		151	6.6	0.756	43.8	LOS D	20	0.99	0.86	33.0
Five Islands Rd (W)										
10	L	579	7.1	0.327	11.4	LOS B#	8#	0.00	0.69	58.8
11	T	661	7.4	0.969	59.3	LOS E	73	1.00	1.33	27.6
Approach		1240	7.3	0.969	36.9	LOS C	73	0.53	1.03	36.6
All Vehicles		4303	7.3	1.000	19.2	LOS B	90	0.52	0.62	49.5

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: 2016 AM + Stage 1 dev traffic
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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

AM 2016 peak with Stage 1 Development Traffic

Signalised - Fixed time Cycle Time = 100 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Springhill Road S										
1	L	999	7.4	0.817	36.1	LOS C	142	0.89	0.94	30.2
2	T	1731	7.0	0.817	27.6	LOS B	145	0.93	0.89	34.1
Approach		2730	7.1	0.817	30.7	LOS C	145	0.92	0.91	32.6
Springhill Road N										
8	T	534	6.9	0.227	8.4	LOS A	25	0.46	0.40	48.7
9	R	427	7.0	0.805	62.2	LOS E	35	1.00	0.93	22.3
Approach		961	7.0	0.805	32.3	LOS C	35	0.70	0.63	31.9
Masters Road										
10	L	433	6.9	0.597	33.3	LOS C	75	0.84	0.84	31.4
12	R	1008	7.4	0.762	48.6	LOS D	74	0.99	0.91	25.8
Approach		1441	7.3	0.762	44.0	LOS D	75	0.94	0.89	27.3
All Vehicles		5132	7.2	0.817	34.7	LOS C	145	0.88	0.85	30.8

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	50	44.2	LOS E	0	0.94	0.94
All Peds	50	44.2	LOS D	0	0.94	0.94

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

Site: 2016 AM + Stage 1 dev traffic
Q:\60039301_PKOHD\4. Tech work area\4.5. Planning\Transport 0709\2009_0915 SIDRA Analysis\Springhill_Masters.aap
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2016 PM peak with Stage 1 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
King St (S)										
1	L	33	6.1	0.520	31.2	LOS C	40	0.79	0.81	32.5
2	T	957	7.0	0.522	23.9	LOS B	56	0.82	0.71	39.8
3	R	25	8.0	0.213	55.3	LOS D	5	0.98	0.71	26.1
Approach		1015	7.0	0.522	24.9	LOS B	56	0.83	0.71	39.0
Five Islands Rd										
4	L	74	6.8	0.588	40.0	LOS C	39	0.93	0.87	28.7
5	T	164	6.7	0.588	32.0	LOS C	39	0.93	0.82	31.9
6	R	609	7.1	0.738	46.5	LOS D	60	0.98	0.90	28.8
Approach		847	7.0	0.738	43.1	LOS D	60	0.97	0.88	29.3
King St (N)										
7	L	566	7.1	0.398	10.3	LOS A	18	0.27	0.70	50.1
8	T	1555	7.0	0.758	28.6	LOS C	95	0.94	0.86	33.6
9	R	74	6.8	0.626	56.6	LOS E	16	1.00	0.80	23.6
Approach		2195	7.0	0.758	24.8	LOS B	95	0.77	0.82	36.5
Wattle St										
10	L	8	12.5	0.388	55.5	LOS D	9	0.99	0.79	26.1
11	T	93	7.5	0.388	46.2	LOS D	10	0.99	0.76	29.4
12	R	23	8.7	0.197	54.0	LOS D	5	0.98	0.71	24.3
Approach		124	8.1	0.388	48.3	LOS D	10	0.99	0.75	28.1
All Vehicles		4181	7.0	0.758	29.2	LOS C	95	0.83	0.80	35.0

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

Site: 2016 PM + Stage 1 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2016 PM peak with Stage 1 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Five Islands Rd (SE)										
22	T	1580	7.0	0.364	3.0	LOS A	29	0.34	0.30	72.3
23	R	1	0.0	0.007	47.9	LOS D	0	0.94	0.59	28.7
Approach		1581	7.0	0.364	3.0	LOS A	29	0.34	0.30	72.2
Flinders Street										
24	L	1	0.0	0.672	88.3	LOS F	37	1.00	0.86	19.3
26	R	173	12.7	0.678	71.0	LOS F	37	1.00	0.85	22.4
Approach		174	12.6	0.678	71.1	LOS F	37	1.00	0.85	22.4
Five Islands Rd (NW)										
27	L	144	13.9	0.671	21.5	LOS B	86	0.68	0.86	44.5
28	T	2205	7.0	0.672	10.6	LOS A	90	0.69	0.64	59.7
Approach		2349	7.4	0.672	11.3	LOS A	90	0.69	0.65	58.6
All Vehicles		4104	7.5	0.678	10.6	LOS A	90	0.57	0.53	58.9

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

Five Islands Road / Springhill Road

2016 PM peak with Stage 1 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Five Islands Rd (E)										
5	T	1073	7.3	0.288	0.0	LOS B#	7#	0.00	0.00	79.9
6	R	1342	7.5	0.997	24.9	LOS B	90	0.98	0.90	44.4
Approach		2415	7.4	0.997	13.8	LOS A	90	0.55	0.50	55.5
Springhill Road										
7	L	290	6.9	0.936	68.6	LOS E	70	1.00	1.16	24.7
9	R	56	7.1	0.091	41.9	LOS C	4	0.87	0.73	33.9
Approach		346	6.9	0.936	64.3	LOS E	70	0.98	1.09	25.8
Five Islands Rd (W)										
10	L	241	7.1	0.136	11.4	LOS A#	3#	0.00	0.69	58.9
11	T	577	7.5	0.955	63.6	LOS E	74	1.00	1.21	26.3
Approach		818	7.3	0.955	48.2	LOS D	74	0.71	1.06	31.4
All Vehicles		3579	7.3	0.997	26.6	LOS B	90	0.63	0.68	43.1

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: 2016 PM + Stage 1 dev traffic
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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

PM 2016 peak with Stage 1 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Springhill Road S										
1	L	716	7.5	0.801	45.7	LOS D	81	0.99	0.96	26.6
2	T	902	7.0	0.801	36.9	LOS C	84	0.99	0.95	29.8
Approach		1618	7.2	0.801	40.8	LOS C	84	0.99	0.95	28.3
Springhill Road N										
8	T	1007	7.0	0.467	11.7	LOS A	58	0.62	0.55	45.4
9	R	984	7.0	0.795	47.9	LOS D	68	1.00	0.95	26.1
Approach		1991	7.0	0.795	29.6	LOS C	68	0.81	0.75	33.2
Masters Road										
10	L	204	6.9	0.225	17.6	LOS B	19	0.49	0.75	40.6
12	R	1199	7.3	0.784	43.6	LOS D	80	0.98	0.94	27.5
Approach		1403	7.3	0.784	39.8	LOS C	80	0.91	0.91	28.8
All Vehicles		5012	7.1	0.801	36.1	LOS C	84	0.90	0.86	30.2

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	50	38.3	LOS D	0	0.92	0.92
All Peds	50	38.3	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

Site: 2016 PM + Stage 1 dev traffic
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Appendix E 2036 Intersection Modelling (SIDRA 3.2) Results - with Concept Plan Approval development

SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2036 AM peak with Stage 3 Development Traffic

Signalised - Fixed time Cycle Time = 100 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
King St (S)										
1	L	30	6.7	0.880	39.4	LOS C	90	0.79	0.94	29.0
2	T	1908	7.0	0.873	34.9	LOS C	172	0.93	0.97	33.9
3	R	42	7.1	0.396	62.0	LOS E	10	1.00	0.73	24.3
Approach		1980	7.0	0.873	35.5	LOS C	172	0.93	0.96	33.5
Five Islands Rd										
4	L	60	6.7	0.503	41.7	LOS C	33	0.94	0.83	28.1
5	T	124	7.3	0.504	33.6	LOS C	33	0.94	0.79	31.2
6	R	594	9.1	0.896	66.6	LOS E	80	1.00	1.10	23.3
Approach		778	8.6	0.896	59.4	LOS E	80	0.99	1.03	24.5
King St (N)										
7	L	566	9.2	0.420	10.7	LOS A	24	0.28	0.71	49.8
8	T	937	7.0	0.372	19.4	LOS B	45	0.70	0.61	39.1
9	R	53	7.5	0.501	61.3	LOS E	12	1.00	0.75	22.4
Approach		1556	7.8	0.501	17.7	LOS B	45	0.56	0.65	41.6
Wattle St										
10	L	16	6.2	0.646	71.0	LOS F	20	1.00	0.88	22.3
11	T	139	7.2	0.646	57.7	LOS E	20	1.00	0.84	25.9
12	R	34	5.9	0.318	60.2	LOS E	8	0.99	0.72	22.7
Approach		189	6.9	0.646	59.3	LOS E	20	1.00	0.82	25.0
All Vehicles		4503	7.6	0.896	34.5	LOS C	172	0.82	0.86	33.1

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: 2036 AM + Stage 3 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2036 AM peak with Stage 3 Development Traffic

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)
Five Islands Rd (SE)										
22	T	2535	7.5	0.552	3.9	LOS A	134	0.35	0.33	71.1
23	R	1	0.0	0.012	75.5	LOS E	1	0.97	0.59	21.0
Approach		2536	7.5	0.552	3.9	LOS A	134	0.35	0.33	71.0
Flinders Street										
24	L	1	0.0	0.456	89.0	LOS F	59	1.00	0.79	19.1
26	R	150	21.3	0.552	82.4	LOS F	59	1.00	0.78	20.3
Approach		151	21.2	0.552	82.5	LOS F	59	1.00	0.78	20.3
Five Islands Rd (NW)										
27	L	308	14.0	0.456	16.1	LOS B	101	0.38	0.79	50.0
28	T	1549	7.0	0.455	7.1	LOS A	123	0.43	0.39	65.2
Approach		1857	8.1	0.455	8.6	LOS A	123	0.42	0.46	62.4
All Vehicles		4544	8.2	0.552	8.4	LOS A	134	0.40	0.40	62.4

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: 2036 AM + Stage 3 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Springhill Road

2036 AM peak with Stage 3 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Five Islands Rd (E)										
5	T	913	3.2	0.729	0.0	LOS D#	17#	0.00	0.00	79.7
6	R	2664	14.7	1.000#	22.8	LOS B	90	0.98	0.89	46.1
Approach		3577	7.6	1.000	8.8	LOS A	90	0.38	0.34	55.6
Springhill Road										
7	L	147	6.8	0.968	74.2	LOS F	34	1.00	1.20	23.4
9	R	23	8.7	0.077	45.1	LOS D	2	0.95	0.68	32.5
Approach		170	7.1	0.968	70.3	LOS E	34	0.99	1.13	24.3
Five Islands Rd (W)										
10	L	883	7.0	0.499	11.5	LOS C#	12#	0.00	0.69	58.7
11	T	824	7.6	0.970	66.3	LOS E	106	1.00	1.33	25.6
Approach		1707	7.3	0.970	37.9	LOS C	106	0.48	1.00	36.0
All Vehicles		5454	7.5	1.000	19.9	LOS B	106	0.43	0.57	43.6

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: 2036 AM + Stage 3 dev traffic
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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

AM 2036 peak with Stage 3 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Springhill Road S										
1	L	1205	7.6	0.993	65.0	LOS E	417	1.00	1.16	21.5
2	T	2389	7.0	0.993	94.5	LOS F	426	1.00	1.49	16.7
Approach		3594	7.2	0.993	84.6	LOS F	426	1.00	1.38	18.0
Springhill Road N										
8	T	655	7.0	0.260	8.1	LOS A	34	0.42	0.37	49.1
9	R	520	6.9	0.979	108.8	LOS F	66	1.00	1.28	15.1
Approach		1175	7.0	0.979	52.7	LOS D	66	0.68	0.77	24.6
Masters Road										
10	L	595	7.1	0.997	46.9	LOS D	150	1.00	0.90	26.2
12	R	1190	7.6	1.001	128.2	LOS F	177	1.00	1.49	13.3
Approach		1785	7.5	1.001	101.1	LOS F	177	1.00	1.29	15.9
All Vehicles		6554	7.2	1.001	83.4	LOS F	426	0.94	1.25	18.3

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	50	52.3	LOS E	0	0.93	0.93
All Peds	50	52.3	LOS D	0	0.93	0.93

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

Site: 2036 AM + Stage 3 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Kings Street

2036 PM peak with Stage 3 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
King St (S)										
1	L	41	7.3	0.543	31.4	LOS C	42	0.72	0.80	32.4
2	T	1072	7.0	0.543	25.3	LOS B	77	0.79	0.69	38.9
3	R	31	6.5	0.320	67.2	LOS E	8	1.00	0.72	23.1
Approach		1144	7.0	0.543	26.6	LOS B	77	0.79	0.70	38.0
Five Islands Rd										
4	L	90	6.7	0.696	49.4	LOS D	62	0.96	0.91	25.6
5	T	200	7.0	0.698	41.3	LOS C	62	0.96	0.88	28.1
6	R	696	8.8	0.782	54.3	LOS D	86	0.99	0.93	26.4
Approach		986	8.2	0.782	51.2	LOS D	86	0.98	0.92	26.6
King St (N)										
7	L	670	8.8	0.488	10.5	LOS A	28	0.27	0.70	50.0
8	T	1813	7.0	0.775	30.4	LOS C	129	0.93	0.84	32.7
9	R	62	6.5	0.640	68.2	LOS E	16	1.00	0.80	20.9
Approach		2545	7.5	0.775	26.1	LOS B	129	0.75	0.81	35.8
Wattle St										
10	L	10	10.0	0.538	69.4	LOS E	14	1.00	0.81	22.7
11	T	107	6.5	0.543	59.4	LOS E	14	1.00	0.78	25.4
12	R	28	7.1	0.291	65.8	LOS E	7	0.99	0.72	21.4
Approach		145	6.9	0.543	61.3	LOS E	14	1.00	0.77	24.4
All Vehicles		4820	7.5	0.782	32.4	LOS C	129	0.82	0.80	33.4

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: 2036 PM + Stage 3 dev traffic
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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Flinders Street

2036 PM peak with Stage 3 Development Traffic

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)
Five Islands Rd (SE)										
22	T	1768	7.0	0.395	3.7	LOS A	85	0.32	0.29	71.5
23	R	1	0.0	0.011	70.0	LOS E	1	0.97	0.59	22.2
Approach		1769	7.0	0.395	3.7	LOS A	85	0.32	0.29	71.5
Flinders Street										
24	L	2	0.0	0.663	102.3	LOS F	102	1.00	0.86	17.3
26	R	224	16.5	0.677	86.4	LOS F	102	1.00	0.85	19.6
Approach		226	16.4	0.677	86.5	LOS F	102	1.00	0.85	19.6
Five Islands Rd (NW)										
27	L	181	18.8	0.697	22.8	LOS C	220	0.62	0.85	43.5
28	T	2539	7.0	0.698	11.4	LOS B	227	0.63	0.59	58.5
Approach		2720	7.8	0.698	12.2	LOS B	227	0.63	0.61	57.4
All Vehicles		4715	7.9	0.698	12.6	LOS B	227	0.53	0.50	56.4

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Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Five Islands Road / Springhill Road

2036 PM peak with Stage 3 Development Traffic

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	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Five Islands Rd (E)										
5	T	1324	6.0	0.453	0.1	LOS C#	11#	0.00	0.00	79.7
6	R	1493	10.5	1.000#	32.7	LOS C	90	1.00	0.89	38.9
Approach		2817	7.8	1.000	13.4	LOS A	90	0.41	0.36	56.0
Springhill Road										
7	L	355	7.1	1.000#	59.9	LOS E	89	1.00	0.86	27.1
9	R	87	6.8	0.125	50.5	LOS D	9	0.86	0.75	30.3
Approach		442	7.0	1.000	58.0	LOS E	89	0.97	0.84	27.7
Five Islands Rd (W)										
10	L	301	7.0	0.170	11.4	LOS A#	4#	0.00	0.69	58.8
11	T	758	7.8	0.977	91.9	LOS F	140	1.00	1.27	20.3
Approach		1059	7.6	0.977	69.0	LOS E	140	0.72	1.10	24.8
All Vehicles		4318	7.7	1.000	31.6	LOS C	140	0.54	0.59	39.6

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Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2036 PM + Stage 3 dev traffic
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SIDRA INTERSECTION

Movement Summary

Masters Road / Springhill Road

PM 2036 peak

Signalised - Fixed time Cycle Time = 100 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Springhill Road S										
1	L	721	8.0	0.879	57.3	LOS E	112	1.00	1.07	23.3
2	T	1071	7.0	0.879	48.3	LOS D	116	1.00	1.06	25.8
Approach		1792	7.4	0.879	52.0	LOS D	116	1.00	1.06	24.7
Springhill Road N										
8	T	1220	7.0	0.545	12.6	LOS A	79	0.64	0.58	44.5
9	R	1201	7.0	0.871	56.9	LOS E	100	1.00	1.05	23.5
Approach		2421	7.0	0.871	34.6	LOS C	100	0.82	0.81	30.8
Masters Road										
10	L	262	6.9	0.301	18.4	LOS B	27	0.50	0.76	40.0
12	R	1307	7.6	0.883	57.7	LOS E	112	1.00	1.08	23.3
Approach		1569	7.5	0.883	51.1	LOS D	112	0.92	1.02	25.1
All Vehicles		5782	7.2	0.883	44.5	LOS D	116	0.90	0.95	27.1

Pedestrian Movements

Mov ID	Dem Flow (ped/h)	Aver Delay (sec)	Level of Service	Mean Back of Queue (m)	Prop. Queued	Eff. Stop Rate
P5	50	41.4	LOS E	0	0.91	0.91
All Peds	50	41.4	LOS C	0	0.91	0.91

Symbols which may appear in this table:

Following Degree of Saturation
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* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue

- Density for continuous movement

Site: 2036 PM + Stage 3 dev traffic
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