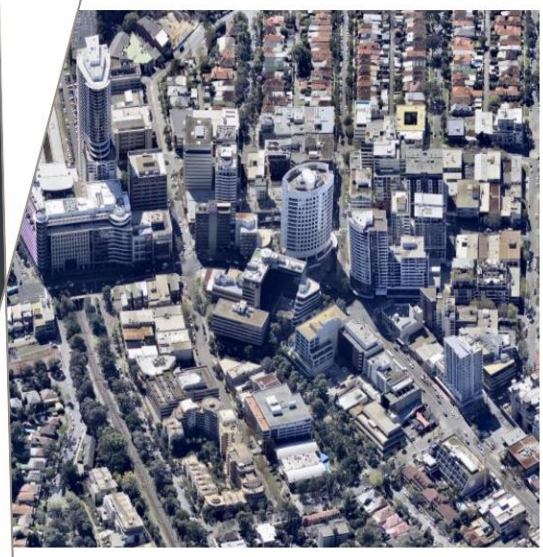
Base Model Development Report

St Leonards and Crows Nest Station Precinct Traffic and Transport Study

80018096



Prepared for

Department of Planning and Environment
Roads and Maritime Services

24 July 2020

Cardno

Contact Information

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

www.cardno.com
Phone +61 2 9496 7700
Fax +61 2 9439 5170

Document Information

Prepared for	Department of Planning and Environment Roads and Maritime Services
Project Name	St Leonards and Crows Nest Station Precinct Traffic and Transport Study
File Reference	80018096-001 St Leonards Base Model Development Report Final REV3.docx
Job Reference	80018096
Date	24 July 2020
Version Number	3.1
Effective Date	24/07/2020
Date Approved	24/07/2020

Author(s):

Kevin Wu
Traffic Modeller

Approved By:

Siavash Shahsavaripour
Transport Modelling Team Leader

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
1	31/08/2018	Draft	Sergio Garcia Kevin Wu	Ivo Pais
2	18/05/2020	Draft	Kevin Wu Jackie Liang	Siavash Shahsavaripour Ivo Pais
3	22/07/2020	Final – response to TfNSW comments	Jackie Liang Aaron Tran	Siavash Shahsavaripour
3.1	24/07/2020	Update travel time on Pacific Hwy	Aaron Tran	Siavash Shahsavaripour

Table of Contents

Appendices

Tables

Figures

1 Introduction

1.1 Background

Cardno has been engaged by The Department of Planning and Environment (now the NSW Department of Planning, Industry and Environment) to undertake traffic and transport analysis to assist in the planning investigations for the St Leonards and Crows Nest Station Precinct and finalising the St Leonards and Crows Nest 2036 Plan.

The Department of Planning, Industry and Environment (DPIE) have been working in consultation with North Sydney, Lane Cove and Willoughby Councils in this precinct, which is subdivided into the areas that are serviced by the St Leonards heavy rail train station and the upcoming Crows Nest Metro Station.

The St Leonards train station provides access to the St Leonards commercial centre, the Royal North Shore Hospital (RNSH) and the surrounding health and education uses in addition to the St Leonards south residential areas. The future Crows Nest Metro Station site is bound between Pacific Highway, Clarke Lane, Oxley Street and Hume Street. The station will service the suburban areas of St Leonards, Wollstonecraft and Crows Nest, including the Willoughby Road shopping district. The precinct is illustrated in **Figure 1-1**.

The Pacific Highway corridor between the Gore Hill Freeway and West Street is the major arterial road serving the study area. This section of the corridor contained within the study area will experience future changes due to population and employment growth and is expected to increase its place function in response to the Sydney Metro project. The document describes the future success of the corridor, given the level of planned development, needs to maximise the use of active and public transport to accommodate this increase in growth, with the implementation of constrained parking provision and policies for future development. The Road Network Plan also states that pedestrian and cycling infrastructure is required to be prioritised at all centres, more specifically around the Crows Nest area, to encourage mode shift to alternatives mode of transport and to manage the future travel demand increase.

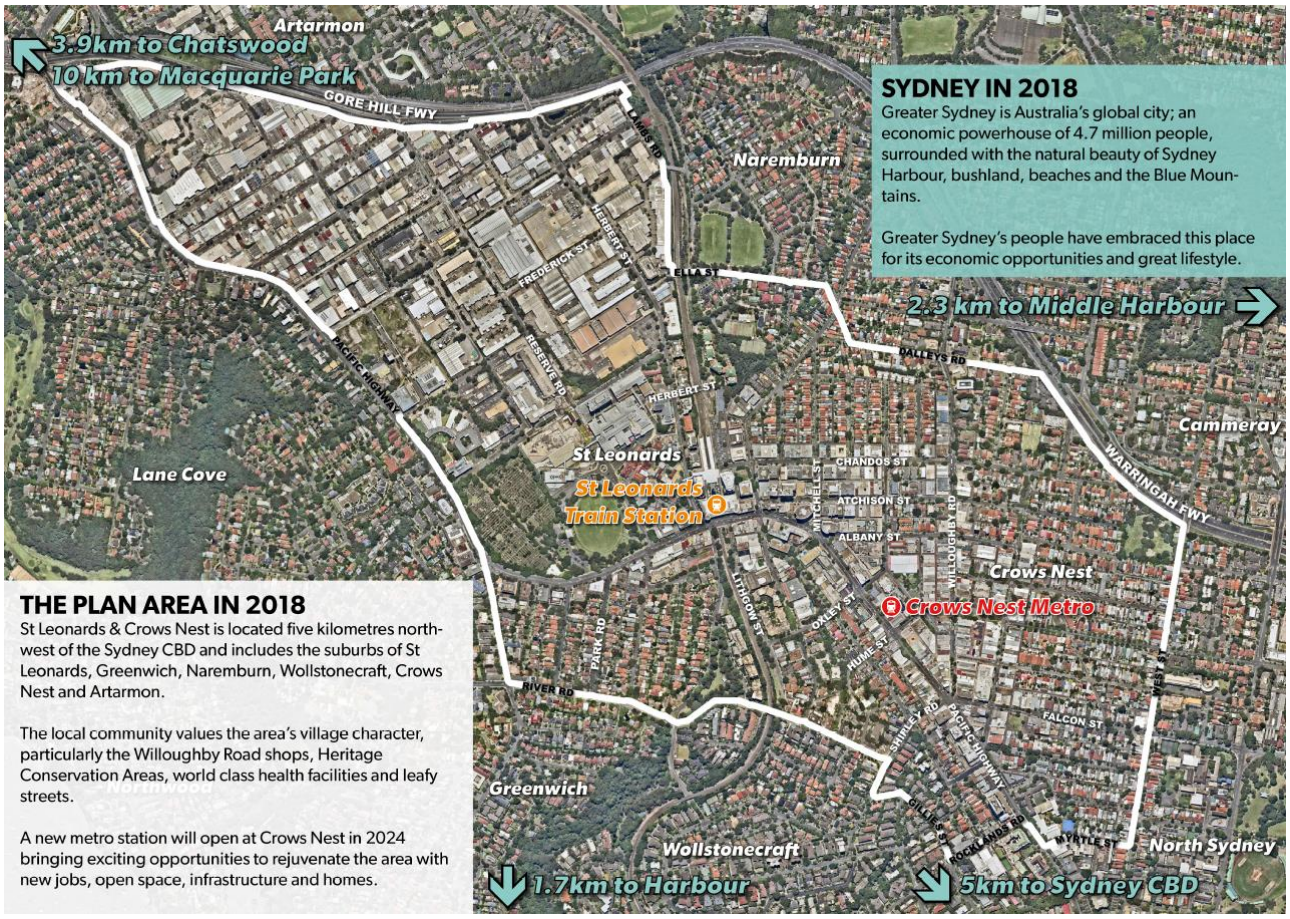


Figure 1-1 St Leonards and Crows Nest Planning Study Area

1.2 Modelling Objectives

The primary objective of this study is to undertake microscopic traffic modelling to evaluate the traffic impacts along the Pacific Highway and broader precinct transport network. The models will assess the DPIE interventions proposed in the draft 2036 Plan and identify additional opportunities to improve accessibility and reduced congestion.

The main objectives of the microsimulation studies are as follows:

- Develop, calibrate and validate year 2016 weekday AM and PM peak base models for the study area to establish a reliable and robust platform for testing future year scenarios;
- Develop future year scenarios (2026 and 2036) models to identify traffic network performance. The future year models will also assess the following:
  - Impact of the proposed DPIE interventions on traffic network performance;
  - Additional infrastructure works to support the DPIE interventions;
  - Future traffic congestion and network capacity;
  - Rerouting and traffic reassignment.

1.3 Scope of Work

The scope of work for this transport and traffic study includes:

- Conduct traffic surveys and assess provided traffic data to analyse the traffic behaviour in the AM and PM peaks in the study area. Each peak period is assessed for a 2-hour duration;
- Review the strategic model for land use and travel patterns for 2016, 2026 and 2036;
- Establish traffic growth and incorporate mode shift for the 2026 and 2036 future year scenarios;
- Review relevant works planned for the precinct;
- Develop a microscopic AIMSUN model of the St Leonards and Crows Nest traffic network for the following scenarios:
  - 2016 Base Model: Develop a Base Model to replicate existing conditions and provide the platform for testing future year scenarios;
  - 2026 Future Model with proposed DPIE upgrades: This scenario will capture the 2026 traffic conditions arising from background growth and impact of the DPIE upgrades proposed in the draft 2036 Plan. This model will also include proposed upgrades required to maintain acceptable traffic conditions.
  - 2036 Future Model with proposed DPIE upgrades: This scenario will capture the 2036 traffic conditions arising from background growth and impact of the DPIE upgrades proposed in the draft 2036 Plan. This model will also include proposed upgrades required to maintain acceptable traffic conditions.

1.4 Reference Documents

Documents referenced in this report include:

- North District Plan (Greater Sydney Commission), March 2018
- St Leonards and Crows Nest Station Precinct Strategic Transport Study (Cardno), September 2018;
- Draft St Leonards and Crows Nest 2036 Plan (Department of Planning, Industry and Environment) October 2018;
- Traffic modelling guidelines (Roads and Maritime Services), February, 2013;
- Editorial Style Guide (Roads and Maritime Services), March 2014;
- Operational modelling reporting structure (Roads and Maritime Services), May 2017.

1.5 Stakeholders

The relevant stakeholders for this investigation are:

- The Department of Planning, Industry and Environment
- Transport for New South Wales
- NSW Health Infrastructure
- Lane Cove Council
- North Sydney Council
- Willoughby Council

1.6 Report Outline

The structure of this report is outlined below:

- **Section 1 – Introduction**: outline of the background, project objective, scope of works and study area;
- **Section 2 – Existing Conditions**: outline existing network operations, traffic survey scope for intersection counts, queue lengths and travel time;
- **Section 3 – Model Assumptions**: discussion of the assumptions underlying the development of the Base Model and explanation of the study methodology;
- **Section 4 – Model Stability**: statistical analysis of the stability of the model in accordance with the relevant guidelines;
- **Section 5 – Model calibration and validation**: summary of the base model calibration and validation procedure and results;
- **Section 6 – Limitations**: discussion of the limitations of the model that could affect the future year modelling and suggestions for accounting for these limitations in future year model outputs;
- **Section 7 – Conclusions**: a summary of the main outcomes and overall performance of the Base Model.

2 Existing Conditions

2.1 Study Area

The study area presented in **Figure 2-1** covers areas from the suburbs of Artarmon, St Leonards, Naremburn, Crows Nest, and Wollstonecraft. The study area is bound by the Gore Hill Freeway in the north, Pacific Highway in the east, River Road in the south and West street in the east. These areas are overseen by the Councils of North Sydney, Lane Cove and Willoughby**.**

Figure 2-1 St Leonards, Crows Nest and Artarmon Study Area

2.2 Key Routes within the Study Network

The major roads within the study network are shown in **Table 2-1** below:

Table 2-1 Key Roads

Road	Description	Posted speed limit (km/h)	Key place uses	Key movement uses
Pacific Highway	The portion of Pacific Highway in the study area was substituted by Warringah Freeway and Gore Hill Freeway as the national highway. This portion of Pacific Highway is a state road that travels from the north-western end of the study area to south-east and connects to or provides connectivity to all other major roads in the study area. Outside of the study area, Pacific Highway connects the Sydney CBD to the northern border of New South Wales. The road within the study area has 11 signalised intersections between Alexander Street to Hotham Parade.	60	Residential, Bulk retail, Medical, Education, Transport Interchange, small retail, restaurants.	Significant regional north-south corridor for several bus routes and private vehicles. More freight uses in Artarmon, less so south of Falcon Street.
River Road	River Road runs parallel to Pacific Highway on the southern boundary of the study area. The modelled area includes the section of River Road bound by Greenwich Road and Shirley	50	Residential, recreational.	Regional east west link. 261 bus route. Moderate difficulty cycleway.
Greenwich Road	Greenwich Road provides connectivity between Pacific Highway and River Road within the study area. The road serves as the main connectivity in and out of the suburb of Greenwich.	50	Residential	Pacific Highway to River Road connector. Moderate difficulty cycleway. Residential access.
Herbert Street	Herbert Street runs north-south and intersects with the Pacific Highway in the centre of the study area. The road separates the St Leonards Train station and the Hospital Precinct. High volumes of pedestrians cross Herbert street to access the public transport facilities, hospital precinct and commercial sections.	50	Health, Residential, Commercial, Industry, St Leonards interchange.	Local connector between Artarmon and St Leonards. Moderate difficulty cycleway. Night bus route/ rail replacement route. Community buses.
Chandos Street	Chandos Street runs along the northern border of the study area and provides connectivity from the St Leonards Train Station to the Warringah Freeway via Brook Street. The road intersects with many other major roads such as Oxley Street, Christie and Willoughby Road.	50	Commercial/ Office, Restaurants/ Café, Residential.	Warringah Freeway to Pacific Highway connector.
Christie Street	Christie Street runs north-south and provides connectivity between Pacific Highway and Chandos Street. The street also provides access to drop off and pick-up areas on the eastern side of the St Leonards Train Station.	50	Commercial.	Chandos Street to Pacific Highway connector. Moderate to hard cycleway.
Albany Street	Albany Street runs east-west and provides connectivity between Pacific Highway to Willoughby Road and Alexander Street.	50	Retail (High Street function near Pacific Highway), Commercial, Residential.	Local access road to Crows Nest. Can be used as an east-west link.

Road	Description	Posted speed limit (km/h)	Key place uses	Key movement uses
Willoughby Road	The road experiences high volumes of pedestrian movement due to the presence of shops and restaurants. Willoughby Road has several wombat crossing treatments and bus stop blisters.	50 40 in Crows Nest village.	Significant place function. Crows Nest Village high street shopping and dining. Commercial and residential.	Several north-south bus routes. Local access.
Alexander Street	Alexander Street is a north-south route and provides access from Pacific Highway to the Warringah Freeway via Chandos / Brook Street. The road also intersects with other major roads such as Falcon Street, Albany Street and also provides access to Willoughby Road.	50	Crows Nest Village high street shopping. Residential.	North-south local connector.
Falcon Street	Falcon Street is a major east-west route and provides access from Pacific Highway to Miller Street, Warringah Freeway and Military Road. Falcon Street also intersects with Alexander Street and experiences a high volume of pedestrian movements due to the shopping district and public transport stops near Pacific Highway.	60	South end of Crows Nest village. Residential, education, recreation. Retail pockets at some intersections.	Regional east-west connector. Freight route. Several bus routes.
Shirley Road	Shirley Street provides connectivity between Pacific Highway and River Road.	50	Residential	Regional east-west connector. 261 bus route.
Hume Street	Hume Street intersects with Pacific Highway and provides access to Willoughby Road via Clarke Street. The road runs along the south-east border of the future Sydney Metro Crows Nest Station site. The road is currently closed due to Sydney Metro Construction activities.	50	Retail, future Crows Nest Metro station access.	Local access.
Oxley Street	Oxley Street intersects with Pacific Highway, Albany Street and Chandos Street. The road runs along the north-west border of the future Sydney Metro Crows Nest Station site.	50	Commercial, retail residential.	Local access.

2.3 Land Use

The existing land-use within the study area is listed below:

- Private recreation
- Public recreation
- Infrastructure (Educational)
- Infrastructure (Road corridor)
- Infrastructure (Rail)
- Infrastructure (Health Services)
- Mixed Use
- Recreational Waterways
- General Residential
- Commercial Core
- Low density residential
- Local centre

Future land use changes in the study area include uplift of the residential zone and employment along the Pacific Highway Corridor. Additional changes shown in **Figure 2-2** below and detailed in the *St Leonards and Crows Nest 2036 Draft Plan*.

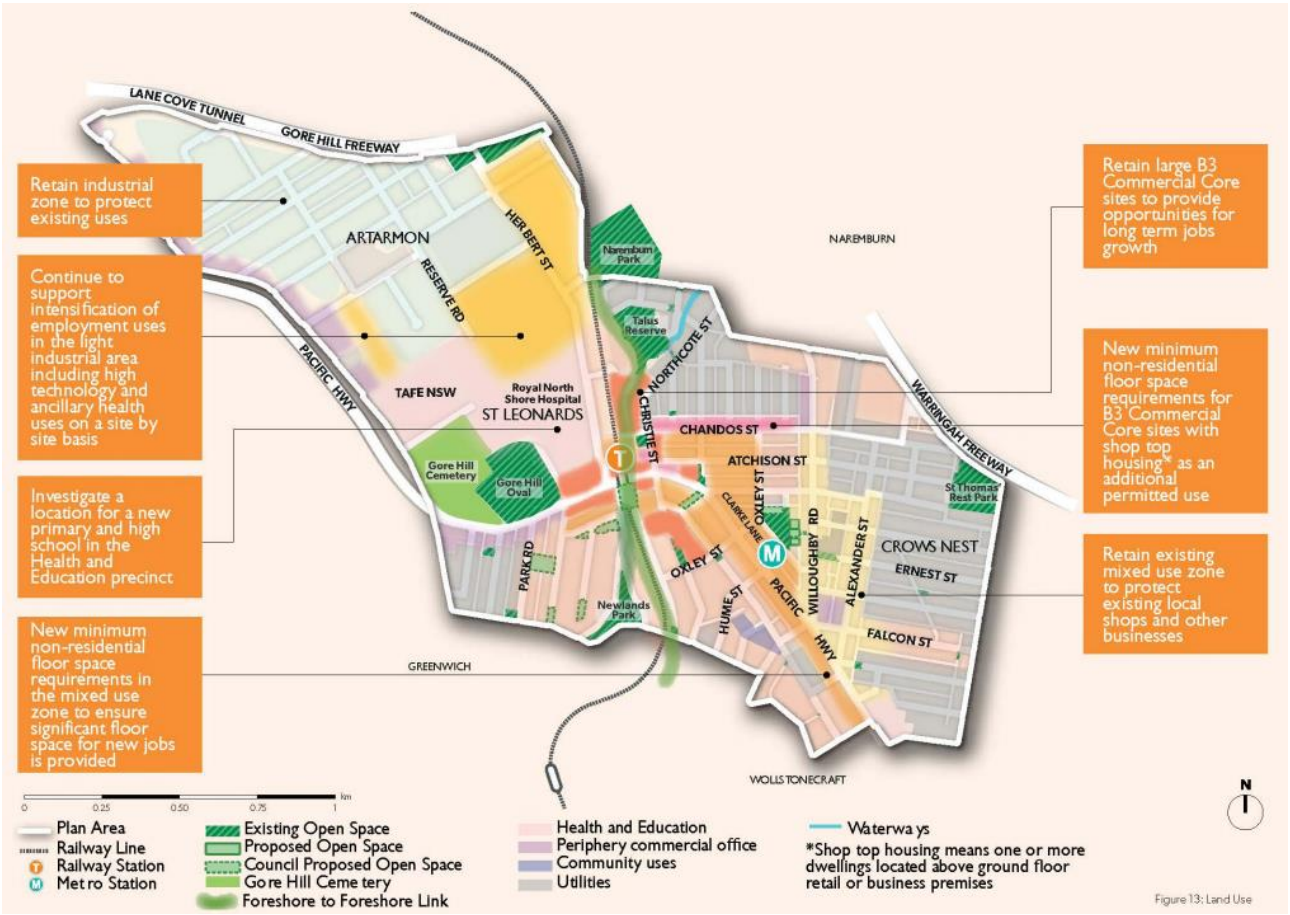


Figure 2-2 Future Land Use (St Leonards and Crows Nest 2036 Draft Plan. DPIE 2018)

2.4 Transport Infrastructure

The main access routes in and out of the St Leonards and Crows Nest study area are:

- Pacific Highway which travels down the centre of the study area and connects the Sydney CBD to north of New South Wales;
- River Road which provides east-west connectivity parallel to Pacific Highway. The road provides alternate access to Epping Road in the west via Longueville Road;
- Alexander Street provides north-south access from Pacific Highway to the Warringah Freeway north via Chandos Street and Brook Street;
- Chandos Street connects the St Leonards Station area to the Warringah Freeway via Brook Street;
- Herbert Street provides north-south connectivity between Pacific Highway to Artarmon in the north via Hampden Road;
- Falcon Street provides access to major roads east of the model. Falcon Street to Pacific Highway and intersects with Miller Street, the Warringah Freeway and Military Road. Military Road is the main road connecting the Northern Beaches suburbs to the Sydney CBD area.

There are three railway crossings in the study area:

- Ella Street Bridge, connecting Herbert Street to Willoughby Road via Dalleys Road;
- Pacific Highway which runs over the railway in the centre of the study area;
- River Road Bridge which runs over the railway at the southern boundary of the study area.

2.5 Concessional and Higher Mass Limit Vehicle Routes

Figure 2-3 and **Figure 2-4** show the restricted vehicle access maps from RMS (valid as of 15/05/2020). Highlighted in green is the concessional mass limit (CML) vehicle routes and highlighted in blue is the higher mass limit (HML) vehicle routes.

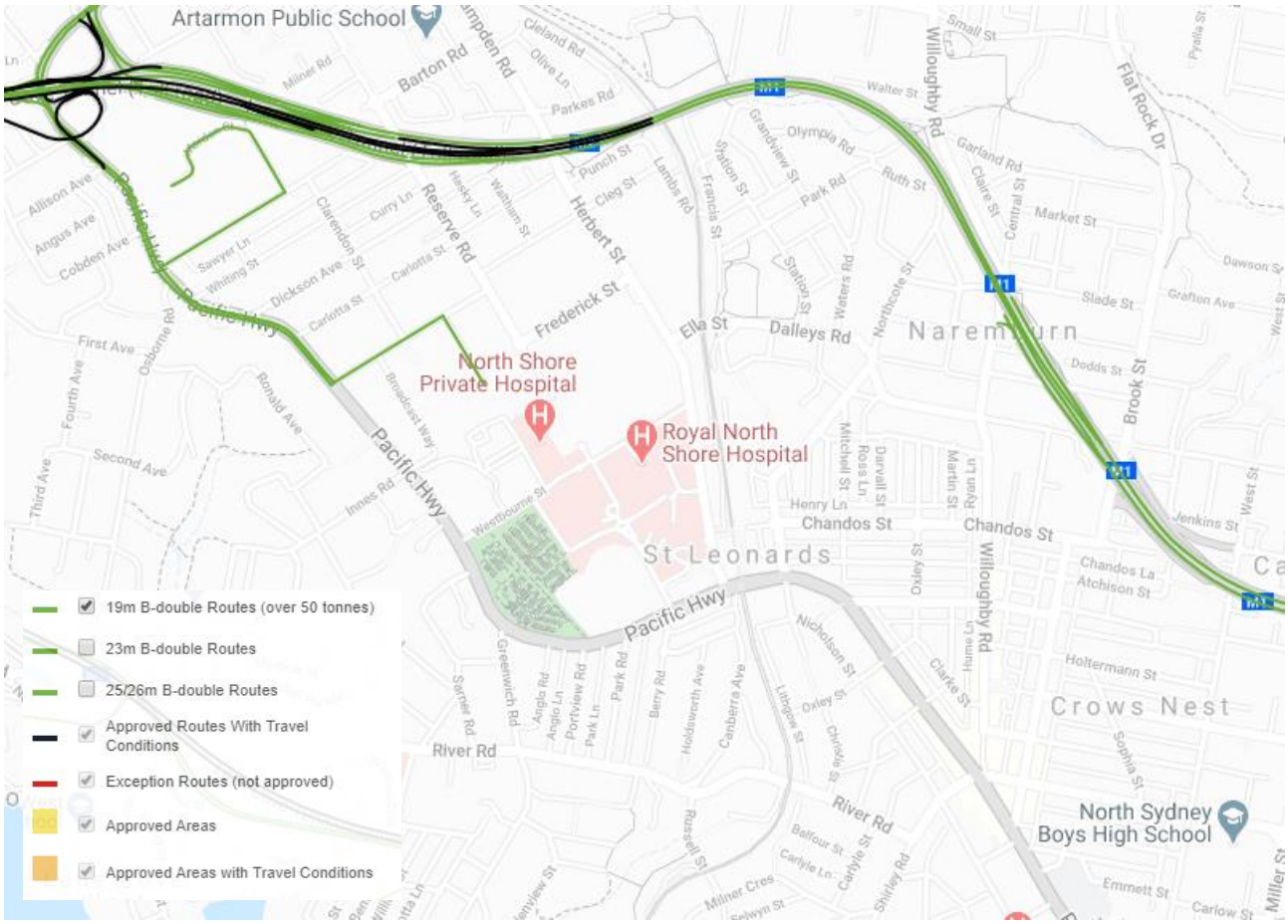


Figure 2-3 Concessional Limit Mass Routes (19m B-Double Routes)

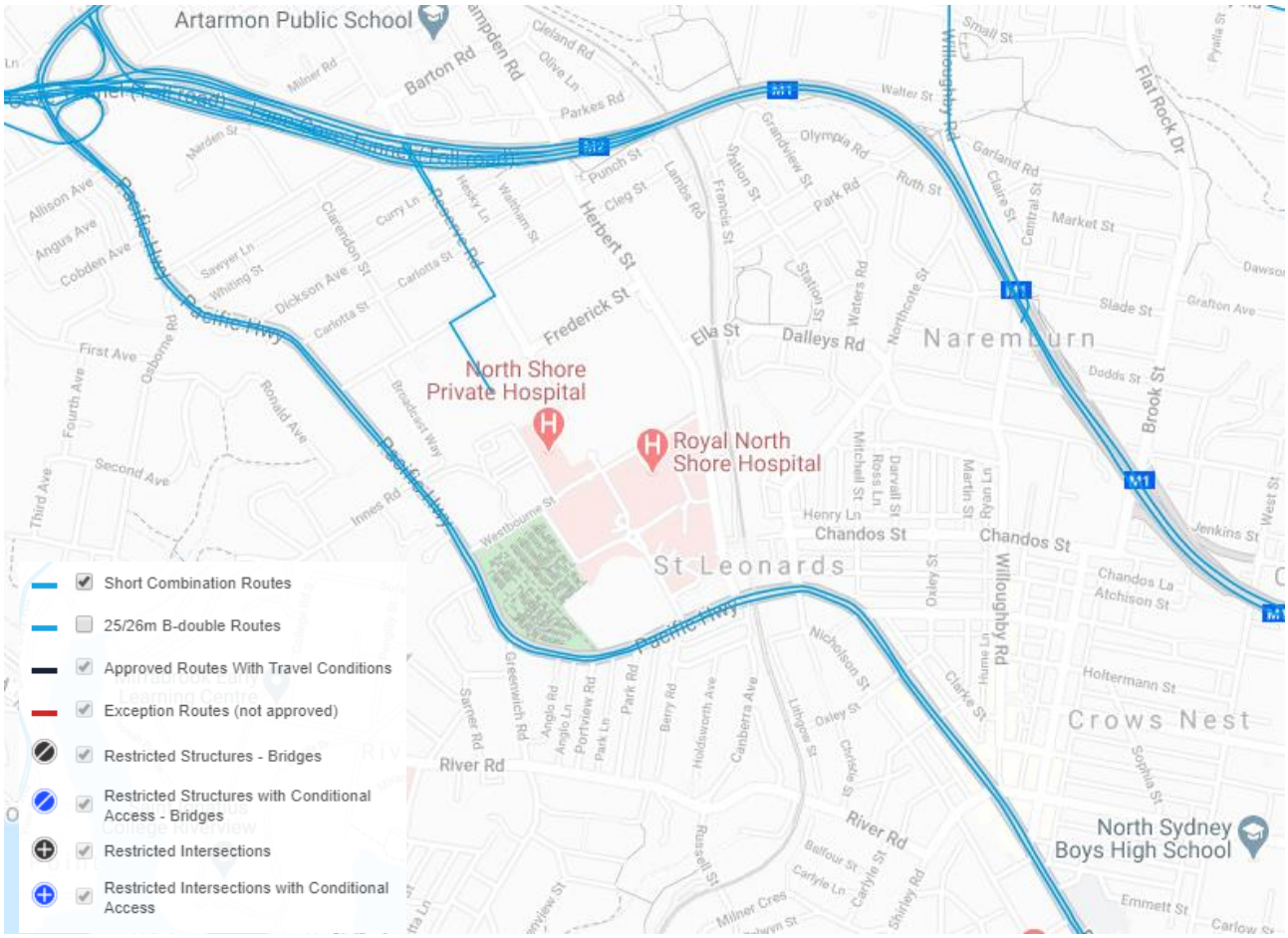


Figure 2-4 Higher Mass Limit Routes (Short Combination Routes)

Concessional Mass Limit 23m and 25/26m B doubles are not permitted on Pacific Highway south of the Lane Cove Tunnel. Similarly, Higher Mass Limit 25/26m B-doubles are also not permitted on Pacific Highway south of the Lane Cove Tunnel.

2.6 Kerbside Lane Running and Parking Constraints

There are multiple road segments in the study area with parking not permitted on the kerbside lane during the AM and PM peak times. This measure aims to maximise road capacity during peak periods. The corridors of interest to be modelled in the St Leonards microsimulation model are listed below.

- Pacific Highway
- Shirley Road
- River Road
- Oxley Street
- Alexander Street
- Falcon Street
- Chandos Street
- Willoughby Road
- Herbert Street
- Christie Street
- Greenwich Road

Figure 2-5 illustrates the areas where the kerbside lane can be utilised as a traffic lane during the AM and PM peak period.

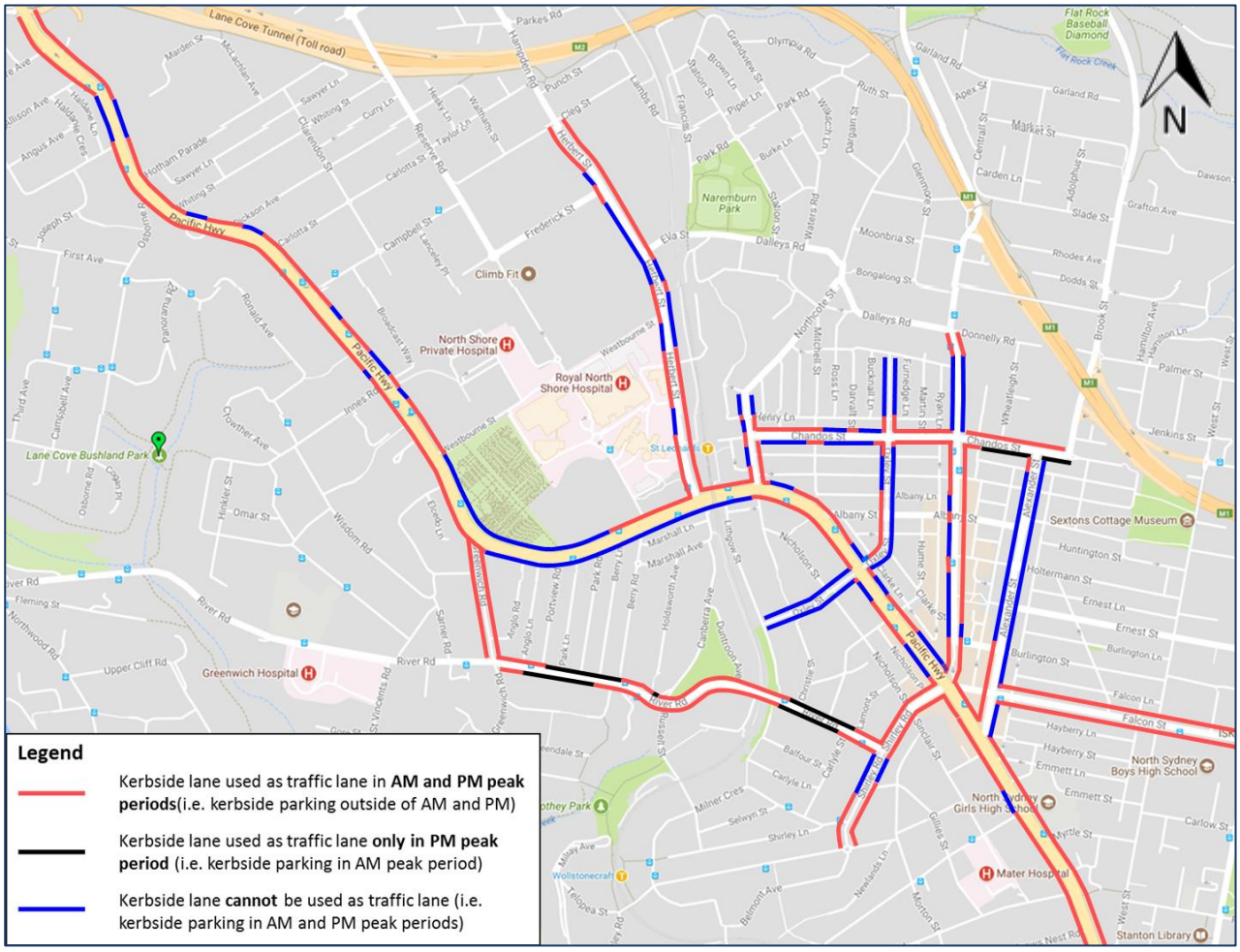


Figure 2-5 Kerbside Lane Utilisation

Source: Nearmap (viewed June 2018)

2.7 School Zones

There are two schools, Naremburn School and North Sydney Girls High School, which are located within or in close proximity to the study area.

There is a 40km/h school zone on surrounding roads from 8:00am – 9:30am and 2:30pm – 4:00pm around North Sydney Girls High School, and from 8:00am – 9:30am and 2pm – 3pm around Naremburn School.

The affected roads are summarised in **Table 2-2** and shown in **Figure 2-6**.

Table 2-2 School Zones Roads in the Study Area

Road	Section
Pacific Highway	Between David Street & Myrtle Street
Willoughby Road	Between Lawson Lane & Dalleys Road
Emmett Street	Between Bernard Lane & Emmett Lane
Emmett Lane	Between Bernard Lane & Pacific Highway
David Street	Between Pacific Highway & Hayberry Street

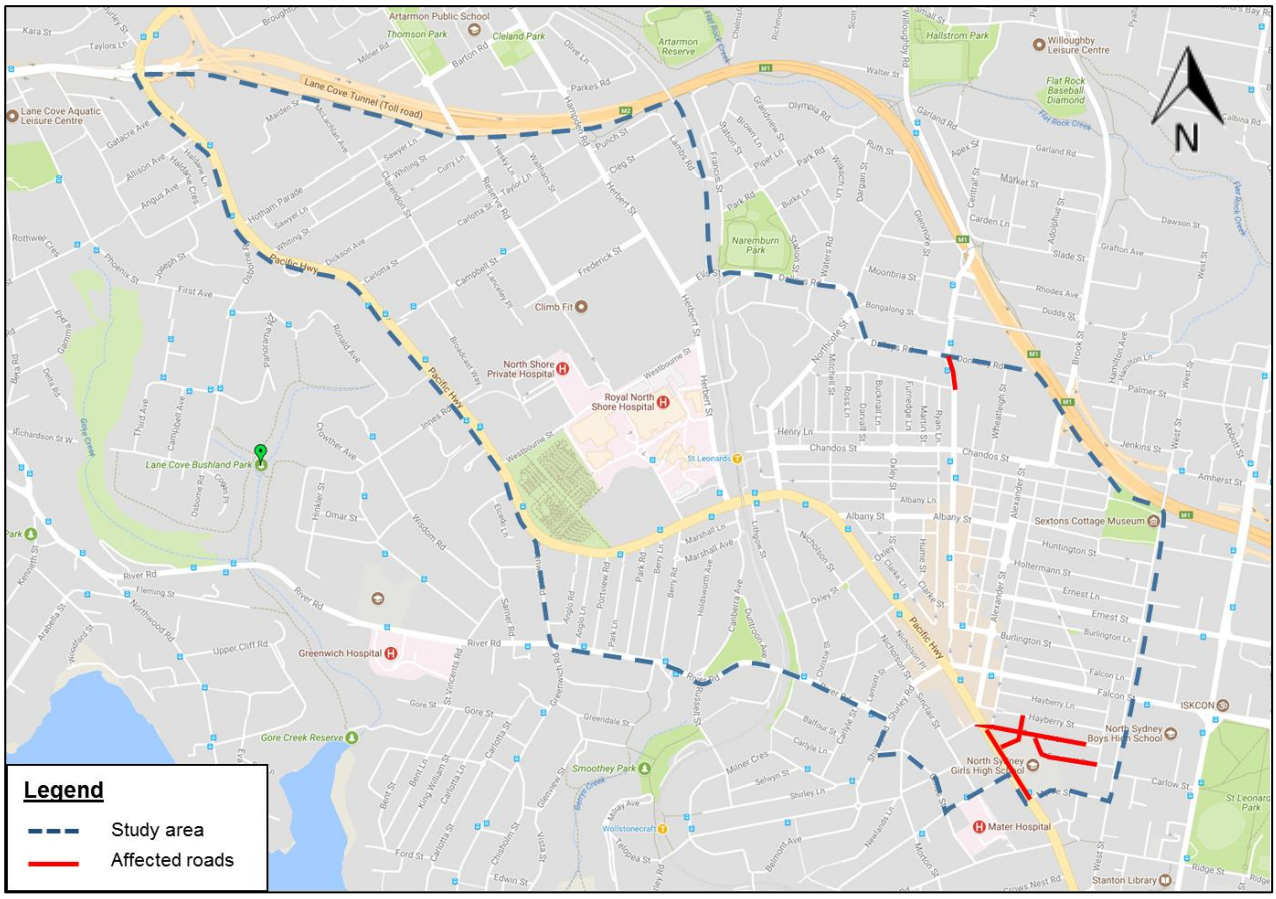


Figure 2-6 School Zones Source: Nearmap (viewed June 2018)

2.8 Traffic Surveys

2.8.1 Overview

A comprehensive list of transport data was used to develop the AIMSUN model replicating existing conditions. Traffic surveys collected in November 2016 were provided by DPIE with additional surveys commissioned by Cardno in May 2018. Survey data was combined with strategic modelling outputs provided by TfNSW for the development of the model. The main types of surveyed traffic data used for this project are:

- Classified Intersection Counts
- Travel Time Route data

Annual Average Daily Traffic (AADT) over the previous three years from the Roads and Maritime Count station on River Road and SCATS detector count data for intersections of interest (**Figure 2-7**) were reviewed for preliminary analysis to identify overall traffic growth. The volumes indicated negligible growth between 2016 and 2018, enabling the reuse of surveyed classified intersection counts undertaken in 2016.

These surveys were undertaken on Thursday the 17th of November 2016 for four hours in the morning period (6.00am to 10.00am) and four hours in the afternoon period (3.00pm to 7.00pm). Additional surveys were undertaken on Tuesday the 15th May 2018 for the same morning and afternoon periods to supplement the 2016 data.

2.8.2 Classified Intersection Counts

The locations for the classified intersection counts (CIC) undertaken in both November 2016 and May 2018 are illustrated in **Figure 2-7** and described in **Table 2-3**.

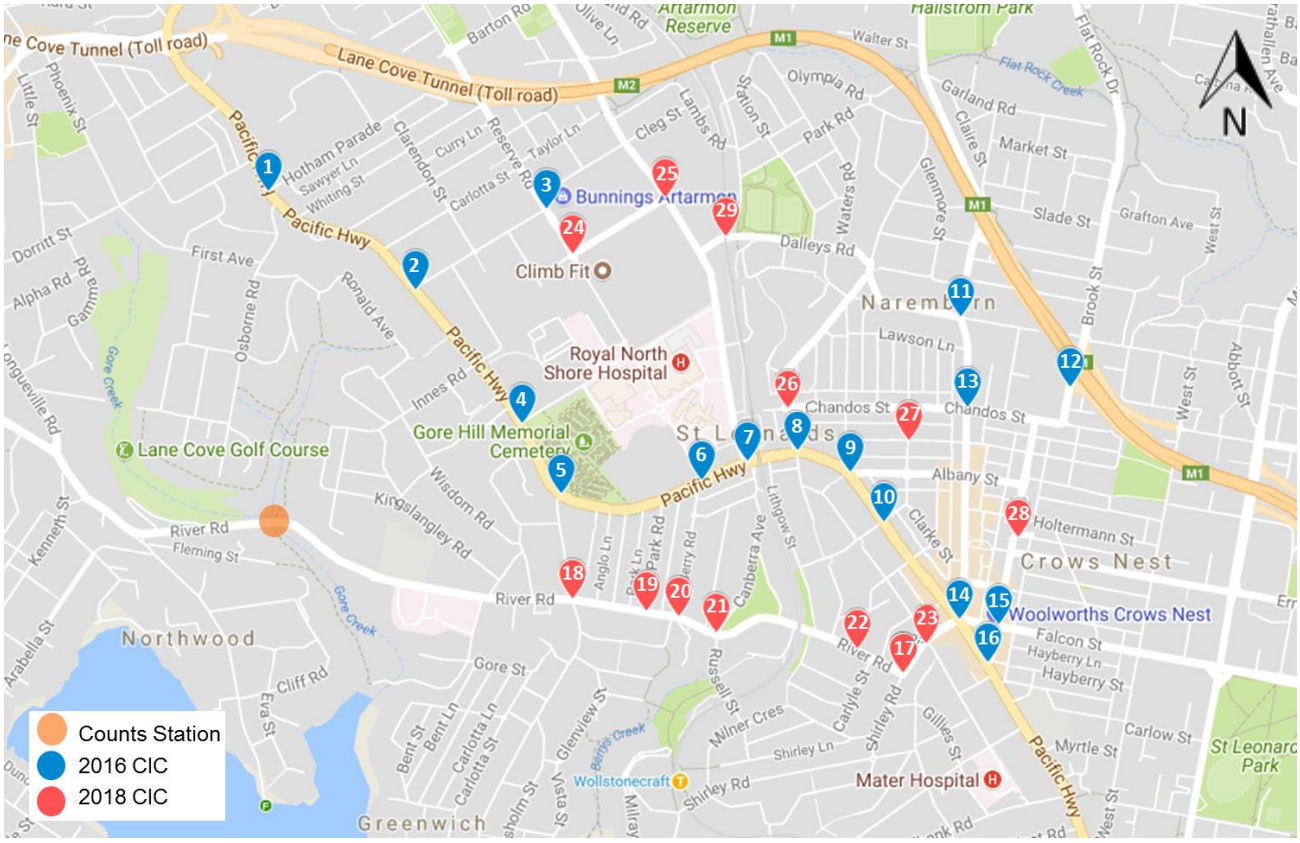


Figure 2-7 Classified Intersection Counts Locations

Table 2-3 Classified Intersection Count Locations

ID	Location	ID	Location
1.	Pacific Highway / Hotham Parade	16.	Pacific Highway / Alexander Street
2.	Pacific Highway / Campbell Street	17.	River Road / Shirley Road
3.	Reserve Road / Campbell Street	18.	River Road / Greenwich Road
4.	Pacific Highway / Westbourne Street	19.	River Road / Park Road
5.	Pacific Highway / Greenwich Road	20.	River Road / Eastview Street
6.	Pacific Highway / Reserve Road / Berry Road	21.	River Road / Canberra Avenue
7.	Pacific Highway / Herbert Street	22.	River Road / Hume Street
8.	Pacific Highway / Christie Street	23.	Shirley Road / Nicholson Street
9.	Pacific Highway / Albany Street	24.	Frederick Street / Reserve Road
10.	Pacific Highway / Oxley Street	25.	Frederick Street / Herbert Street
11.	Willoughby Road / Donnelly Road / Dalleys Road	26.	Chandos Street / Christie Street
12.	Warringah Freeway / Brook Street	27.	Oxley Street / Atchison Street
13.	Willoughby Road / Chandos Street	28.	Alexander Street / Ernest Street
14.	Pacific Highway / Falcon Street	29.	Ella Street Bridge
15.	Falcon Street / Alexander Street		

2.8.3 Travel Time Data

Travel time data and speed data was extracted from the TomTom big data portal for vehicles travelling on seven routes in the study area for two hours in the AM peak and two hours in the PM peak during weekdays for the full month of November 2016. The route description and the length of the routes are outlined in **Table 2-4** with **Figure 2-8** displaying the locations of the routes in the study area.

TomTom captures 3.5 million km of floating car data (FCD) every day in Australia. The data is collected from a combination of TomTom devices (fleet and consumer), third party Auto Original Equipment Manufacturers (OEMs) and mobile devices.

FCD provides a new method for measuring speeds, travel times and thus road performance. Probe devices in vehicles, which may be cellular phones or GPS devices, provide average travel time data in large sample sizes per route segments.

Table 2-4 Travel Time Routes

ID	Route	Direction	Length (m)
1	**Pacific Highway** between Hotham Parade and Alexander Street	Northbound	3,031
		Southbound	2,942
2	Willoughby Road between M1 and **Pacific Highway**	Northbound	1,356
		Southbound	1,146
3	Alexander Street between **Pacific Highway** and Chandos Street	Northbound	724
		Southbound	730
4	Chandos Street corridor between Brook Street and **Pacific Highway**	Eastbound	1,138
		Westbound	1,081
5	Reserve Road and Campbell Street corridor Herbert Street and **Pacific Highway**	Eastbound	933
		Westbound	957
6	Falcon Street between **Pacific Highway** and West Street	Eastbound	707
		Westbound	731
7	River Road between **Pacific Highway** / Greenwich Road and **Pacific Highway** / Shirley Road	Eastbound	1,545
		Westbound	1,504

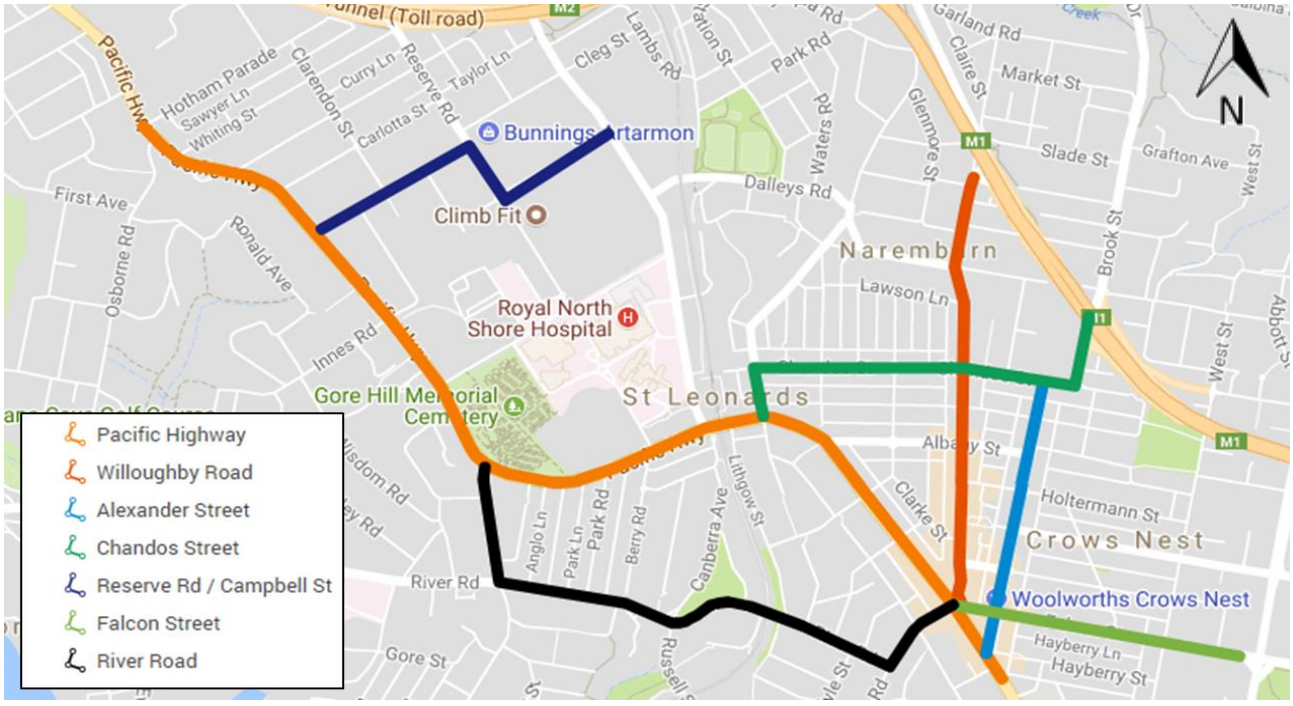


Figure 2-8 Location of Travel Time Routes

The average travel time and posted speed along the eight travel routes are summarised in **Table 2-5**.

Table 2-5 Travel Time and Speed Data

ID	Route	Direction	7:30 – 8:30 AM (mm:ss)	8:30 – 9:30 AM (mm:ss)	3:45 – 4:45 PM (mm:ss)	4:45 – 5:45 PM (mm:ss)	Posted Speed (km/hr)
1	Pacific Highway	Northbound	06:24	07:00	07:05	06:48	60
		Sample size	*752*	*812*	*768*	*766*	
		Southbound	07:34	07:07	07:28	07:38	60
		Sample size	*1,221*	*1,299*	*1,083*	*1,390*	
2	Willoughby Road	Northbound	02:41	02:49	02:40	02:42	50
		Sample size	*195*	*197*	*221*	*256*	
		Southbound	03:31	03:41	04:16	03:54	50
		Sample size	*204*	*184*	*179*	*201*	
3	Alexander Street	Northbound	03:33	03:33	04:15	04:03	50
		Sample size	*143*	*165*	*172*	*197*	
		Southbound	03:13	03:14	03:27	03:42	50
		Sample size	*151*	*163*	*177*	*209*	
4	Chandos Street	Eastbound	02:31	02:32	02:44	02:29	50
		Sample size	*212*	*224*	*286*	*264*	
		Westbound	03:22	03:11	03:27	02:57	50
		Sample size	*241*	*297*	*196*	*173*	
5	Reserve Road and Campbell Street	Eastbound	03:07	02:53	03:00	02:43	50
		Sample size	*174*	*201*	*144*	*145*	
		Westbound	02:49	03:01	03:05	02:33	50
		Sample size	*128*	*159*	*209*	*117*	
6	Falcon Street	Eastbound	00:51	00:47	00:53	00:58	60
		Sample size	*465*	*503*	*504*	*652*	
		Westbound	01:46	01:24	01:22	01:59	60
		Sample size	*588*	*550*	*551*	*562*	
7	River Road	Eastbound	05:43	04:40	04:54	05:52	50
		Sample size	*528*	*460*	*334*	*434*	
		Westbound	03:10	03:04	03:30	03:03	50
		Sample size	*356*	*269*	*563*	*487*	

2.9 Strategic Modelling Outputs

Strategic modelling outputs provided by TfNSW and used to develop the traffic demand. The strategic cordon is shown in **Figure 2-9**. There is a total of 32 centroid connections within the strategic matrix output.

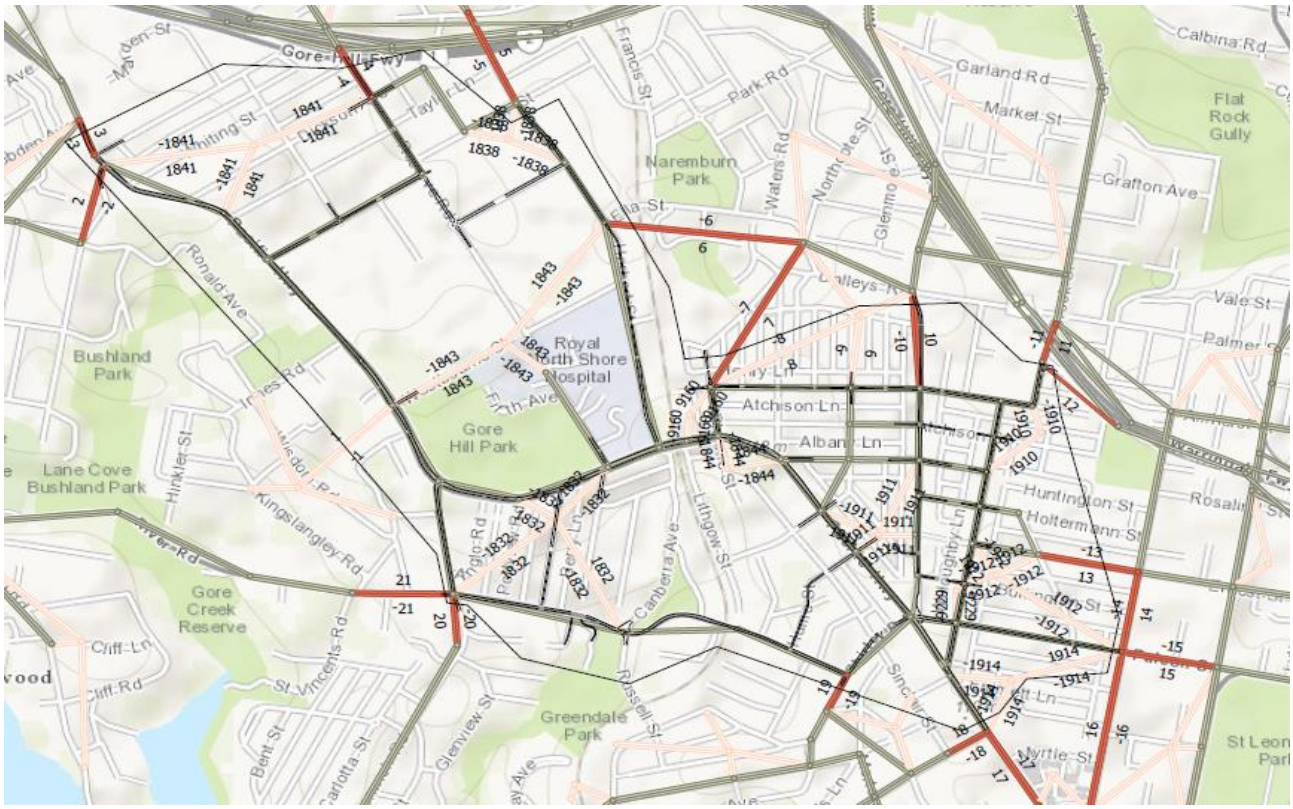


Figure 2-9 Strategic Model Cordon

2.10 Public Transport

Currently, there are 24 bus routes and the St Leonards train station in the study area. The bus services are summarised in **Table 2-6** and the locations of public transport facilities are shown in **Figure 2-10**.

Table 2-6 Bus services description

Route	Description
143	Manly to Chatswood via Balgowlah & St Leonards
144	Manly to Chatswood via Royal North Shore Hospital
252	Gladesville to City King Street Wharf via North Sydney
254	Riverview to McMahons Point
286	Denistone East to Milsons Point via St Leonards & North Sydney
287	Ryde to Milsons Point via St Leonards & North Sydney
290	Epping to City Erskine St via Macquarie University & North Sydney
291	Epping to McMahons Point
200	Bondi Junction to Chatswood
602X	Rouse Hill to North Sydney
612X	Kellyville to Milsons Point
622	Dural to Milsons Point via Cherrybrook
653	West Pennant Hills to Milsons Point
M20	Botany to Gore Hill
261	Lane Cove to City King St Wharf via Longueville
265	Lane Cove to North Sydney via Greenwich
343	Kingsford to Chatswood
257	Chatswood to Balmoral via Crows Nest
267	Chatswood to Crows Nest
263	Crows Nest to City Bridge via Cremorne
N90	Hornsby to City Town Hall via Chatswood
N91	Bondi Junction to Macquarie Park via City Town Hall
12T1	Central, then all stations to Chatswood (temporary bus)
15T1	Central, then Town Hall, Wynyard, North Sydney, St Leonards, Artarmon, Chatswood (temporary bus)

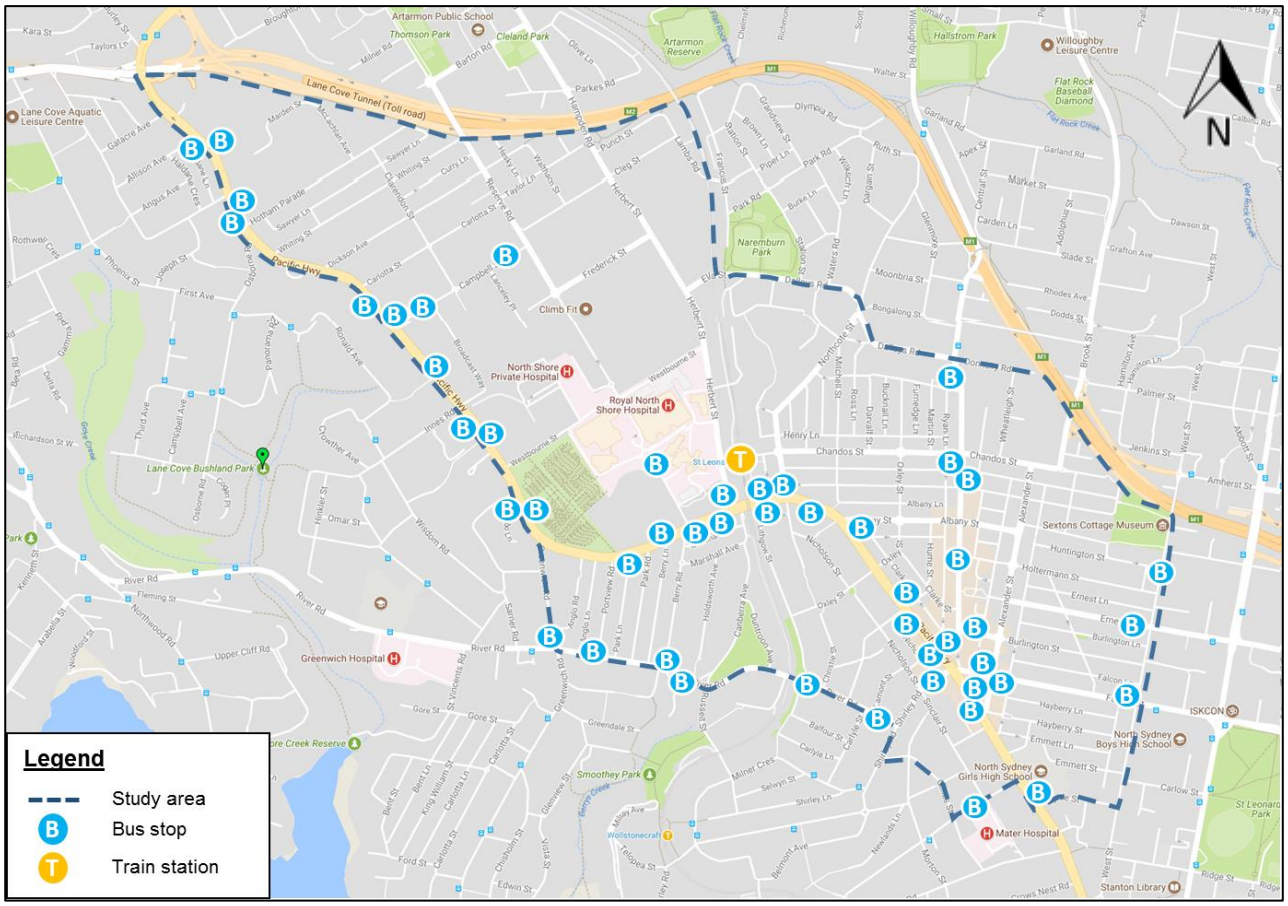


Figure 2-10 Public Transport Facility Locations Sourced from Nearmaps (viewed June 2018)

2.11 Signal and SCATS Data

IDM Data was provided by Roads and Maritime (from 12:00:00 AM to 11:59:59 PM, on 17 November 2016) and aggregated in 15-minute frequencies with minimum phase time, maximum phase time, average phase time and total cycle time.

There are 34 intersections controlled by the SCATS system in the study area as shown in **Table 2-7.** The locations of the traffic signals are shown in **Figure 2-11.**

Table 2-7 Signalised Intersections

TCS #	Intersection	TCS #	Intersection
0138	Pacific Highway / Longueville Road	0764	Falcon Street / Alexander Street
0579	Pacific Highway / Hotham Parade	0895	Falcon Street / West Street
0579	Pacific Highway / Osborne Road	0088	Falcon Street / Miller Street
0585	Pacific Highway / Campbell Street	1306	Ernest Street / Alexander Street
Unknown	Pacific Highway between Innes Road and Westbourne Street (pedestrian signal)	1355	Ernest Street / West Street
1111	Pacific Highway / Westbourne Street	0151	Ernest Street / Miller Street
0883	Pacific Highway / Greenwich Road	0516	Willoughby Road / Albany Street
0771	Pacific Highway / Reserve Road / Berry Road	0564	Willoughby Road / Chandos Street
0770	Pacific Highway / Herbert Street	0600	Willoughby Road / Donnelly Road / Dalleys Road
0769	Pacific Highway / Christie Street	3518	Herbert Street / Frederick Street
0768	Pacific Highway / Albany Street	1047	Herbert Street / Cleg Street
0767	Pacific Highway / Oxley Street	Unknown	Christie Street / Sergeants Lane
0766	Pacific Highway / Hume Street	3622	Reserve Road / Campbell Street
0765	Pacific Highway / Falcon Street / Shirley Road	3556	Reserve Road / Dickson Avenue
0763	Pacific Highway / Alexander Street	2861	Reserve Road / Gore Hill Freeway (M1)
0762	Pacific Highway / Rocklands Road	1362	Brook Street / Warringah Freeway (M1)
1357	Pacific Highway / Hazelbank Road	0452	Greenwich Road / River Road

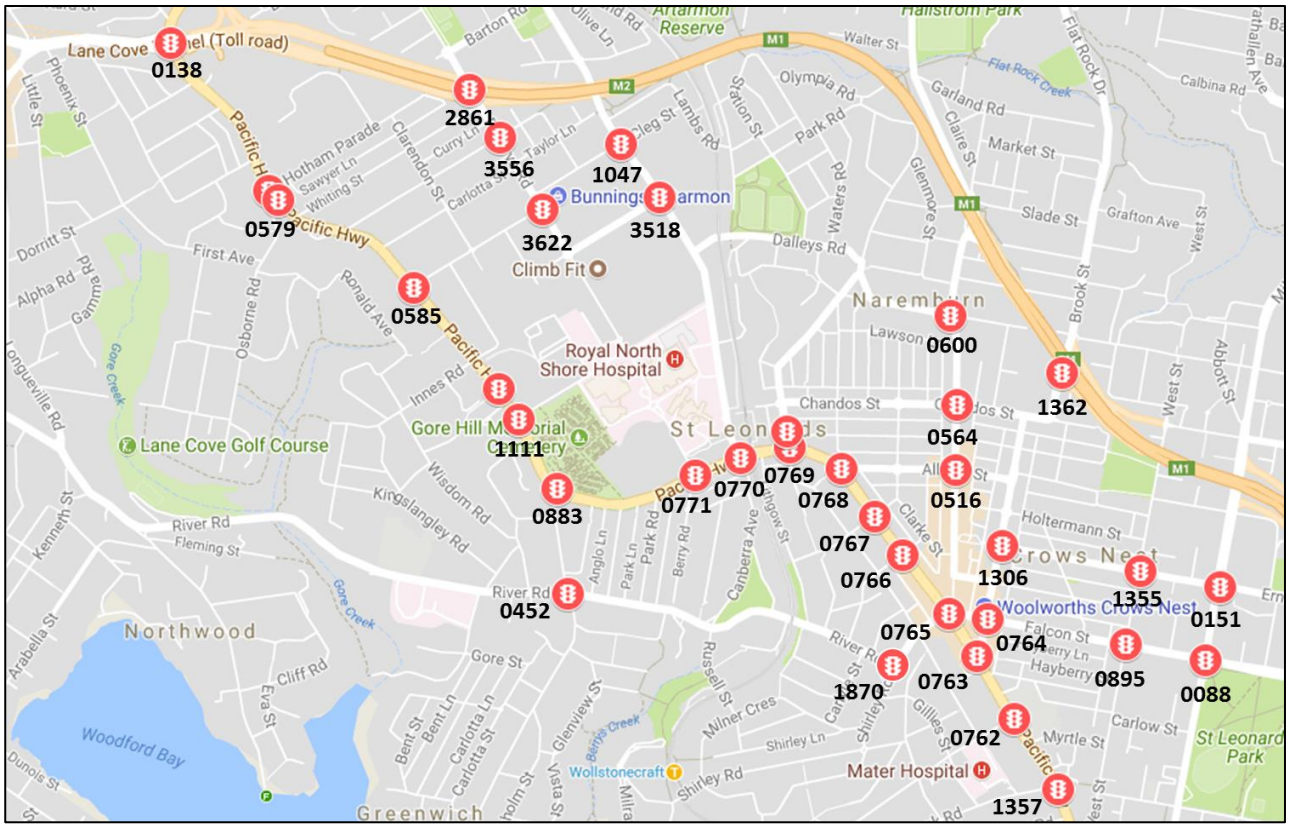


Figure 2-11 Signalised Intersection Locations

2.12 Congestion Locations

TomTom travel speed data was extracted for two hours in the AM peak and two hours in the PM peak during weekdays for the month of November 2016. This enabled pinpointing the main congestion hotspots within the study area. These consist of six main locations as seen in **Figure 2-12** and described in **Table 2-8**.

The data shows that the St Leonards precinct experiences similar patterns of congestion in the AM and PM peak periods.

Overall, the following comments can be made about the road network in the study area:

- Some sections of River Road are identified as operating at near free flow speeds. However, when approaching the Greenwich Road and Shirley Road intersections, this corridor typically experiences congestion during peak periods **(Locations 1 and 3).**
- The Pacific Highway (mostly in the southbound direction) is identified as the significant road corridor which is impacted by noticeable levels of congestion. **(Locations 2, 3 and 4).**
- The most poorly performing area of the road network is the triangle bounded by the Pacific Highway, Chandos Street and Alexander Street. For this area, Alexander Street is the single street which performs most poorly between the Pacific Highway and Chandos Street. **(Location 4 and 5).**
- Elsewhere in the study area, there is a pedestrian crossing on Herbert Street north of the Pacific Highway which services the hospital precinct which services a high volume of pedestrians. The impacts to travel speeds are clear in the data.

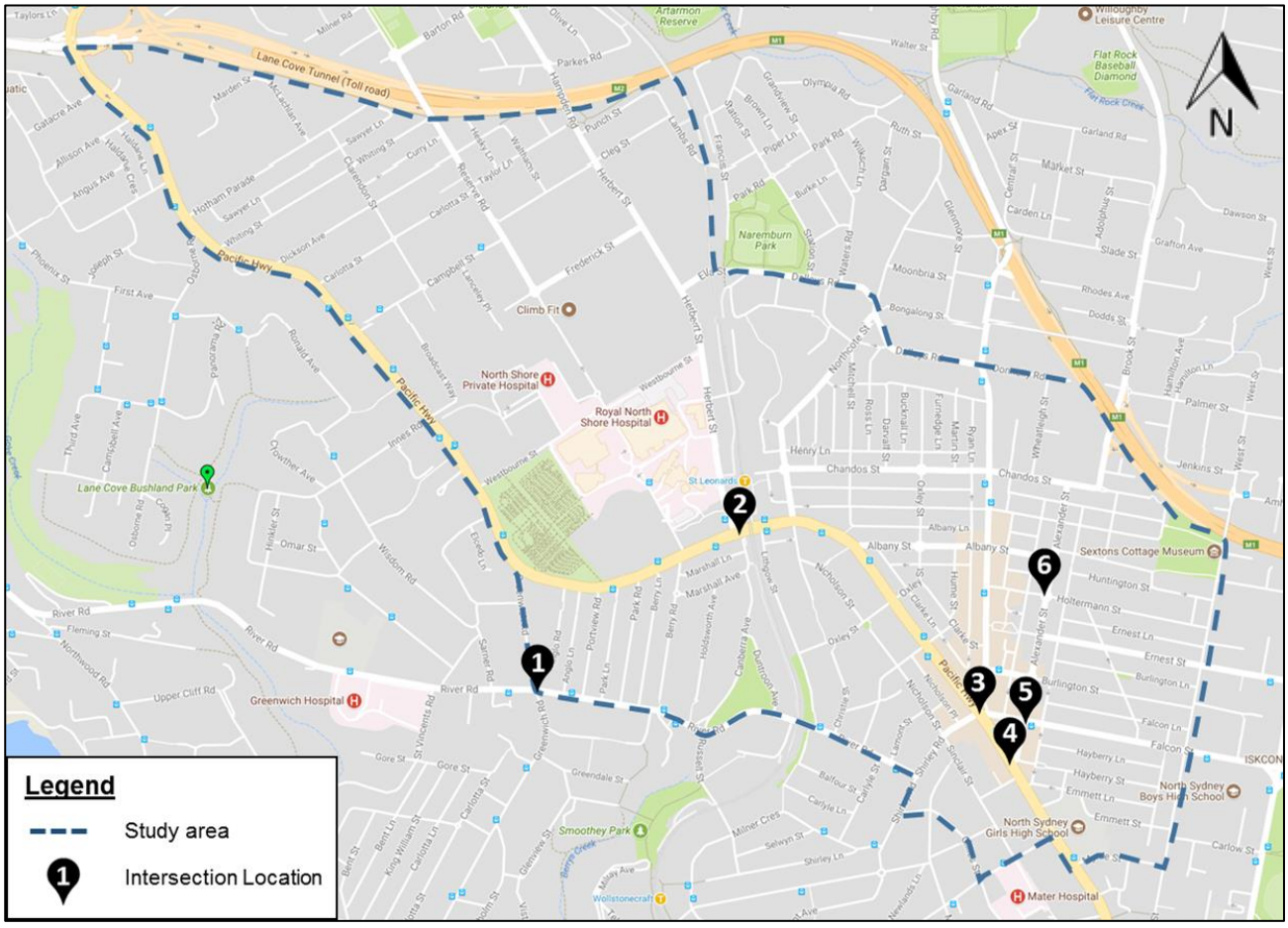


Figure 2-12 Congested Locations

Table 2-8 Intersection Description

ID	Location	Description
1	River Road / Greenwich Road	Greenwich Road the connecting link between River Road to the Pacific Highway and to Crows Nest.
2	Pacific Highway / Herbert Street	Herbert Street provides access to residential areas, the Royal North Shore Hospital, St Leonards train station and the Pacific Highway.
3	Pacific Highway / Shirley Road	Shirley Road connects residential areas to the main arterial road, Pacific Highway and commercial areas.
4	Pacific Highway / Alexander Street	Alexander Street intersects with the Pacific Highway, Falcon Street, Ernest Street, Albany Street and Chandos Street.
5	Falcon Street / Alexander Street	Alexander Street intersects with Falcon Street that is a major road into Crows Nest from suburbs in the east.
6	Holtermann Street / Alexander Street	Alexander Street intersects with Holtermann Street by a roundabout.

Congestion is inferred from the Level of Service (LoS) that provides an indication of the mid-block performance on the road network. This measure is the average speed as a percentage of the base Free Flow Speed (FFS), which is placed on a scale from 'A' to 'F'. **Table 2-9** outlines the criteria presented in Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis that is used to assess the performance. The acceptable traffic conditions is associated with a Level of Service D.

Table 2-9 Austroads Midblock Performance Thresholds for Urban Streets

LoS	Description	Travel speed as a percentage of base FFS (%)
A	Good operation	> 85
B	Good with acceptable delays and spare capacity	67-85
C	Satisfactory	50-67
D	Operating near capacity	40-50
E	At capacity	30-40
F	Unsatisfactory and requires additional capacity	≤ 30

Using GIS data, the Level of Service of the roads in the study area are mapped by the hour for the AM and PM peak period. The Level of Service Plots for the study area for November 2016 are shown below.

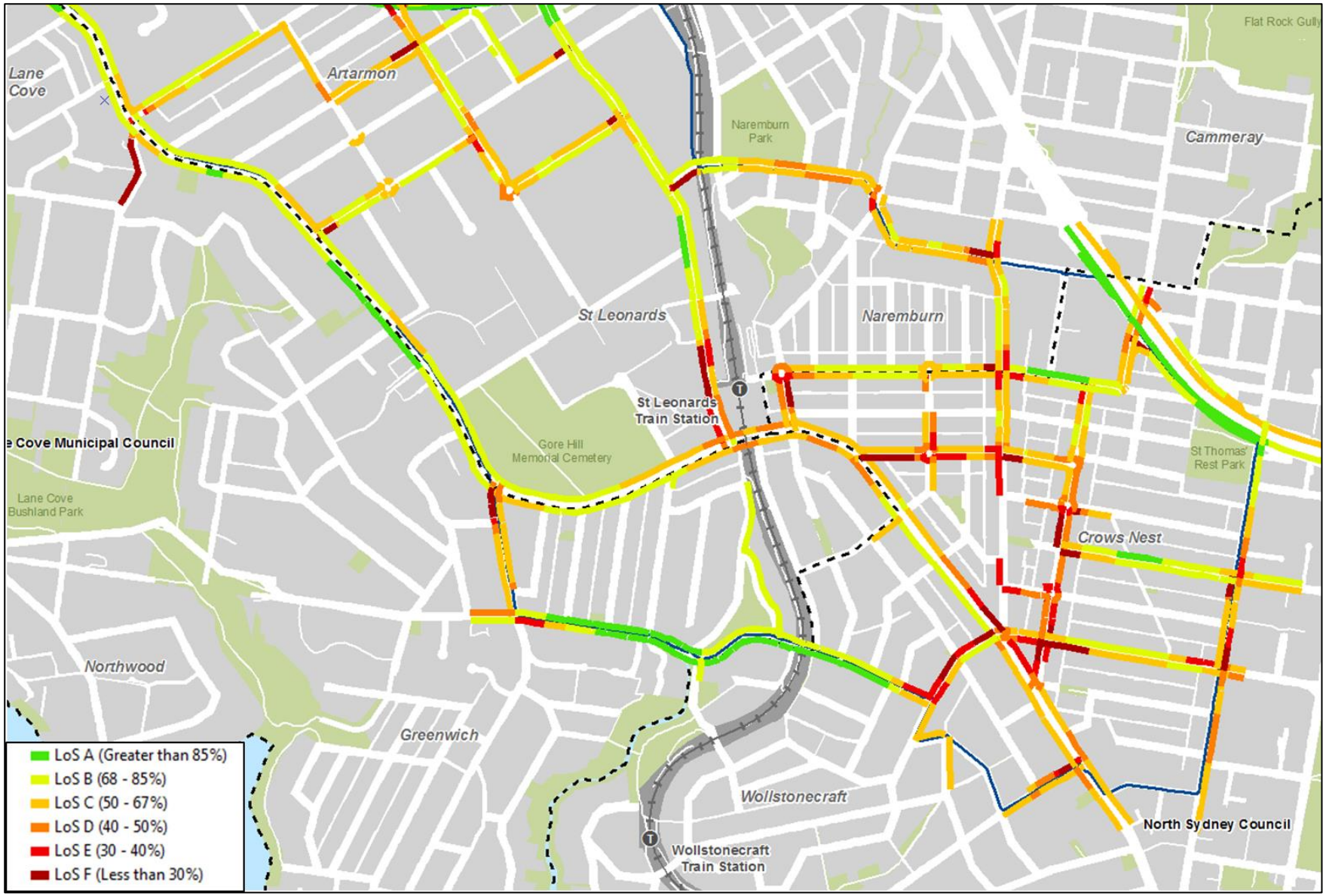


Figure 2-13 Level of Service AM Peak – 7:30am to 8:30am (TomTom Speed Data November 2016)

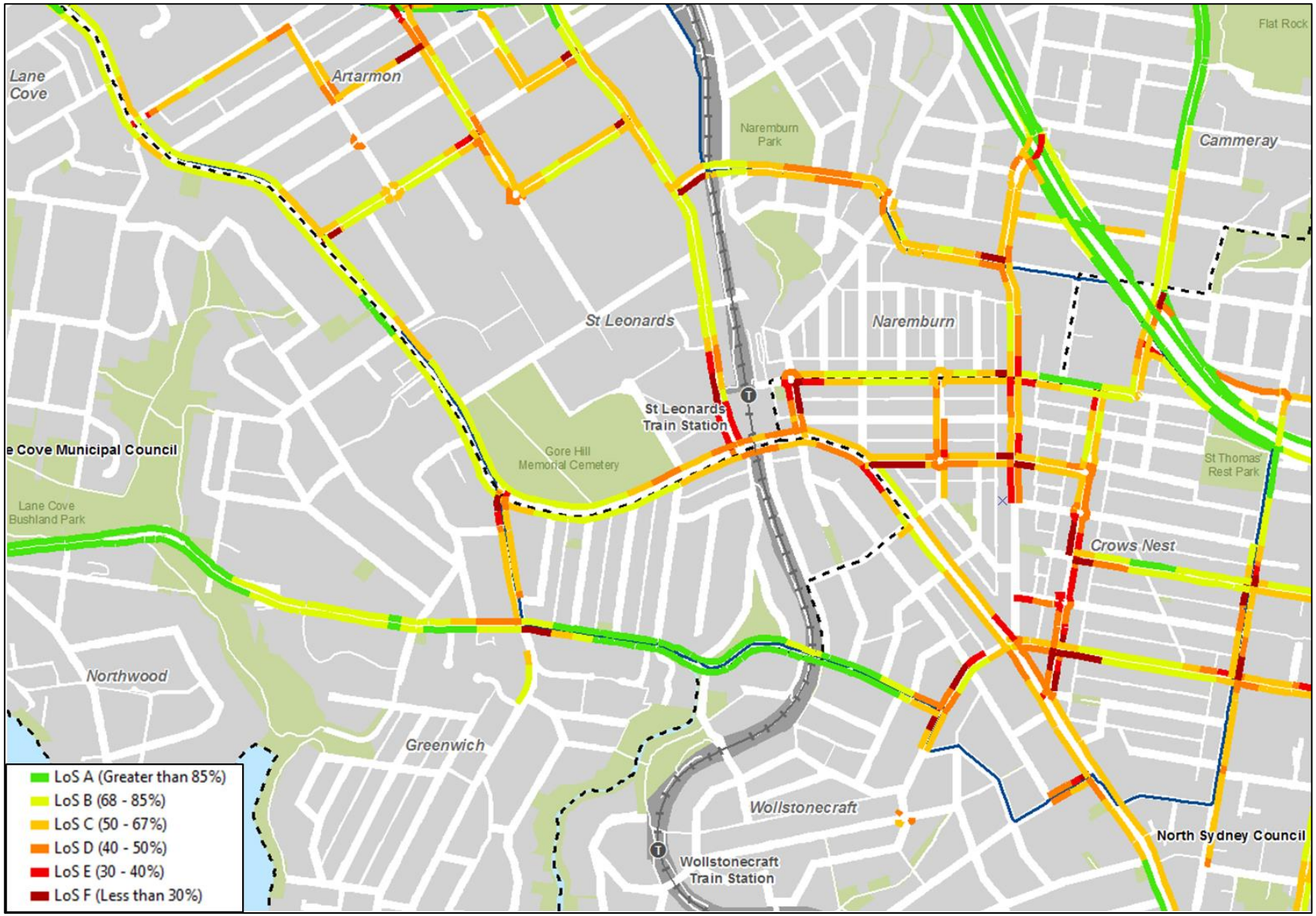


Figure 2-14 Level of Service AM Peak – 8:30am to 9:30am (TomTom Speed Data November 2016)

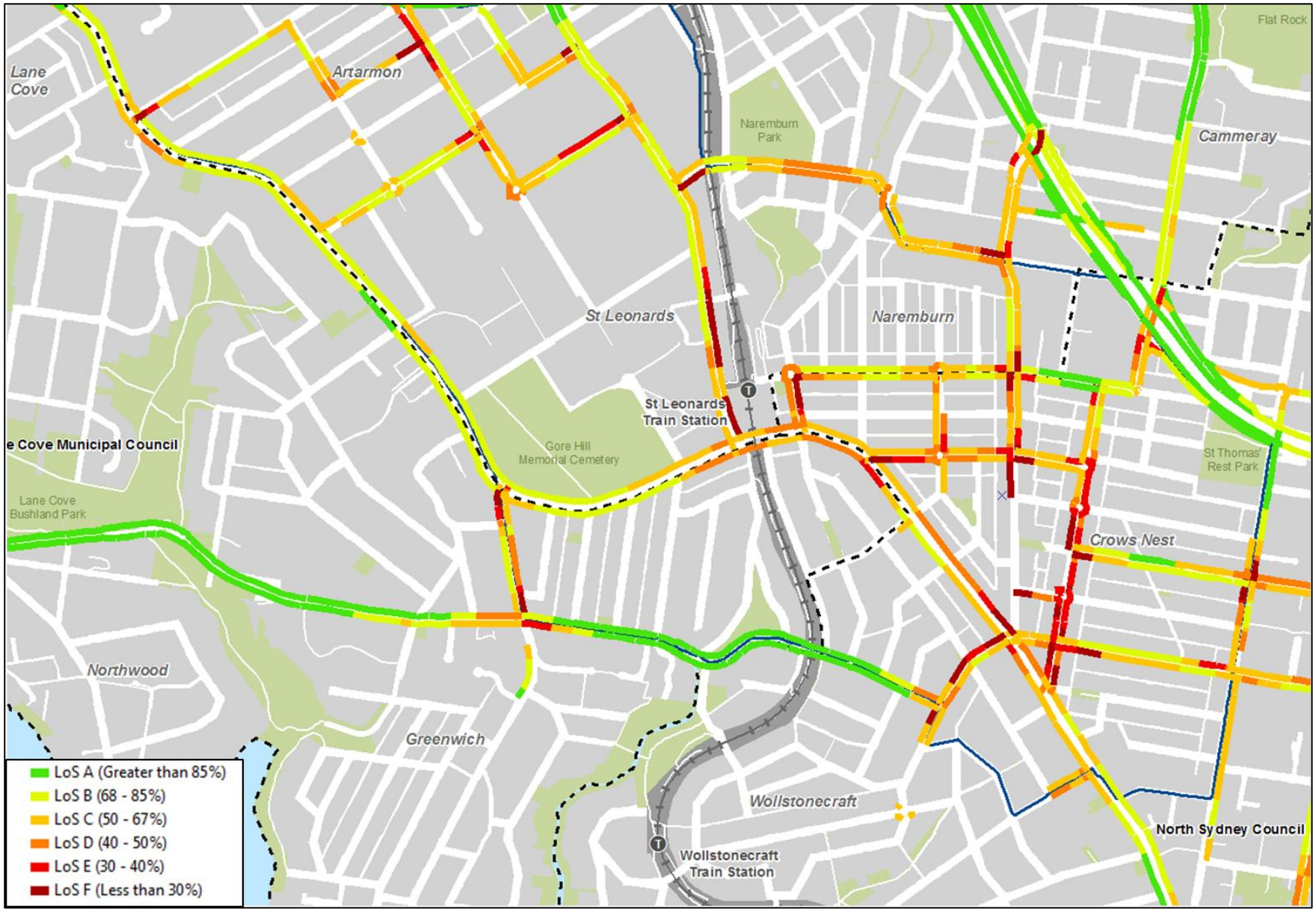


Figure 2-15 Level of Service PM Peak – 4:45pm to 5:45pm (TomTom Speed Data November 2016)

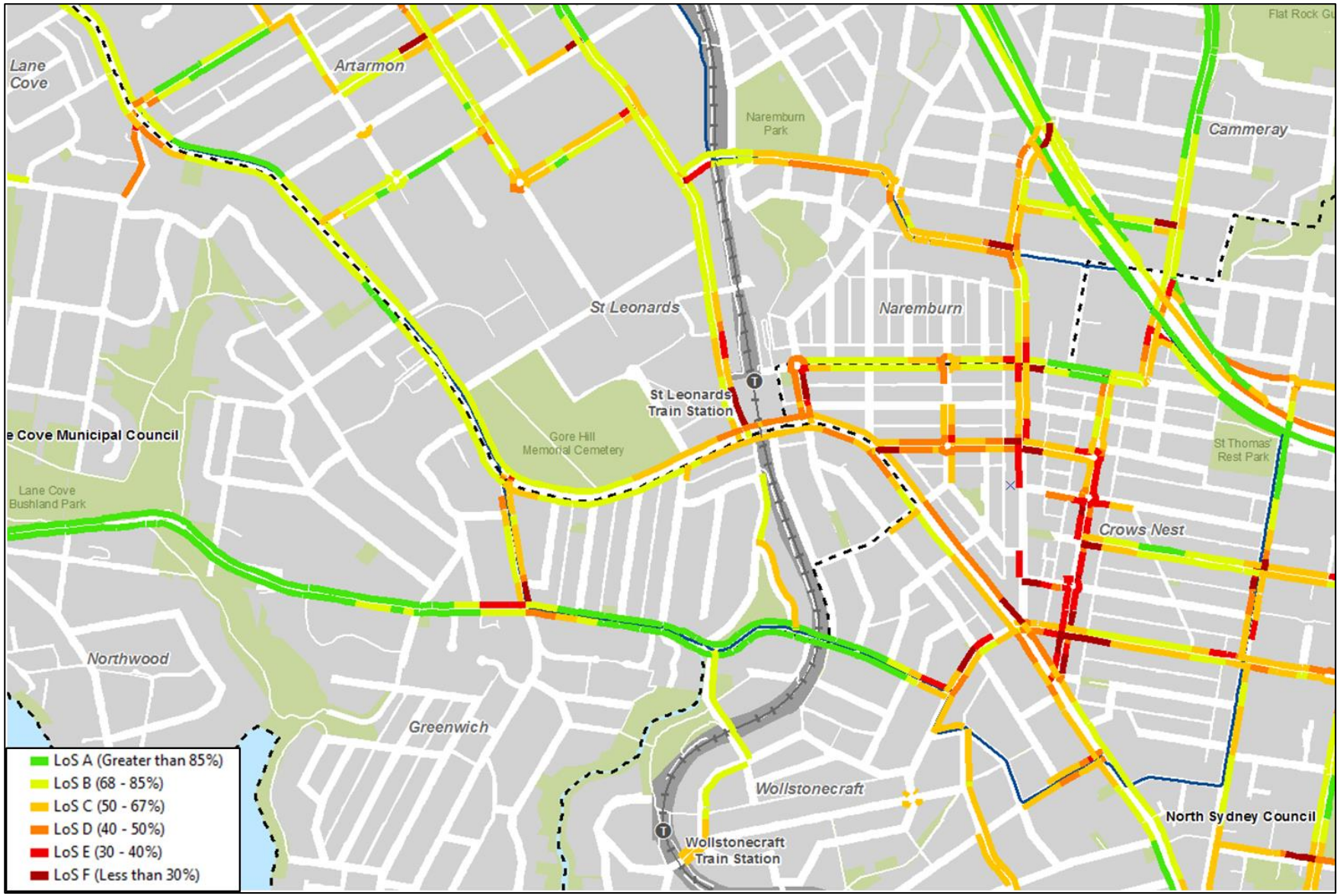


Figure 2-16 Level of Service PM Peak – 5:45pm to 6:45pm (TomTom Speed Data November 2016)

3 Model Assumptions

3.1 Modelling Platform

AIMSUN version 8.4.0 Thu May 2019 (afba3b3059 x64 Python 2) was used to develop the microscopic model. The microscopic simulation model wll be used to assess network statistics and impact of future land use scenarios.

3.2 Time Period

Two peak periods were assessed in this study, the Weekday AM peak and the Weekday PM peak. The modelled peak periods covered a two-hour period in each peak. These were determined based on the obtained traffic survey data, with separate model scenarios developed for each peak period. The 15-minute volumes for the surveyed peak periods are shown in **Figure 3-1** and **Figure 3-2** below:

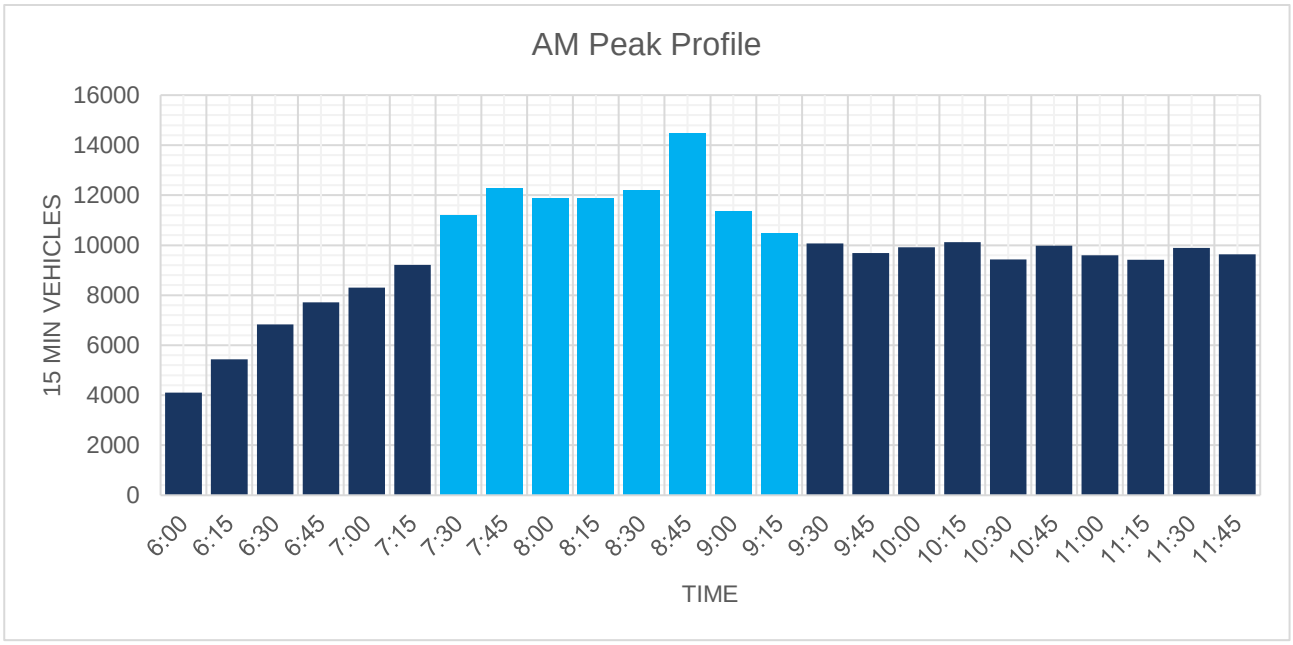


Figure 3-1 AM Peak Profile

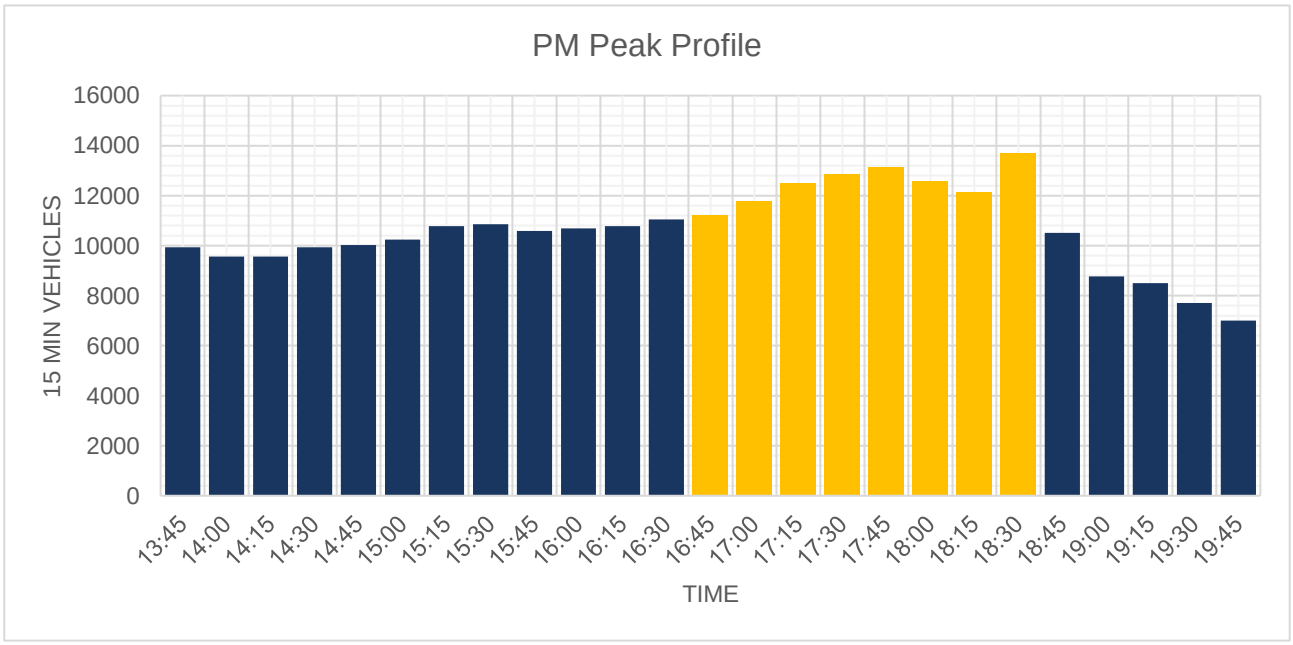


Figure 3-2 PM Peak Profile

For each peak period, a 'warm-up' period of 60 minutes was developed before the two-hour simulation period according to the traffic survey profiles, with the overall modelled periods assumed in Aimsun shown in **Table 3-1**. The model is calibrated and validated for these peak periods.

Table 3-1 Modelled Time Periods in Aimsun

Peak Period	Warm-up (1 hour)	Modelled Peak Period (2 hours)
Weekday AM	6:30 – 7:30 AM	7:30 – 8:30 AM
		8:30 – 9:30 AM
Weekday PM	15:45 – 16:45 PM	16:45 – 17:45 PM
		17:45 – 18:45 PM

3.3 Network Coding

The AIMSUN model was coded based on Nearmap and Google maps supplemented by site visit observations. The extent of the coded network is shown in **Figure 3-3**.

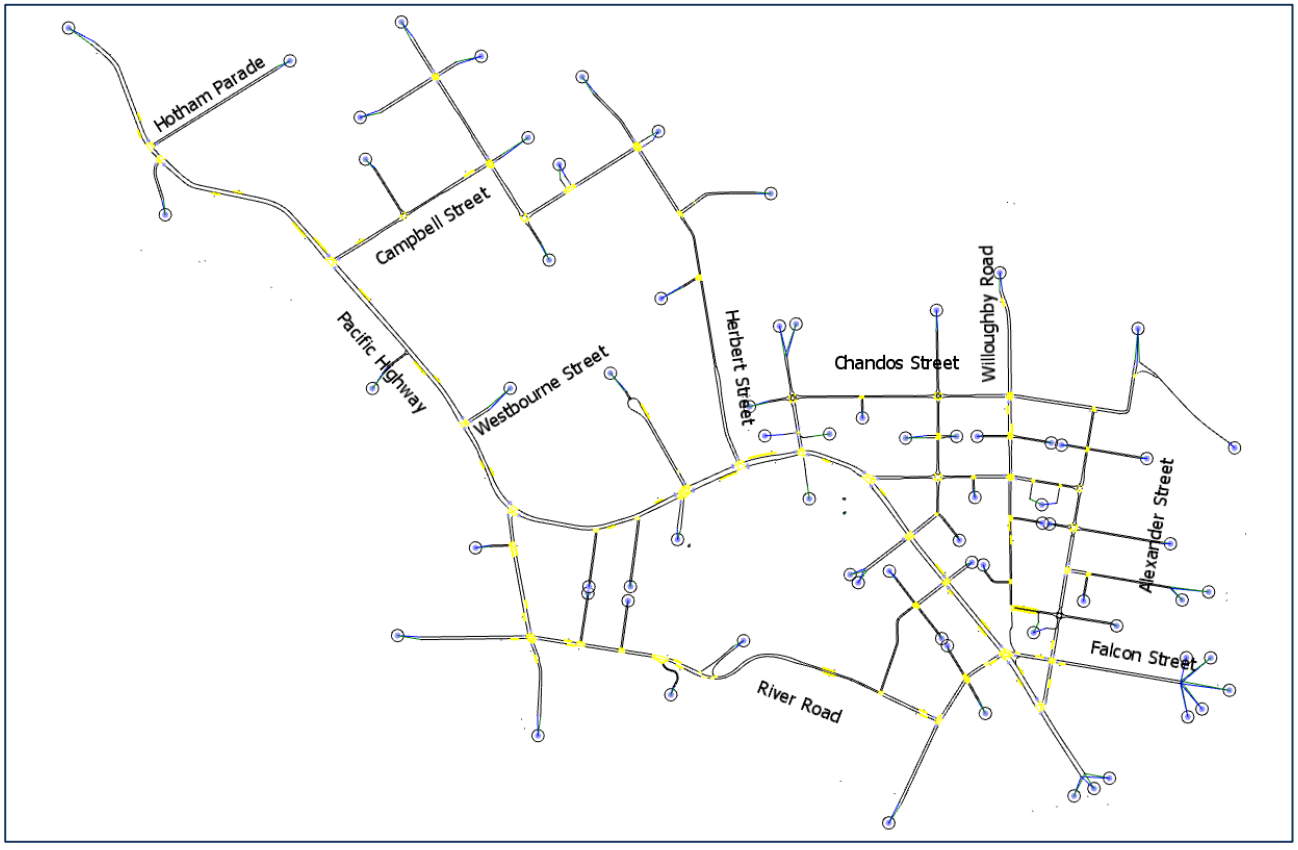


Figure 3-3 Modelled Network

3.4 Assignment Type

Given how this study involves assessing options which impact vehicular traffic route choice, the dynamic user equilibrium (DUE) assignment model was utilised.

Dynamic assignment is based on an iterative simulation process where the drivers choose their routes through the network based on the travel cost they experienced during the preceding simulations. The simulation is continued until a stable model environment is reached which means that the volumes and travel times on specific sections of the network do not change significantly from one iteration to the next.

In order for a dynamic user equilibrium to be achieved, the travel times of each OD pair for vehicles departing at the same time on all used routes are equal and less than any unused route experienced by a single vehicle.

3.5 Vehicle Types

Three vehicle types have been modelled in the Aimsun microscopic model. These are as follows:

- Light vehicles (cars)
- Heavy vehicles (trucks)
- Articulated heavy vehicles
- Buses (the demand was adopted using fixed routes and timetables)

Default values of vehicle type parameters (e.g. vehicle dimensions and driving behaviour) from the AIMSUN default parameters. No departures from the defaults were made.

3.6 Model Road Network

Roads network parameters were coded as shown in **Table 3-2** and **Figure 3-4**.

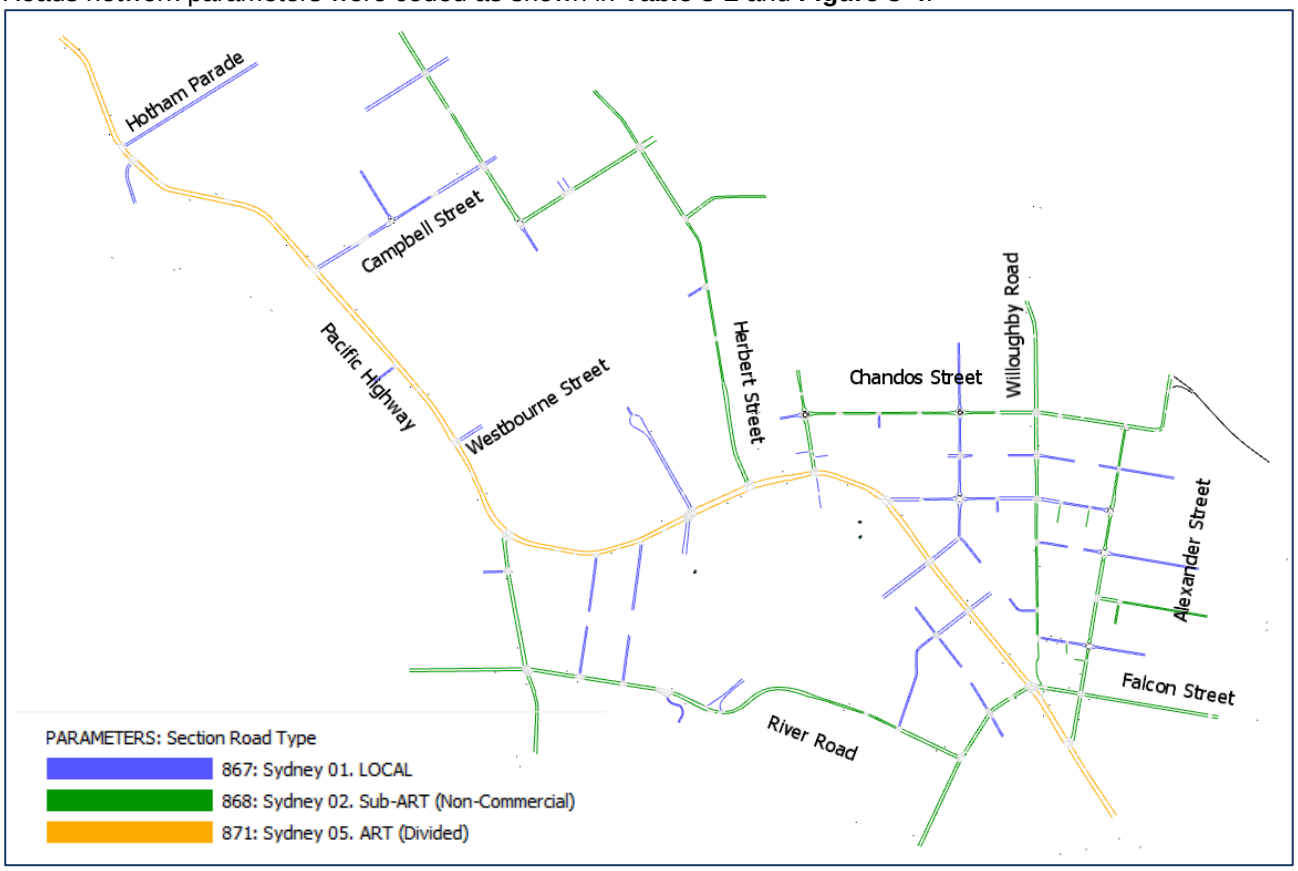


Figure 3-4 Modelled Road Network

Table 3-2 Road Network Parameters

Road Type	Maximum Speed (km/h)	Capacity (PCU/h/lane)
Arterial	60	900
Sub-arterial	50	900
Local	50	800

3.7 Traffic Zones/ Input

The St Leonards Aimsun Microsimulation Model was developed with a zoning system consistent with the Travel Zone 2011 (TZ11) used by the Transport Performance Analytics (TPA), branch of TfNSW, for the Sydney Greater Metropolitan Area. Travel Zones (TZs) are the smallest standard geography used for a number of transport datasets in NSW. They represent geographical areas that are used in origin-destination transport modelling and largely aligns with the 2011 ABS Destination Zones and the associated ASGS (SA2, SA3, and SA4) structure.

The transport area modelled encompasses 11 travel zones defined in the TfNSW Sydney Greater Metropolitan Area. The travel zones are 1832, 1838, 1841, 1842, 1843, 1844, 1910, 1911, 1912, 1914 and 1915. There are 6, 3 and 2 travel zones in the Crows Nest and Naremburn, St Leonards and Artarmon areas respectively. The travel zones in study are illustrated in **Figure 3-5**.

Subdivision of zones in centroids was required to increase the resolution of the model in the study area and provide a more realistic trip loading and unloading of major corridors, collectors and arterial roads in the road network. In these cases, zones were disaggregated in centroids using a method that tracks the process of zone splitting to enable aggregation of zones. External zones were informed by the strategic model cordon.

A total of 27 centroids by disaggregating the TZ11 system have been considered into the model. Centroids within the model are strategically placed to best represent the loading and unloading of travel demand in and out of the modelled area. Centroids are classified according to the travel zone within, with one or more centroids within a larger travel zone. The centroids are shown in **Figure 3-5** and listed in **Table 3-3.**

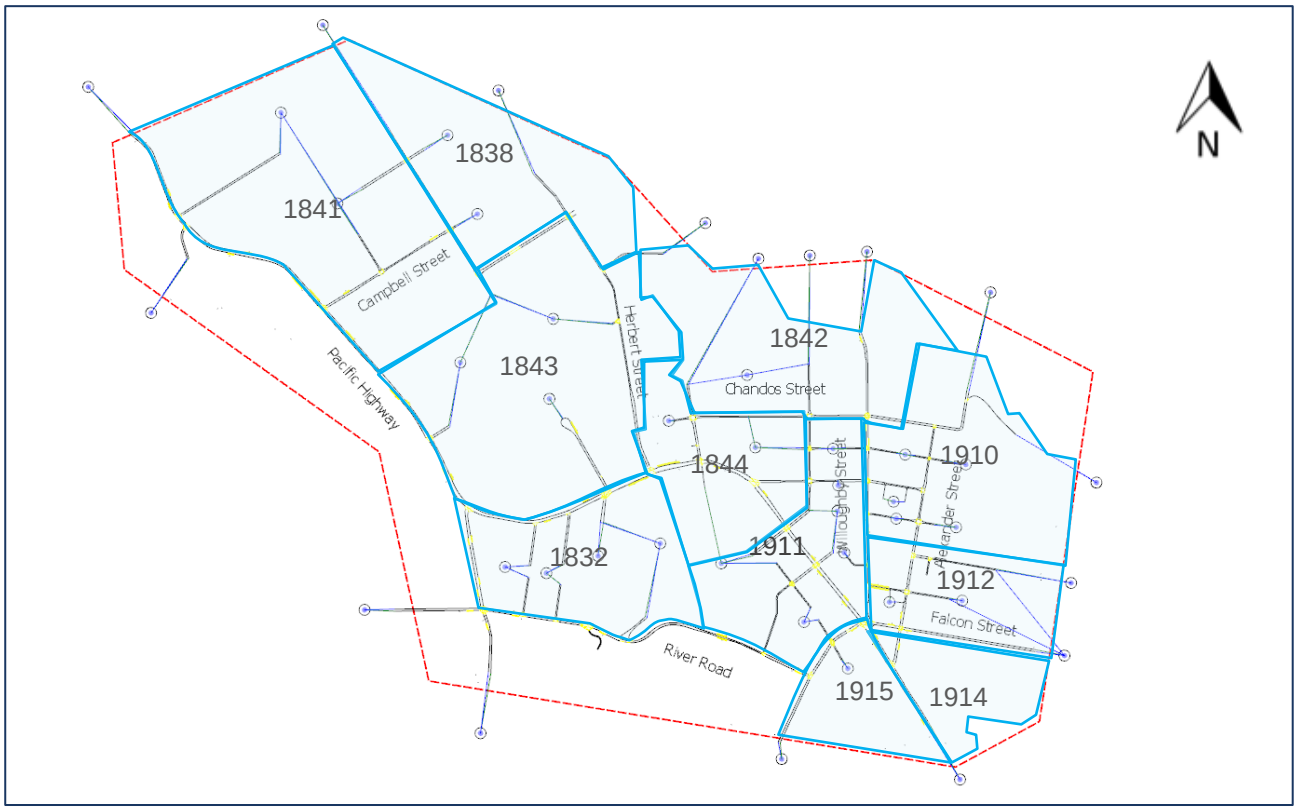


Figure 3-5 Travel Zones Map

Table 3-3 Travel Zones within the Model Network

Parent Zone ID	Child Zones	Description
TZ1915	N/A	Mater Misericordiae Hospital ▪ Low and medium density residential ▪ Health and educational precincts ▪ Includes Mater Hospital and Cammeraygal High School
TZ1914	N/A	North Sydney Girls High School North ▪ Low density residential ▪ Education precinct ▪ Includes Crows Nest Kindergarten and North Sydney Girls High School
TZ1912	4	Crows Nest ▪ Retail and commercial between Willoughby Road and Alexander Street ▪ Mostly low density residential east of Alexander Lane ▪ Contains Woolworths
TZ1911	6	Wollstonecraft Rose and Macleod Plaza in Crows Nest ▪ Travel zone surrounding the currently under construction Crows Nest Station ▪ Retail and commercial west of Willoughby Road ▪ High density mixed use buildings
TZ1910	4	Crows Nest Plaza ▪ Northern Crows Nest area with low density residential and low density mixed use development ▪ Contains the north east corner of the Willoughby Road commercial and retail strip
TZ1844	2	St Leonards ▪ East of the North Shore train line and north of the Pacific Highway ▪ Contains the commercial and employment core area of St Leonards with significant office space and new development. Primarily office blocks, for example, the Forum, with some high density residential (existing and under construction) ▪ Contains St Leonards Train Station, station parking and Pacific Highway bus interchange
TZ1843	3	Royal North Shore Hospital ▪ West of the North Shore train line and north of the Pacific Highway ▪ St Leonards Hospital and health precinct. Second employment core area, which contains the Royal North Shore Hospital and North Shore Private Hospital ▪ Education precinct east of the rail line with some medium and low density residential and commercial areas. Contains the St Leonards TAFE and Gorehill Sports Oval ▪ Industrial and commercial located on the northern section of the travel zone
TZ1841	2	Artarmon Industrial Area Western End ▪ On the north west section of the modelled area ▪ Contains mixture of commercial, retail and industrial (light and heavy) with very minimal residential development ▪ Located south west of Clarendon St, north of the Pacific Highway and south of the Gore Hill Freeway
TZ1838	2	Artarmon ▪ On the north west section of the modelled area ▪ Contains mixture of commercial, retail and industrial without any residential ▪ Located north east of Clarendon St and bound by the Gore Hill Freeway
TZ1832	4	St Leonards - Park Road and River Road ▪ A number of retail, commercial and office areas along Pacific Highway road ▪ Predominant low density residential and some medium density residential ▪ Includes age care facility and is nearby Greenwich Hospital

3.8 Speed Profiles

The desired speed of a vehicle is determined by the minimum of the maximum desired speed of a vehicle and the posted speed limit. The posted speed limits assumed in the St Leonards Aimsun Microsimulation Model area are shown in **Figure 3-6**.

Figure 3-6 Maximum Speed for the Modelled Road Network

3.9 Traffic Signals

The traffic signal data was provided by TfNSW for the locations shown in **Section 2.11**. Signals were implemented in the model as actuated with the cycle time, minimum and maximum periods calculated per hour from provided SCATS data. Signal offsets were calculated using LX files provided as part of the signal data. Individual signal plans were developed for the periods shown in **Table 3-4**. Signal timings for the warm-up period were adopted from the signal timings in the first peak hour.

Table 3-4 Signal Plan Periods

Peak Period	Signal Plan
AM Warm-up Period	7:30 – 8:30 AM
AM Peak Hour 1	7:30 – 8:30 AM
AM Peak Hour 2	8:30 – 9:30 AM
PM Warm-up Period	16:45 – 17:45 PM
PM Peak Hour 1	16:45 – 17:45 PM
PM Peak Hour 2	17:45 – 18:45 PM

3.10 Public Transport

Public Transport and General Transit Feed Specification (GTFS) Data was imported to provide the routes, arrival time and dwell times of the bus network.

GTFS data is typically used for TfNSW Transport Info, Realtime transport app developers and online map services (e.g. Google Maps and Apple Maps). GTFS data is provided in nine (9) data files:

- Agency.txt – Defines one or more transit agencies (Operators) that provide the data in this feed
- Calendar.txt – Defines dates for service IDs using a weekly schedule. It also provides the start and end dates as well as the days of the week the service is available
- Routes.txt – Defines transit routes
- Shapes.txt – Defines rules for drawings lines on a map to represent a transit organisation's routes Stop_times.txt – Provides the times that a vehicle arrives at and departs from individual stops for each trip (including dwelling times)
- Stops.txt – Provides individual locations where vehicles pick up or drop off passengers
- Trips.txt – Provides the trips for each route. A trip is a sequence of two or more stops that occurs at a
- specific time
- Notes.txt – This file is an extension on the GTFS File set standard. It contains a list of notes referenced
- from trips.txt and stop_times.txt.

To incorporate the data into the base model, GTFS data from May 2018 was sourced from the TfNSW Opendata Database and imported into the base model for the AM and PM peak hours. GTFS database did not include information for school only routes. Public transport routes were reviewed for broken routes, misaligned stops and arrival frequency.

3.11 School Zones

The roads identified in **Section 2.7** fall outside the modelled road network. No school zone restrictions were therefore coded into the model.

3.12 Demand Estimation

The base model was developed with the demand estimation and calibration processes undertaken separately. A cordon matrix was extracted from the strategic EMME model (Strategic Transport Model) containing the traffic demands. **Figure 2-9** shows the cordon created with the zone connections. There is a total of 32 centroid connections in the strategic matrix output. This was then imported into the Aimsun network and the internal zones were disaggregated further. The Aimsun model has a total of 70 centroids.

The methodology for the development of the trip demand matrices for each of the modelled periods is detailed below:

1. Develop a prior traffic demand matrix based on strategic modelling data provided by TfNSW
2. A real data set (RDS) was developed by porting the surveyed turning counts into AIMSUN
3. Use the AIMSUN Static OD Adjustment tool to refine the matrix using the imported RDS and produce the first iteration of route choice estimation
4. Use the AIMSUN OD Departure adjustment scenario to profile the traffic volumes to the 15-minute intervals defined in the RDS
5. Run DUE and SRC scenarios to determine the likelihood and portion of vehicles route choice.
   - The dynamic user equilibrium (DUE) assignment is a form of traffic assignment that uses an iterative process to determine the traffic flows across the network based on the costs of travel routes between origin and destination (OD) pairs derived in previous iterations until it converges to an equilibrium state
   - The stochastic route choice (SRC) assignment is based on discrete route choice models or on a user-defined assignment. The discrete route choice models are based on discrete choice theory and emulates a driver's decision of selecting a path from those that are available.
6. Manual adjustment of the AIMSUN matrix to further refine volumes in accordance to RDS.
7. Repeat step 6 and 7 iterate with step 5 until calibration and validation requirements are met.

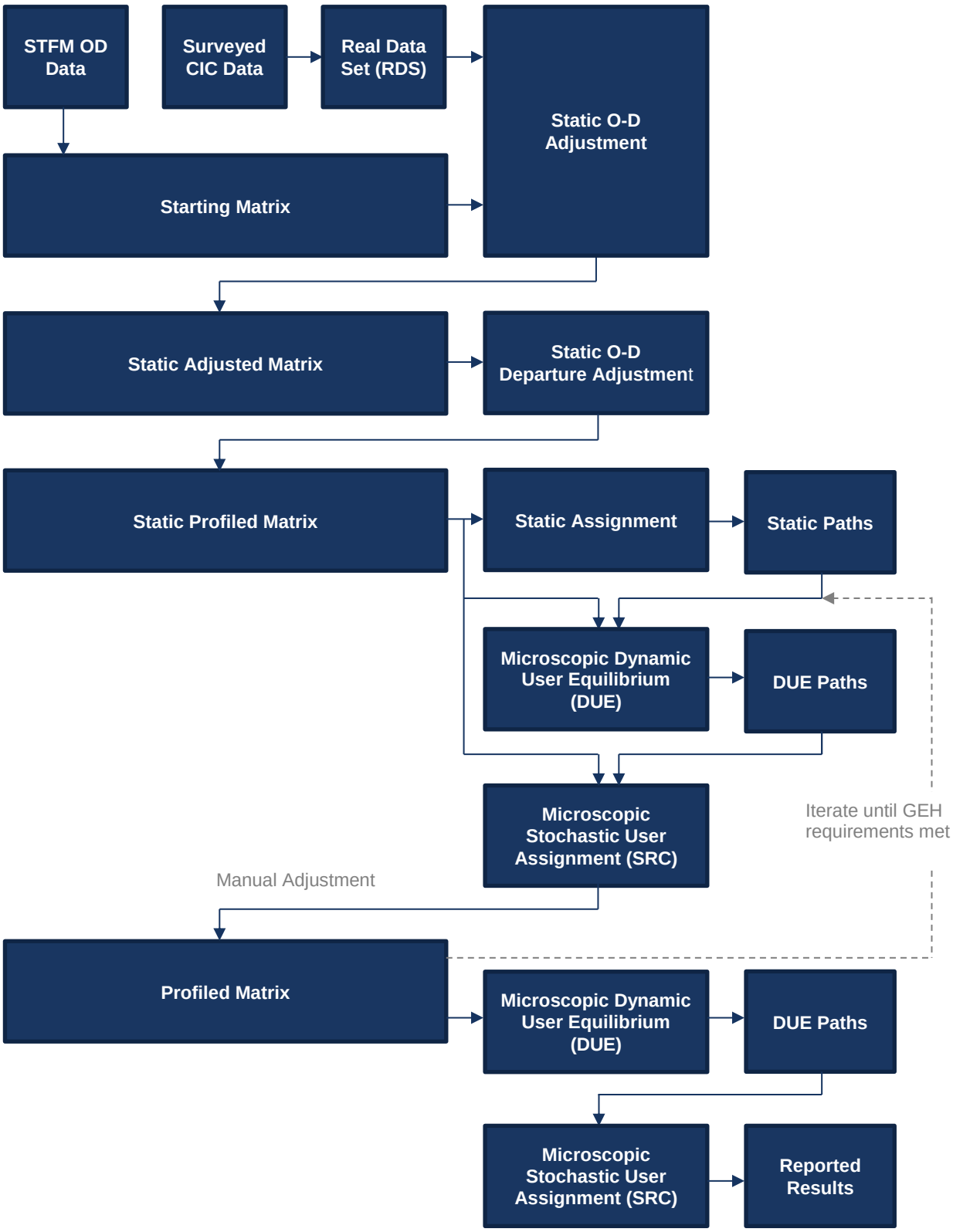


Figure 3-7 Multilevel Modelling Framework Process

3.13 Trip Length Distribution

While applying the matrix estimation process, particular care was taken to ensure that the trip patterns in the prior matrix were not significantly altered when creating the estimated traffic matrices. **Figure 3-8** to **Figure 3-11** show the trip length distribution between the original traffic demand from the microscopic model and the adjusted demand based on observed and real data set in the AM and PM peak respectively.

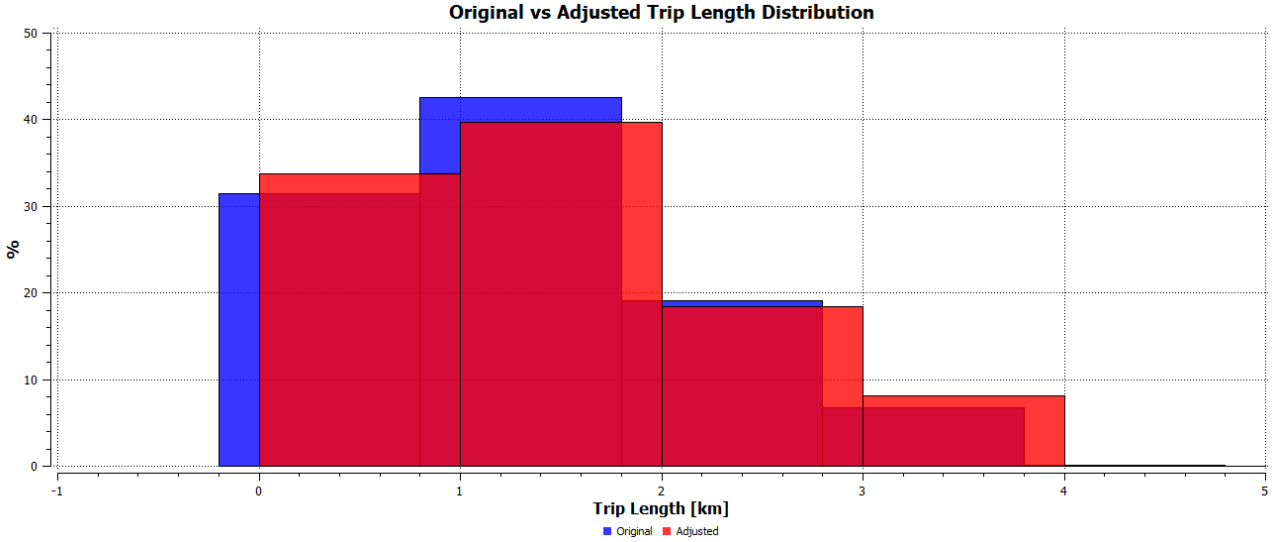


Figure 3-8 AM Peak Light Vehicle Trip Length Distribution

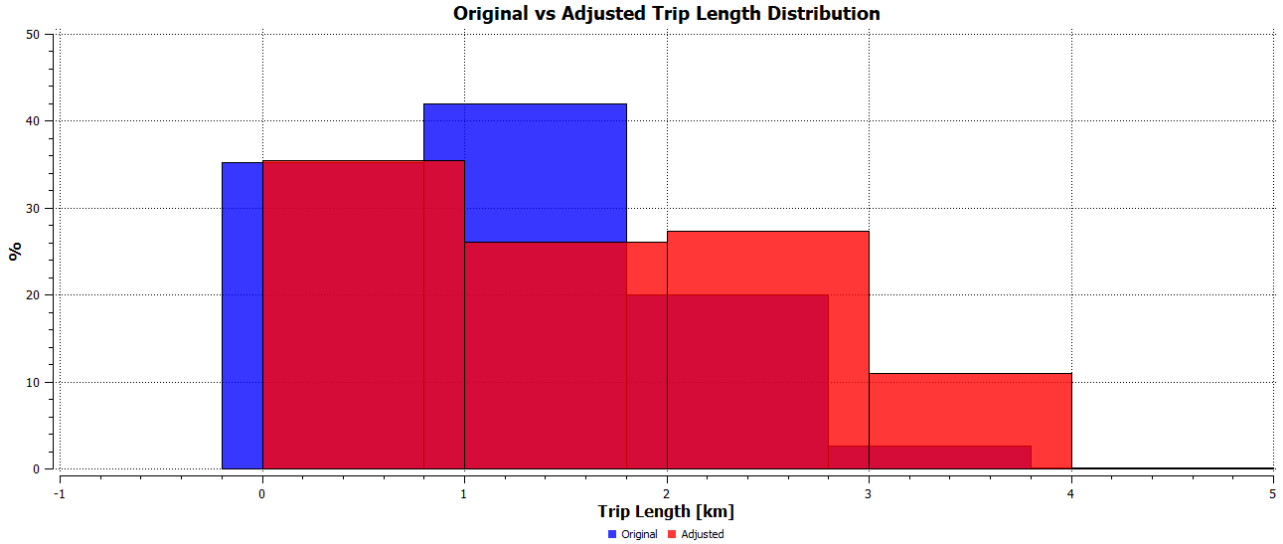


Figure 3-9 AM Peak Heavy Vehicle Trip Length Distribution

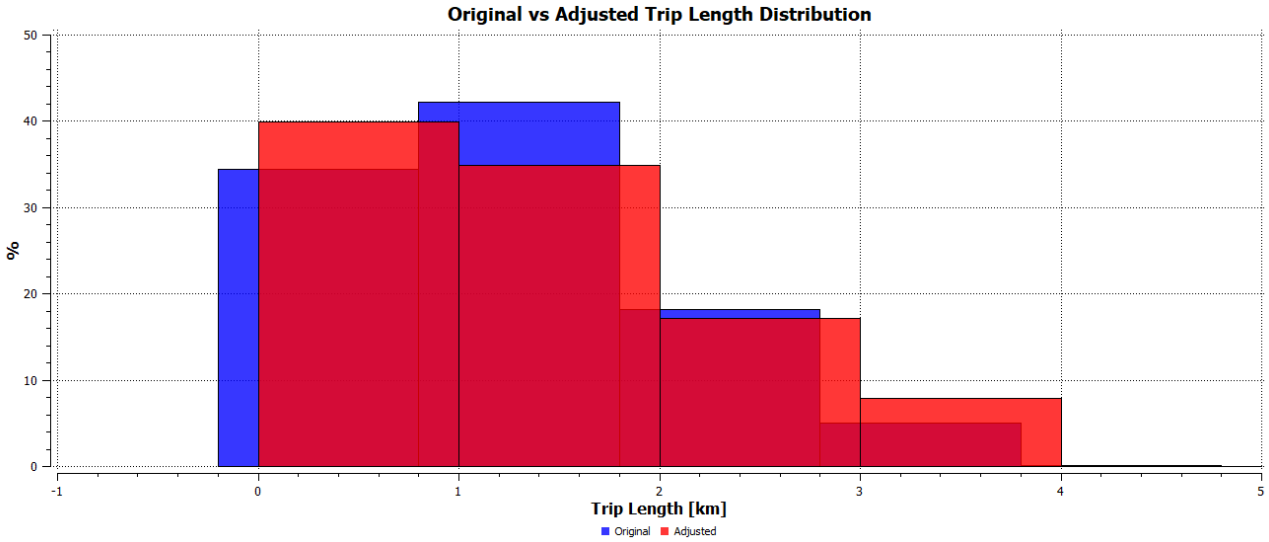


Figure 3-10 PM Peak Light Vehicle Trip Length Distribution

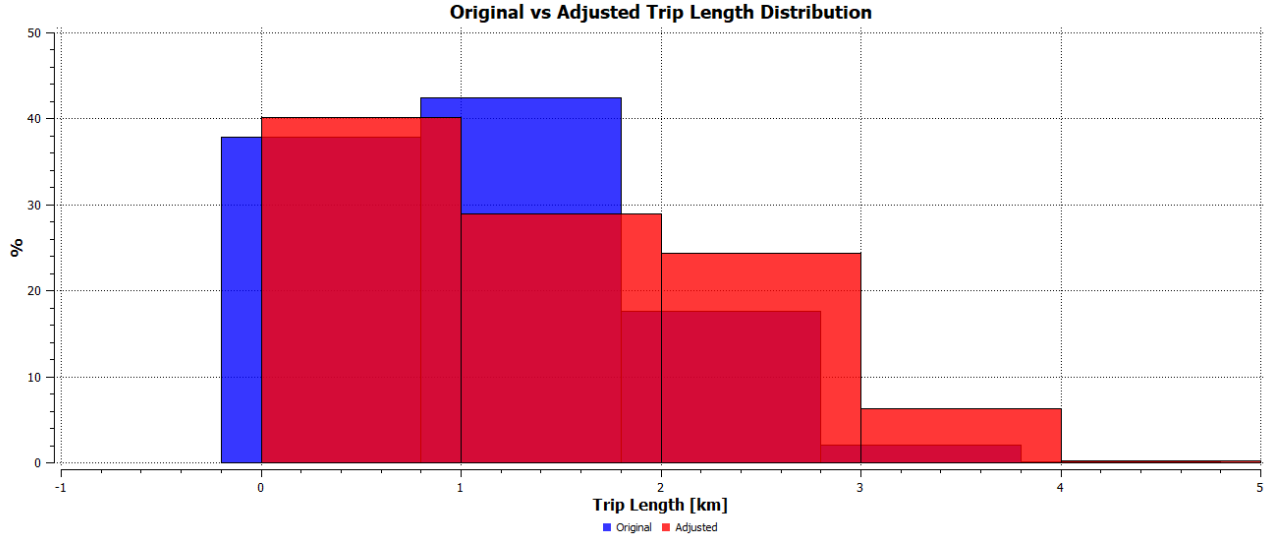


Figure 3-11 PM Trip Length Distribution

AM redistribution of light vehicle trips show minor adjustment of trip lengths between 1 – 2 km to trips in 0 – 1 km. The distribution plots for heavy vehicles showed greater redistribution of trips in the 1 – 2 km length. Approximately 15% of the volume were redistributed towards longer trips in the 2 – 3 and 3 – 4 km trip length range.

PM redistribution of light vehicle trips show minor adjustment of trip lengths between 1 – 2 km to trips in 0 – 1 km. The distribution plots for heavy vehicles showed greater redistribution of trips in the 1 – 2km length. Approximately 10% of the volume were redistributed towards longer trips in the 2 – 3 and 3 – 4 km trip length range.

3.14 Pedestrians and Cyclists

Pedestrians protection have been included in the intersection signal controllers for all the left and right turning movements.

On road cyclists are not explicitly accounted for in the model and their impact on traffic congestion is expected to be minor.

3.15 Traffic Profile

The model covers the weekday AM and PM peak periods including a warm-up period (i.e. one hour) to generate sufficient demand on the network at the start of each analysis period. The AM and PM peak period profiles derived from traffic surveys 15 minutes intersection counts are shown in **Table 3-5** to **Table 3-6**.

Table 3-5 AM Peak Traffic Demand Profile

	Time Period	Percentage of 2 hour profile
AM Peak Hour 1	07:30 – 07:45	12.34%
	07:45 – 08:00	13.33%
	08:00 – 08:15	12.90%
	08:15 – 08:30	12.67%
AM Peak Hour 2	08:15 – 08:30	12.87%
	08:30 – 08:45	12.64%
	08:45 – 09:00	12.21%
	09:00 – 09:15	11.10%

Table 3-6 PM Peak Traffic Demand Profile

	Time Period	Percentage of 2 hour profile
PM Peak Hour 1	16:45 – 17:00	11.90 %
	17:00 – 17:15	12.56 %
	17:15 – 17:30	13.27 %
	17:30 – 17:45	13.72 %
PM Peak Hour 2	17:45 – 18:00	13.21 %
	18:00 – 18:15	12.69 %
	18:15 – 18:30	12.11 %
	18:30 – 18:45	10.51 %

3.16 Behaviour Parameters

The speed profile of the road network was be based on the posted speed limits and was not changed. Reaction time factors were applied where appropriate to replicate the observed vehicle behaviour. These factors were mainly applied at:

- Pacific Highway near Campbell Street
- Pacific Highway near Herbert Street
- Pacific Highway near Oxley Street
- Pacific Highway near Alexander Street
- Alexander Street near Pacific Highway
- Shirley Road near Pacific Highway
- Alexander Street
- Willoughby Road

The following AIMSUN driving behaviours were applied to the dynamic scenarios for both the AM and PM peaks as shown in **Table 3-7**.

Table 3-7 Diving Behaviour Parameter adjustments

Vehicle Class	Parameter	Default Parameters
All	Reaction Time	1.2
	Reaction Time at Traffic Light	1.6

3.17 Traffic Composition

Three private vehicle types are coded in the model including light vehicles, heavy vehicles and articulated heavy vehicles. Total traffic volumes were split into these three categories. These split factors were based on the total intersection throughput surveyed within the study area.

Table 3-8 Traffic Composition

Peak	Modelled Light Vehicles	Modelled Heavy Vehicles	Modelled Heavy Articulated Vehicles
AM 7:30 – 9:30	95.1%	4.3%	0.5%
PM 4:45 – 6:45	97.2%	2.6%	0.2%

3.18 Calibration and Validation Targets

Calibration and validation targets are identified in the *Traffic Modelling Guidelines* (Roads and Maritime, 2013) and are defined in the following sections:

3.18.1 Network-Wide Calibration Criteria

The model was calibrated using suitable criteria for the project purpose to ensure the model reflects the observed traffic conditions to a statistically high level of accuracy.

The method of calibration recommended by the modelling guidelines is the modified Chi-Square empirical, commonly known as the GEH statistic, for individual flows. The R-Square (R^2) statistical measure is used for the correlation of the entire data set.

The GEH formula is:

$$GEH = \sqrt{\frac{(V_o - V_m)^2}{0.5(V_o + V_m)}}$$

Where:

V_o is the observed traffic flow; and

V_m is the modelled traffic flow.

A GEH of 5.0 or less is considered to provide a good match between the modelled and observed traffic flows. The following criteria were used during the turning count calibration process for the whole network:

- 100% of turn and link flow comparisons with GEH less than 10
- 85% of turn and link flow comparisons with GEH less than 5
- R^2 statistics should be between 0.95 and 1.05 for a flow plot of observed vs modelled turn volumes (where R^2 = 1.0 is a perfect correlation).

A GEH value of five or less is generally considered a good correlation while a GEH value of ten or greater requires further explanation.

3.18.2 Travel Time Validation Criteria

The Roads and Maritime Services Traffic Modelling Guidelines set the travel time validation criteria for traffic models as the average modelled travel time to be within 15% or one minute (whichever is greater) of observed travel time for full length of route for 95% of observed travel time routes. Furthermore, sections of the route are expected to be within 15% of observed travel time.

4 Model Stability

The stochasticity of a mirosimulation model can cause instability. This can undermine the reliability of the model to forecast future traffic conditions. It is important that the base model is stable and has an appropriate degree of accuracy for future options assessment. To determine the stability of a model, a total of five seed values and the default time-step value in Aimsun are initially used to iteratively determine the number of runs, as recommended by the *Traffic Modelling Guidelines* (Roads and Maritime, 2013).

Vehicle hours travelled (VHT) was the statistic chosen to determine the model stability. The VHT results are a single-figure summary that provide an indication of whole-network performance by identifying whether the model has unrealistic gridlocks and/or excessive delays. VHT is calculated by summing the individual travel time for each vehicle across the whole network. In Aimsun, VHT is only calculated using vehicles which complete a trip from their origin to their destination; any vehicles remaining in the system at the conclusion of the simulation period are excluded from the VHT.

4.1 Seed Runs

In order to analyse the model stability, each peak period models were assessed across five seed values. The results from different seed values were produced for number of vehicles in the network for regular intervals within peaks throughout the simulation. The following five seeds were selected as per the **Table 11.8** in RMS Modelling Guidelines:

- 560
- 28
- 7771
- 86254
- 2849

4.2 Stability Assessment

Figure 4-1 and **Figure 4-2** show the variation in VHT by 15-minute interval across the five seeds for both peaks.

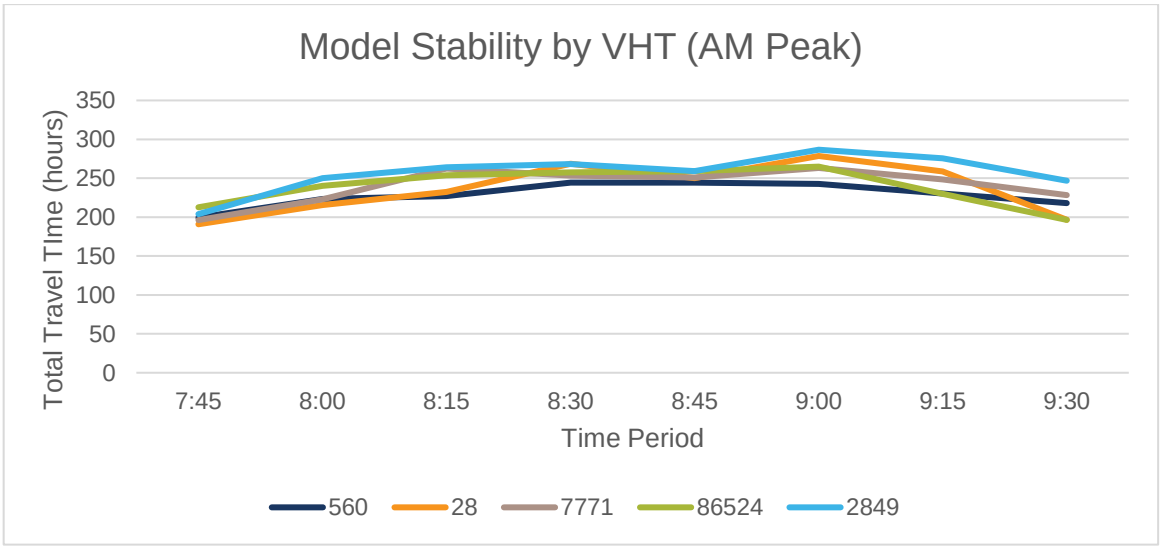


Figure 4-1 Vehicle Hours Travelled (VHT) AM Peak

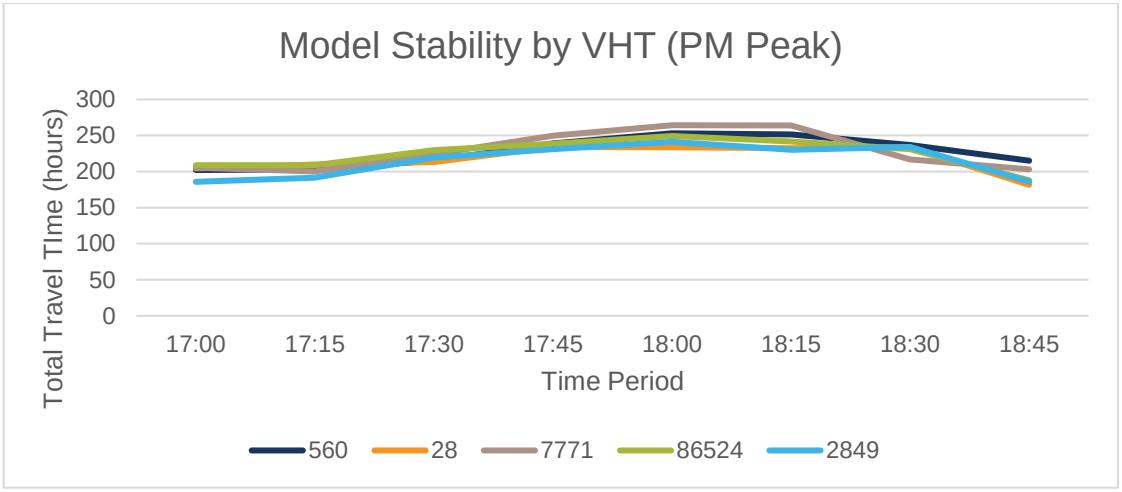


Figure 4-2 Vehicle Hours Travelled (VHT) PM Peak

The VHT during the AM and PM peaks are consistent and independent across the five seed values. This confirms that one seed for the model can be considered to be representative of a general model run. The peak hour models are therefore stable and demonstrate that the model is robust and remains stable under varying conditions. The number of seed runs required to determine the stability of the model is calculated iteratively using **Equation 1**:

$$N = \left(\frac{t\sigma}{\Delta}\right)^2$$ Equation 1

where:

N = number of runs required
t = two-tailed inverse of Student's t-distribution
σ = standard deviation
Δ = Acceptable error (product of precision and sample mean).

The t-value required for a confidence interval of 95% given five initial seeds is 2.776. The number of runs required for the AM and PM peak periods are shown in **Table 4-1**.

Table 4-1 Number of Simulation Runs Required

	AM	PM
t	2.8	2.8
σ	82.3	47.2
$\bar{x}$	1923.3	1780.5
Δ	96.2	89.0
N	5	2

The number of simulation runs required is below the initial five seeds used in both peaks, therefore it is sufficient to retain the initial five seeds for a confidence interval of 95 per cent. **Table 4-2** below display the characteristics of the median seed value.

4.3 Adopted Seed Number

Table 4-2 outlines the adopted seed value and how it compares to the statistics of the five seed runs.

Table 4-2 Median Seed Values

	VHT statistics of Five Seed Runs			Adopted Seed	
Peak	Mean VHT	Lower Bound VHT	Upper Bound VHT	VHT	Seed Value
AM	1914.6	1829.6	2054.6	1914.6	86254
PM	1780.5	1719.3	1827.8	1796.2	86524

5 Model Calibration and Validation

This section sets out the key calibration and validation statistics from the preparation of the base (existing conditions) model. The calibration and validation of a base model is important to ensure a robust base from which to test options and provide statistical comparisons of existing layouts against options. The results are from the median seed as determined by the network VHT in *Section 4 MODEL STABILITY.*

5.1 Convergence

The models converged with the DUE assignment within 6 runs for both peak periods to below 1%. The RGap plots are shown in **Figure 5-1** to **Figure 5-2.**

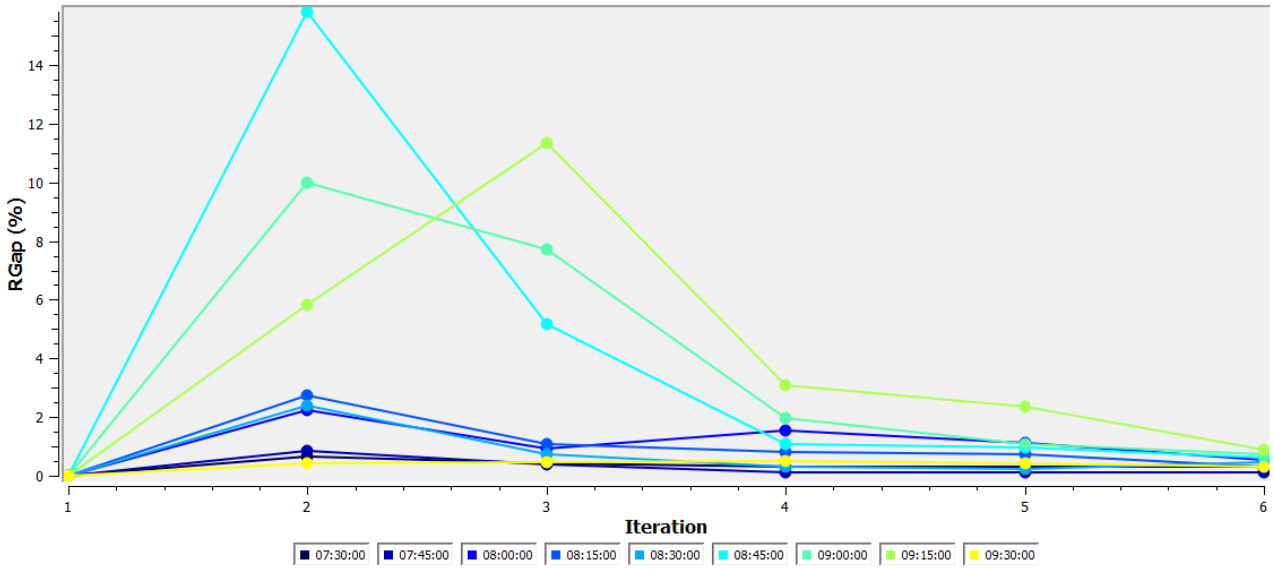


Figure 5-1 Rgap Convergance Plot - AM Peak

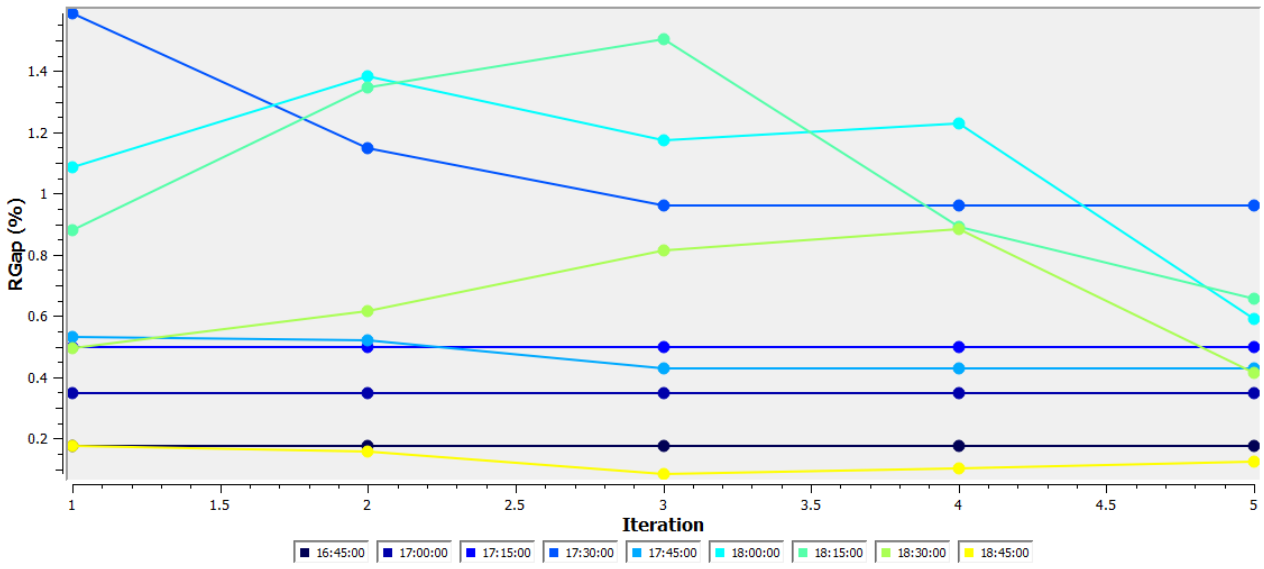


Figure 5-2 Rgap Convergance Plot - PM Peak

5.2 Calibration

A turning count calibration was used to compare observed on-site traffic volumes with the equivalent outputs from the model. Turning count calibration was undertaken for each of the surveyed intersections.

5.2.1 Turn Flow Calibration Results

The following tables and figures summarise the comparison of the modelled turn flows against the surveyed (observed) turn and turning movement counts, compared against the network wide criteria. The full table of GEH results are provided in **Appendix A**.

Table 5-1 Summary of GEH Statistics for AM Peak Light Vehicles

	AIMSUN Objects	Count	Percentage	Calibration
7:30 – 8:30 AM	Number of Turning Counts with GEH < 5	193	93.7%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓
8:30 – 9:30 AM	Number of Turning Counts with GEH < 5	192	93.2%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓

Table 5-2 Summary of GEH Statistics for AM Peak Heavy Vehicles

	AIMSUN Objects	Count	Percentage	Calibration
7:30 – 8:30 AM	Number of Turning Counts with GEH < 5	200	97.1%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓
8:30 – 9:30 AM	Number of Turning Counts with GEH < 5	203	98.5%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓

Table 5-3 Summary of GEH Statistics for PM Light Vehicles

	AIMSUN Objects	Count	Percentage	Calibration
4:45 – 5:45 PM	Number of Turning Counts with GEH < 5	194	94.2%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓
5:45 – 6:45 PM	Number of Turning Counts with GEH < 5	200	97.1%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓

Table 5-4 Summary of GEH Statistics for PM Heavy Vehicles

	AIMSUN Objects	Count	Percentage	Calibration
3:45 – 4:45 PM	Number of Turning Counts with GEH < 5	202	98.1%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓
4:45 – 5:45 PM	Number of Turning Counts with GEH < 5	203	98.5%	✓
	Number of Turning Counts with GEH < 10	206	100%	✓

Figure 5-3 to **Figure 5-6** show plots of observed versus modelled traffic volumes for the AM and PM peak hour models respectively.

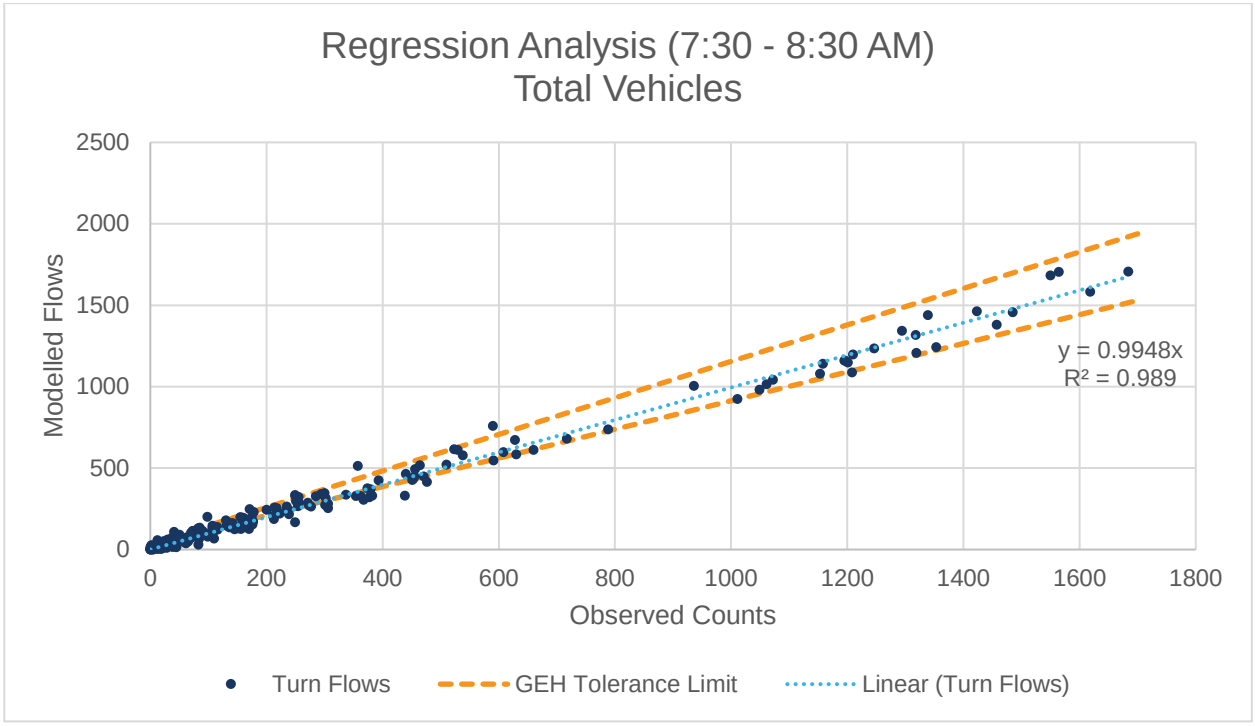


Figure 5-3 AM Hour 1 Regression Plot

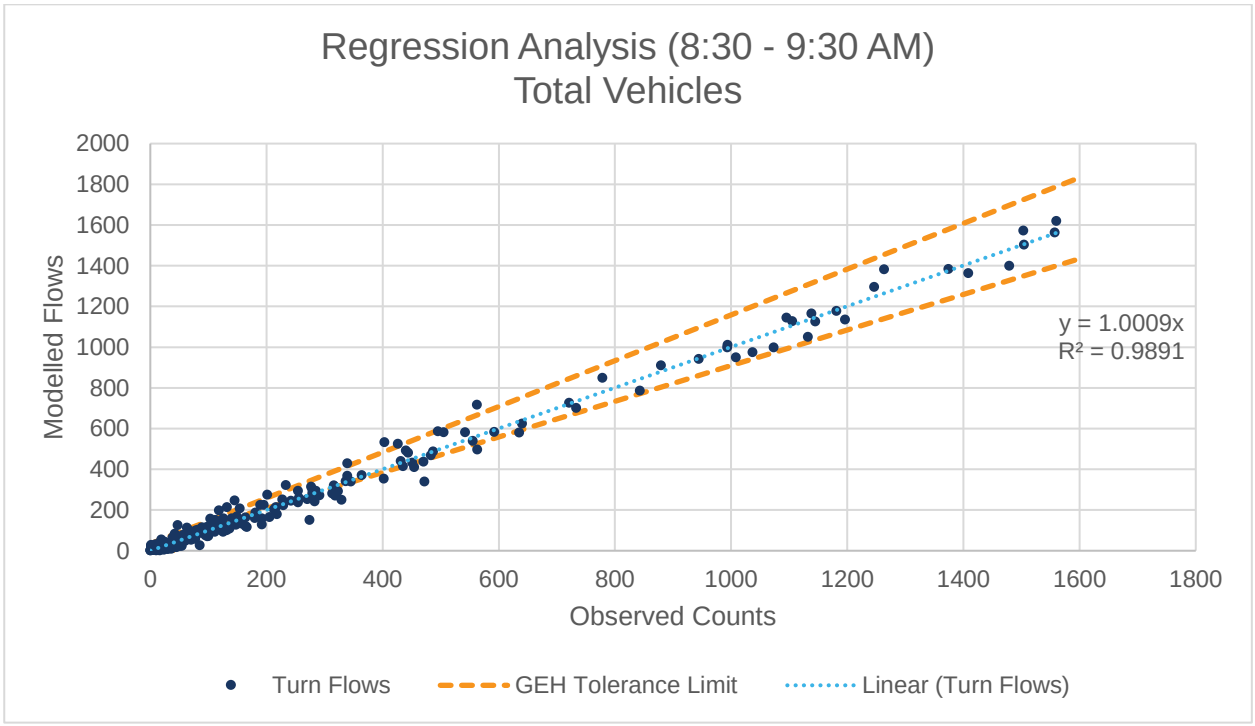


Figure 5-4 AM Hour 2 Regression Plot

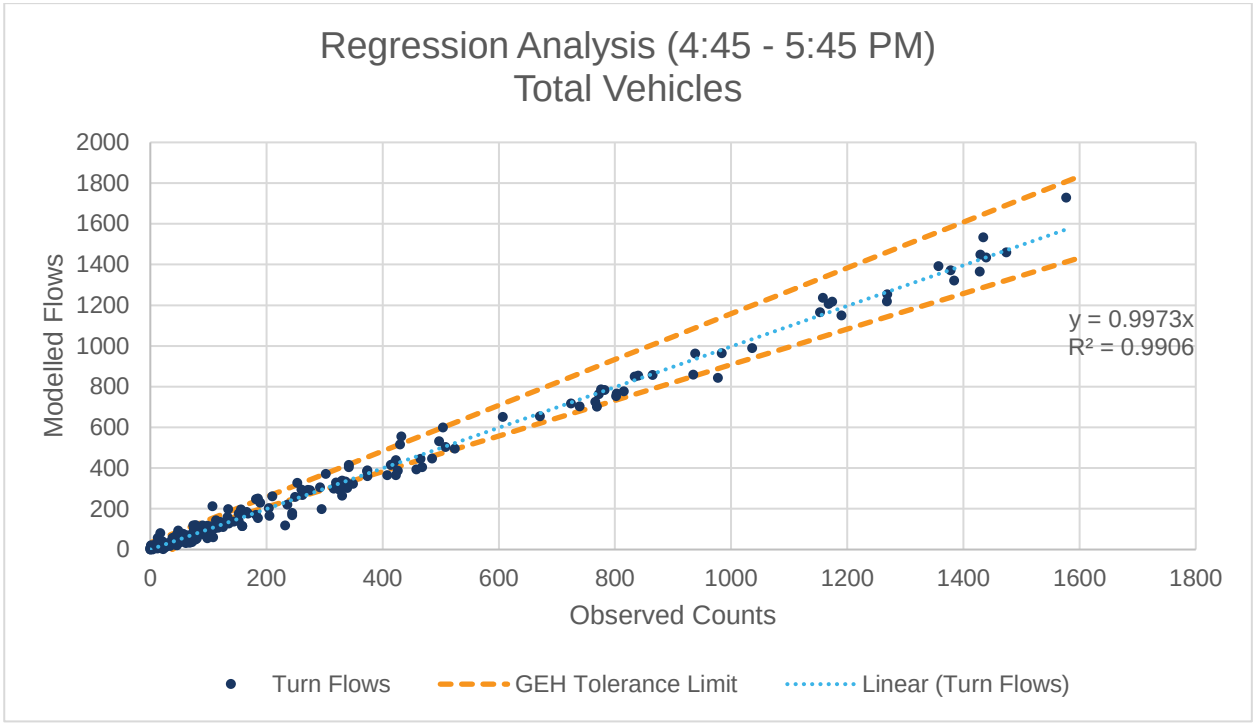


Figure 5-5 PM Hour 1 Regression Plot

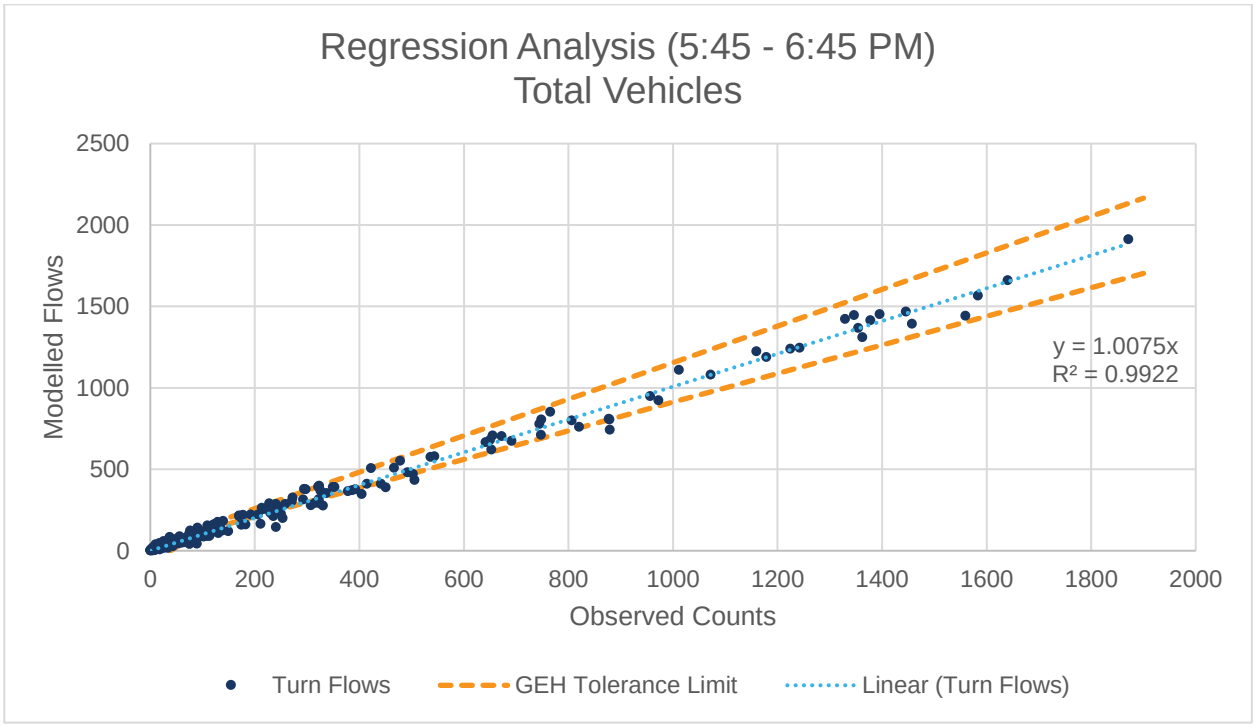


Figure 5-6 PM Hour 2 Regression Plot

5.3 Travel Time Validation

The model has been validated to the travel time survey undertaken for the routes as detailed in **Section 2.8.3** and shown in **Table 5-5** to **Table 5-8**. The cumulative travel time plots are provided in **Appendix D**.

Table 5-5 Travel Time Validation Table (7:30 – 8:30 AM)

	7:30 - 8:30 AM				
	Surveyed Time (mm:ss)	Modelled Time (mm:ss)	Difference (s)	Difference (%)	<15% or 60s
Alexander Street Northbound	03:33	03:43	10	**5%**	✓
Alexander Street Southbound	03:13	04:00	47	**24%**	✓
Chandos Street Eastbound	02:31	02:21	-10	**-7%**	✓
Chandos Street Westbound	03:22	03:10	-11	**-6%**	✓
Falcon Street Eastbound	00:51	00:52	1	**2%**	✓
Falcon Street Westbound	01:46	01:44	-2	**-2%**	✓
Herbert Street Southbound	02:32	02:22	-10	**-7%**	✓
Herbert Street Northbound	02:20	02:32	12	**8%**	✓
Pacific Highway Northbound	06:24	06:28	4	**1%**	✓
Pacific Highway Southbound	07:34	07:51	16	**4%**	✓
Reserve Road & Campbell Street Westbound	03:07	02:51	-16	**-8%**	✓
Reserve Road & Campbell Street Eastbound	02:49	02:51	3	**2%**	✓
River Road Eastbound	05:43	04:05	-98	**-29%**	✗
River Road Westbound	03:10	03:53	43	**23%**	✓
Willoughby Road Northbound	02:41	03:17	36	**22%**	✓
Willoughby Road Southbound	03:31	03:46	15	**7%**	✓

Table 5-6 Travel Time Validation Table (8:30 – 9:30 AM)

	8:30 – 9:30 AM				
	Surveyed Time (mm:ss)	Modelled Time (mm:ss)	Difference (s)	Difference (%)	<15% or 60s
Alexander Street Northbound	03:33	03:43	10	**5%**	✓
Alexander Street Southbound	03:14	04:00	46	**24%**	✓
Chandos Street Eastbound	02:32	02:21	-11	**-7%**	✓
Chandos Street Westbound	03:11	03:10	-1	**0%**	✓
Falcon Street Eastbound	00:47	00:52	5	**11%**	✓
Falcon Street Westbound	01:24	01:44	20	**24%**	✓
Herbert Street Southbound	02:31	02:22	-9	**-6%**	✓
Herbert Street Northbound	02:18	02:32	14	**10%**	✓
Pacific Highway Northbound	07:00	06:28	-32	**-8%**	✓
Pacific Highway Southbound	07:07	07:51	44	**10%**	✓
Reserve Road & Campbell Street Westbound	02:53	02:51	-2	**-1%**	✓
Reserve Road & Campbell Street Eastbound	03:01	02:51	-10	**-5%**	✓
River Road Eastbound	04:40	04:05	-35	**-12%**	✓
River Road Westbound	03:04	03:53	48	**26%**	✓
Willoughby Road Northbound	02:49	03:17	28	**16%**	✓
Willoughby Road Southbound	03:41	03:46	5	**2%**	✓

Table 5-7 Travel Time Validation Table (3:45 – 4:45 PM)

	4:45 – 5:45 PM				
	Surveyed Time (mm:ss)	Modelled Time (mm:ss)	Difference (s)	Difference (%)	<15% or 60s
Alexander Street Northbound	4:15	3:33	-42	**-17%**	✓
Alexander Street Southbound	3:27	3:00	-27	**-13%**	✓
Chandos Street Eastbound	2:44	2:21	-23	**-14%**	✓
Chandos Street Westbound	3:27	3:09	-18	**-9%**	✓
Falcon Street Eastbound	0:53	0:51	-2	**-4%**	✓
Falcon Street Westbound	1:22	1:32	10	**12%**	✓
Herbert Street Southbound	3:24	3:29	5	**2%**	✓
Herbert Street Northbound	1:56	1:48	-8	**-7%**	✓
Pacific Highway Northbound	7:05	6:40	-25	**-6%**	✓
Pacific Highway Southbound	7:28	7:06	-22	**-5%**	✓
Reserve Road & Campbell Street Westbound	3:00	2:52	-8	**-5%**	✓
Reserve Road & Campbell Street Eastbound	3:05	2:34	-31	**-17%**	✓
River Road Eastbound	2:54	2:23	-31	**-11%**	✓
River Road Westbound	3:30	3:28	-2	**-1%**	✓
Willoughby Road Northbound	2:40	2:40	0	**0%**	✓
Willoughby Road Southbound	4:16	3:16	-60	**-24%**	✓

Table 5-8 Travel Time Validation Table (5:45 – 6:45 PM)

	5:45 – 6:45 PM				
	Surveyed Time (mm:ss)	Modelled Time (mm:ss)	Difference (s)	Difference (%)	<15% or 60s
Alexander Street Northbound	4:03	3:45	-18	**-7%**	✓
Alexander Street Southbound	3:42	2:35	-67	**-30%**	✗
Chandos Street Eastbound	2:29	2:17	-12	**-8%**	✓
Chandos Street Westbound	2:57	2:49	-8	**-5%**	✓
Falcon Street Eastbound	0:58	1:01	3	**6%**	✓
Falcon Street Westbound	1:59	1:38	-21	**-17%**	✓
Herbert Street Southbound	2:40	2:36	-4	**-3%**	✓
Herbert Street Northbound	1:39	1:47	8	**9%**	✓
Pacific Highway Northbound	6:48	6:26	-22	**-5%**	✓
Pacific Highway Southbound	7:38	7:43	-5	**1%**	✓
Reserve Road & Campbell Street Westbound	2:43	2:36	-7	**-4%**	✓
Reserve Road & Campbell Street Eastbound	2:33	2:20	-13	**-9%**	✓
River Road Eastbound	5:52	4:59	-63	**-18%**	✗
River Road Westbound	3:03	3:14	11	**6%**	✓
Willoughby Road Northbound	2:42	2:37	-5	**-4%**	✓
Willoughby Road Southbound	3:54	4:02	8	**3%**	✓

The tables above show the route travel time validation results between modelled and TomTom data for each peak period. In total (considering all segments and all peak periods) 64 validation comparisons are shown and 62 of these are fully compliant with the validation targets. More specifically:

- AM Peak: The plots indicate that the modelled travel times for the full length of each route are within 15% or 60s of observed travel times in the AM peak periods.
- PM Peak: The plots indicate that the modelled travel times for the full length of each route are within 15% or 60s of observed travel times in the AM peak periods with the exception of Alexander Street (northbound) and River Road (eastbound) for the peak hour of 5:45 PM. These two segments are outside the validation range by a difference of 7 seconds and 3 seconds respectively.

Overall, the calibration and validation results show a very good match between modelled and surveyed conditions. Some marginal discrepancy in the last hour of the PM peak was observed for two travel time segments, which is not considered to compromise the model accuracy and robustness. Importantly, both occurrences show modelled travel times faster than those obtained from the TomTom big data portal for November 2016. It is likely that factors such as on street parking manoeuvres, individual driveway access and jaywalking influenced the results for these two segments. These are factors that can often lead to slower speeds in real life compared to the modelled results (as is the case with the results above) given the limitations for operational models to reflect those factors.

It is also important to account for the natural variability of average speeds across the different weeks / months. As noted, the models were developed using a combination of November 2016 and March 2018 traffic counts but the travel times correspond to November 2016.

5.4 Congestion hotspot validation

Congestion hotspot validation is used to confirm the reproduction of congestion patterns within the study area. The comparison between TomTom speed ratio and modelled speed ratios are shown from **Figure 5-7** to **Figure 5-14**. Comparison between the plots show replication of congestion patterns at major intersections and routes.

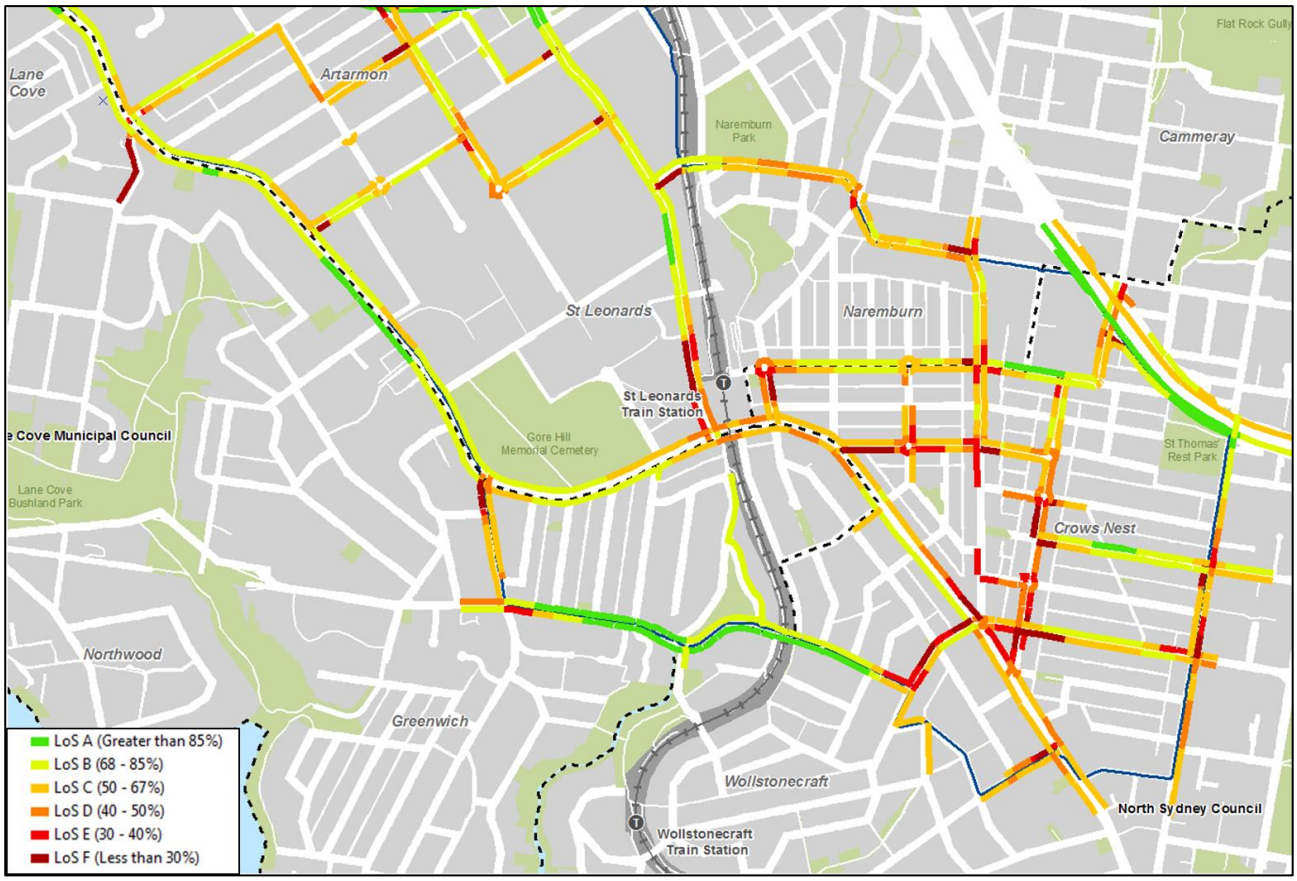


Figure 5-7 TomTom Network Level of Service (7:30 – 8:30 AM)

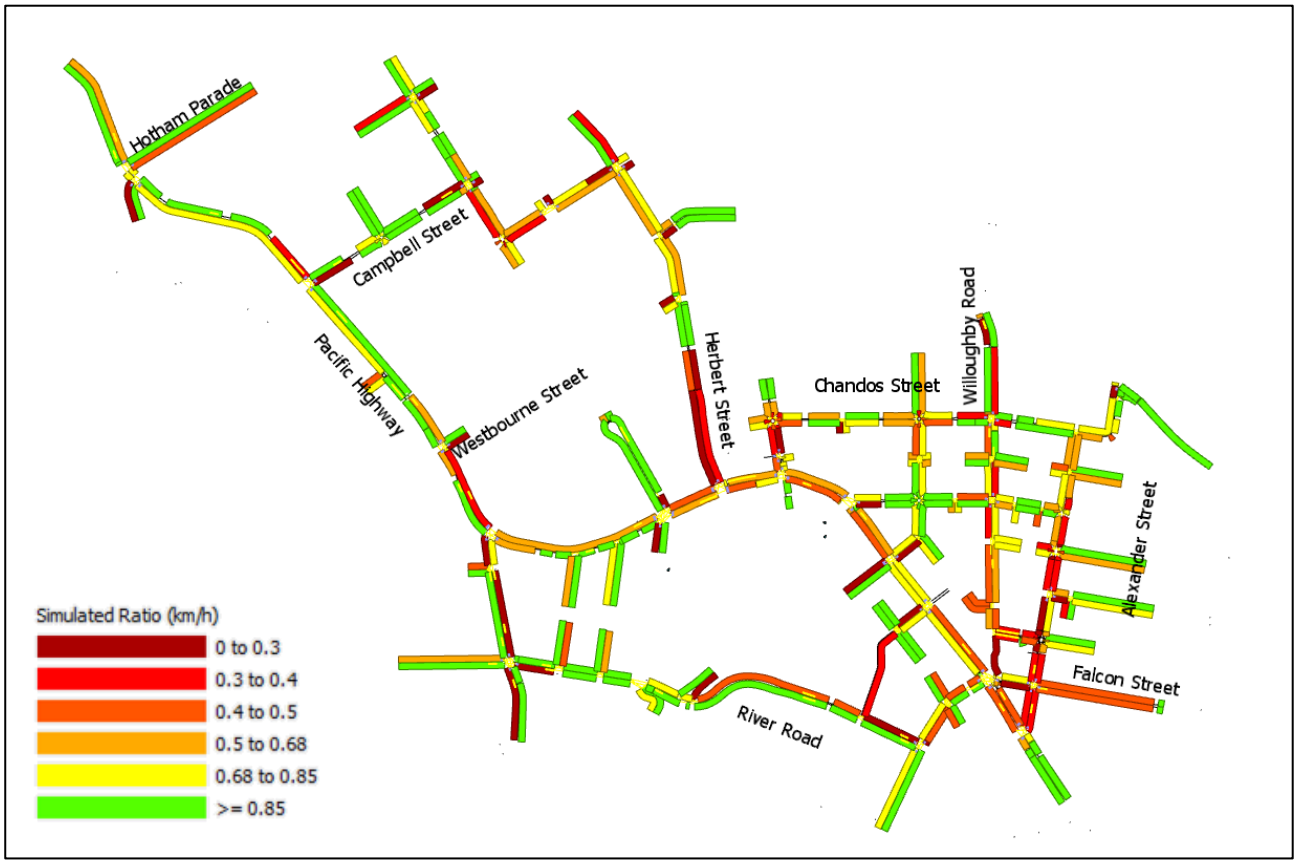


Figure 5-8 Modelled Network Level of Service (7:30 – 8:30 AM)

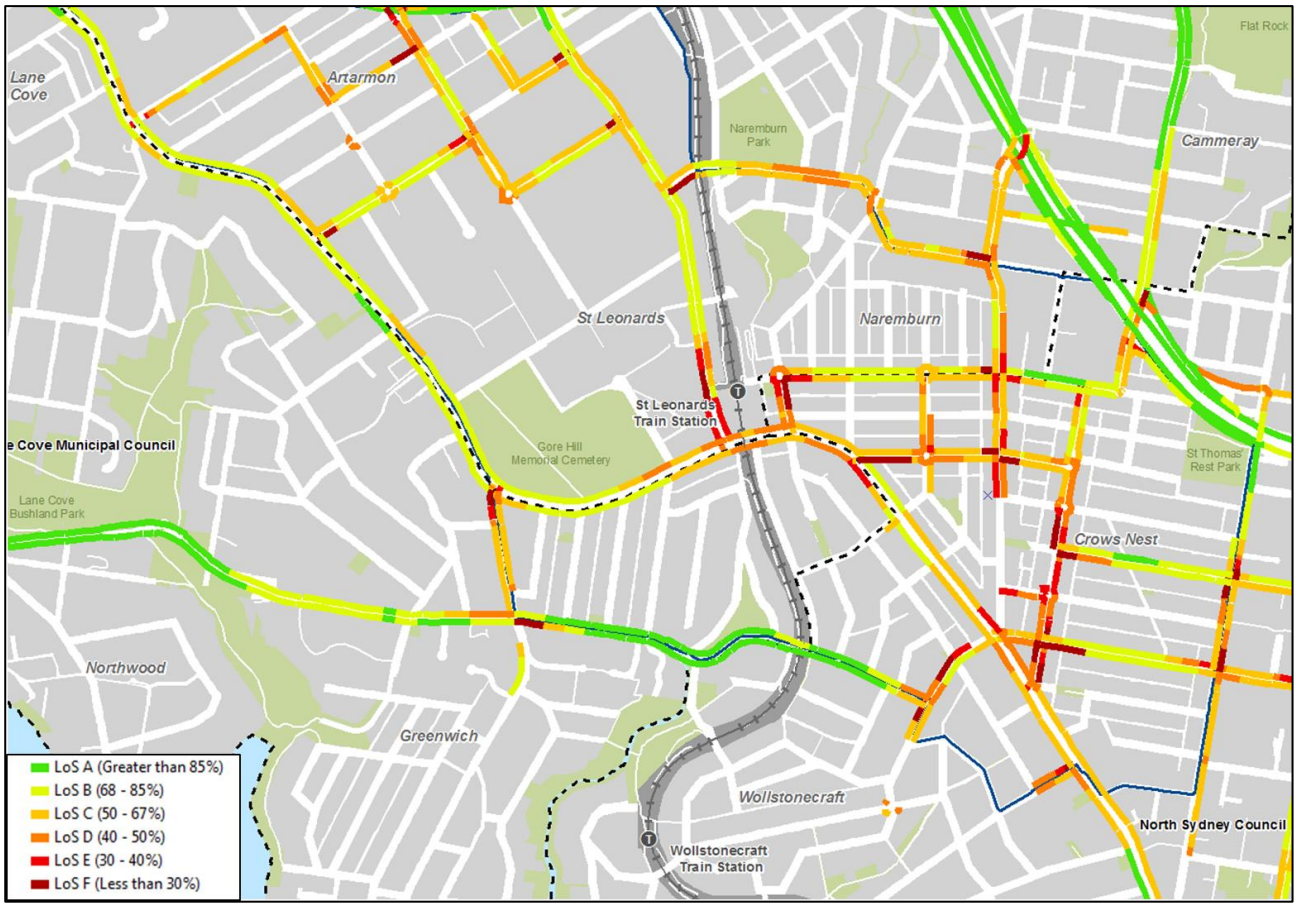


Figure 5-9 TomTom Network Level of Service (8:30 – 9:30 AM)

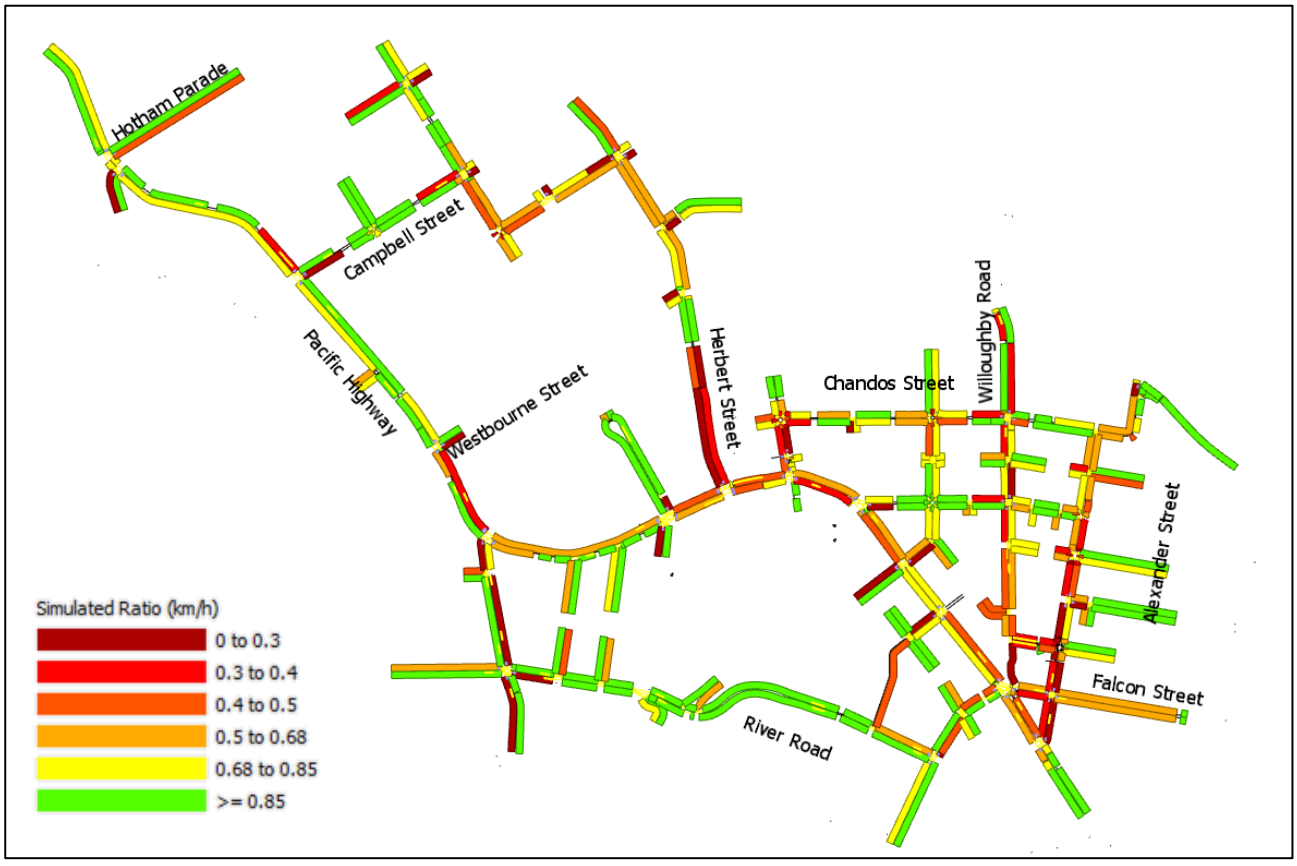


Figure 5-10 Modelled Network Level of Service (8:30 – 9:30 AM)

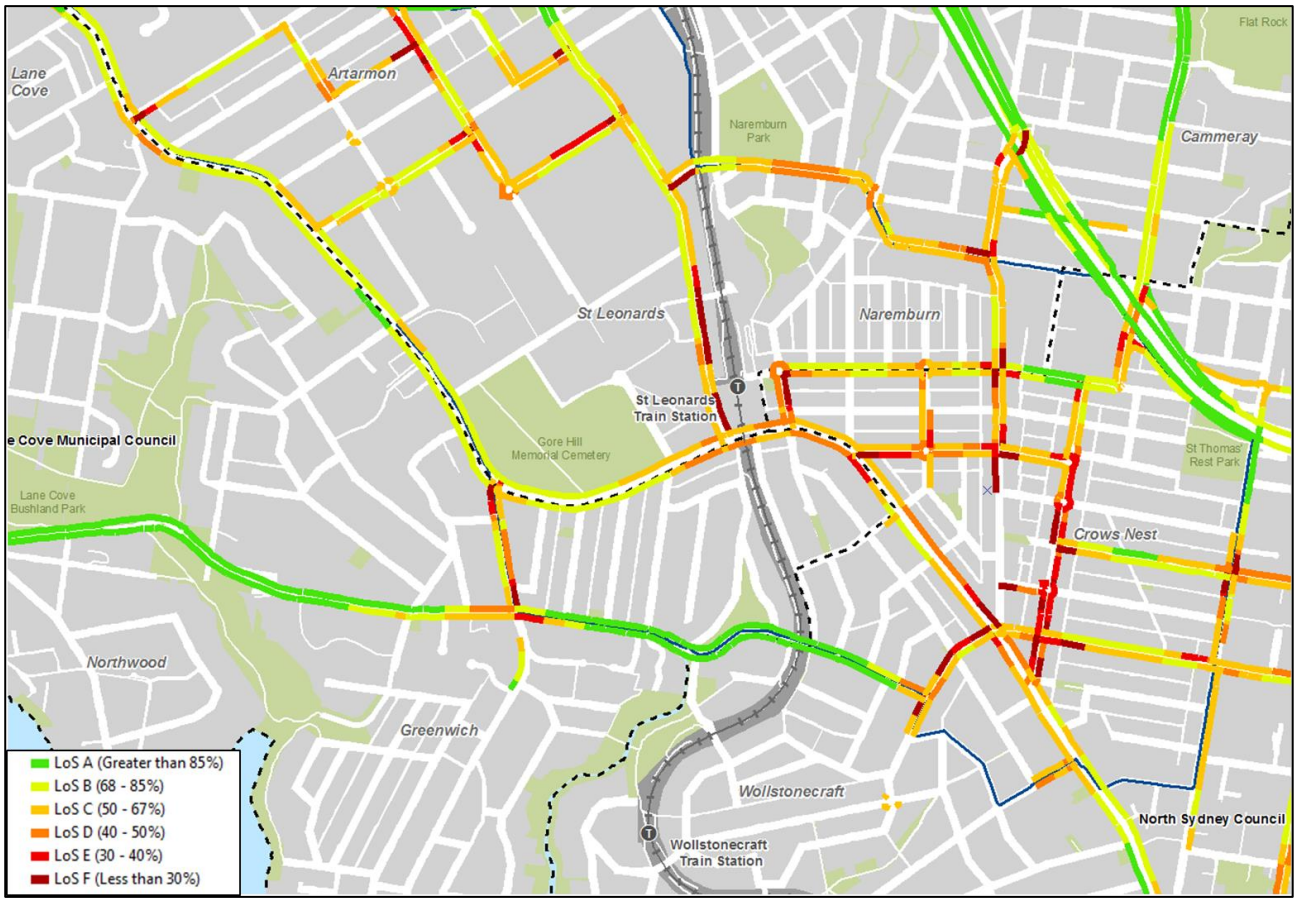


Figure 5-11 TomTom Network Level of Service (4:45 – 5:45 PM)

Figure 5-12 Modelled Network Level of Service (4:45 – 5:45 PM)

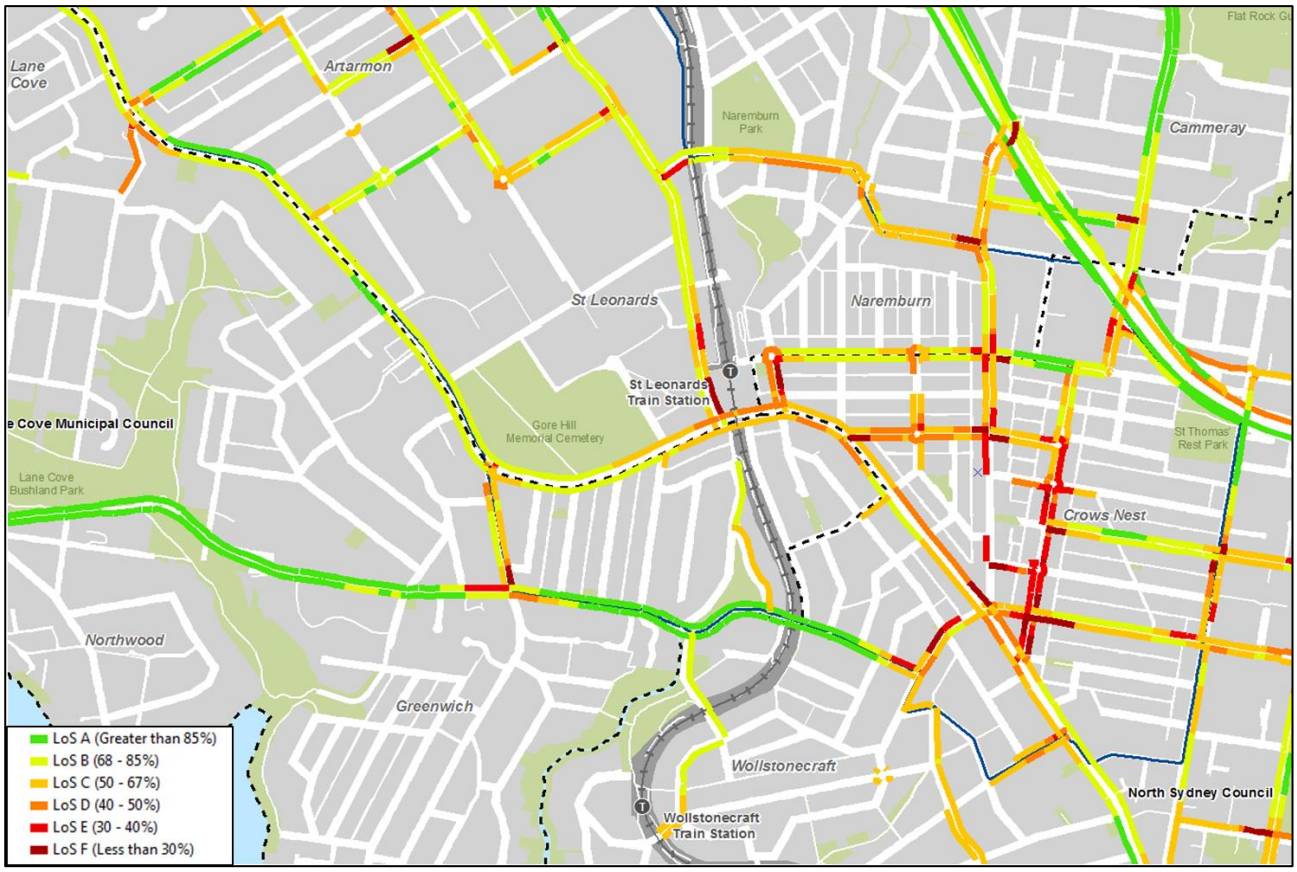


Figure 5-13 TomTom Network Level of Service (5:45 – 6:45 PM)

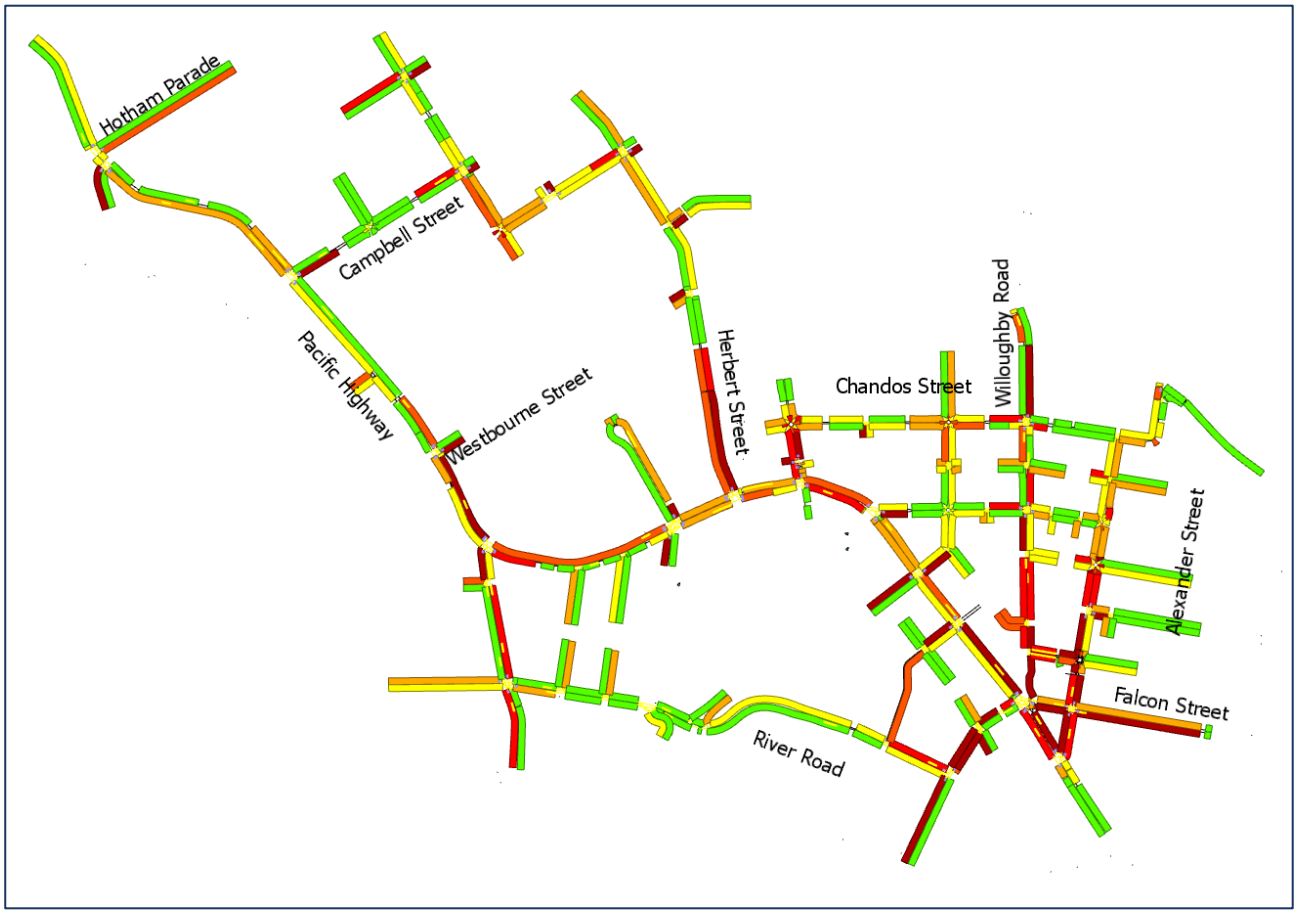


Figure 5-14 Modelled Network Level of Service (5:45 – 6:45 PM)

6 Model Limitations

The calibration and validation of the St Leonards microscopic model documented in this report is subject to the following limitations:

- Traffic analysis has been limited to the morning (07:30 – 09:30), the evening (16:45 – 18:45) peak periods.
- The base model development and demand calibration relied on November 2016 and May 2018 intersection count survey data.
- Road infrastructure modifications implemented since November 2016 are not factored in the base model (e.g. - the closure of Hume Street near the future Metro station, signalisation of the Alexander St / Chandos St intersection or new zebra crossings on all approaches of the Albany St / Oxley St intersection).
- Origin and Destination surveys were not adopted for this modelling exercise due to project timeframe constraints. Origin and Destination information derived from strategic models was used in the form of cordon matrices instead. This was discussed and agreed with Roads and Maritime during modelling framework and project meeting attended on the 7th of May 2018.
- Following Roads and Maritime advice, SCATS detector count for 2016 and 2018 was compared to identify inconsistencies between 2016 and 2018 surveys. The data analysis and comparison showed no significant changes in traffic flows and counts between 2016 and 2018.
- TomTom data presented significantly greater data sample size for travel time analysis and validation compared with traditional floating car surveys and was therefore adopted. Importantly, this method also allowed to use historical travel time data for the same period when 2016 traffic surveys were collected.
- Pedestrian delays were considered at signalised crossings typically in the form of late start for left turn traffic and filter movements.
- Loop bus services frequently utilise roads not modelled in the St Leonards microscopic model. When these buses exit the available roads in the network, they are not reintroduced.
- School bus services are not included in the GTFS database and therefore not included in the St Leonards and Crows Nest microscopic model

7 Conclusion

The Base (2016) Weekday AM and PM two-hour models conform to Roads and Maritime Services Traffic Modelling Guidelines for traffic modelling. The modelling results show that the models have:

- At least 85% of the turning counts with a GEH of less than 5 and 100% of the turning counts with a GEH of less than 10, for both light and heavy vehicle types.
- Travel time results within 15% and/or one minute of average observed travel time were achieved for 62 out of 64 segment comparisons. A discrepancy of 3 seconds and 7 seconds were observed in the two occasions where full travel time validation criteria was not fully observed, which is not considered to compromise the ability of the base model to represent typical traffic operation in the study area.
- The average travel times from the model against observed travel times replicates at enough statistical accuracy the expected travel patterns and behaviour for the overall traffic model.

The model calibration and validation statistics summarised above are consistent with the minimum requirements as set out in the NSW Roads and Maritime Traffic Modelling Guidelines and is therefore considered fit-for-purpose.

It is concluded that the AM and PM peak base models appropriately reflect existing year conditions and provide a suitable basis for the development of present and subsequent performance assessment for the 2026 and 2036 future year horizons.

APPENDIX A

GEH RESULTS

Calibration Results - LV (7:30am - 8:30am)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	206	217	11	0.8
		Pacific Highway (S)	Through	946	1521	1475	-46	1.2
	Hotham Parade	Pacific Highway (S)	Left	944	34	14	-20	4.1
		Pacific Highway (N)	Right	945	87	115	28	2.8
	Pacific Highway (S)	Pacific Highway (N)	Through	943	1092	1087	-5	0.2
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	94	189	95	8.0
		Pacific Highway (NW)	Right	1308	111	163	52	4.4
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	893	961	68	2.2
		Campbell Street	Right	1311	223	196	-27	1.9
	Pacific Highway (NW)	Campbell Street	Left	1306	153	165	12	1.0
		Pacific Highway (SE)	Through	1307	1342	1364	22	0.6
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	22	28	6	1.2
		Campbell Street (SW)	Through	2148	34	46	12	1.9
		Reserve Road (NW)	Right	2147	28	31	3	0.6
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	175	217	42	3.0
		Reserve Road (NW)	Through	1589	208	187	-21	1.5
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	58	89	31	3.6
		Bunnings Artarmon	Through	2144	30	41	11	1.8
		Reserve Road (SE)	Right	1590	175	155	-20	1.6
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	50	48	-2	0.3
		Reserve Road (SE)	Through	1592	575	536	-39	1.7
		Campbell Street (SW)	Right	1593	101	104	3	0.3
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	39	96	57	6.9
		Pacific Highway (NW)	Right	1320	26	37	11	2.0
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	1141	1139	-2	0.1
		Westbourne Street	Right	1319	167	125	-42	3.5
	Pacific Highway (NW)	Westbourne Street	Left	1317	155	198	43	3.2
		Pacific Highway (SE)	Through	1316	1379	1347	-32	0.9
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	294	337	43	2.4
		Pacific Highway (NW)	Through	1332	1128	1113	-15	0.4
	Greenwich Road	Pacific Highway (NW)	Left	1330	139	147	8	0.7
		Pacific Highway (E)	Right	1329	464	432	-32	1.5
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	1236	1324	88	2.5
		Greenwich Road	Right	1333	151	120	-31	2.7
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	63	80	17	2.0
		Berry Road	Through	1400	5	0	-5	3.2
		Pacific Highway (W)	Right	1399	29	46	17	2.8
	Pacific Highway (E)	Berry Road	Left	1397	71	98	27	2.9
		Pacific Highway (W)	Through	1396	1180	1177	-3	0.1
		Reserve Road	Right	1398	108	136	28	2.5
	Berry Road	Pacific Highway (W)	Left	1393	59	59	0	0.0
		Reserve Road	Through	1395	4	0	-4	2.8
		Pacific Highway (E)	Right	1394	83	65	-18	2.1
	Pacific Highway (W)	Reserve Road	Left	1392	82	132	50	4.8
		Pacific Highway (E)	Through	1391	1460	1580	120	3.1
		Berry Road	Right	1390	44	54	10	1.4
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	447	399	-48	2.3
		Pacific Highway (W)	Right	1405	143	119	-24	2.1
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	1222	1285	63	1.8
		Herbert Street	Right	1408	329	316	-13	0.7
	Pacific Highway (W)	Herbert Street	Left	1403	146	145	-1	0.1
		Pacific Highway (E)	Through	1404	1458	1575	117	3.0
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	27	49	22	3.6
		Christie Street (S)	Through	1420	82	70	-12	1.4
		Pacific Highway (W)	Right	1418	277	311	34	2.0
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	43	66	23	3.1
		Christie Street (S)	Through	1415	1381	1316	-65	1.8
	Pacific Highway (W)	Christie Street (N)	Left	1414	370	357	-13	0.7
		Pacific Highway (E)	Through	1412	1578	1595	17	0.4
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	19	30	11	2.2
		Pacific Highway (NW)	Right	1437	448	474	26	1.2
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	979	931	-48	1.6
		Albany Street	Right	1436	99	94	-5	0.5
	Pacific Highway (NW)	Albany Street	Left	1434	348	486	138	6.8
		Pacific Highway (SE)	Through	1433	1255	1158	-97	2.8
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	42	12	-30	5.8
		Oxley Street (SW)	Through	1446	100	129	29	2.7
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	101	93	-8	0.8
		Pacific Highway (NW)	Through	1445	1039	996	-43	1.3
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	38	31	-7	1.2
		Oxley Street (NE)	Through	1441	48	81	33	4.1
		Pacific Highway (SE)	Right	1440	34	16	-18	3.6
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	51	50	-1	0.1
		Pacific Highway (SE)	Through	1450	1222	1131	-91	2.7

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	447	422	-25	1.2
	Warringah Freeway	Brook Street (S)	Left	1698	363	293	-70	3.9
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	82	80	-2	0.2
		Willoughby Road (S)	Through	1669	349	316	-33	1.8
		Chandos Street (W)	Right	1667	105	90	-15	1.5
	Chandos Street (E)	Willoughby Road (S)	Left	1672	36	37	1	0.2
		Chandos Street (W)	Through	1670	452	439	-13	0.6
		Willoughby Road (N)	Right	1671	175	150	-25	2.0
	Willoughby Road (S)	Chandos Street (W)	Left	1673	24	19	-5	1.1
		Willoughby Road (N)	Through	1674	238	156	-82	5.8
		Chandos Street (E)	Right	1675	25	14	-11	2.5
	Chandos Street (W)	Willoughby Road (N)	Left	1664	80	113	33	3.4
		Chandos Street (E)	Through	1665	296	271	-25	1.5
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	1	22	21	6.2
		Shirley Road	Through	1472	268	274	6	0.4
		Pacific Highway (NW)	Right	1474	354	353	-1	0.1
	Pacific Highway (SE)	Shirley Road	Left	1469	196	242	46	3.1
		Pacific Highway (NW)	Through	1471	594	552	-42	1.8
	Shirley Road	Pacific Highway (NW)	Left	1468	11	56	45	7.8
		Falcon Street	Through	1467	285	334	49	2.8
		Pacific Highway (SE)	Right	1466	251	287	36	2.2
	Pacific Highway (NW)	Falcon Street	Left	1477	270	238	-32	2.0
		Pacific Highway (SE)	Through	1476	993	947	-46	1.5
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	36	33	-3	0.5
		Alexander Street (S)	Through	1524	238	317	79	4.7
	Falcon Street (E)	Alexander Street (S)	Left	1527	63	48	-15	2.0
		Falcon Street (W)	Through	1528	596	634	38	1.5
	Alexander Street (S)	Falcon Street (W)	Left	1518	27	16	-11	2.4
		Alexander Street (N)	Through	1519	224	233	9	0.6
		Falcon Street (E)	Right	1520	20	27	7	1.4
	Falcon Street (W)	Alexander Street (N)	Left	1522	71	60	-11	1.4
		Falcon Street (E)	Through	1523	529	561	32	1.4
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	260	265	5	0.3
		Pacific Highway (NW)	Right	1488	41	90	49	6.1
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	749	711	-38	1.4
		Alexander Street	Right	1485	263	251	-12	0.7
	Pacific Highway (NW)	Alexander Street	Left	1490	6	19	13	3.7
		Pacific Highway (SE)	Through	1489	1241	1247	6	0.2
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	73	110	37	3.9
		River Road	Right	2019	386	409	23	1.2
	Shirley Road (S)	River Road	Left	2020	158	190	32	2.4
		Shirley Road (N)	Through	2021	82	28	-54	7.3
	River Road	Shirley Road (N)	Left	2023	566	753	187	7.3
		Shirley Road (S)	Right	2022	435	330	-105	5.4
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	106	141	35	3.1
		Greenwich Road (S)	Through	1935	64	68	4	0.5
		River Road (W)	Right	1936	206	180	-26	1.9
	River Road (E)	Greenwich Road (S)	Left	1931	62	75	13	1.6
		River Road (W)	Through	1933	500	505	5	0.2
	Greenwich Road (S)	River Road (W)	Left	1942	46	55	9	1.3
		Greenwich Road (N)	Through	1941	128	136	8	0.7
		River Road (E)	Right	1940	150	128	-22	1.9
	River Road (W)	Greenwich Road (N)	Left	1939	297	299	2	0.1
		River Road (E)	Through	1937	995	923	-72	2.3
		Greenwich Road (S)	Right	1938	34	54	20	3.0
River Road / Park Road	Park Road	River Road (E)	Left	2102	14	0	-14	5.3
		River Road (W)	Right	2103	8	18	10	2.8
	River Road (E)	River Road (W)	Through	2105	592	582	-10	0.4
		Park Road	Right	2104	61	36	-25	3.6
	River Road (W)	Park Road	Left	2100	18	20	2	0.5
		River Road (E)	Through	2101	1181	1152	-29	0.8
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	2	1	-1	0.8
		River Road (W)	Through	2061	647	596	-51	2.0
	Eastview Street	River Road (W)	Left	2064	3	23	20	5.5
		River Road (E)	Right	2065	3	0	-3	2.4
	River Road (W)	River Road (E)	Through	2058	1178	1141	-37	1.1
		Eastview Street	Right	2059	0	12	12	4.9
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	0	0	0	0.0
	River Road (E)	River Road (W)	Through	1997	506	597	91	3.9
	River Road (W)	Canberra Avenue	Left	1972	37	68	31	4.3
		River Road (E)	Through	1973	1134	1073	-61	1.8
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	6	3	-3	1.4
		River Road (W)	Right	2012	3	7	4	1.8
	River Road (E)	River Road (W)	Through	2014	516	592	76	3.2
	River Road (W)	River Road (E)	Through	2016	1187	1081	-106	3.1
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	28	10	-18	4.1
		Shirley Road (SW)	Through	2375	449	502	53	2.4
		Nicholson Street	Right	2374	12	4	-8	2.8

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	1	1	1.4
	Shirley Road (SW)	Nicholson Street	Left	2373	21	51	30	5.0
		Shirley Road (NE)	Through	2372	698	672	-26	1.0
		Sinclair Street	Right	14706	30	61	31	4.6
	Nicholson Street	Shirley Road (NE)	Left	2370	19	3	-16	4.8
		Sinclair Street	Through	14707	20	5	-15	4.2
		Shirley Road (SW)	Right	2371	10	19	9	2.4
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	108	109	1	0.1
		Reserve Road (NW)	Right	1584	230	295	65	4.0
	Reserve Road (SE)		Through & Right	1582	107	117	10	0.9
	Reserve Road (NW)	Frederick Street	Left	1585	422	435	13	0.6
		Reserve Road (SE)	Through	1583	301	281	-20	1.2
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	4	4	0	0.0
		Frederick Street	Through	14675	10	9	-1	0.3
		Herbert Street (NW)	Right	14674	2	5	3	1.6
	Herbert Street (SE)	Frederick Street	Left	1510	229	306	77	4.7
		Herbert Street (NW)	Through	1511	215	246	31	2.0
		St Leonards Corporate Centre	Right	14673	2	11	9	3.5
	Frederick Street	Herbert Street (NW)	Left	1509	67	98	31	3.4
		St Leonards Corporate Centre	Through	14672	23	14	-9	2.1
		Herbert Street (SE)	Right	1508	355	304	-51	2.8
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	28	25	-3	0.6
		Herbert Street (SE)	Through	1513	446	425	-21	1.0
		Frederick Street	Right	1512	134	130	-4	0.3
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	17	23	6	1.3
			Through & Right	1543	106	133	27	2.5
	Chandos Street (E)	Christie Street (S)	Left	1548	250	282	32	2.0
			Through & Right	1544	154	159	5	0.4
	Christie Street (S)	Chandos Street (W)	Left	1549	89	114	25	2.5
			Through & Right	1545	209	246	37	2.5
	Chandos Street (W)	Christie Street (N)	Left	1546	39	33	-6	1.0
			Through & Right	1542	97	77	-20	2.1
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	18	27	9	1.9
		Oxley Street (S)	Through	14690	168	240	72	5.0
		Atchison Street (W)	Right	14691	6	19	13	3.7
	Atchison Street (E)	Oxley Street (S)	Left	14693	42	75	33	4.3
		Atchison Street (W)	Through	14694	15	22	7	1.6
		Oxley Street (N)	Right	14695	11	22	11	2.7
	Oxley Street (S)	Atchison Street (W)	Left	14684	25	33	8	1.5
		Oxley Street (N)	Through	14685	170	192	22	1.6
		Atchison Street (E)	Right	14686	17	15	-2	0.5
	Atchison Street (W)	Oxley Street (N)	Left	14688	11	26	15	3.5
		Atchison Street (E)	Through	14689	11	6	-5	1.7
		Oxley Street (S)	Right	14687	18	25	7	1.5
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	346	328	-18	1.0
		Alexander Street (S)	Through	1847	227	259	32	2.1
	Ernest Street	Alexander Street (S)	Left	1845	78	120	42	4.2
		Alexander Street (N)	Right	1846	369	321	-48	2.6
	Alexander Street (S)	Alexander Street (N)	Through	1844	139	153	14	1.2
		Ernest Street	Right	1843	55	58	3	0.4
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	251	253	2	0.1
	Ella Street (SW)	Ella Street (NE)	Through	15183	233	233	0	0.0

Calibration Results - LV (8:30am - 9:30am)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	192	212	20	1.4
		Pacific Highway (S)	Through	946	1406	1397	-9	0.2
	Hotham Parade	Pacific Highway (S)	Left	944	40	17	-23	4.3
		Pacific Highway (N)	Right	945	119	106	-13	1.2
	Pacific Highway (S)	Pacific Highway (N)	Through	943	969	918	-51	1.7
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	98	145	47	4.3
		Pacific Highway (NW)	Right	1308	116	139	23	2.0
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	739	806	67	2.4
		Campbell Street	Right	1311	241	225	-16	1.0
	Pacific Highway (NW)	Campbell Street	Left	1306	162	141	-21	1.7
		Pacific Highway (SE)	Through	1307	1295	1282	-13	0.4
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	33	22	-11	2.1
		Campbell Street (SW)	Through	2148	38	37	-1	0.2
		Reserve Road (NW)	Right	2147	34	22	-12	2.3
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	145	189	44	3.4
		Reserve Road (NW)	Through	1589	208	167	-41	3.0
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	74	48	-26	3.3
		Bunnings Artarmon	Through	2144	60	41	-19	2.7
		Reserve Road (SE)	Right	1590	145	162	17	1.4
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	48	46	-2	0.3
		Reserve Road (SE)	Through	1592	556	490	-66	2.9
		Campbell Street (SW)	Right	1593	114	80	-34	3.5
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	67	84	17	2.0
		Pacific Highway (NW)	Right	1320	47	23	-24	4.1
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	1034	1072	38	1.2
		Westbourne Street	Right	1319	157	120	-37	3.1
	Pacific Highway (NW)	Westbourne Street	Left	1317	178	186	8	0.6
		Pacific Highway (SE)	Through	1316	1298	1252	-46	1.3
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	274	274	0	0.0
		Pacific Highway (NW)	Through	1332	1032	1092	60	1.8
	Greenwich Road	Pacific Highway (NW)	Left	1330	157	113	-44	3.8
		Pacific Highway (E)	Right	1329	464	337	-127	6.3
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	1147	1257	110	3.2
		Greenwich Road	Right	1333	188	124	-64	5.1
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	73	85	12	1.4
		Berry Road	Through	1400	2	2	0	0.0
		Pacific Highway (W)	Right	1399	42	43	1	0.2
	Pacific Highway (E)	Berry Road	Left	1397	77	93	16	1.7
		Pacific Highway (W)	Through	1396	1121	1129	8	0.2
		Reserve Road	Right	1398	130	158	28	2.3
	Berry Road	Pacific Highway (W)	Left	1393	49	63	14	1.9
		Reserve Road	Through	1395	10	1	-9	3.8
		Pacific Highway (E)	Right	1394	61	72	11	1.3
	Pacific Highway (W)	Reserve Road	Left	1392	86	114	28	2.8
		Pacific Highway (E)	Through	1391	1448	1437	-11	0.3
		Berry Road	Right	1390	46	24	-22	3.7
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	410	419	9	0.4
		Pacific Highway (W)	Right	1405	149	139	-10	0.8
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	1179	1243	64	1.8
		Herbert Street	Right	1408	349	349	0	0.0
	Pacific Highway (W)	Herbert Street	Left	1403	174	135	-39	3.1
		Pacific Highway (E)	Through	1404	1403	1452	49	1.3
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	39	41	2	0.3
		Christie Street (S)	Through	1420	94	73	-21	2.3
		Pacific Highway (W)	Right	1418	262	247	-15	0.9
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	42	69	27	3.6
		Christie Street (S)	Through	1415	1404	1331	-73	2.0
	Pacific Highway (W)	Christie Street (N)	Left	1414	440	403	-37	1.8
		Pacific Highway (E)	Through	1412	1451	1486	35	0.9
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	19	36	17	3.2
		Pacific Highway (NW)	Right	1437	437	454	17	0.8
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	1005	942	-63	2.0
		Albany Street	Right	1436	133	106	-27	2.5
	Pacific Highway (NW)	Albany Street	Left	1434	392	496	104	4.9
		Pacific Highway (SE)	Through	1433	1097	1033	-64	2.0
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	52	21	-31	5.1
		Oxley Street (SW)	Through	1446	164	138	-26	2.1
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	125	88	-37	3.6
		Pacific Highway (NW)	Through	1445	1100	1000	-100	3.1
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	42	40	-2	0.3
		Oxley Street (NE)	Through	1441	83	79	-4	0.4
		Pacific Highway (SE)	Right	1440	44	16	-28	5.1
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	73	56	-17	2.1
		Pacific Highway (SE)	Through	1450	1044	1023	-21	0.7

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	451	431	-20	1.0
	Warringah Freeway	Brook Street (S)	Left	1698	340	331	-9	0.5
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	110	90	-20	2.0
		Willoughby Road (S)	Through	1669	318	322	4	0.2
		Chandos Street (W)	Right	1667	96	115	19	1.8
	Chandos Street (E)	Willoughby Road (S)	Left	1672	44	29	-15	2.5
		Chandos Street (W)	Through	1670	483	478	-5	0.2
		Willoughby Road (N)	Right	1671	118	193	75	6.0
	Willoughby Road (S)	Chandos Street (W)	Left	1673	25	19	-6	1.3
		Willoughby Road (N)	Through	1674	257	144	-113	8.0
		Chandos Street (E)	Right	1675	35	7	-28	6.1
	Chandos Street (W)	Willoughby Road (N)	Left	1664	71	83	12	1.4
		Chandos Street (E)	Through	1665	305	281	-24	1.4
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	8	27	19	4.5
		Shirley Road	Through	1472	273	297	24	1.4
		Pacific Highway (NW)	Right	1474	418	391	-27	1.3
	Pacific Highway (SE)	Shirley Road	Left	1469	140	233	93	6.8
		Pacific Highway (NW)	Through	1471	597	548	-49	2.0
	Shirley Road	Pacific Highway (NW)	Left	1468	18	48	30	5.2
		Falcon Street	Through	1467	312	300	-12	0.7
		Pacific Highway (SE)	Right	1466	254	252	-2	0.1
	Pacific Highway (NW)	Falcon Street	Left	1477	248	225	-23	1.5
		Pacific Highway (SE)	Through	1476	812	826	14	0.5
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	44	33	-11	1.8
		Alexander Street (S)	Through	1524	218	308	90	5.5
	Falcon Street (E)	Alexander Street (S)	Left	1527	69	48	-21	2.7
		Falcon Street (W)	Through	1528	675	696	21	0.8
	Alexander Street (S)	Falcon Street (W)	Left	1518	24	18	-6	1.3
		Alexander Street (N)	Through	1519	178	219	41	2.9
		Falcon Street (E)	Right	1520	20	31	11	2.2
	Falcon Street (W)	Alexander Street (N)	Left	1522	69	72	3	0.4
		Falcon Street (E)	Through	1523	547	514	-33	1.4
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	241	251	10	0.6
		Pacific Highway (NW)	Right	1488	46	115	69	7.7
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	691	665	-26	1.0
		Alexander Street	Right	1485	216	246	30	2.0
	Pacific Highway (NW)	Alexander Street	Left	1490	6	24	18	4.6
		Pacific Highway (SE)	Through	1489	1066	1077	11	0.3
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	62	112	50	5.4
		River Road	Right	2019	332	414	82	4.2
	Shirley Road (S)	River Road	Left	2020	109	146	37	3.3
		Shirley Road (N)	Through	2021	83	26	-57	7.7
	River Road	Shirley Road (N)	Left	2023	552	696	144	5.8
		Shirley Road (S)	Right	2022	327	250	-77	4.5
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	119	138	19	1.7
		Greenwich Road (S)	Through	1935	91	71	-20	2.2
		River Road (W)	Right	1936	163	156	-7	0.6
	River Road (E)	Greenwich Road (S)	Left	1931	72	90	18	2.0
		River Road (W)	Through	1933	426	478	52	2.4
	Greenwich Road (S)	River Road (W)	Left	1942	52	46	-6	0.9
		Greenwich Road (N)	Through	1941	136	125	-11	1.0
		River Road (E)	Right	1940	89	105	16	1.6
	River Road (W)	Greenwich Road (N)	Left	1939	320	288	-32	1.8
		River Road (E)	Through	1937	836	783	-53	1.9
		Greenwich Road (S)	Right	1938	75	56	-19	2.3
River Road / Park Road	Park Road	River Road (E)	Left	2102	23	1	-22	6.4
		River Road (W)	Right	2103	7	14	7	2.2
	River Road (E)	River Road (W)	Through	2105	523	568	45	1.9
		Park Road	Right	2104	51	28	-23	3.7
	River Road (W)	Park Road	Left	2100	25	22	-3	0.6
		River Road (E)	Through	2101	984	995	11	0.3
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	3	0	-3	2.4
		River Road (W)	Through	2061	575	567	-8	0.3
	Eastview Street	River Road (W)	Left	2064	1	28	27	7.1
		River Road (E)	Right	2065	1	0	-1	1.4
	River Road (W)	River Road (E)	Through	2058	976	982	6	0.2
		Eastview Street	Right	2059	1	16	15	5.1
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	3	0	-3	2.4
	River Road (E)	River Road (W)	Through	1997	478	567	89	3.9
	River Road (W)	Canberra Avenue	Left	1972	54	57	3	0.4
		River Road (E)	Through	1973	929	925	-4	0.1
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	8	4	-4	1.6
		River Road (W)	Right	2012	8	5	-3	1.2
	River Road (E)	River Road (W)	Through	2014	488	562	74	3.2
	River Road (W)	River Road (E)	Through	2016	995	931	-64	2.1
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	30	14	-16	3.4
		Shirley Road (SW)	Through	2375	409	509	100	4.7
		Nicholson Street	Right	2374	29	7	-22	5.2

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	2	2	2.0
		Shirley Road (NE)	Right	14703	0	1	1	1.4
	Shirley Road (SW)	Nicholson Street	Left	2373	19	55	36	5.9
		Shirley Road (NE)	Through	2372	621	603	-18	0.7
		Sinclair Street	Right	14706	38	63	25	3.5
	Nicholson Street	Shirley Road (NE)	Left	2370	16	1	-15	5.1
		Sinclair Street	Through	14707	17	6	-11	3.2
		Shirley Road (SW)	Right	2371	11	18	7	1.8
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	90	98	8	0.8
		Reserve Road (NW)	Right	1584	223	266	43	2.7
	Reserve Road (SE)		Through & Right	1582	99	100	1	0.1
	Reserve Road (NW)	Frederick Street	Left	1585	465	453	-12	0.6
		Reserve Road (SE)	Through	1583	188	224	36	2.5
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	6	5	-1	0.4
		Frederick Street	Through	14675	16	4	-12	3.8
		Herbert Street (NW)	Right	14674	3	3	0	0.0
	Herbert Street (SE)	Frederick Street	Left	1510	251	282	31	1.9
		Herbert Street (NW)	Through	1511	312	259	-53	3.1
		St Leonards Corporate Centre	Right	14673	1	17	16	5.3
	Frederick Street	Herbert Street (NW)	Left	1509	81	83	2	0.2
		St Leonards Corporate Centre	Through	14672	26	11	-15	3.5
		Herbert Street (SE)	Right	1508	329	356	27	1.5
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	22	22	0	0.0
		Herbert Street (SE)	Through	1513	460	430	-30	1.4
		Frederick Street	Right	1512	127	117	-10	0.9
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	23	30	7	1.4
			Through & Right	1543	123	101	-22	2.1
	Chandos Street (E)	Christie Street (S)	Left	1548	276	263	-13	0.8
			Through & Right	1544	131	211	80	6.1
	Christie Street (S)	Chandos Street (W)	Left	1549	107	134	27	2.5
			Through & Right	1545	278	266	-12	0.7
	Chandos Street (W)	Christie Street (N)	Left	1546	30	30	0	0.0
			Through & Right	1542	55	77	22	2.7
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	11	29	18	4.0
		Oxley Street (S)	Through	14690	198	262	64	4.2
		Atchison Street (W)	Right	14691	20	25	5	1.1
	Atchison Street (E)	Oxley Street (S)	Left	14693	69	56	-13	1.6
		Atchison Street (W)	Through	14694	29	24	-5	1.0
		Oxley Street (N)	Right	14695	29	20	-9	1.8
	Oxley Street (S)	Atchison Street (W)	Left	14684	29	24	-5	1.0
		Oxley Street (N)	Through	14685	209	198	-11	0.8
		Atchison Street (E)	Right	14686	13	15	2	0.5
	Atchison Street (W)	Oxley Street (N)	Left	14688	20	21	1	0.2
		Atchison Street (E)	Through	14689	12	11	-1	0.3
		Oxley Street (S)	Right	14687	24	38	14	2.5
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	285	270	-15	0.9
		Alexander Street (S)	Through	1847	225	220	-5	0.3
	Ernest Street	Alexander Street (S)	Left	1845	113	115	2	0.2
		Alexander Street (N)	Right	1846	394	351	-43	2.2
	Alexander Street (S)	Alexander Street (N)	Through	1844	150	127	-23	2.0
		Ernest Street	Right	1843	63	83	20	2.3
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	238	238	0	0.0
	Ella Street (SW)	Ella Street (NE)	Through	15183	280	281	1	0.1

Calibration Results - HV (7:30am - 8:30am)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	17	3	-14	4.4
		Pacific Highway (S)	Through	946	97	107	10	1.0
	Hotham Parade	Pacific Highway (S)	Left	944	8	7	-1	0.4
		Pacific Highway (N)	Right	945	26	21	-5	1.0
	Pacific Highway (S)	Pacific Highway (N)	Through	943	66	53	-13	1.7
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	4	11	7	2.6
		Pacific Highway (NW)	Right	1308	19	16	-3	0.7
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	43	42	-1	0.2
		Campbell Street	Right	1311	16	20	4	0.9
	Pacific Highway (NW)	Campbell Street	Left	1306	12	19	7	1.8
		Pacific Highway (SE)	Through	1307	81	97	16	1.7
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	0	3	3	2.4
		Campbell Street (SW)	Through	2148	0	1	1	1.4
		Reserve Road (NW)	Right	2147	0	2	2	2.0
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	3	12	9	3.3
		Reserve Road (NW)	Through	1589	3	16	13	4.2
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	15	25	10	2.2
		Bunnings Artarmon	Through	2144	0	8	8	4.0
		Reserve Road (SE)	Right	1590	2	16	14	4.7
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	0	0	0	0.0
		Reserve Road (SE)	Through	1592	16	9	-7	2.0
		Campbell Street (SW)	Right	1593	9	16	7	2.0
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	2	11	9	3.5
		Pacific Highway (NW)	Right	1320	0	2	2	2.0
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	69	57	-12	1.5
		Westbourne Street	Right	1319	3	0	-3	2.4
	Pacific Highway (NW)	Westbourne Street	Left	1317	0	0	0	0.0
		Pacific Highway (SE)	Through	1316	106	109	3	0.3
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	6	8	2	0.8
		Pacific Highway (NW)	Through	1332	67	46	-21	2.8
	Greenwich Road	Pacific Highway (NW)	Left	1330	1	12	11	4.3
		Pacific Highway (E)	Right	1329	7	15	8	2.4
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	103	114	11	1.1
		Greenwich Road	Right	1333	5	6	1	0.4
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	9	3	-6	2.4
		Berry Road	Through	1400	0	0	0	0.0
		Pacific Highway (W)	Right	1399	1	10	9	3.8
	Pacific Highway (E)	Berry Road	Left	1397	1	4	3	1.9
		Pacific Highway (W)	Through	1396	66	56	-10	1.3
		Reserve Road	Right	1398	7	0	-7	3.7
	Berry Road	Pacific Highway (W)	Left	1393	2	1	-1	0.8
		Reserve Road	Through	1395	0	0	0	0.0
		Pacific Highway (E)	Right	1394	1	0	-1	1.4
	Pacific Highway (W)	Reserve Road	Left	1392	3	1	-2	1.4
		Pacific Highway (E)	Through	1391	104	124	20	1.9
		Berry Road	Right	1390	2	3	1	0.6
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	29	16	-13	2.7
		Pacific Highway (W)	Right	1405	2	4	2	1.2
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	72	56	-16	2.0
		Herbert Street	Right	1408	8	19	11	3.0
	Pacific Highway (W)	Herbert Street	Left	1403	22	18	-4	0.9
		Pacific Highway (E)	Through	1404	92	106	14	1.4
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	1	1	0	0.0
		Christie Street (S)	Through	1420	2	1	-1	0.8
		Pacific Highway (W)	Right	1418	8	14	6	1.8
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	2	4	2	1.2
		Christie Street (S)	Through	1415	76	63	-13	1.6
	Pacific Highway (W)	Christie Street (N)	Left	1414	9	11	2	0.6
		Pacific Highway (E)	Through	1412	106	110	4	0.4
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	2	0	-2	2.0
		Pacific Highway (NW)	Right	1437	8	19	11	3.0
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	70	50	-20	2.6
		Albany Street	Right	1436	3	2	-1	0.6
	Pacific Highway (NW)	Albany Street	Left	1434	9	27	18	4.2
		Pacific Highway (SE)	Through	1433	98	83	-15	1.6
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	3	2	-1	0.6
		Oxley Street (SW)	Through	1446	38	31	-7	1.2
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	2	8	6	2.7
		Pacific Highway (NW)	Through	1445	33	46	13	2.1
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	4	7	3	1.3
		Oxley Street (NE)	Through	1441	2	9	7	3.0
		Pacific Highway (SE)	Right	1440	4	0	-4	2.8
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	3	5	2	1.0
		Pacific Highway (SE)	Through	1450	97	76	-21	2.3

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	4	3	-1	0.5
	Warringah Freeway	Brook Street (S)	Left	1698	4	12	8	2.8
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	3	3	0	0.0
		Willoughby Road (S)	Through	1669	13	12	-1	0.3
		Chandos Street (W)	Right	1667	2	2	0	0.0
	Chandos Street (E)	Willoughby Road (S)	Left	1672	2	2	0	0.0
		Chandos Street (W)	Through	1670	3	9	6	2.4
		Willoughby Road (N)	Right	1671	1	2	1	0.8
	Willoughby Road (S)	Chandos Street (W)	Left	1673	1	1	0	0.0
		Willoughby Road (N)	Through	1674	11	10	-1	0.3
		Chandos Street (E)	Right	1675	0	0	0	0.0
	Chandos Street (W)	Willoughby Road (N)	Left	1664	3	4	1	0.5
		Chandos Street (E)	Through	1665	5	1	-4	2.3
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	1	2	1	0.8
		Shirley Road	Through	1472	3	13	10	3.5
		Pacific Highway (NW)	Right	1474	20	22	2	0.4
	Pacific Highway (SE)	Shirley Road	Left	1469	4	1	-3	1.9
		Pacific Highway (NW)	Through	1471	36	32	-4	0.7
	Shirley Road	Pacific Highway (NW)	Left	1468	1	0	-1	1.4
		Falcon Street	Through	1467	9	6	-3	1.1
		Pacific Highway (SE)	Right	1466	5	1	-4	2.3
	Pacific Highway (NW)	Falcon Street	Left	1477	36	14	-22	4.4
		Pacific Highway (SE)	Through	1476	68	67	-1	0.1
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	3	2	-1	0.6
		Alexander Street (S)	Through	1524	12	10	-2	0.6
	Falcon Street (E)	Alexander Street (S)	Left	1527	2	0	-2	2.0
		Falcon Street (W)	Through	1528	32	37	5	0.9
	Alexander Street (S)	Falcon Street (W)	Left	1518	1	0	-1	1.4
		Alexander Street (N)	Through	1519	14	9	-5	1.5
		Falcon Street (E)	Right	1520	0	4	4	2.8
	Falcon Street (W)	Alexander Street (N)	Left	1522	39	6	-33	7.0
		Falcon Street (E)	Through	1523	9	16	7	2.0
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	13	5	-8	2.7
		Pacific Highway (NW)	Right	1488	1	6	5	2.7
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	39	26	-13	2.3
		Alexander Street	Right	1485	14	12	-2	0.6
	Pacific Highway (NW)	Alexander Street	Left	1490	2	1	-1	0.8
		Pacific Highway (SE)	Through	1489	77	69	-8	0.9
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	0	0	0	0.0
		River Road	Right	2019	7	14	7	2.2
	Shirley Road (S)	River Road	Left	2020	2	3	1	0.6
		Shirley Road (N)	Through	2021	1	0	-1	1.4
	River Road	Shirley Road (N)	Left	2023	24	6	-18	4.6
		Shirley Road (S)	Right	2022	3	0	-3	2.4
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	1	4	3	1.9
		Greenwich Road (S)	Through	1935	6	2	-4	2.0
		River Road (W)	Right	1936	7	7	0	0.0
	River Road (E)	Greenwich Road (S)	Left	1931	1	0	-1	1.4
		River Road (W)	Through	1933	10	16	6	1.7
	Greenwich Road (S)	River Road (W)	Left	1942	4	0	-4	2.8
		Greenwich Road (N)	Through	1941	3	8	5	2.1
		River Road (E)	Right	1940	1	2	1	0.8
	River Road (W)	Greenwich Road (N)	Left	1939	5	14	9	2.9
		River Road (E)	Through	1937	16	0	-16	5.7
		Greenwich Road (S)	Right	1938	4	0	-4	2.8
River Road / Park Road	Park Road	River Road (E)	Left	2102	1	3	2	1.4
		River Road (W)	Right	2103	0	0	0	0.0
	River Road (E)	River Road (W)	Through	2105	16	15	-1	0.3
		Park Road	Right	2104	0	0	0	0.0
	River Road (W)	Park Road	Left	2100	1	0	-1	1.4
		River Road (E)	Through	2101	16	5	-11	3.4
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	0	3	3	2.4
		River Road (W)	Through	2061	13	15	2	0.5
	Eastview Street	River Road (W)	Left	2064	0	0	0	0.0
		River Road (E)	Right	2065	0	0	0	0.0
	River Road (W)	River Road (E)	Through	2058	23	7	-16	4.1
		Eastview Street	Right	2059	0	1	1	1.4
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	0	0	0	0.0
	River Road (E)	River Road (W)	Through	1997	17	18	1	0.2
	River Road (W)	Canberra Avenue	Left	1972	0	2	2	2.0
		River Road (E)	Through	1973	19	5	-14	4.0
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	0	0	0	0.0
		River Road (W)	Right	2012	0	0	0	0.0
	River Road (E)	River Road (W)	Through	2014	13	18	5	1.3
	River Road (W)	River Road (E)	Through	2016	21	6	-15	4.1
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	0	0	0	0.0
		Shirley Road (SW)	Through	2375	15	14	-1	0.3
		Nicholson Street	Right	2374	0	0	0	0.0

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	0	0	0.0
	Shirley Road (SW)	Nicholson Street	Left	2373	2	0	-2	2.0
		Shirley Road (NE)	Through	2372	19	7	-12	3.3
		Sinclair Street	Right	14706	0	0	0	0.0
	Nicholson Street	Shirley Road (NE)	Left	2370	0	0	0	0.0
		Sinclair Street	Through	14707	0	0	0	0.0
		Shirley Road (SW)	Right	2371	0	0	0	0.0
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	0	0	0	0.0
		Reserve Road (NW)	Right	1584	25	26	1	0.2
	Reserve Road (SE)		Through & Right	1582	9	4	-5	2.0
	Reserve Road (NW)	Frederick Street	Left	1585	18	28	10	2.1
		Reserve Road (SE)	Through	1583	5	0	-5	3.2
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	0	2	2	2.0
		Frederick Street	Through	14675	1	2	1	0.8
		Herbert Street (NW)	Right	14674	0	3	3	2.4
	Herbert Street (SE)	Frederick Street	Left	1510	20	27	7	1.4
		Herbert Street (NW)	Through	1511	3	7	4	1.8
		St Leonards Corporate Centre	Right	14673	0	7	7	3.7
	Frederick Street	Herbert Street (NW)	Left	1509	3	4	1	0.5
		St Leonards Corporate Centre	Through	14672	0	1	1	1.4
		Herbert Street (SE)	Right	1508	22	16	-6	1.4
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	0	0	0	0.0
		Herbert Street (SE)	Through	1513	7	8	1	0.4
		Frederick Street	Right	1512	2	4	2	1.2
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	0	0	0	0.0
			Through & Right	1543	1	0	-1	1.4
	Chandos Street (E)	Christie Street (S)	Left	1548	1	15	14	4.9
			Through & Right	1544	5	5	0	0.0
	Christie Street (S)	Chandos Street (W)	Left	1549	1	0	-1	1.4
			Through & Right	1545	5	11	6	2.1
	Chandos Street (W)	Christie Street (N)	Left	1546	1	0	-1	1.4
			Through & Right	1542	2	0	-2	2.0
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	1	0	-1	1.4
		Oxley Street (S)	Through	14690	3	7	4	1.8
		Atchison Street (W)	Right	14691	0	0	0	0.0
	Atchison Street (E)	Oxley Street (S)	Left	14693	0	3	3	2.4
		Atchison Street (W)	Through	14694	0	0	0	0.0
		Oxley Street (N)	Right	14695	1	0	-1	1.4
	Oxley Street (S)	Atchison Street (W)	Left	14684	0	4	4	2.8
		Oxley Street (N)	Through	14685	5	3	-2	1.0
		Atchison Street (E)	Right	14686	0	0	0	0.0
	Atchison Street (W)	Oxley Street (N)	Left	14688	0	3	3	2.4
		Atchison Street (E)	Through	14689	0	0	0	0.0
		Oxley Street (S)	Right	14687	2	1	-1	0.8
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	8	0	-8	4.0
		Alexander Street (S)	Through	1847	8	3	-5	2.1
	Ernest Street	Alexander Street (S)	Left	1845	4	10	6	2.3
		Alexander Street (N)	Right	1846	13	8	-5	1.5
	Alexander Street (S)	Alexander Street (N)	Through	1844	3	7	4	1.8
		Ernest Street	Right	1843	7	0	-7	3.7
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	3	11	8	3.0
	Ella Street (SW)	Ella Street (NE)	Through	15183	2	12	10	3.8

Calibration Results - HV (8:30am - 9:30am)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	24	1	-23	6.5
		Pacific Highway (S)	Through	946	98	106	8	0.8
	Hotham Parade	Pacific Highway (S)	Left	944	10	5	-5	1.8
		Pacific Highway (N)	Right	945	20	19	-1	0.2
	Pacific Highway (S)	Pacific Highway (N)	Through	943	68	56	-12	1.5
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	5	12	7	2.4
		Pacific Highway (NW)	Right	1308	10	19	9	2.4
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	39	42	3	0.5
		Campbell Street	Right	1311	13	12	-1	0.3
	Pacific Highway (NW)	Campbell Street	Left	1306	18	18	0	0.0
		Pacific Highway (SE)	Through	1307	79	101	22	2.3
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	0	3	3	2.4
		Campbell Street (SW)	Through	2148	0	0	0	0.0
		Reserve Road (NW)	Right	2147	1	5	4	2.3
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	9	17	8	2.2
		Reserve Road (NW)	Through	1589	10	11	1	0.3
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	24	22	-2	0.4
		Bunnings Artarmon	Through	2144	0	7	7	3.7
		Reserve Road (SE)	Right	1590	4	6	2	0.9
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	1	0	-1	1.4
		Reserve Road (SE)	Through	1592	7	6	-1	0.4
		Campbell Street (SW)	Right	1593	17	20	3	0.7
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	0	15	15	5.5
		Pacific Highway (NW)	Right	1320	2	4	2	1.2
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	71	55	-16	2.0
		Westbourne Street	Right	1319	7	0	-7	3.7
	Pacific Highway (NW)	Westbourne Street	Left	1317	3	0	-3	2.4
		Pacific Highway (SE)	Through	1316	110	111	1	0.1
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	5	8	3	1.2
		Pacific Highway (NW)	Through	1332	63	52	-11	1.5
	Greenwich Road	Pacific Highway (NW)	Left	1330	9	3	-6	2.4
		Pacific Highway (E)	Right	1329	8	2	-6	2.7
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	116	124	8	0.7
		Greenwich Road	Right	1333	4	4	0	0.0
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	8	16	8	2.3
		Berry Road	Through	1400	0	0	0	0.0
		Pacific Highway (W)	Right	1399	7	14	7	2.2
	Pacific Highway (E)	Berry Road	Left	1397	1	6	5	2.7
		Pacific Highway (W)	Through	1396	60	48	-12	1.6
		Reserve Road	Right	1398	10	0	-10	4.5
	Berry Road	Pacific Highway (W)	Left	1393	2	1	-1	0.8
		Reserve Road	Through	1395	0	0	0	0.0
		Pacific Highway (E)	Right	1394	1	0	-1	1.4
	Pacific Highway (W)	Reserve Road	Left	1392	3	0	-3	2.4
		Pacific Highway (E)	Through	1391	109	125	16	1.5
		Berry Road	Right	1390	6	1	-5	2.7
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	21	21	0	0.0
		Pacific Highway (W)	Right	1405	4	2	-2	1.2
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	67	52	-15	1.9
		Herbert Street	Right	1408	15	22	7	1.6
	Pacific Highway (W)	Herbert Street	Left	1403	18	23	5	1.1
		Pacific Highway (E)	Through	1404	100	119	19	1.8
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	1	4	3	1.9
		Christie Street (S)	Through	1420	1	1	0	0.0
		Pacific Highway (W)	Right	1418	8	5	-3	1.2
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	0	13	13	5.1
		Christie Street (S)	Through	1415	75	68	-7	0.8
	Pacific Highway (W)	Christie Street (N)	Left	1414	14	6	-8	2.5
		Pacific Highway (E)	Through	1412	109	133	24	2.2
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	5	7	2	0.8
		Pacific Highway (NW)	Right	1437	7	26	19	4.7
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	68	55	-13	1.7
		Albany Street	Right	1436	3	1	-2	1.4
	Pacific Highway (NW)	Albany Street	Left	1434	11	36	25	5.2
		Pacific Highway (SE)	Through	1433	99	102	3	0.3
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	2	1	-1	0.8
		Oxley Street (SW)	Through	1446	41	27	-14	2.4
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	0	4	4	2.8
		Pacific Highway (NW)	Through	1445	32	49	17	2.7
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	0	5	5	3.2
		Oxley Street (NE)	Through	1441	1	7	6	3.0
		Pacific Highway (SE)	Right	1440	1	0	-1	1.4
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	3	9	6	2.4
		Pacific Highway (SE)	Through	1450	101	102	1	0.1

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	0	1	1	1.4
	Warringah Freeway	Brook Street (S)	Left	1698	5	8	3	1.2
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	1	2	1	0.8
		Willoughby Road (S)	Through	1669	18	19	1	0.2
		Chandos Street (W)	Right	1667	1	1	0	0.0
	Chandos Street (E)	Willoughby Road (S)	Left	1672	1	1	0	0.0
		Chandos Street (W)	Through	1670	4	8	4	1.6
		Willoughby Road (N)	Right	1671	0	4	4	2.8
	Willoughby Road (S)	Chandos Street (W)	Left	1673	2	1	-1	0.8
		Willoughby Road (N)	Through	1674	17	6	-11	3.2
		Chandos Street (E)	Right	1675	1	1	0	0.0
	Chandos Street (W)	Willoughby Road (N)	Left	1664	1	4	3	1.9
		Chandos Street (E)	Through	1665	8	0	-8	4.0
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	1	3	2	1.4
		Shirley Road	Through	1472	6	3	-3	1.4
		Pacific Highway (NW)	Right	1474	17	24	7	1.5
	Pacific Highway (SE)	Shirley Road	Left	1469	5	13	8	2.7
		Pacific Highway (NW)	Through	1471	38	32	-6	1.0
	Shirley Road	Pacific Highway (NW)	Left	1468	1	0	-1	1.4
		Falcon Street	Through	1467	4	20	16	4.6
		Pacific Highway (SE)	Right	1466	2	1	-1	0.8
	Pacific Highway (NW)	Falcon Street	Left	1477	35	16	-19	3.8
		Pacific Highway (SE)	Through	1476	67	84	17	2.0
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	2	0	-2	2.0
		Alexander Street (S)	Through	1524	15	14	-1	0.3
	Falcon Street (E)	Alexander Street (S)	Left	1527	1	4	3	1.9
		Falcon Street (W)	Through	1528	46	29	-17	2.8
	Alexander Street (S)	Falcon Street (W)	Left	1518	0	1	1	1.4
		Alexander Street (N)	Through	1519	11	5	-6	2.1
		Falcon Street (E)	Right	1520	0	0	0	0.0
	Falcon Street (W)	Alexander Street (N)	Left	1522	32	15	-17	3.5
		Falcon Street (E)	Through	1523	8	24	16	4.0
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	15	8	-7	2.1
		Pacific Highway (NW)	Right	1488	1	10	9	3.8
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	42	36	-6	1.0
		Alexander Street	Right	1485	11	5	-6	2.1
	Pacific Highway (NW)	Alexander Street	Left	1490	0	1	1	1.4
		Pacific Highway (SE)	Through	1489	72	87	15	1.7
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	1	1	0	0.0
		River Road	Right	2019	7	15	8	2.4
	Shirley Road (S)	River Road	Left	2020	3	4	1	0.5
		Shirley Road (N)	Through	2021	2	0	-2	2.0
	River Road	Shirley Road (N)	Left	2023	10	21	11	2.8
		Shirley Road (S)	Right	2022	2	0	-2	2.0
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	2	6	4	2.0
		Greenwich Road (S)	Through	1935	9	1	-8	3.6
		River Road (W)	Right	1936	1	6	5	2.7
	River Road (E)	Greenwich Road (S)	Left	1931	2	1	-1	0.8
		River Road (W)	Through	1933	14	13	-1	0.3
	Greenwich Road (S)	River Road (W)	Left	1942	3	0	-3	2.4
		Greenwich Road (N)	Through	1941	11	2	-9	3.5
		River Road (E)	Right	1940	2	3	1	0.6
	River Road (W)	Greenwich Road (N)	Left	1939	3	4	1	0.5
		River Road (E)	Through	1937	7	2	-5	2.4
		Greenwich Road (S)	Right	1938	2	2	0	0.0
River Road / Park Road	Park Road	River Road (E)	Left	2102	0	3	3	2.4
		River Road (W)	Right	2103	0	1	1	1.4
	River Road (E)	River Road (W)	Through	2105	19	13	-6	1.5
		Park Road	Right	2104	0	3	3	2.4
	River Road (W)	Park Road	Left	2100	0	1	1	1.4
		River Road (E)	Through	2101	10	16	6	1.7
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	0	3	3	2.4
		River Road (W)	Through	2061	17	16	-1	0.2
	Eastview Street	River Road (W)	Left	2064	0	0	0	0.0
		River Road (E)	Right	2065	0	3	3	2.4
	River Road (W)	River Road (E)	Through	2058	17	16	-1	0.2
		Eastview Street	Right	2059	0	3	3	2.4
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	0	2	2	2.0
	River Road (E)	River Road (W)	Through	1997	17	19	2	0.5
	River Road (W)	Canberra Avenue	Left	1972	1	3	2	1.4
		River Road (E)	Through	1973	15	16	1	0.3
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	0	3	3	2.4
		River Road (W)	Right	2012	1	0	-1	1.4
	River Road (E)	River Road (W)	Through	2014	17	19	2	0.5
	River Road (W)	River Road (E)	Through	2016	13	18	5	1.3
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	1	0	-1	1.4
		Shirley Road (SW)	Through	2375	17	16	-1	0.2
		Nicholson Street	Right	2374	1	0	-1	1.4

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	0	0	0.0
	Shirley Road (SW)	Nicholson Street	Left	2373	0	0	0	0.0
		Shirley Road (NE)	Through	2372	19	21	2	0.4
		Sinclair Street	Right	14706	0	0	0	0.0
	Nicholson Street	Shirley Road (NE)	Left	2370	0	0	0	0.0
		Sinclair Street	Through	14707	0	0	0	0.0
		Shirley Road (SW)	Right	2371	1	0	-1	1.4
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	0	0	0	0.0
		Reserve Road (NW)	Right	1584	31	28	-3	0.6
	Reserve Road (SE)		Through & Right	1582	6	3	-3	1.4
	Reserve Road (NW)	Frederick Street	Left	1585	18	15	-3	0.7
		Reserve Road (SE)	Through	1583	7	0	-7	3.7
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	0	1	1	1.4
		Frederick Street	Through	14675	1	1	0	0.0
		Herbert Street (NW)	Right	14674	1	2	1	0.8
	Herbert Street (SE)	Frederick Street	Left	1510	26	32	6	1.1
		Herbert Street (NW)	Through	1511	6	11	5	1.7
		St Leonards Corporate Centre	Right	14673	0	6	6	3.5
	Frederick Street	Herbert Street (NW)	Left	1509	5	6	1	0.4
		St Leonards Corporate Centre	Through	14672	2	2	0	0.0
		Herbert Street (SE)	Right	1508	10	11	1	0.3
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	0	0	0	0.0
		Herbert Street (SE)	Through	1513	10	6	-4	1.4
		Frederick Street	Right	1512	0	3	3	2.4
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	0	0	0	0.0
			Through & Right	1543	1	0	-1	1.4
	Chandos Street (E)	Christie Street (S)	Left	1548	5	8	3	1.2
			Through & Right	1544	1	2	1	0.8
	Christie Street (S)	Chandos Street (W)	Left	1549	2	0	-2	2.0
			Through & Right	1545	13	6	-7	2.3
	Chandos Street (W)	Christie Street (N)	Left	1546	1	0	-1	1.4
			Through & Right	1542	1	0	-1	1.4
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	0	0	0	0.0
		Oxley Street (S)	Through	14690	3	13	10	3.5
		Atchison Street (W)	Right	14691	2	2	0	0.0
	Atchison Street (E)	Oxley Street (S)	Left	14693	0	1	1	1.4
		Atchison Street (W)	Through	14694	0	0	0	0.0
		Oxley Street (N)	Right	14695	0	0	0	0.0
	Oxley Street (S)	Atchison Street (W)	Left	14684	2	6	4	2.0
		Oxley Street (N)	Through	14685	4	4	0	0.0
		Atchison Street (E)	Right	14686	0	0	0	0.0
	Atchison Street (W)	Oxley Street (N)	Left	14688	3	2	-1	0.6
		Atchison Street (E)	Through	14689	0	0	0	0.0
		Oxley Street (S)	Right	14687	1	3	2	1.4
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	2	0	-2	2.0
		Alexander Street (S)	Through	1847	4	2	-2	1.2
	Ernest Street	Alexander Street (S)	Left	1845	4	4	0	0.0
		Alexander Street (N)	Right	1846	8	2	-6	2.7
	Alexander Street (S)	Alexander Street (N)	Through	1844	6	6	0	0.0
		Ernest Street	Right	1843	6	0	-6	3.5
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	4	7	3	1.3
	Ella Street (SW)	Ella Street (NE)	Through	15183	5	12	7	2.4

Calibration Results - LV (4:45pm - 5:45pm)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	98	60	-38	4.3
		Pacific Highway (S)	Through	946	1237	1239	2	0.1
	Hotham Parade	Pacific Highway (S)	Left	944	74	45	-29	3.8
		Pacific Highway (N)	Right	945	407	403	-4	0.2
	Pacific Highway (S)	Pacific Highway (N)	Through	943	1375	1397	22	0.6
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	151	173	22	1.7
		Pacific Highway (NW)	Right	1308	270	279	9	0.5
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	1116	1167	51	1.5
		Campbell Street	Right	1311	146	127	-19	1.6
	Pacific Highway (NW)	Campbell Street	Left	1306	111	108	-3	0.3
		Pacific Highway (SE)	Through	1307	1150	1196	46	1.3
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	45	19	-26	4.6
		Campbell Street (SW)	Through	2148	51	67	16	2.1
		Reserve Road (NW)	Right	2147	42	45	3	0.5
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	107	197	90	7.3
		Reserve Road (NW)	Through	1589	459	399	-60	2.9
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	96	95	-1	0.1
		Bunnings Artarmon	Through	2144	43	53	10	1.4
		Reserve Road (SE)	Right	1590	107	95	-12	1.2
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	50	37	-13	2.0
		Reserve Road (SE)	Through	1592	323	335	12	0.7
		Campbell Street (SW)	Right	1593	86	95	9	0.9
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	88	71	-17	1.9
		Pacific Highway (NW)	Right	1320	90	116	26	2.6
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	1322	1275	-47	1.3
		Westbourne Street	Right	1319	59	49	-10	1.4
	Pacific Highway (NW)	Westbourne Street	Left	1317	78	48	-30	3.8
		Pacific Highway (SE)	Through	1316	1340	1346	6	0.2
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	494	522	28	1.2
		Pacific Highway (NW)	Through	1332	1205	1183	-22	0.6
	Greenwich Road	Pacific Highway (NW)	Left	1330	113	133	20	1.8
		Pacific Highway (E)	Right	1329	323	289	-34	1.9
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	1122	1209	87	2.5
		Greenwich Road	Right	1333	241	162	-79	5.6
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	175	159	-16	1.2
		Berry Road	Through	1400	3	4	1	0.5
		Pacific Highway (W)	Right	1399	89	100	11	1.1
	Pacific Highway (E)	Berry Road	Left	1397	47	75	28	3.6
		Pacific Highway (W)	Through	1396	1412	1406	-6	0.2
		Reserve Road	Right	1398	47	49	2	0.3
	Berry Road	Pacific Highway (W)	Left	1393	69	64	-5	0.6
		Reserve Road	Through	1395	4	0	-4	2.8
		Pacific Highway (E)	Right	1394	58	73	15	1.9
	Pacific Highway (W)	Reserve Road	Left	1392	45	66	21	2.8
		Pacific Highway (E)	Through	1391	1318	1358	40	1.1
		Berry Road	Right	1390	65	69	4	0.5
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	425	486	61	2.9
		Pacific Highway (W)	Right	1405	142	133	-9	0.8
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	1372	1382	10	0.3
		Herbert Street	Right	1408	329	259	-70	4.1
	Pacific Highway (W)	Herbert Street	Left	1403	145	105	-40	3.6
		Pacific Highway (E)	Through	1404	1401	1498	97	2.5
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	45	19	-26	4.6
		Christie Street (S)	Through	1420	47	31	-16	2.6
		Pacific Highway (W)	Right	1418	325	314	-11	0.6
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	22	33	11	2.1
		Christie Street (S)	Through	1415	1364	1326	-38	1.0
	Pacific Highway (W)	Christie Street (N)	Left	1414	331	326	-5	0.3
		Pacific Highway (E)	Through	1412	1535	1672	137	3.4
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	38	35	-3	0.5
		Pacific Highway (NW)	Right	1437	462	435	-27	1.3
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	923	932	9	0.3
		Albany Street	Right	1436	109	110	1	0.1
	Pacific Highway (NW)	Albany Street	Left	1434	429	529	100	4.6
		Pacific Highway (SE)	Through	1433	1150	1120	-30	0.9
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	68	30	-38	5.4
		Oxley Street (SW)	Through	1446	75	62	-13	1.6
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	80	48	-32	4.0
		Pacific Highway (NW)	Through	1445	924	930	6	0.2
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	104	112	8	0.8
		Oxley Street (NE)	Through	1441	168	175	7	0.5
		Pacific Highway (SE)	Right	1440	98	54	-44	5.0
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	72	35	-37	5.1
		Pacific Highway (SE)	Through	1450	1110	1135	25	0.7

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	798	751	-47	1.7
	Warringah Freeway	Brook Street (S)	Left	1698	233	211	-22	1.5
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	80	68	-12	1.4
		Willoughby Road (S)	Through	1669	305	290	-15	0.9
		Chandos Street (W)	Right	1667	204	161	-43	3.2
	Chandos Street (E)	Willoughby Road (S)	Left	1672	29	28	-1	0.2
		Chandos Street (W)	Through	1670	242	177	-65	4.5
		Willoughby Road (N)	Right	1671	134	189	55	4.3
	Willoughby Road (S)	Chandos Street (W)	Left	1673	26	10	-16	3.8
		Willoughby Road (N)	Through	1674	284	197	-87	5.6
		Chandos Street (E)	Right	1675	34	17	-17	3.4
	Chandos Street (W)	Willoughby Road (N)	Left	1664	133	155	22	1.8
		Chandos Street (E)	Through	1665	485	446	-39	1.8
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	22	25	3	0.6
		Shirley Road	Through	1472	416	433	17	0.8
		Pacific Highway (NW)	Right	1474	362	358	-4	0.2
	Pacific Highway (SE)	Shirley Road	Left	1469	362	372	10	0.5
		Pacific Highway (NW)	Through	1471	468	469	1	0.0
	Shirley Road	Pacific Highway (NW)	Left	1468	37	55	18	2.7
		Falcon Street	Through	1467	342	408	66	3.4
		Pacific Highway (SE)	Right	1466	165	182	17	1.3
	Pacific Highway (NW)	Falcon Street	Left	1477	440	376	-64	3.2
		Pacific Highway (SE)	Through	1476	843	842	-1	0.0
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	43	61	18	2.5
		Alexander Street (S)	Through	1524	248	320	72	4.3
	Falcon Street (E)	Alexander Street (S)	Left	1527	73	61	-12	1.5
		Falcon Street (W)	Through	1528	787	768	-19	0.7
	Alexander Street (S)	Falcon Street (W)	Left	1518	13	54	41	7.1
		Alexander Street (N)	Through	1519	264	289	25	1.5
		Falcon Street (E)	Right	1520	20	33	13	2.5
	Falcon Street (W)	Alexander Street (N)	Left	1522	84	92	8	0.9
		Falcon Street (E)	Through	1523	772	743	-29	1.1
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	244	255	11	0.7
		Pacific Highway (NW)	Right	1488	77	109	32	3.3
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	753	730	-23	0.8
		Alexander Street	Right	1485	281	301	20	1.2
	Pacific Highway (NW)	Alexander Street	Left	1490	16	76	60	8.8
		Pacific Highway (SE)	Through	1489	1011	973	-38	1.2
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	118	131	13	1.2
		River Road	Right	2019	653	645	-8	0.3
	Shirley Road (S)	River Road	Left	2020	154	195	41	3.1
		Shirley Road (N)	Through	2021	158	114	-44	3.8
	River Road	Shirley Road (N)	Left	2023	496	587	91	3.9
		Shirley Road (S)	Right	2022	232	118	-114	8.6
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	74	111	37	3.8
		Greenwich Road (S)	Through	1935	100	107	7	0.7
		River Road (W)	Right	1936	342	394	52	2.7
	River Road (E)	Greenwich Road (S)	Left	1931	111	101	-10	1.0
		River Road (W)	Through	1933	777	783	6	0.2
	Greenwich Road (S)	River Road (W)	Left	1942	71	75	4	0.5
		Greenwich Road (N)	Through	1941	108	110	2	0.2
		River Road (E)	Right	1940	84	87	3	0.3
	River Road (W)	Greenwich Road (N)	Left	1939	183	151	-32	2.5
		River Road (E)	Through	1937	510	492	-18	0.8
		Greenwich Road (S)	Right	1938	50	34	-16	2.5
River Road / Park Road	Park Road	River Road (E)	Left	2102	43	27	-16	2.7
		River Road (W)	Right	2103	16	22	6	1.4
	River Road (E)	River Road (W)	Through	2105	924	855	-69	2.3
		Park Road	Right	2104	21	1	-20	6.0
	River Road (W)	Park Road	Left	2100	9	10	1	0.3
		River Road (E)	Through	2101	720	705	-15	0.6
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	0	0	0	0.0
		River Road (W)	Through	2061	965	840	-125	4.2
	Eastview Street	River Road (W)	Left	2064	1	16	15	5.1
		River Road (E)	Right	2065	1	5	4	2.3
	River Road (W)	River Road (E)	Through	2058	762	718	-44	1.6
		Eastview Street	Right	2059	1	14	13	4.7
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	2	1	-1	0.8
	River Road (E)	River Road (W)	Through	1997	830	844	14	0.5
	River Road (W)	Canberra Avenue	Left	1972	35	28	-7	1.2
		River Road (E)	Through	1973	733	695	-38	1.4
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	9	22	13	3.3
		River Road (W)	Right	2012	4	8	4	1.6
	River Road (E)	River Road (W)	Through	2014	824	840	16	0.6
	River Road (W)	River Road (E)	Through	2016	764	692	-72	2.7
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	12	12	0	0.0
		Shirley Road (SW)	Through	2375	766	773	7	0.3
		Nicholson Street	Right	2374	23	22	-1	0.2

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	7	7	3.7
	Shirley Road (SW)	Nicholson Street	Left	2373	33	33	0	0.0
		Shirley Road (NE)	Through	2372	601	640	39	1.6
		Sinclair Street	Right	14706	19	20	1	0.2
	Nicholson Street	Shirley Road (NE)	Left	2370	19	6	-13	3.7
		Sinclair Street	Through	14707	2	3	1	0.6
		Shirley Road (SW)	Right	2371	5	9	4	1.5
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	12	4	-8	2.8
		Reserve Road (NW)	Right	1584	394	402	8	0.4
	Reserve Road (SE)		Through & Right	1582	426	385	-41	2.0
	Reserve Road (NW)	Frederick Street	Left	1585	297	360	63	3.5
		Reserve Road (SE)	Through	1583	48	93	45	5.4
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	7	17	10	2.9
		Frederick Street	Through	14675	48	39	-9	1.4
		Herbert Street (NW)	Right	14674	14	9	-5	1.5
	Herbert Street (SE)	Frederick Street	Left	1510	242	274	32	2.0
		Herbert Street (NW)	Through	1511	315	328	13	0.7
		St Leonards Corporate Centre	Right	14673	2	5	3	1.6
	Frederick Street	Herbert Street (NW)	Left	1509	117	105	-12	1.1
		St Leonards Corporate Centre	Through	14672	8	8	0	0.0
		Herbert Street (SE)	Right	1508	372	379	7	0.4
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	6	7	1	0.4
		Herbert Street (SE)	Through	1513	345	309	-36	2.0
		Frederick Street	Right	1512	52	60	8	1.1
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	17	35	18	3.5
			Through & Right	1543	91	72	-19	2.1
	Chandos Street (E)	Christie Street (S)	Left	1548	202	188	-14	1.0
			Through & Right	1544	97	116	19	1.8
	Christie Street (S)	Chandos Street (W)	Left	1549	55	77	22	2.7
			Through & Right	1545	326	319	-7	0.4
	Chandos Street (W)	Christie Street (N)	Left	1546	61	31	-30	4.4
			Through & Right	1542	134	127	-7	0.6
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	23	25	2	0.4
		Oxley Street (S)	Through	14690	181	243	62	4.3
		Atchison Street (W)	Right	14691	8	5	-3	1.2
	Atchison Street (E)	Oxley Street (S)	Left	14693	42	48	6	0.9
		Atchison Street (W)	Through	14694	13	18	5	1.3
		Oxley Street (N)	Right	14695	7	7	0	0.0
	Oxley Street (S)	Atchison Street (W)	Left	14684	20	37	17	3.2
		Oxley Street (N)	Through	14685	261	267	6	0.4
		Atchison Street (E)	Right	14686	31	27	-4	0.7
	Atchison Street (W)	Oxley Street (N)	Left	14688	32	29	-3	0.5
		Atchison Street (E)	Through	14689	27	13	-14	3.1
		Oxley Street (S)	Right	14687	44	38	-6	0.9
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	406	364	-42	2.1
		Alexander Street (S)	Through	1847	184	247	63	4.3
	Ernest Street	Alexander Street (S)	Left	1845	73	96	23	2.5
		Alexander Street (N)	Right	1846	331	301	-30	1.7
	Alexander Street (S)	Alexander Street (N)	Through	1844	209	257	48	3.1
		Ernest Street	Right	1843	75	106	31	3.3
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	421	349	-72	3.7
	Ella Street (SW)	Ella Street (NE)	Through	15183	188	218	30	2.1

Calibration Results - LV (5:45pm - 6:45pm)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	74	73	-1	0.1
		Pacific Highway (S)	Through	946	1425	1370	-55	1.5
	Hotham Parade	Pacific Highway (S)	Left	944	33	54	21	3.2
		Pacific Highway (N)	Right	945	204	215	11	0.8
	Pacific Highway (S)	Pacific Highway (N)	Through	943	1195	1212	17	0.5
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	129	132	3	0.3
		Pacific Highway (NW)	Right	1308	169	203	34	2.5
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	1031	1049	18	0.6
		Campbell Street	Right	1311	126	122	-4	0.4
	Pacific Highway (NW)	Campbell Street	Left	1306	84	111	27	2.7
		Pacific Highway (SE)	Through	1307	1325	1343	18	0.5
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	22	26	4	0.8
		Campbell Street (SW)	Through	2148	36	55	19	2.8
		Reserve Road (NW)	Right	2147	37	37	0	0.0
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	108	138	30	2.7
		Reserve Road (NW)	Through	1589	334	340	6	0.3
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	74	94	20	2.2
		Bunnings Artarmon	Through	2144	43	64	21	2.9
		Reserve Road (SE)	Right	1590	108	78	-30	3.1
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	33	29	-4	0.7
		Reserve Road (SE)	Through	1592	401	343	-58	3.0
		Campbell Street (SW)	Right	1593	72	55	-17	2.1
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	74	99	25	2.7
		Pacific Highway (NW)	Right	1320	84	80	-4	0.4
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	1174	1209	35	1.0
		Westbourne Street	Right	1319	75	41	-34	4.5
	Pacific Highway (NW)	Westbourne Street	Left	1317	77	56	-21	2.6
		Pacific Highway (SE)	Through	1316	1523	1418	-105	2.7
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	417	503	86	4.0
		Pacific Highway (NW)	Through	1332	1126	1161	35	1.0
	Greenwich Road	Pacific Highway (NW)	Left	1330	113	105	-8	0.8
		Pacific Highway (E)	Right	1329	306	277	-29	1.7
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	1339	1388	49	1.3
		Greenwich Road	Right	1333	208	165	-43	3.1
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	119	155	36	3.1
		Berry Road	Through	1400	6	6	0	0.0
		Pacific Highway (W)	Right	1399	75	118	43	4.4
	Pacific Highway (E)	Berry Road	Left	1397	49	60	11	1.5
		Pacific Highway (W)	Through	1396	1287	1411	124	3.4
		Reserve Road	Right	1398	65	64	-1	0.1
	Berry Road	Pacific Highway (W)	Left	1393	56	60	4	0.5
		Reserve Road	Through	1395	2	0	-2	2.0
		Pacific Highway (E)	Right	1394	79	65	-14	1.6
	Pacific Highway (W)	Reserve Road	Left	1392	38	62	24	3.4
		Pacific Highway (E)	Through	1391	1543	1537	-6	0.2
		Berry Road	Right	1390	65	75	10	1.2
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	527	555	28	1.2
		Pacific Highway (W)	Right	1405	132	163	31	2.6
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	1269	1380	111	3.0
		Herbert Street	Right	1408	321	281	-40	2.3
	Pacific Highway (W)	Herbert Street	Left	1403	136	114	-22	2.0
		Pacific Highway (E)	Through	1404	1610	1631	21	0.5
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	43	24	-19	3.3
		Christie Street (S)	Through	1420	54	43	-11	1.6
		Pacific Highway (W)	Right	1418	318	383	65	3.5
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	19	29	10	2.0
		Christie Street (S)	Through	1415	1301	1271	-30	0.8
	Pacific Highway (W)	Christie Street (N)	Left	1414	291	311	20	1.2
		Pacific Highway (E)	Through	1412	1826	1865	39	0.9
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	38	35	-3	0.5
		Pacific Highway (NW)	Right	1437	409	403	-6	0.3
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	914	889	-25	0.8
		Albany Street	Right	1436	113	116	3	0.3
	Pacific Highway (NW)	Albany Street	Left	1434	462	489	27	1.2
		Pacific Highway (SE)	Through	1433	1404	1437	33	0.9
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	59	46	-13	1.8
		Oxley Street (SW)	Through	1446	48	80	32	4.0
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	34	49	15	2.3
		Pacific Highway (NW)	Through	1445	944	914	-30	1.0
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	80	85	5	0.6
		Oxley Street (NE)	Through	1441	120	159	39	3.3
		Pacific Highway (SE)	Right	1440	85	59	-26	3.1
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	89	43	-46	5.7
		Pacific Highway (SE)	Through	1450	1352	1421	69	1.9

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	672	699	27	1.0
	Warringah Freeway	Brook Street (S)	Left	1698	232	205	-27	1.8
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	69	64	-5	0.6
		Willoughby Road (S)	Through	1669	323	272	-51	3.0
		Chandos Street (W)	Right	1667	174	157	-17	1.3
	Chandos Street (E)	Willoughby Road (S)	Left	1672	38	29	-9	1.6
		Chandos Street (W)	Through	1670	249	224	-25	1.6
		Willoughby Road (N)	Right	1671	129	171	42	3.4
	Willoughby Road (S)	Chandos Street (W)	Left	1673	15	14	-1	0.3
		Willoughby Road (N)	Through	1674	246	195	-51	3.4
		Chandos Street (E)	Right	1675	31	18	-13	2.6
	Chandos Street (W)	Willoughby Road (N)	Left	1664	125	158	33	2.8
		Chandos Street (E)	Through	1665	440	409	-31	1.5
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	22	38	16	2.9
		Shirley Road	Through	1472	391	375	-16	0.8
		Pacific Highway (NW)	Right	1474	346	381	35	1.8
	Pacific Highway (SE)	Shirley Road	Left	1469	375	359	-16	0.8
		Pacific Highway (NW)	Through	1471	462	441	-21	1.0
	Shirley Road	Pacific Highway (NW)	Left	1468	24	57	33	5.2
		Falcon Street	Through	1467	322	396	74	3.9
		Pacific Highway (SE)	Right	1466	136	122	-14	1.2
	Pacific Highway (NW)	Falcon Street	Left	1477	473	466	-7	0.3
		Pacific Highway (SE)	Through	1476	990	1089	99	3.1
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	55	63	8	1.0
		Alexander Street (S)	Through	1524	221	229	8	0.5
	Falcon Street (E)	Alexander Street (S)	Left	1527	63	50	-13	1.7
		Falcon Street (W)	Through	1528	731	765	34	1.2
	Alexander Street (S)	Falcon Street (W)	Left	1518	28	23	-5	1.0
		Alexander Street (N)	Through	1519	207	246	39	2.6
		Falcon Street (E)	Right	1520	30	45	15	2.4
	Falcon Street (W)	Alexander Street (N)	Left	1522	95	95	0	0.0
		Falcon Street (E)	Through	1523	763	831	68	2.4
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	224	224	0	0.0
		Pacific Highway (NW)	Right	1488	60	70	10	1.2
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	777	729	-48	1.7
		Alexander Street	Right	1485	248	274	26	1.6
	Pacific Highway (NW)	Alexander Street	Left	1490	17	45	28	5.0
		Pacific Highway (SE)	Through	1489	1129	1203	74	2.2
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	113	111	-2	0.2
		River Road	Right	2019	648	614	-34	1.4
	Shirley Road (S)	River Road	Left	2020	139	178	39	3.1
		Shirley Road (N)	Through	2021	95	116	21	2.0
	River Road	Shirley Road (N)	Left	2023	469	548	79	3.5
		Shirley Road (S)	Right	2022	239	145	-94	6.8
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	90	138	48	4.5
		Greenwich Road (S)	Through	1935	128	107	-21	1.9
		River Road (W)	Right	1936	449	388	-61	3.0
	River Road (E)	Greenwich Road (S)	Left	1931	102	84	-18	1.9
		River Road (W)	Through	1933	877	741	-136	4.8
	Greenwich Road (S)	River Road (W)	Left	1942	69	60	-9	1.1
		Greenwich Road (N)	Through	1941	93	80	-13	1.4
		River Road (E)	Right	1940	80	87	7	0.8
	River Road (W)	Greenwich Road (N)	Left	1939	182	158	-24	1.8
		River Road (E)	Through	1937	499	434	-65	3.0
		Greenwich Road (S)	Right	1938	34	40	6	1.0
River Road / Park Road	Park Road	River Road (E)	Left	2102	28	35	7	1.2
		River Road (W)	Right	2103	20	21	1	0.2
	River Road (E)	River Road (W)	Through	2105	873	803	-70	2.4
		Park Road	Right	2104	24	13	-11	2.6
	River Road (W)	Park Road	Left	2100	8	18	10	2.8
		River Road (E)	Through	2101	643	678	35	1.4
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	3	0	-3	2.4
		River Road (W)	Through	2061	875	799	-76	2.6
	Eastview Street	River Road (W)	Left	2064	4	17	13	4.0
		River Road (E)	Right	2065	4	2	-2	1.2
	River Road (W)	River Road (E)	Through	2058	648	704	56	2.2
		Eastview Street	Right	2059	4	10	6	2.3
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	0	1	1	1.4
	River Road (E)	River Road (W)	Through	1997	746	795	49	1.8
	River Road (W)	Canberra Avenue	Left	1972	34	44	10	1.6
		River Road (E)	Through	1973	634	663	29	1.1
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	9	13	4	1.2
		River Road (W)	Right	2012	8	3	-5	2.1
	River Road (E)	River Road (W)	Through	2014	802	790	-12	0.4
	River Road (W)	River Road (E)	Through	2016	684	670	-14	0.5
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	21	14	-7	1.7
		Shirley Road (SW)	Through	2375	742	704	-38	1.4
		Nicholson Street	Right	2374	34	17	-17	3.4

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	2	2	2.0
	Shirley Road (SW)	Nicholson Street	Left	2373	39	59	20	2.9
		Shirley Road (NE)	Through	2372	536	576	40	1.7
		Sinclair Street	Right	14706	24	35	11	2.0
	Nicholson Street	Shirley Road (NE)	Left	2370	18	7	-11	3.1
		Sinclair Street	Through	14707	5	0	-5	3.2
		Shirley Road (SW)	Right	2371	14	18	4	1.0
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	8	2	-6	2.7
		Reserve Road (NW)	Right	1584	306	341	35	1.9
	Reserve Road (SE)		Through & Right	1582	240	283	43	2.7
	Reserve Road (NW)	Frederick Street	Left	1585	296	361	65	3.6
		Reserve Road (SE)	Through	1583	37	84	47	6.0
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	7	15	8	2.4
		Frederick Street	Through	14675	25	37	12	2.2
		Herbert Street (NW)	Right	14674	7	21	14	3.7
	Herbert Street (SE)	Frederick Street	Left	1510	222	256	34	2.2
		Herbert Street (NW)	Through	1511	272	324	52	3.0
		St Leonards Corporate Centre	Right	14673	1	4	3	1.9
	Frederick Street	Herbert Street (NW)	Left	1509	81	110	29	3.0
		St Leonards Corporate Centre	Through	14672	7	7	0	0.0
		Herbert Street (SE)	Right	1508	291	372	81	4.4
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	5	3	-2	1.0
		Herbert Street (SE)	Through	1513	346	388	42	2.2
		Frederick Street	Right	1512	43	35	-8	1.3
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	10	39	29	5.9
			Through & Right	1543	72	66	-6	0.7
	Chandos Street (E)	Christie Street (S)	Left	1548	226	276	50	3.2
			Through & Right	1544	95	120	25	2.4
	Christie Street (S)	Chandos Street (W)	Left	1549	62	71	9	1.1
			Through & Right	1545	271	300	29	1.7
	Chandos Street (W)	Christie Street (N)	Left	1546	45	38	-7	1.1
			Through & Right	1542	123	126	3	0.3
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	13	16	3	0.8
		Oxley Street (S)	Through	14690	169	208	39	2.8
		Atchison Street (W)	Right	14691	8	7	-1	0.4
	Atchison Street (E)	Oxley Street (S)	Left	14693	35	46	11	1.7
		Atchison Street (W)	Through	14694	12	9	-3	0.9
		Oxley Street (N)	Right	14695	6	10	4	1.4
	Oxley Street (S)	Atchison Street (W)	Left	14684	22	31	9	1.7
		Oxley Street (N)	Through	14685	213	258	45	2.9
		Atchison Street (E)	Right	14686	17	13	-4	1.0
	Atchison Street (W)	Oxley Street (N)	Left	14688	25	40	15	2.6
		Atchison Street (E)	Through	14689	13	15	2	0.5
		Oxley Street (S)	Right	14687	23	41	18	3.2
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	386	370	-16	0.8
		Alexander Street (S)	Through	1847	191	221	30	2.1
	Ernest Street	Alexander Street (S)	Left	1845	109	89	-20	2.0
		Alexander Street (N)	Right	1846	310	289	-21	1.2
	Alexander Street (S)	Alexander Street (N)	Through	1844	247	258	11	0.7
		Ernest Street	Right	1843	54	88	34	4.0
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	319	302	-17	1.0
	Ella Street (SW)	Ella Street (NE)	Through	15183	177	212	35	2.5

Calibration Results - HV (4:45pm - 5:45pm)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	10	0	-10	4.5
		Pacific Highway (S)	Through	946	32	14	-18	3.8
	Hotham Parade	Pacific Highway (S)	Left	944	5	11	6	2.1
		Pacific Highway (N)	Right	945	7	12	5	1.6
	Pacific Highway (S)	Pacific Highway (N)	Through	943	54	50	-4	0.6
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	1	2	1	0.8
		Pacific Highway (NW)	Right	1308	1	13	12	4.5
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	52	38	-14	2.1
		Campbell Street	Right	1311	6	12	6	2.0
	Pacific Highway (NW)	Campbell Street	Left	1306	5	7	2	0.8
		Pacific Highway (SE)	Through	1307	24	21	-3	0.6
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	0	2	2	2.0
		Campbell Street (SW)	Through	2148	0	0	0	0.0
		Reserve Road (NW)	Right	2147	0	0	0	0.0
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	0	15	15	5.5
		Reserve Road (NW)	Through	1589	9	4	-5	2.0
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	9	15	6	1.7
		Bunnings Artarmon	Through	2144	0	9	9	4.2
		Reserve Road (SE)	Right	1590	1	6	5	2.7
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	0	0	0	0.0
		Reserve Road (SE)	Through	1592	7	2	-5	2.4
		Campbell Street (SW)	Right	1593	4	14	10	3.3
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	0	6	6	3.5
		Pacific Highway (NW)	Right	1320	0	2	2	2.0
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	62	46	-16	2.2
		Westbourne Street	Right	1319	0	0	0	0.0
	Pacific Highway (NW)	Westbourne Street	Left	1317	0	0	0	0.0
		Pacific Highway (SE)	Through	1316	38	24	-14	2.5
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	3	9	6	2.4
		Pacific Highway (NW)	Through	1332	63	35	-28	4.0
	Greenwich Road	Pacific Highway (NW)	Left	1330	0	10	10	4.5
		Pacific Highway (E)	Right	1329	2	5	3	1.6
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	36	26	-10	1.8
		Greenwich Road	Right	1333	3	5	2	1.0
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	7	11	4	1.3
		Berry Road	Through	1400	0	0	0	0.0
		Pacific Highway (W)	Right	1399	2	8	6	2.7
	Pacific Highway (E)	Berry Road	Left	1397	0	1	1	1.4
		Pacific Highway (W)	Through	1396	62	53	-9	1.2
		Reserve Road	Right	1398	7	0	-7	3.7
	Berry Road	Pacific Highway (W)	Left	1393	0	4	4	2.8
		Reserve Road	Through	1395	0	0	0	0.0
		Pacific Highway (E)	Right	1394	0	1	1	1.4
	Pacific Highway (W)	Reserve Road	Left	1392	0	0	0	0.0
		Pacific Highway (E)	Through	1391	39	33	-6	1.0
		Berry Road	Right	1390	0	0	0	0.0
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	5	30	25	6.0
		Pacific Highway (W)	Right	1405	2	3	1	0.6
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	67	51	-16	2.1
		Herbert Street	Right	1408	1	5	4	2.3
	Pacific Highway (W)	Herbert Street	Left	1403	13	10	-3	0.9
		Pacific Highway (E)	Through	1404	33	35	2	0.3
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	1	1	0	0.0
		Christie Street (S)	Through	1420	0	1	1	1.4
		Pacific Highway (W)	Right	1418	3	17	14	4.4
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	0	3	3	2.4
		Christie Street (S)	Through	1415	64	39	-25	3.5
	Pacific Highway (W)	Christie Street (N)	Left	1414	5	7	2	0.8
		Pacific Highway (E)	Through	1412	42	56	14	2.0
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	3	1	-2	1.4
		Pacific Highway (NW)	Right	1437	3	10	7	2.7
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	61	32	-29	4.3
		Albany Street	Right	1436	2	2	0	0.0
	Pacific Highway (NW)	Albany Street	Left	1434	3	26	23	6.0
		Pacific Highway (SE)	Through	1433	40	29	-11	1.9
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	0	2	2	2.0
		Oxley Street (SW)	Through	1446	50	47	-3	0.4
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	0	5	5	3.2
		Pacific Highway (NW)	Through	1445	14	32	18	3.8
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	0	1	1	1.4
		Oxley Street (NE)	Through	1441	0	1	1	1.4
		Pacific Highway (SE)	Right	1440	0	1	1	1.4
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	0	0	0	0.0
		Pacific Highway (SE)	Through	1450	43	30	-13	2.2

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	4	2	-2	1.2
	Warringah Freeway	Brook Street (S)	Left	1698	3	9	6	2.4
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	0	2	2	2.0
		Willoughby Road (S)	Through	1669	11	9	-2	0.6
		Chandos Street (W)	Right	1667	1	3	2	1.4
	Chandos Street (E)	Willoughby Road (S)	Left	1672	1	0	-1	1.4
		Chandos Street (W)	Through	1670	2	1	-1	0.8
		Willoughby Road (N)	Right	1671	0	9	9	4.2
	Willoughby Road (S)	Chandos Street (W)	Left	1673	0	0	0	0.0
		Willoughby Road (N)	Through	1674	11	1	-10	4.1
		Chandos Street (E)	Right	1675	0	0	0	0.0
	Chandos Street (W)	Willoughby Road (N)	Left	1664	0	3	3	2.4
		Chandos Street (E)	Through	1665	0	0	0	0.0
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	0	3	3	2.4
		Shirley Road	Through	1472	7	5	-2	0.8
		Pacific Highway (NW)	Right	1474	12	2	-10	3.8
	Pacific Highway (SE)	Shirley Road	Left	1469	11	11	0	0.0
		Pacific Highway (NW)	Through	1471	40	33	-7	1.2
	Shirley Road	Pacific Highway (NW)	Left	1468	1	1	0	0.0
		Falcon Street	Through	1467	0	6	6	3.5
		Pacific Highway (SE)	Right	1466	1	2	1	0.8
	Pacific Highway (NW)	Falcon Street	Left	1477	18	17	-1	0.2
		Pacific Highway (SE)	Through	1476	22	14	-8	1.9
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	4	1	-3	1.9
		Alexander Street (S)	Through	1524	5	7	2	0.8
	Falcon Street (E)	Alexander Street (S)	Left	1527	1	6	5	2.7
		Falcon Street (W)	Through	1528	28	8	-20	4.7
	Alexander Street (S)	Falcon Street (W)	Left	1518	0	2	2	2.0
		Alexander Street (N)	Through	1519	11	2	-9	3.5
		Falcon Street (E)	Right	1520	0	3	3	2.4
	Falcon Street (W)	Alexander Street (N)	Left	1522	20	4	-16	4.6
		Falcon Street (E)	Through	1523	0	19	19	6.2
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	5	3	-2	1.0
		Pacific Highway (NW)	Right	1488	1	10	9	3.8
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	50	35	-15	2.3
		Alexander Street	Right	1485	11	4	-7	2.6
	Pacific Highway (NW)	Alexander Street	Left	1490	1	3	2	1.4
		Pacific Highway (SE)	Through	1489	25	16	-9	2.0
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	2	4	2	1.2
		River Road	Right	2019	18	8	-10	2.8
	Shirley Road (S)	River Road	Left	2020	2	1	-1	0.8
		Shirley Road (N)	Through	2021	0	0	0	0.0
	River Road	Shirley Road (N)	Left	2023	8	11	3	1.0
		Shirley Road (S)	Right	2022	0	0	0	0.0
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	0	7	7	3.7
		Greenwich Road (S)	Through	1935	1	0	-1	1.4
		River Road (W)	Right	1936	0	10	10	4.5
	River Road (E)	Greenwich Road (S)	Left	1931	0	2	2	2.0
		River Road (W)	Through	1933	5	0	-5	3.2
	Greenwich Road (S)	River Road (W)	Left	1942	2	0	-2	2.0
		Greenwich Road (N)	Through	1941	4	6	2	0.9
		River Road (E)	Right	1940	0	5	5	3.2
	River Road (W)	Greenwich Road (N)	Left	1939	2	3	1	0.6
		River Road (E)	Through	1937	14	3	-11	3.8
		Greenwich Road (S)	Right	1938	2	2	0	0.0
River Road / Park Road	Park Road	River Road (E)	Left	2102	0	1	1	1.4
		River Road (W)	Right	2103	0	0	0	0.0
	River Road (E)	River Road (W)	Through	2105	11	3	-8	3.0
		Park Road	Right	2104	1	0	-1	1.4
	River Road (W)	Park Road	Left	2100	0	2	2	2.0
		River Road (E)	Through	2101	4	12	8	2.8
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	0	6	6	3.5
		River Road (W)	Through	2061	12	3	-9	3.3
	Eastview Street	River Road (W)	Left	2064	0	0	0	0.0
		River Road (E)	Right	2065	0	1	1	1.4
	River Road (W)	River Road (E)	Through	2058	4	7	3	1.3
		Eastview Street	Right	2059	0	6	6	3.5
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	0	2	2	2.0
	River Road (E)	River Road (W)	Through	1997	10	9	-1	0.3
	River Road (W)	Canberra Avenue	Left	1972	0	1	1	1.4
		River Road (E)	Through	1973	6	7	1	0.4
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	0	2	2	2.0
		River Road (W)	Right	2012	0	0	0	0.0
	River Road (E)	River Road (W)	Through	2014	10	9	-1	0.3
	River Road (W)	River Road (E)	Through	2016	5	9	4	1.5
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	0	4	4	2.8
		Shirley Road (SW)	Through	2375	10	12	2	0.6
		Nicholson Street	Right	2374	0	0	0	0.0

Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	0	0	0.0
	Shirley Road (SW)	Nicholson Street	Left	2373	0	0	0	0.0
		Shirley Road (NE)	Through	2372	6	10	4	1.4
		Sinclair Street	Right	14706	0	1	1	1.4
	Nicholson Street	Shirley Road (NE)	Left	2370	0	0	0	0.0
		Sinclair Street	Through	14707	0	0	0	0.0
		Shirley Road (SW)	Right	2371	0	0	0	0.0
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	0	0	0	0.0
		Reserve Road (NW)	Right	1584	24	17	-7	1.5
	Reserve Road (SE)		Through & Right	1582	0	2	2	2.0
	Reserve Road (NW)	Frederick Street	Left	1585	5	10	5	1.8
		Reserve Road (SE)	Through	1583	0	0	0	0.0
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	0	3	3	2.4
		Frederick Street	Through	14675	5	0	-5	3.2
		Herbert Street (NW)	Right	14674	0	0	0	0.0
	Herbert Street (SE)	Frederick Street	Left	1510	18	19	1	0.2
		Herbert Street (NW)	Through	1511	5	0	-5	3.2
		St Leonards Corporate Centre	Right	14673	0	1	1	1.4
	Frederick Street	Herbert Street (NW)	Left	1509	0	1	1	1.4
		St Leonards Corporate Centre	Through	14672	0	1	1	1.4
		Herbert Street (SE)	Right	1508	2	9	7	3.0
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	0	0	0	0.0
		Herbert Street (SE)	Through	1513	4	13	9	3.1
		Frederick Street	Right	1512	0	1	1	1.4
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	0	0	0	0.0
			Through & Right	1543	1	1	0	0.0
	Chandos Street (E)	Christie Street (S)	Left	1548	2	14	12	4.2
			Through & Right	1544	1	0	-1	1.4
	Christie Street (S)	Chandos Street (W)	Left	1549	1	0	-1	1.4
			Through & Right	1545	0	7	7	3.7
	Chandos Street (W)	Christie Street (N)	Left	1546	0	0	0	0.0
			Through & Right	1542	1	0	-1	1.4
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	0	0	0	0.0
		Oxley Street (S)	Through	14690	1	4	3	1.9
		Atchison Street (W)	Right	14691	0	0	0	0.0
	Atchison Street (E)	Oxley Street (S)	Left	14693	0	2	2	2.0
		Atchison Street (W)	Through	14694	0	0	0	0.0
		Oxley Street (N)	Right	14695	0	0	0	0.0
	Oxley Street (S)	Atchison Street (W)	Left	14684	0	4	4	2.8
		Oxley Street (N)	Through	14685	1	0	-1	1.4
		Atchison Street (E)	Right	14686	0	0	0	0.0
	Atchison Street (W)	Oxley Street (N)	Left	14688	0	0	0	0.0
		Atchison Street (E)	Through	14689	0	0	0	0.0
		Oxley Street (S)	Right	14687	0	2	2	2.0
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	2	0	-2	2.0
		Alexander Street (S)	Through	1847	1	2	1	0.8
	Ernest Street	Alexander Street (S)	Left	1845	2	2	0	0.0
		Alexander Street (N)	Right	1846	8	1	-7	3.3
	Alexander Street (S)	Alexander Street (N)	Through	1844	1	4	3	1.9
		Ernest Street	Right	1843	5	0	-5	3.2
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	2	16	14	4.7
	Ella Street (SW)	Ella Street (NE)	Through	15183	1	11	10	4.1

Calibration Results - HV (5:45pm - 6:45pm)

Intersection	Approach	Exit	Turn	Aimsun TID	Survey Count	Modelled Flow	Difference	GEH
Pacific Highway / Hotham Parade (TCS 579)	Pacific Highway (N)	Hotham Parade	Left	947	8	0	-8	4.0
		Pacific Highway (S)	Through	946	32	22	-10	1.9
	Hotham Parade	Pacific Highway (S)	Left	944	5	11	6	2.1
		Pacific Highway (N)	Right	945	2	7	5	2.4
	Pacific Highway (S)	Pacific Highway (N)	Through	943	47	34	-13	2.0
Pacific Highway / Campbell Street (TCS 585)	Campbell Street	Pacific Highway (SE)	Left	1309	1	0	-1	1.4
		Pacific Highway (NW)	Right	1308	1	8	7	3.3
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1310	41	31	-10	1.7
		Campbell Street	Right	1311	10	4	-6	2.3
	Pacific Highway (NW)	Campbell Street	Left	1306	6	11	5	1.7
		Pacific Highway (SE)	Through	1307	29	24	-5	1.0
Reserve Road / Campbell Street / Bunnings Artarmon (TCS 3662)	Bunnings Artarmon	Reserve Road (SE)	Left	2146	0	0	0	0.0
		Campbell Street (SW)	Through	2148	0	0	0	0.0
		Reserve Road (NW)	Right	2147	0	0	0	0.0
	Reserve Road (SE)	Campbell Street (SW)	Left	1588	1	16	15	5.1
		Reserve Road (NW)	Through	1589	3	12	9	3.3
	Campbell Street (SW)	Reserve Road (NW)	Left	1591	13	13	0	0.0
		Bunnings Artarmon	Through	2144	0	2	2	2.0
		Reserve Road (SE)	Right	1590	5	12	7	2.4
	Reserve Road (NW)	Bunnings Artarmon	Left	2145	0	0	0	0.0
		Reserve Road (SE)	Through	1592	3	4	1	0.5
		Campbell Street (SW)	Right	1593	4	10	6	2.3
Pacific Highway / Westbourne Street (TCS 1111)	Westbourne Street	Pacific Highway (SE)	Left	1321	0	5	5	3.2
		Pacific Highway (NW)	Right	1320	0	3	3	2.4
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1318	50	31	-19	3.0
		Westbourne Street	Right	1319	0	0	0	0.0
	Pacific Highway (NW)	Westbourne Street	Left	1317	0	0	0	0.0
		Pacific Highway (SE)	Through	1316	36	23	-13	2.4
Pacific Highway / Greenwich Road (TCS 883)	Pacific Highway (E)	Greenwich Road	Left	1331	5	3	-2	1.0
		Pacific Highway (NW)	Through	1332	52	27	-25	4.0
	Greenwich Road	Pacific Highway (NW)	Left	1330	1	5	4	2.3
		Pacific Highway (E)	Right	1329	1	2	1	0.8
	Pacific Highway (NW)	Pacific Highway (E)	Through	1334	38	27	-11	1.9
		Greenwich Road	Right	1333	3	0	-3	2.4
Pacific Highway / Reserve Road / Berry Road (TCS 771)	Reserve Road	Pacific Highway (E)	Left	1401	3	5	2	1.0
		Berry Road	Through	1400	0	0	0	0.0
		Pacific Highway (W)	Right	1399	1	5	4	2.3
	Pacific Highway (E)	Berry Road	Left	1397	0	9	9	4.2
		Pacific Highway (W)	Through	1396	59	34	-25	3.7
		Reserve Road	Right	1398	3	0	-3	2.4
	Berry Road	Pacific Highway (W)	Left	1393	0	2	2	2.0
		Reserve Road	Through	1395	0	0	0	0.0
		Pacific Highway (E)	Right	1394	0	0	0	0.0
	Pacific Highway (W)	Reserve Road	Left	1392	1	0	-1	1.4
		Pacific Highway (E)	Through	1391	40	29	-11	1.9
		Berry Road	Right	1390	0	0	0	0.0
Pacific Highway / Herbert Street (TCS 770)	Herbert Street	Pacific Highway (E)	Left	1406	9	19	10	2.7
		Pacific Highway (W)	Right	1405	2	1	-1	0.8
	Pacific Highway (E)	Pacific Highway (W)	Through	1407	60	42	-18	2.5
		Herbert Street	Right	1408	3	9	6	2.4
	Pacific Highway (W)	Herbert Street	Left	1403	13	5	-8	2.7
		Pacific Highway (E)	Through	1404	30	29	-1	0.2
Pacific Highway / Christie Street (TCS 769)	Christie Street (N)	Pacific Highway (E)	Left	1419	0	2	2	2.0
		Christie Street (S)	Through	1420	0	1	1	1.4
		Pacific Highway (W)	Right	1418	3	10	7	2.7
	Pacific Highway (E)	Pacific Highway (W)	Left	1416	2	1	-1	0.8
		Christie Street (S)	Through	1415	61	40	-21	3.0
	Pacific Highway (W)	Christie Street (N)	Left	1414	1	3	2	1.4
		Pacific Highway (E)	Through	1412	45	47	2	0.3
Pacific Highway / Albany Street (TCS 768)	Albany Street	Pacific Highway (SE)	Left	1438	2	0	-2	2.0
		Pacific Highway (NW)	Right	1437	5	7	2	0.8
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1435	58	34	-24	3.5
		Albany Street	Right	1436	1	1	0	0.0
	Pacific Highway (NW)	Albany Street	Left	1434	4	20	16	4.6
		Pacific Highway (SE)	Through	1433	41	31	-10	1.7
Pacific Highway / Oxley Street (TCS 767)	Oxley Street (NE)	Pacific Highway (SE)	Left	1447	0	3	3	2.4
		Oxley Street (SW)	Through	1446	46	25	-21	3.5
	Pacific Highway (SE)	Oxley Street (SW)	Left	1443	0	5	5	3.2
		Pacific Highway (NW)	Through	1445	12	34	22	4.6
	Oxley Street (SW)	Pacific Highway (NW)	Left	1442	1	1	0	0.0
		Oxley Street (NE)	Through	1441	1	1	0	0.0
		Pacific Highway (SE)	Right	1440	0	0	0	0.0
	Pacific Highway (NW)	Oxley Street (NE)	Left	1451	0	0	0	0.0
		Pacific Highway (SE)	Through	1450	43	31	-12	2.0

Warringah Fwy / Brook St	Brook Street (S)	Brook Street (N)	Through	2576	0	3	3	2.4
	Warringah Freeway	Brook Street (S)	Left	1698	3	6	3	1.4
Willoughby Road / Chandos Street (TCS 564)	Willoughby Road (N)	Chandos Street (E)	Left	1668	0	0	0	0.0
		Willoughby Road (S)	Through	1669	7	5	-2	0.8
		Chandos Street (W)	Right	1667	0	1	1	1.4
	Chandos Street (E)	Willoughby Road (S)	Left	1672	0	0	0	0.0
		Chandos Street (W)	Through	1670	1	1	0	0.0
		Willoughby Road (N)	Right	1671	0	4	4	2.8
	Willoughby Road (S)	Chandos Street (W)	Left	1673	0	1	1	1.4
		Willoughby Road (N)	Through	1674	7	4	-3	1.3
		Chandos Street (E)	Right	1675	0	0	0	0.0
	Chandos Street (W)	Willoughby Road (N)	Left	1664	0	3	3	2.4
		Chandos Street (E)	Through	1665	1	0	-1	1.4
Pacific Highway / Falcon Street / Shirley Road (TCS 765)	Falcon Street	Pacific Highway (SE)	Left	1058	1	1	0	0.0
		Shirley Road	Through	1472	1	2	1	0.8
		Pacific Highway (NW)	Right	1474	6	10	4	1.4
	Pacific Highway (SE)	Shirley Road	Left	1469	3	5	2	1.0
		Pacific Highway (NW)	Through	1471	40	30	-10	1.7
	Shirley Road	Pacific Highway (NW)	Left	1468	1	0	-1	1.4
		Falcon Street	Through	1467	1	3	2	1.4
		Pacific Highway (SE)	Right	1466	1	0	-1	1.4
	Pacific Highway (NW)	Falcon Street	Left	1477	19	15	-4	1.0
		Pacific Highway (SE)	Through	1476	21	21	0	0.0
Falcon Street / Alexander Street (TCS 764)	Alexander Street (N)	Falcon Street (E)	Left	1526	2	0	-2	2.0
		Alexander Street (S)	Through	1524	8	4	-4	1.6
	Falcon Street (E)	Alexander Street (S)	Left	1527	0	1	1	1.4
		Falcon Street (W)	Through	1528	13	13	0	0.0
	Alexander Street (S)	Falcon Street (W)	Left	1518	0	0	0	0.0
		Alexander Street (N)	Through	1519	9	8	-1	0.3
		Falcon Street (E)	Right	1520	1	4	3	1.9
	Falcon Street (W)	Alexander Street (N)	Left	1522	19	3	-16	4.8
		Falcon Street (E)	Through	1523	2	21	19	5.6
Pacific Highway / Alexander Street (TCS 763)	Alexander Street	Pacific Highway (SE)	Left	1487	8	2	-6	2.7
		Pacific Highway (NW)	Right	1488	0	3	3	2.4
	Pacific Highway (SE)	Pacific Highway (NW)	Through	1486	43	31	-12	2.0
		Alexander Street	Right	1485	10	11	1	0.3
	Pacific Highway (NW)	Alexander Street	Left	1490	0	1	1	1.4
		Pacific Highway (SE)	Through	1489	30	21	-9	1.8
River Road / Shirley Road (TCS 1870)	Shirley Road (N)	Shirley Road (S)	Through	2018	0	0	0	0.0
		River Road	Right	2019	4	6	2	0.9
	Shirley Road (S)	River Road	Left	2020	0	3	3	2.4
		Shirley Road (N)	Through	2021	1	0	-1	1.4
	River Road	Shirley Road (N)	Left	2023	9	3	-6	2.4
		Shirley Road (S)	Right	2022	1	0	-1	1.4
River Road / Greenwich Road (TCS 452)	Greenwich Road (N)	River Road (E)	Left	1934	0	3	3	2.4
		Greenwich Road (S)	Through	1935	2	0	-2	2.0
		River Road (W)	Right	1936	1	0	-1	1.4
	River Road (E)	Greenwich Road (S)	Left	1931	0	2	2	2.0
		River Road (W)	Through	1933	2	1	-1	0.8
	Greenwich Road (S)	River Road (W)	Left	1942	3	0	-3	2.4
		Greenwich Road (N)	Through	1941	1	5	4	2.3
		River Road (E)	Right	1940	0	0	0	0.0
	River Road (W)	Greenwich Road (N)	Left	1939	0	3	3	2.4
		River Road (E)	Through	1937	6	0	-6	3.5
		Greenwich Road (S)	Right	1938	1	3	2	1.4
River Road / Park Road	Park Road	River Road (E)	Left	2102	0	0	0	0.0
		River Road (W)	Right	2103	0	0	0	0.0
	River Road (E)	River Road (W)	Through	2105	4	5	1	0.5
		Park Road	Right	2104	0	1	1	1.4
	River Road (W)	Park Road	Left	2100	0	1	1	1.4
		River Road (E)	Through	2101	7	2	-5	2.4
River Road / Eastview Street	River Road (E)	Eastview Street	Left	2062	0	3	3	2.4
		River Road (W)	Through	2061	3	6	3	1.4
	Eastview Street	River Road (W)	Left	2064	0	0	0	0.0
		River Road (E)	Right	2065	0	2	2	2.0
	River Road (W)	River Road (E)	Through	2058	7	2	-5	2.4
		Eastview Street	Right	2059	0	0	0	0.0
River Road / Canberra Avenue	Canberra Avenue	River Road (E)	Left	1975	0	1	1	1.4
	River Road (E)	River Road (W)	Through	1997	2	9	7	3.0
	River Road (W)	Canberra Avenue	Left	1972	0	2	2	2.0
		River Road (E)	Through	1973	7	2	-5	2.4
River Road / Hume Street	Hume Street	River Road (E)	Left	2011	0	0	0	0.0
		River Road (W)	Right	2012	0	0	0	0.0
	River Road (E)	River Road (W)	Through	2014	4	9	5	2.0
	River Road (W)	River Road (E)	Through	2016	7	3	-4	1.8
treet /	Shirley Road (NE)	Sinclair Street	Left	14705	0	1	1	1.4
		Shirley Road (SW)	Through	2375	5	6	1	0.4
		Nicholson Street	Right	2374	0	0	0	0.0

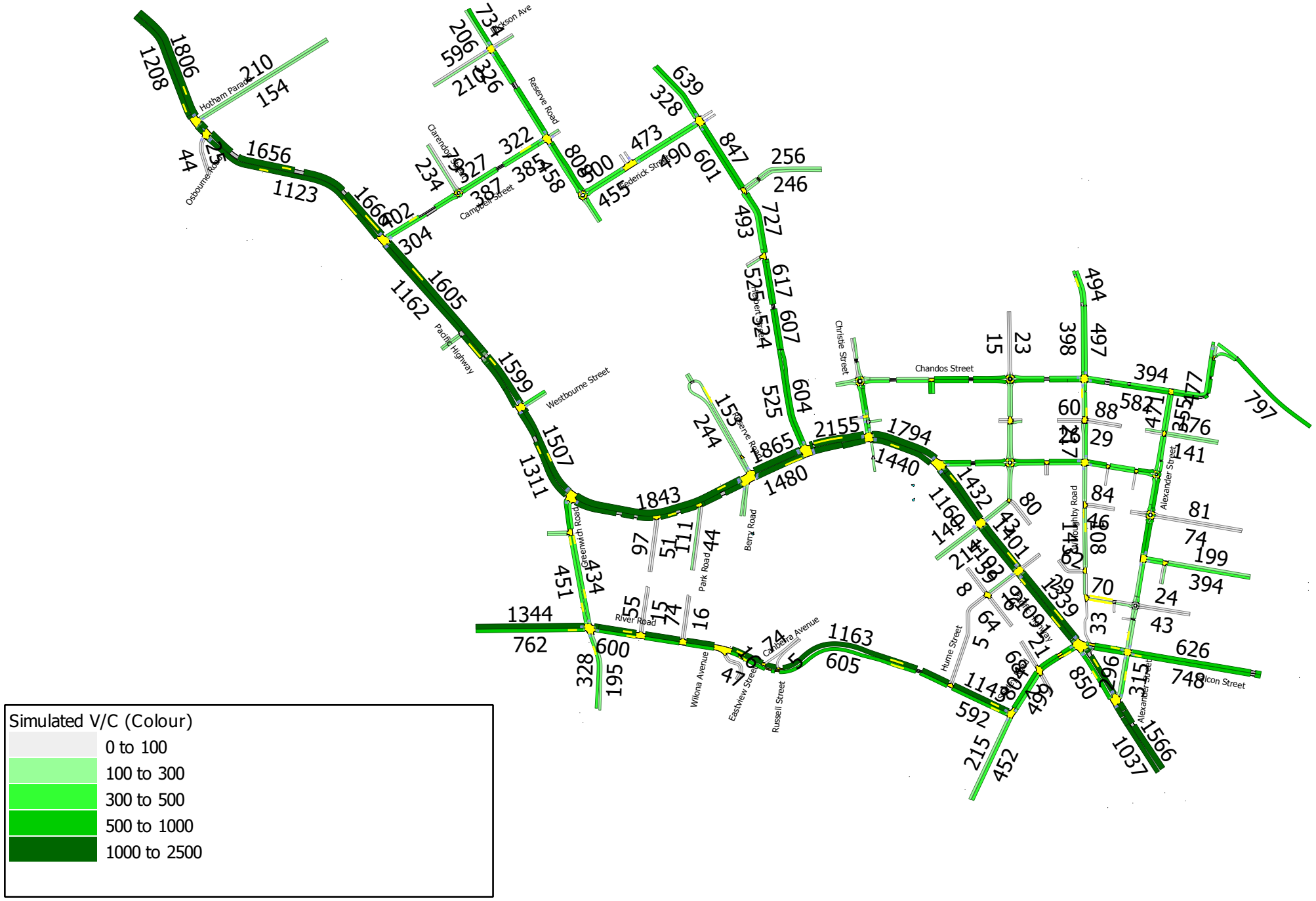
Shirley Road / Sinclair St Nicholson Street	Sinclair Street	Shirley Road (SW)	Left	14702	0	0	0	0.0
		Nicholson Street	Through	14704	0	0	0	0.0
		Shirley Road (NE)	Right	14703	0	0	0	0.0
	Shirley Road (SW)	Nicholson Street	Left	2373	1	0	-1	1.4
		Shirley Road (NE)	Through	2372	7	3	-4	1.8
		Sinclair Street	Right	14706	0	0	0	0.0
	Nicholson Street	Shirley Road (NE)	Left	2370	0	0	0	0.0
		Sinclair Street	Through	14707	0	0	0	0.0
		Shirley Road (SW)	Right	2371	0	0	0	0.0
Reserve Road / Frederick Street	Frederick Street	Reserve Road (SE)	Left	1586	0	0	0	0.0
		Reserve Road (NW)	Right	1584	19	27	8	1.7
	Reserve Road (SE)		Through & Right	1582	0	2	2	2.0
	Reserve Road (NW)	Frederick Street	Left	1585	1	16	15	5.1
		Reserve Road (SE)	Through	1583	0	0	0	0.0
Herbert Street / Frederick Street / St Leonards Corporate Centre (TCS 3518)	St Leonards Corporate Centre	Herbert Street (SE)	Left	14676	0	5	5	3.2
		Frederick Street	Through	14675	0	2	2	2.0
		Herbert Street (NW)	Right	14674	0	1	1	1.4
	Herbert Street (SE)	Frederick Street	Left	1510	16	22	6	1.4
		Herbert Street (NW)	Through	1511	0	2	2	2.0
		St Leonards Corporate Centre	Right	14673	0	1	1	1.4
	Frederick Street	Herbert Street (NW)	Left	1509	0	0	0	0.0
		St Leonards Corporate Centre	Through	14672	0	0	0	0.0
		Herbert Street (SE)	Right	1508	3	7	4	1.8
	Herbert Street (NW)	St Leonards Corporate Centre	Left	14671	0	0	0	0.0
		Herbert Street (SE)	Through	1513	3	3	0	0.0
		Frederick Street	Right	1512	0	5	5	3.2
Chandos Street / Christie Street	Christie Street (N)	Chandos Street (E)	Left	1547	0	0	0	0.0
			Through & Right	1543	0	0	0	0.0
	Chandos Street (E)	Christie Street (S)	Left	1548	1	13	12	4.5
			Through & Right	1544	0	0	0	0.0
	Christie Street (S)	Chandos Street (W)	Left	1549	0	0	0	0.0
			Through & Right	1545	0	3	3	2.4
	Chandos Street (W)	Christie Street (N)	Left	1546	1	0	-1	1.4
			Through & Right	1542	0	0	0	0.0
Oxley Street / Atchison Street	Oxley Street (N)	Atchison Street (E)	Left	14692	0	0	0	0.0
		Oxley Street (S)	Through	14690	1	8	7	3.3
		Atchison Street (W)	Right	14691	0	0	0	0.0
	Atchison Street (E)	Oxley Street (S)	Left	14693	0	1	1	1.4
		Atchison Street (W)	Through	14694	0	0	0	0.0
		Oxley Street (N)	Right	14695	0	0	0	0.0
	Oxley Street (S)	Atchison Street (W)	Left	14684	0	6	6	3.5
		Oxley Street (N)	Through	14685	0	4	4	2.8
		Atchison Street (E)	Right	14686	0	0	0	0.0
	Atchison Street (W)	Oxley Street (N)	Left	14688	0	0	0	0.0
		Atchison Street (E)	Through	14689	0	0	0	0.0
		Oxley Street (S)	Right	14687	0	1	1	1.4
Ernest Street / Alexander Street (TCS 1306)	Alexander Street (N)	Ernest Street	Left	1848	0	0	0	0.0
		Alexander Street (S)	Through	1847	1	1	0	0.0
	Ernest Street	Alexander Street (S)	Left	1845	0	1	1	1.4
		Alexander Street (N)	Right	1846	5	2	-3	1.6
	Alexander Street (S)	Alexander Street (N)	Through	1844	1	9	8	3.6
		Ernest Street	Right	1843	2	0	-2	2.0
Ella Street	Ella Street (NE)	Ella Street (SW)	Through	15185	3	14	11	3.8
	Ella Street (SW)	Ella Street (NE)	Through	15183	0	7	7	3.7

APPENDIX

B

SIMULATED FLOW

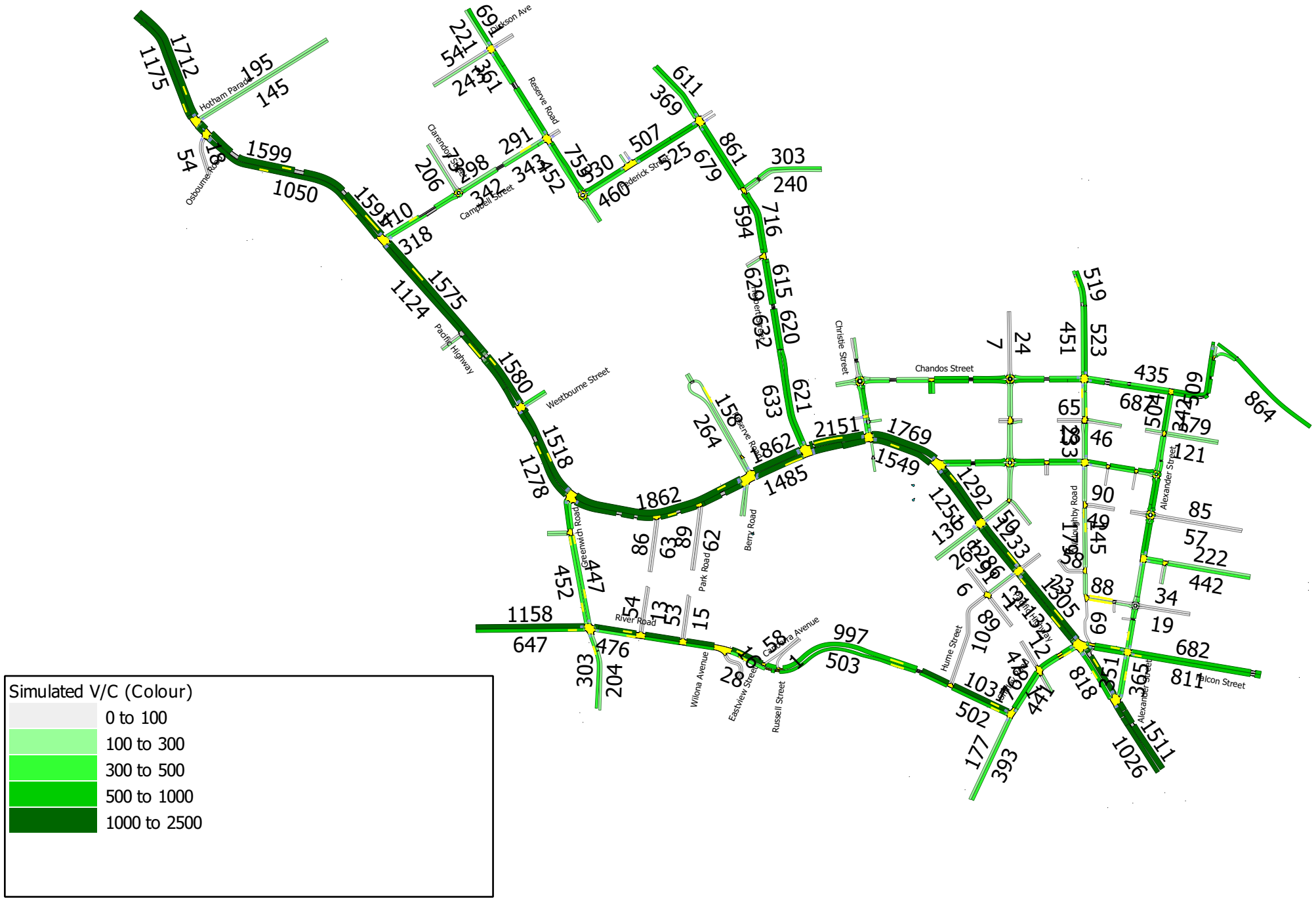
AM MODEL 86254
SIMULATED FLOW
7:30 - 8:30 AM



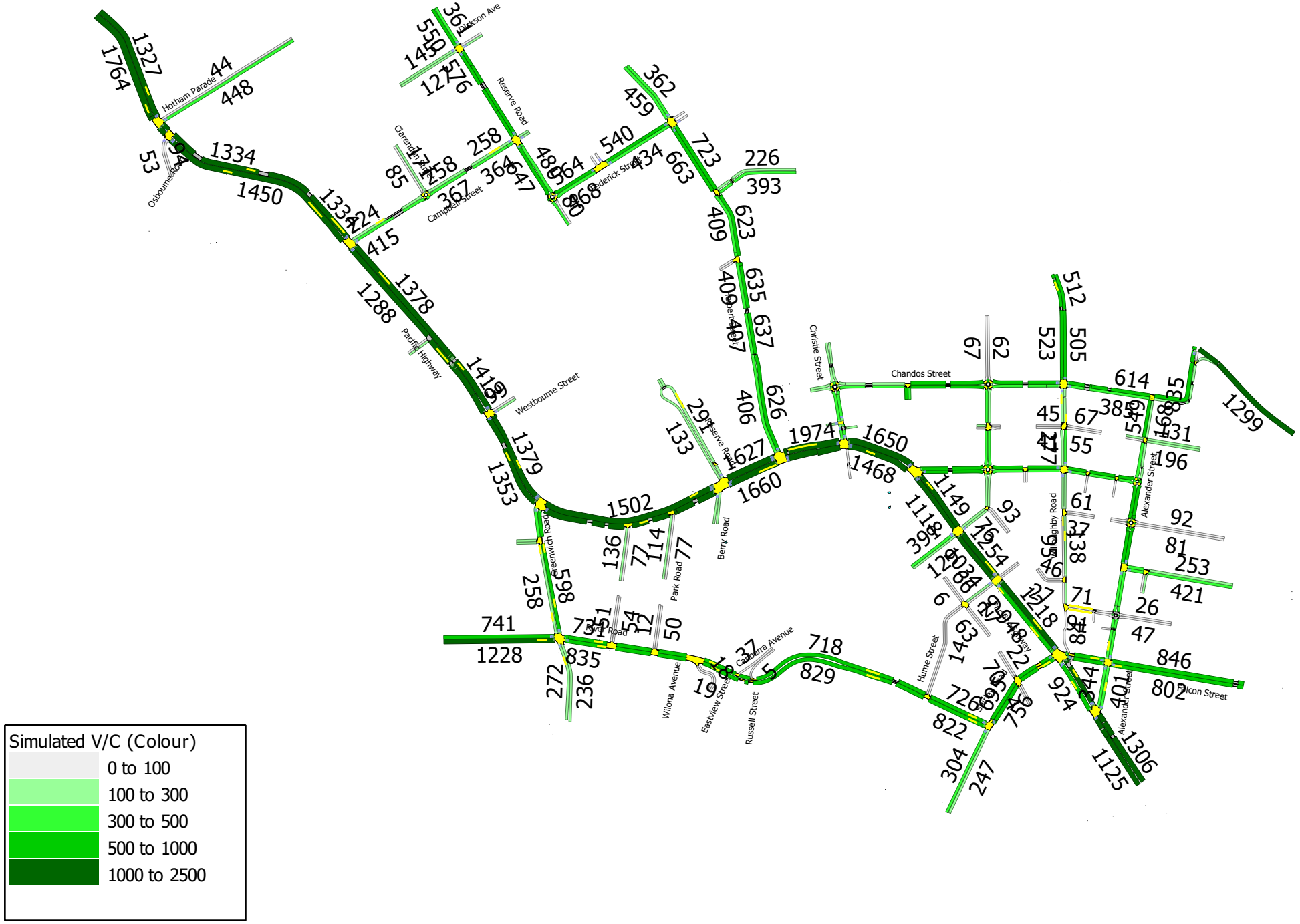
Simulated V/C (Colour)

- 0 to 100
- 100 to 300
- 300 to 500
- 500 to 1000
- 1000 to 2500

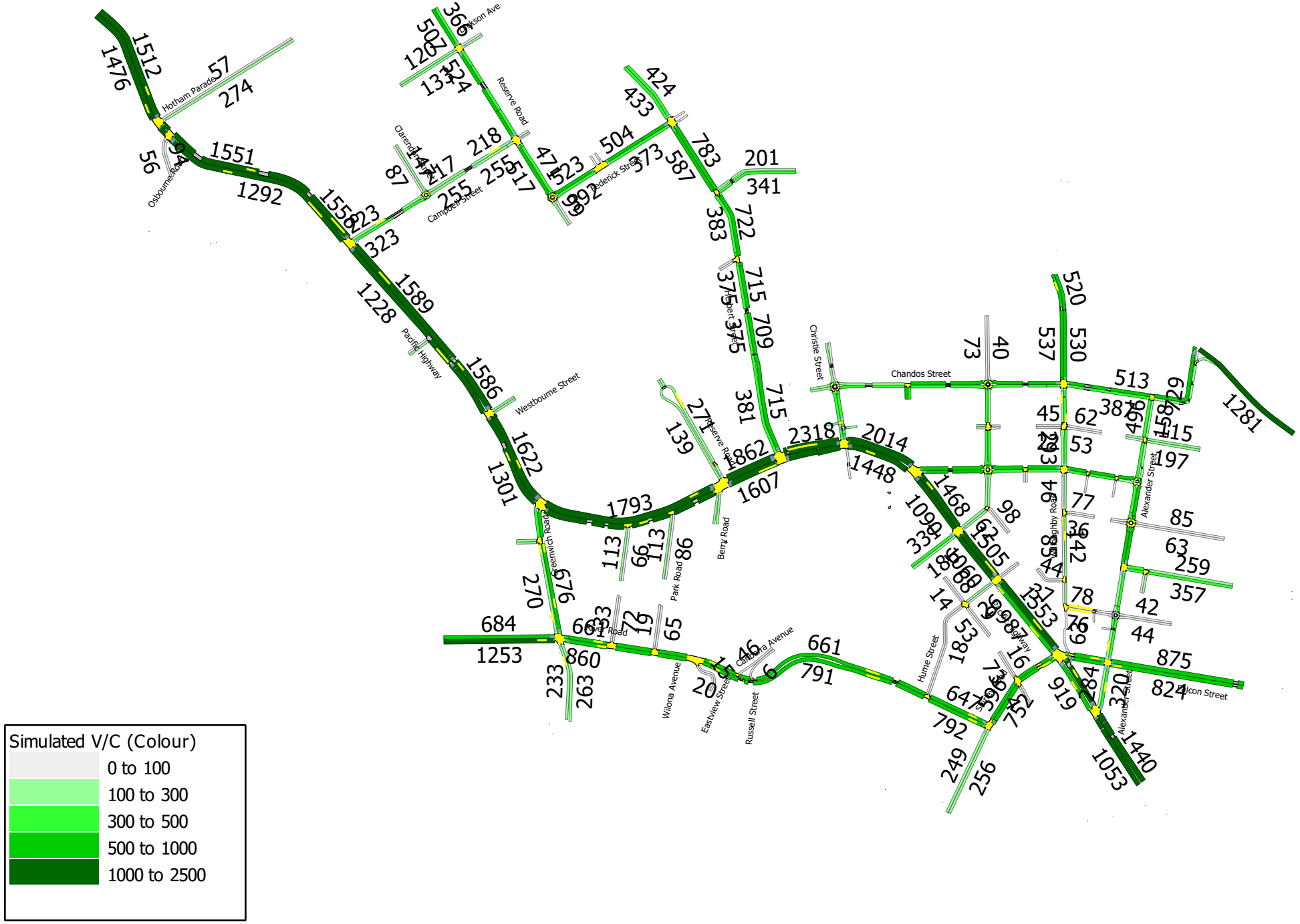
AM MODEL 86254
SIMULATED FLOW
8:30 - 9:30 AM



PM MODEL 86254
SIMULATED FLOW
4:45 - 5:45 PM



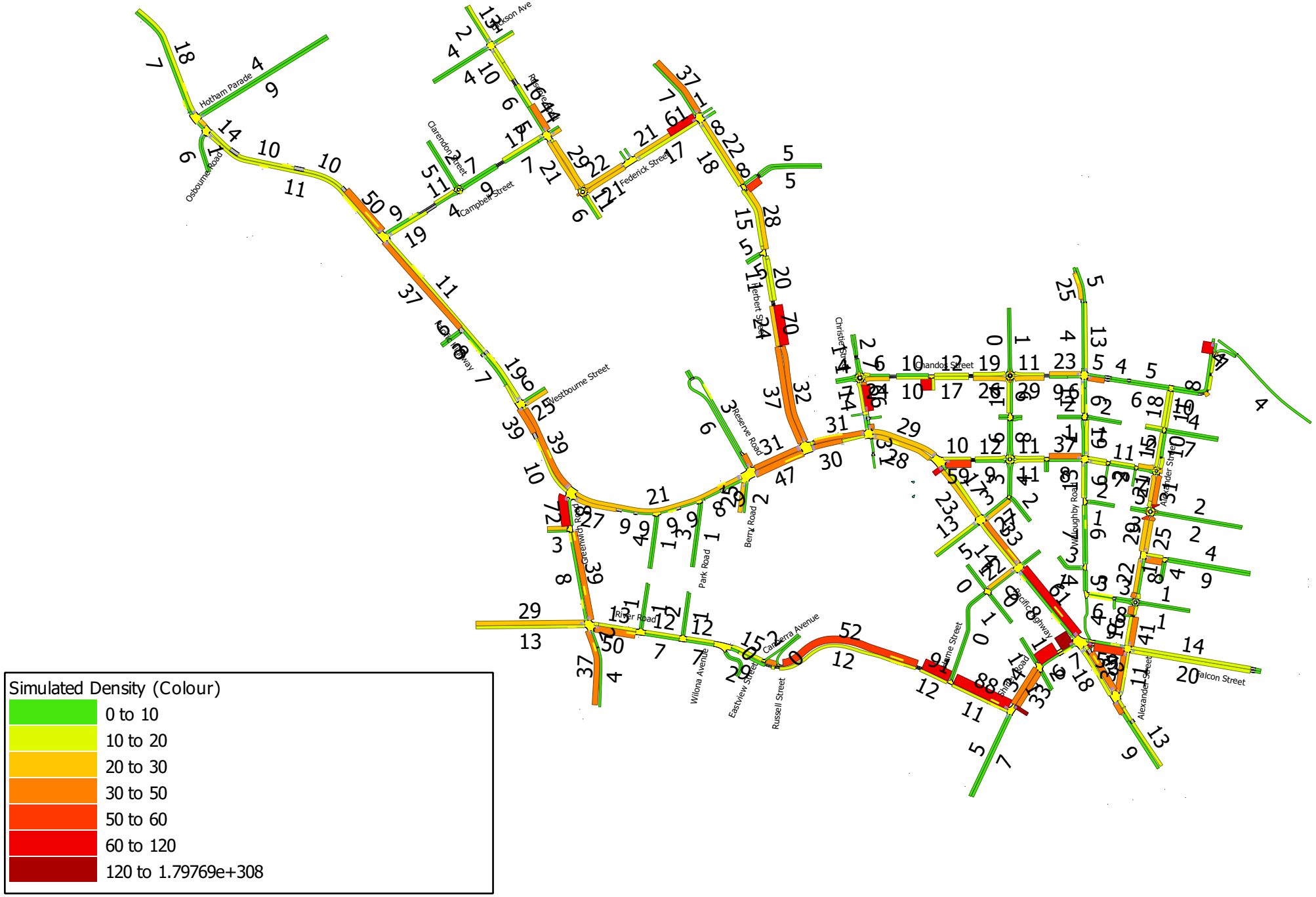
PM MODEL 86254
SIMULATED FLOW
5:45 - 6:45 PM



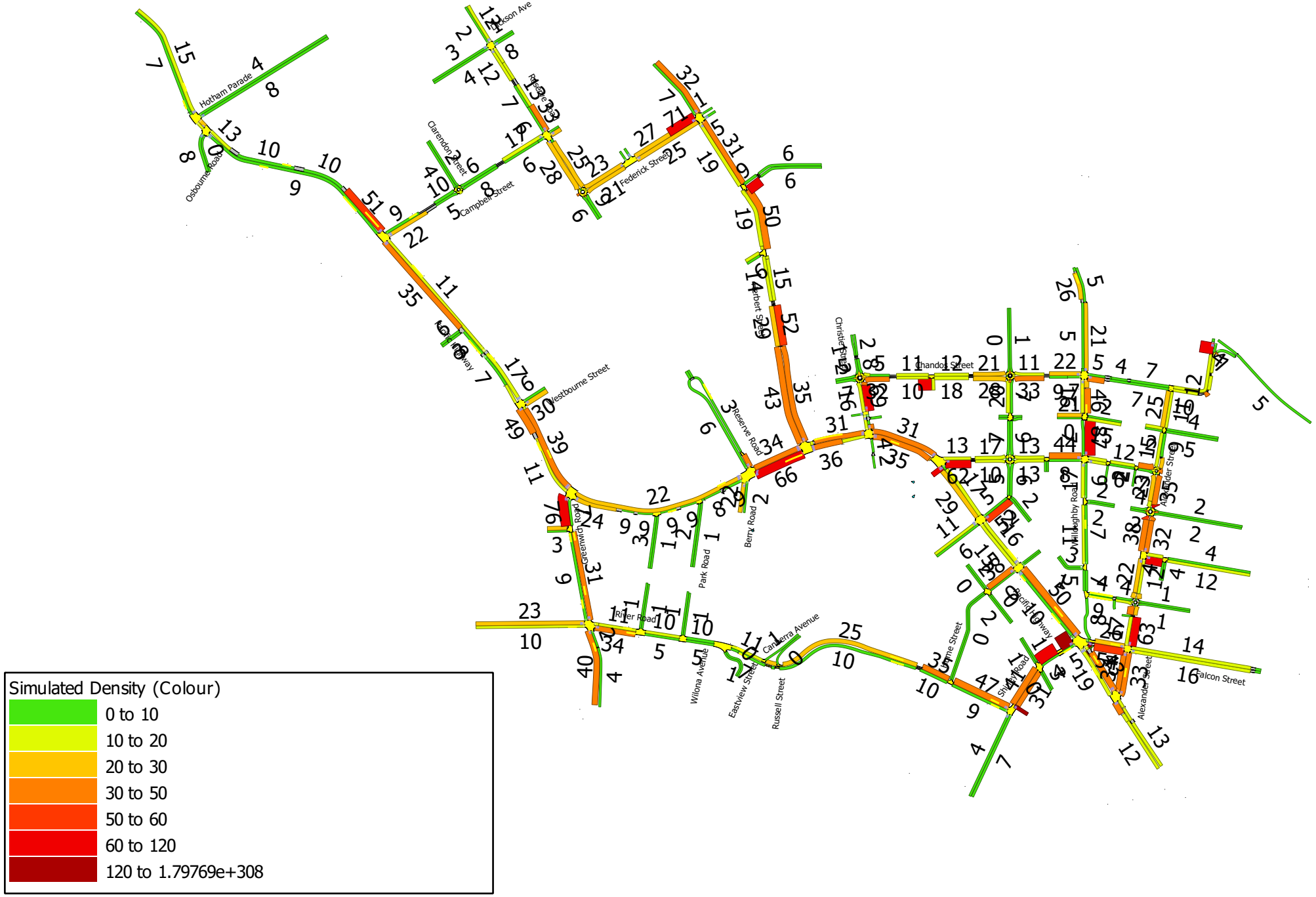
APPENDIX C

DENSITY FLOW

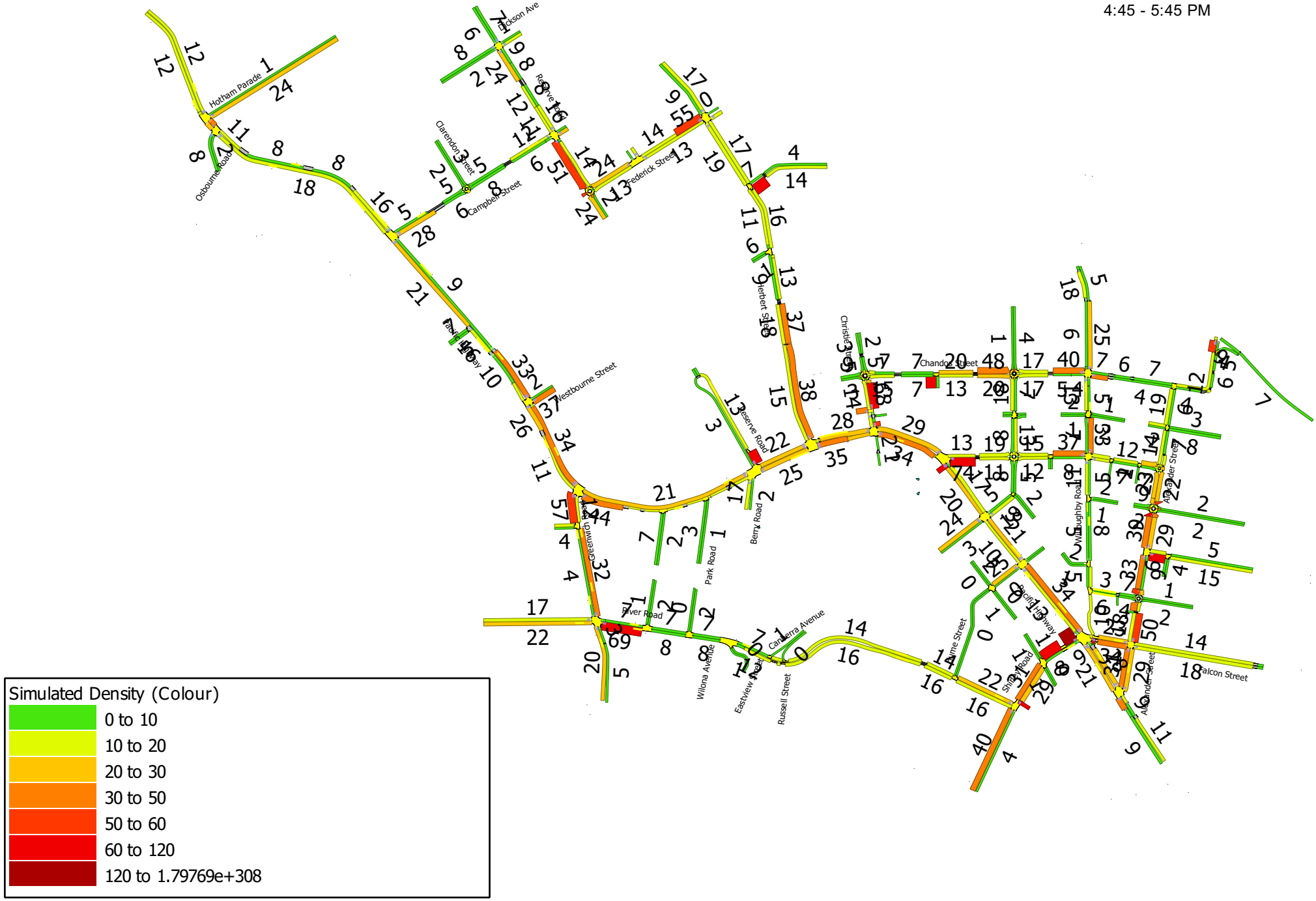
AM MODEL 86254
SIMULATED DENSITY
7:30 - 8:30 AM



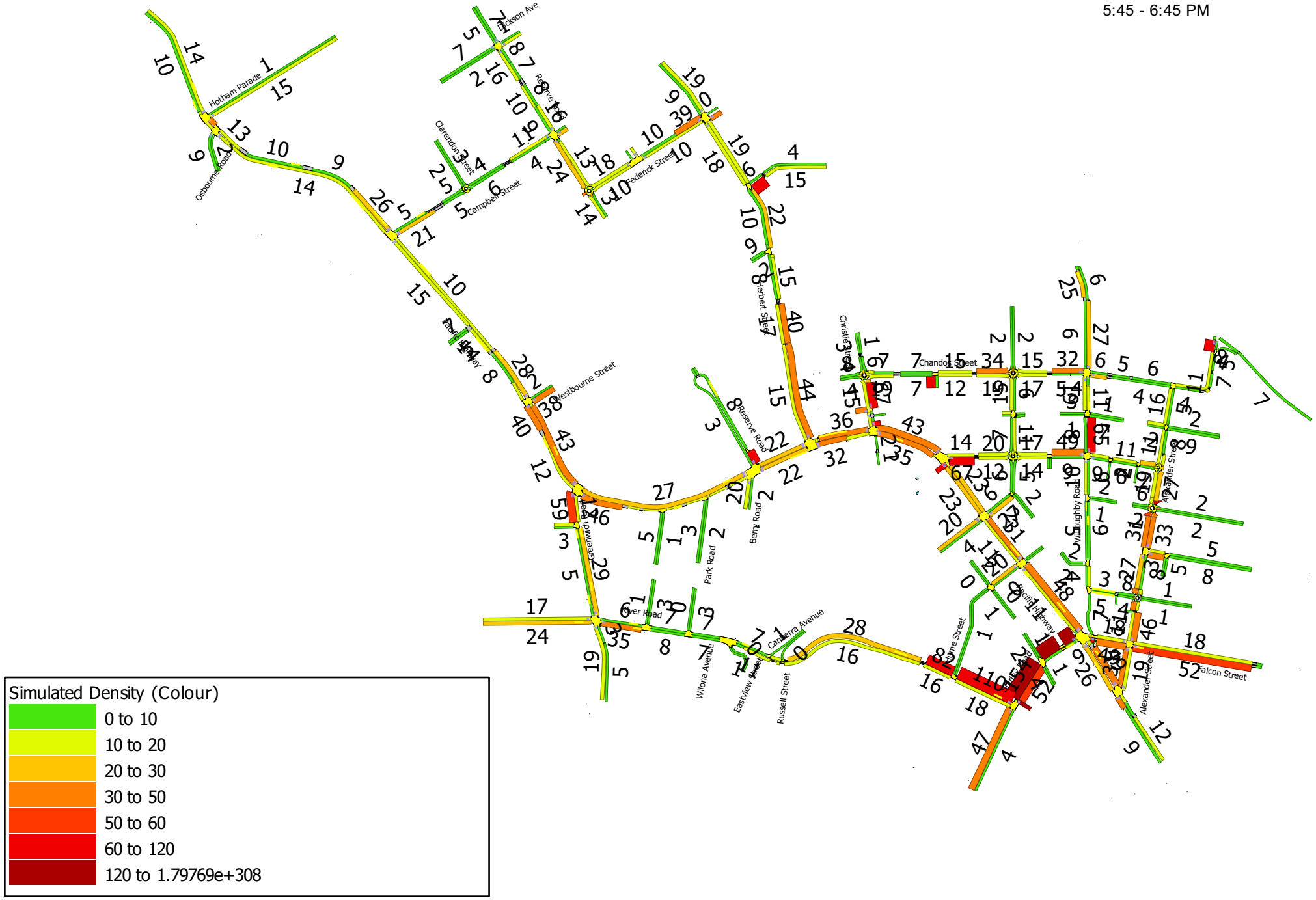
AM MODEL 86254
SIMULATED DENSITY
8:30 - 9:30 AM



PM MODEL 86254
SIMULATED DENSITY
4:45 - 5:45 PM



PM MODEL 86254
SIMULATED DENSITY
5:45 - 6:45 PM



Simulated Density (Colour)

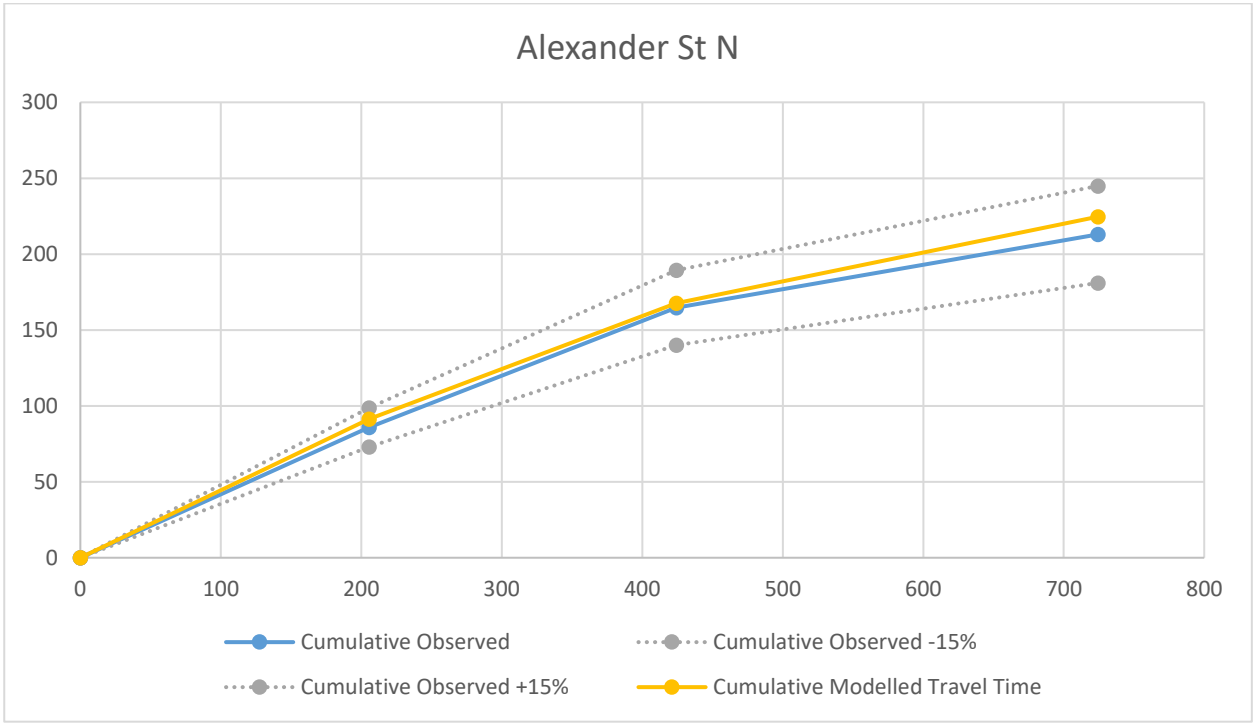
- 0 to 10
- 10 to 20
- 20 to 30
- 30 to 50
- 50 to 60
- 60 to 120
- 120 to 1.79769e+308

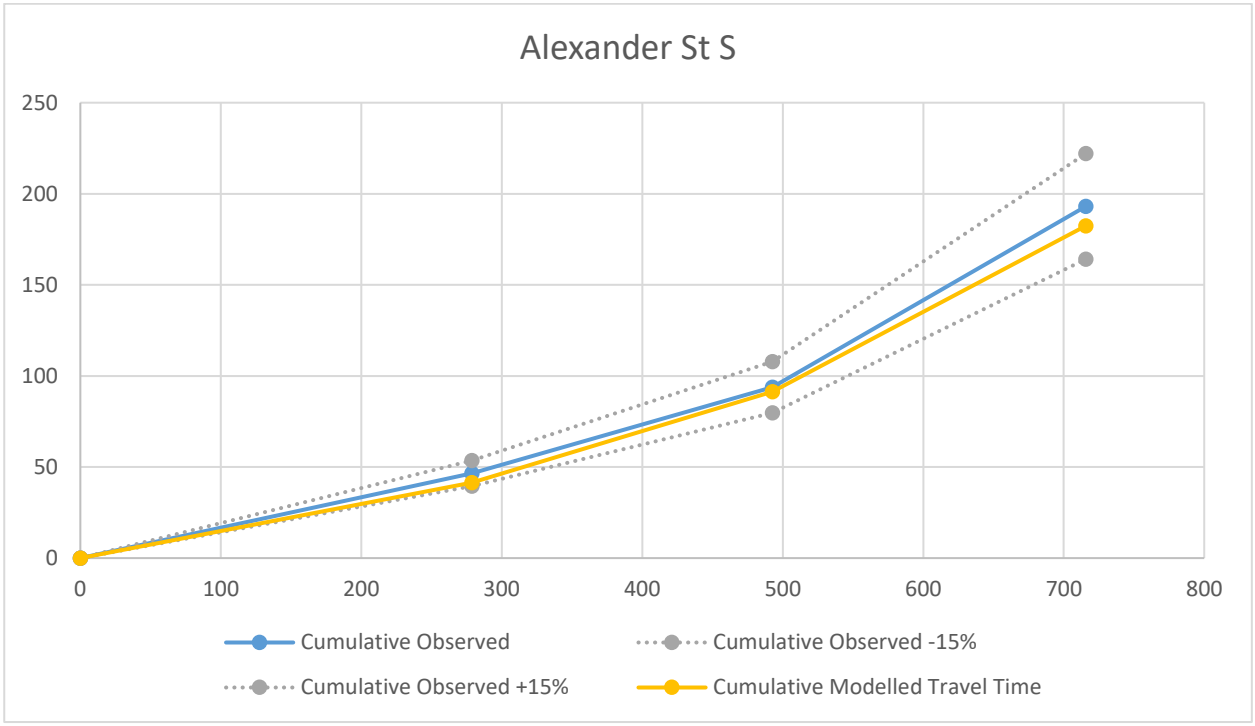
APPENDIX

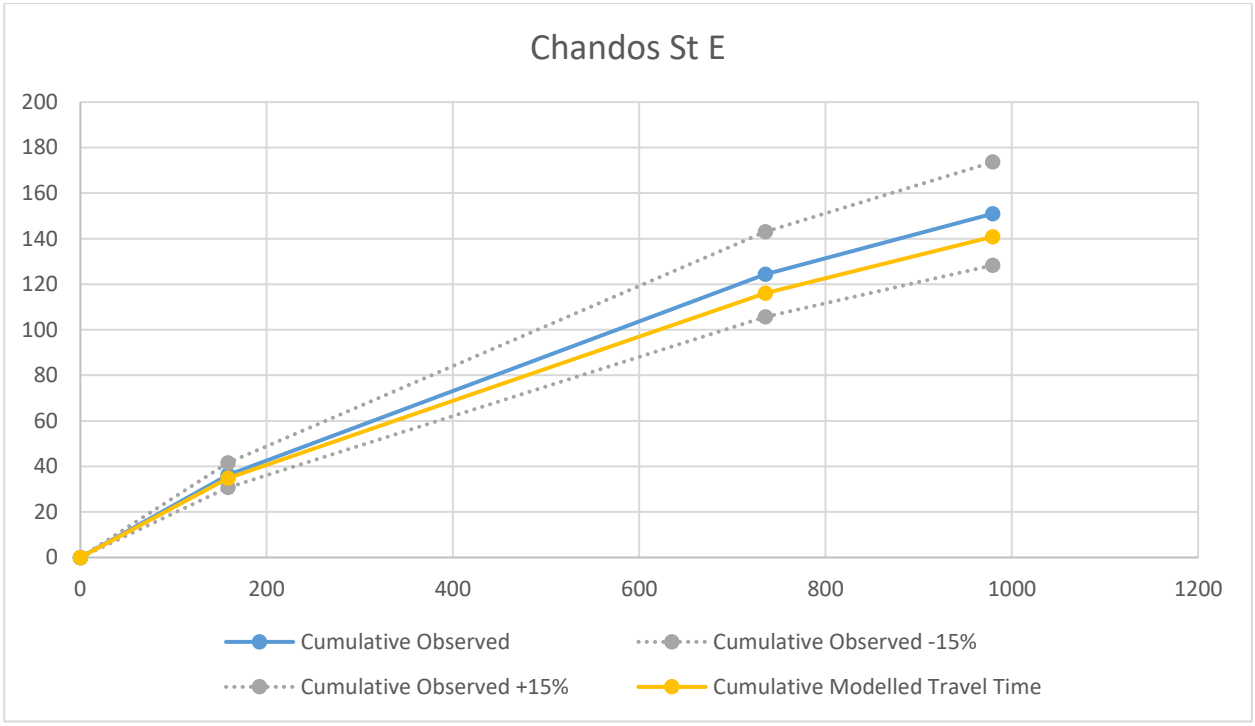
D

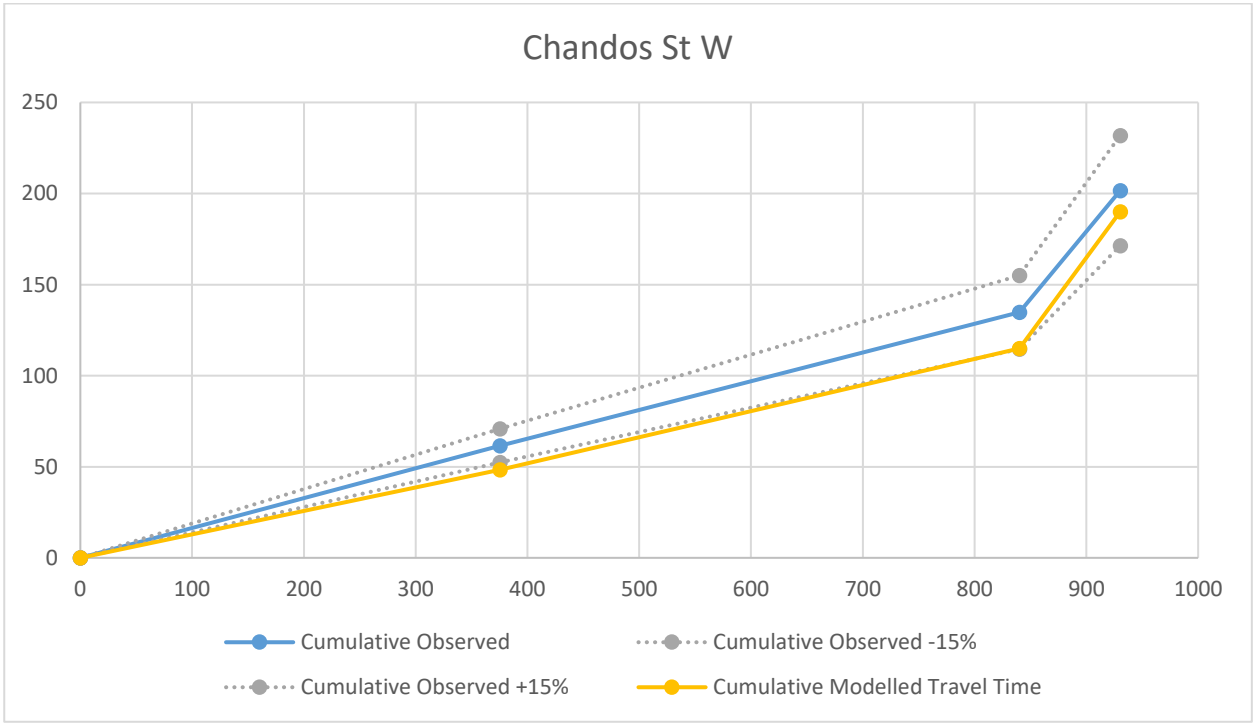
CUMULATIVE TRAVEL TIME PLOTS

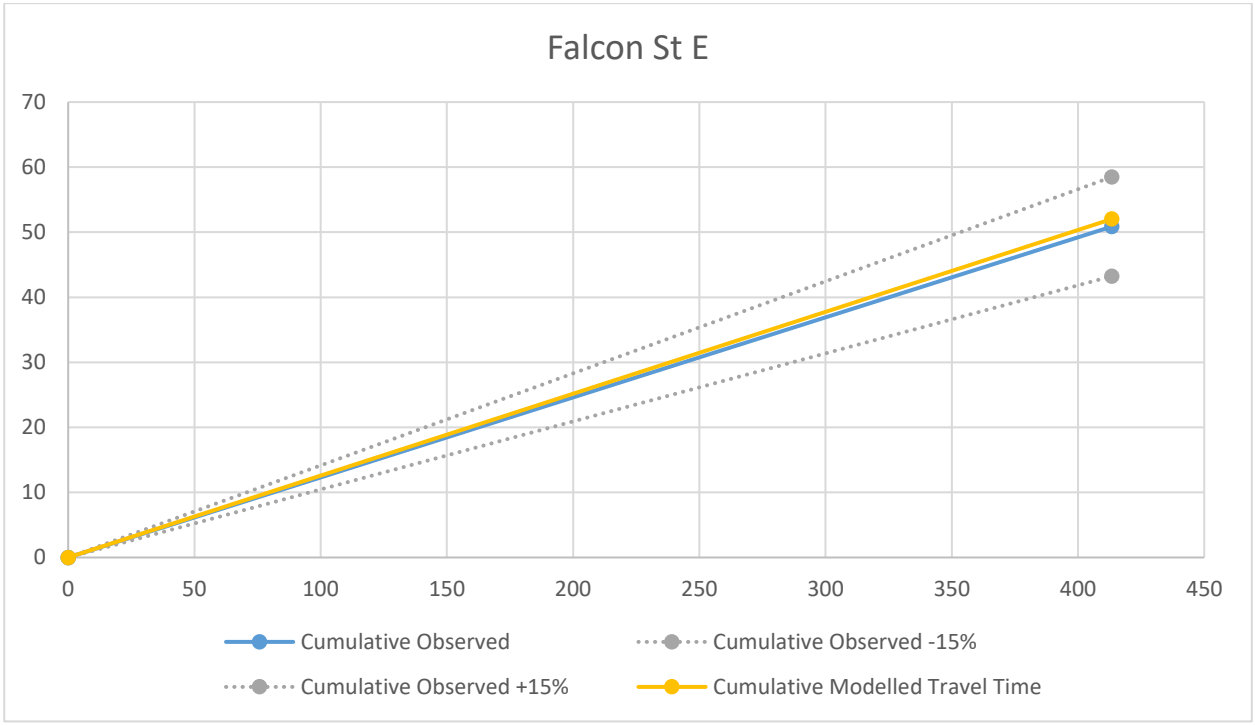
AM Peak (7:30am – 8:30am)

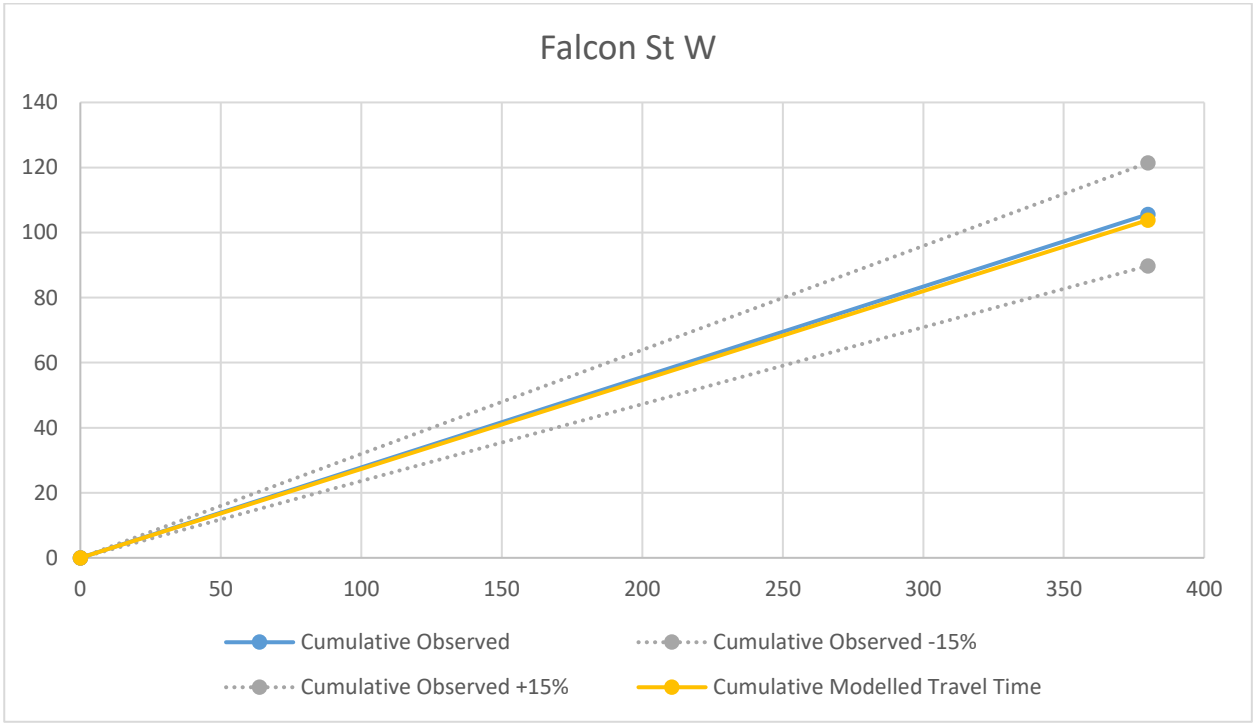


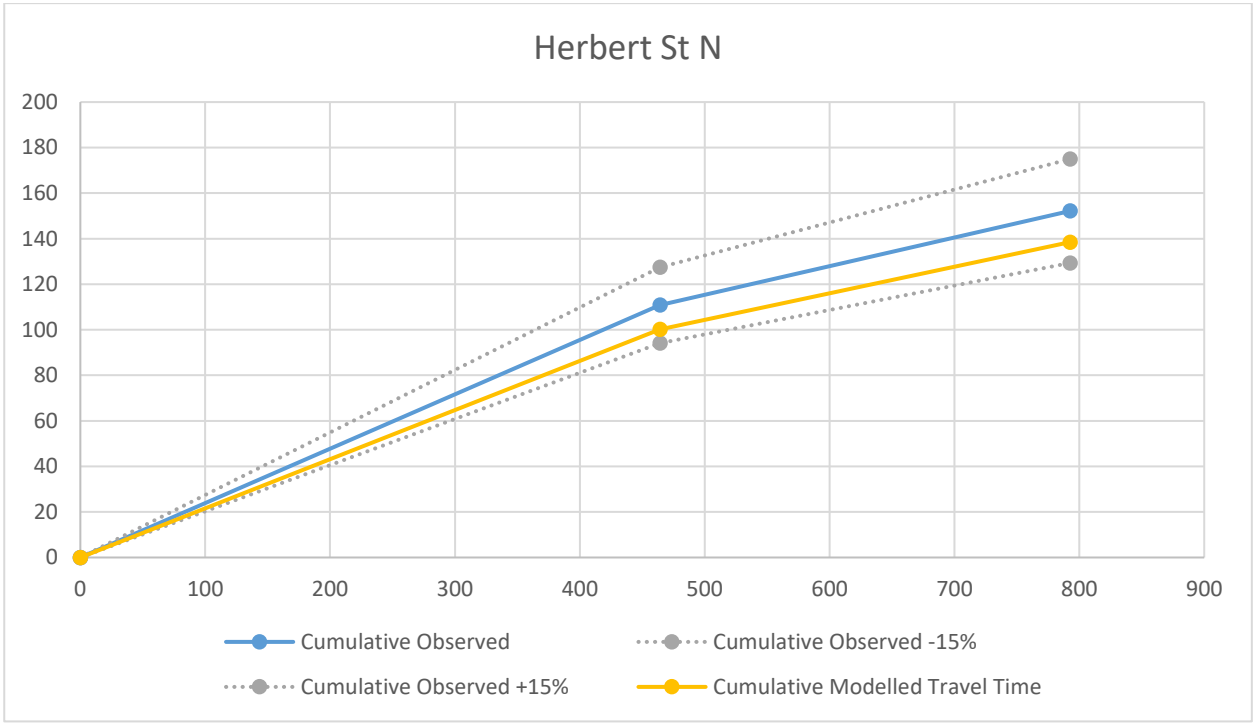


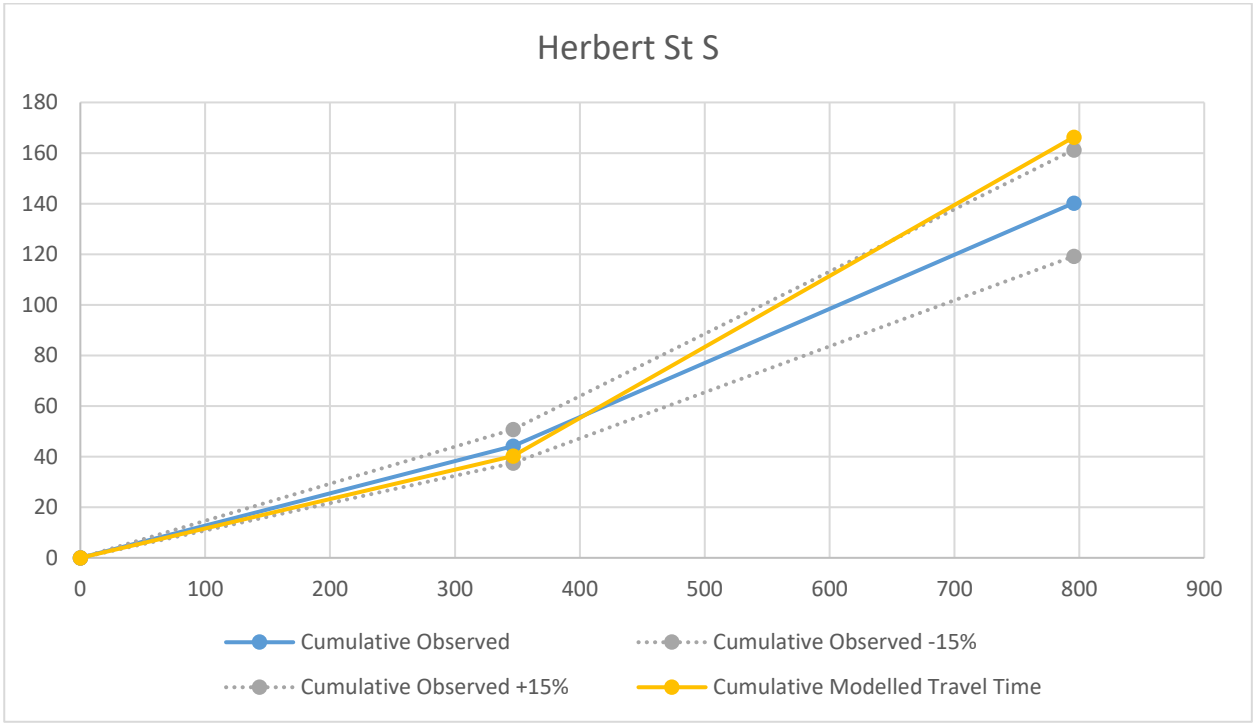

Chandos St E
200
180
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

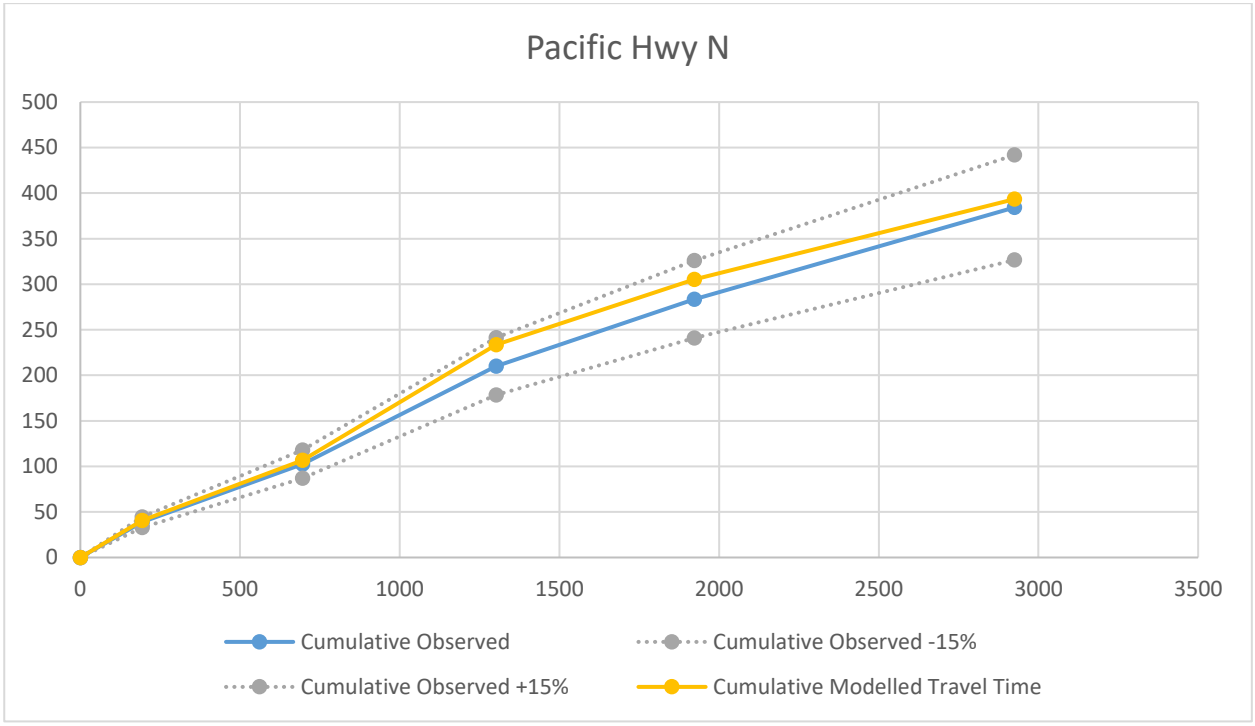

Chandos St W
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

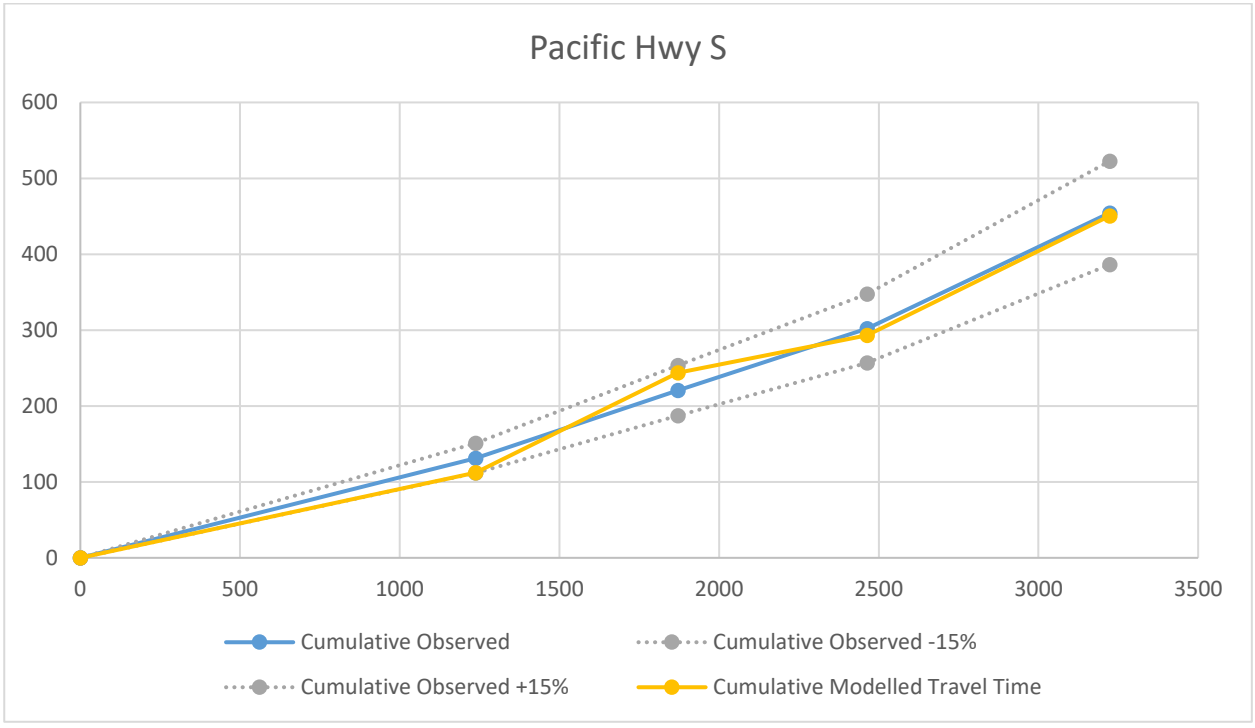

Falcon St E
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

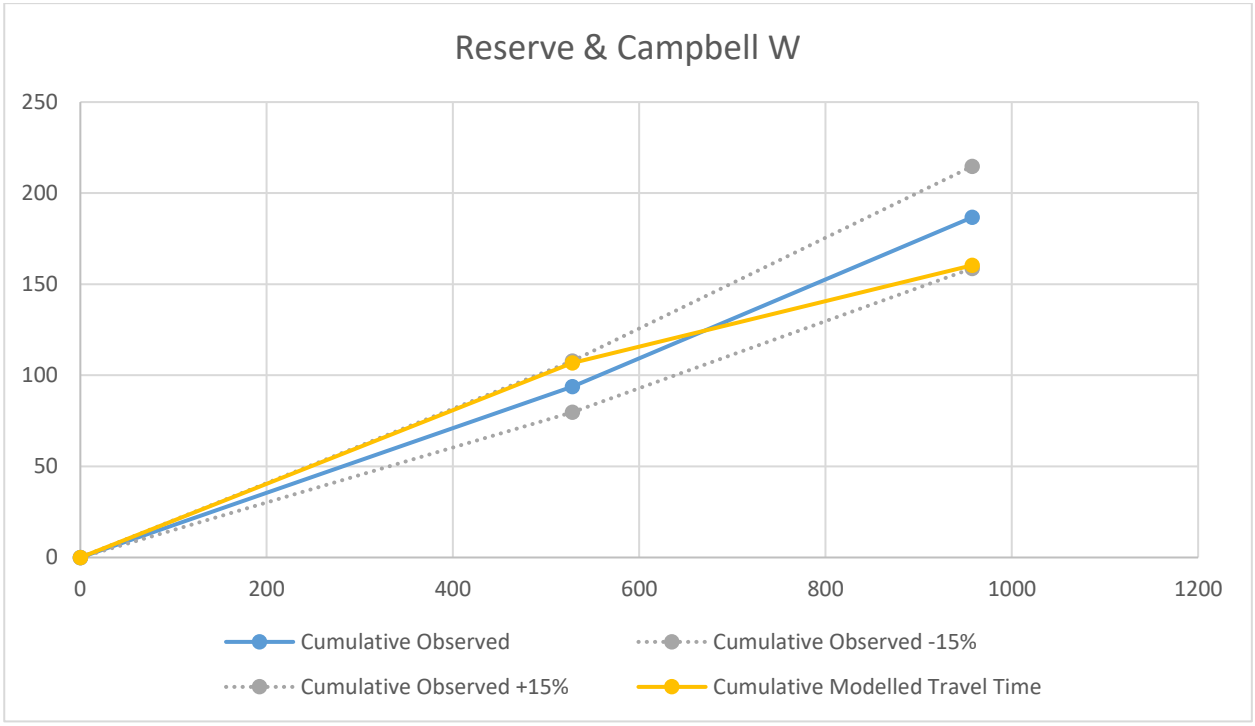

Falcon St W
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

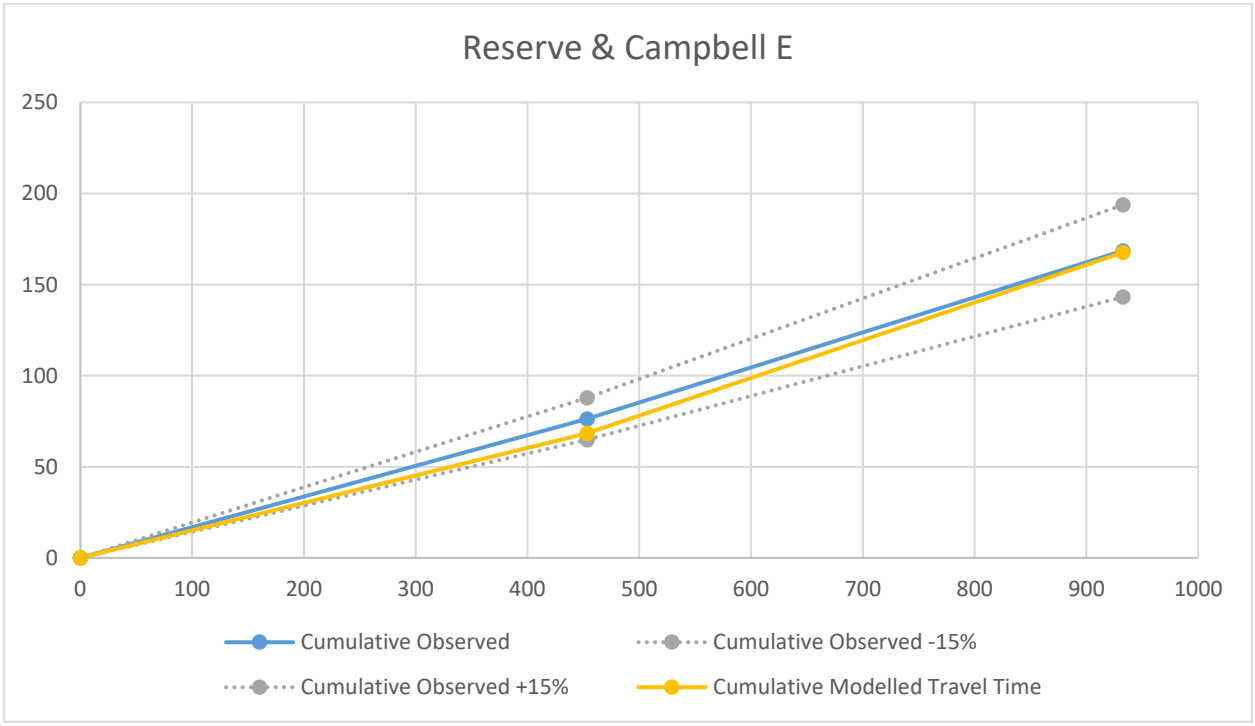

Herbert St N
200
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

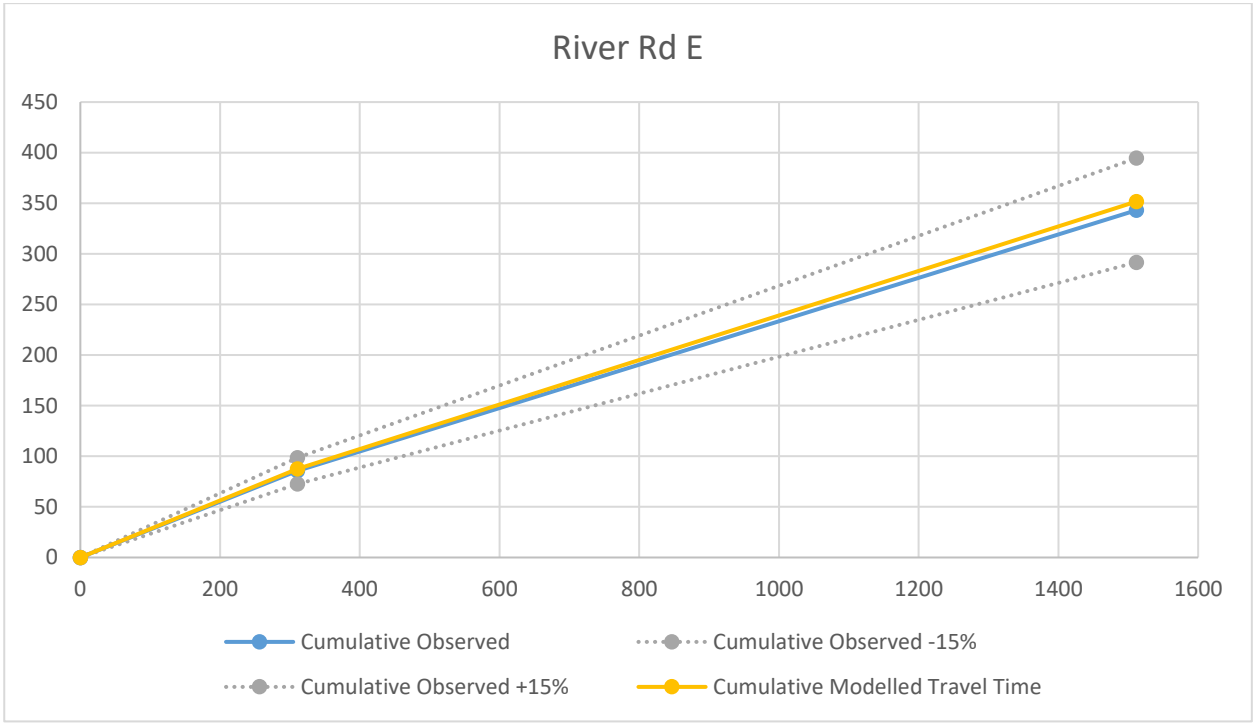

Herbert St S
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

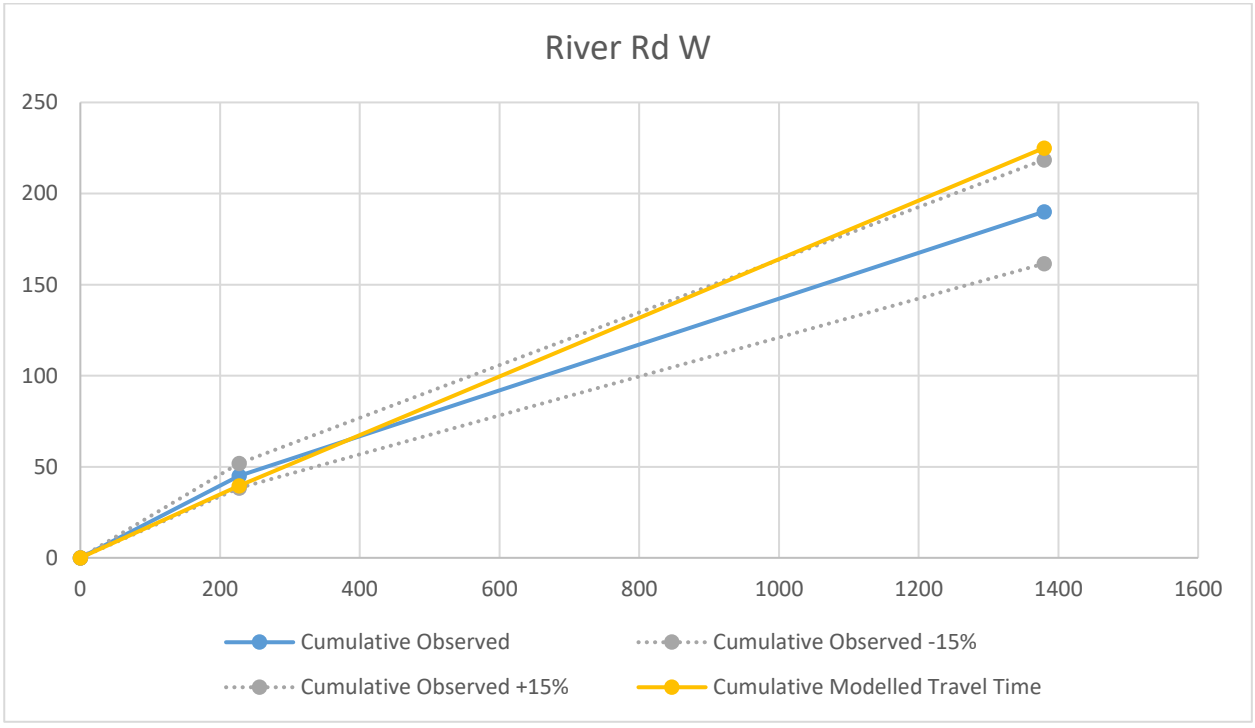

Pacific Hwy N
500
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

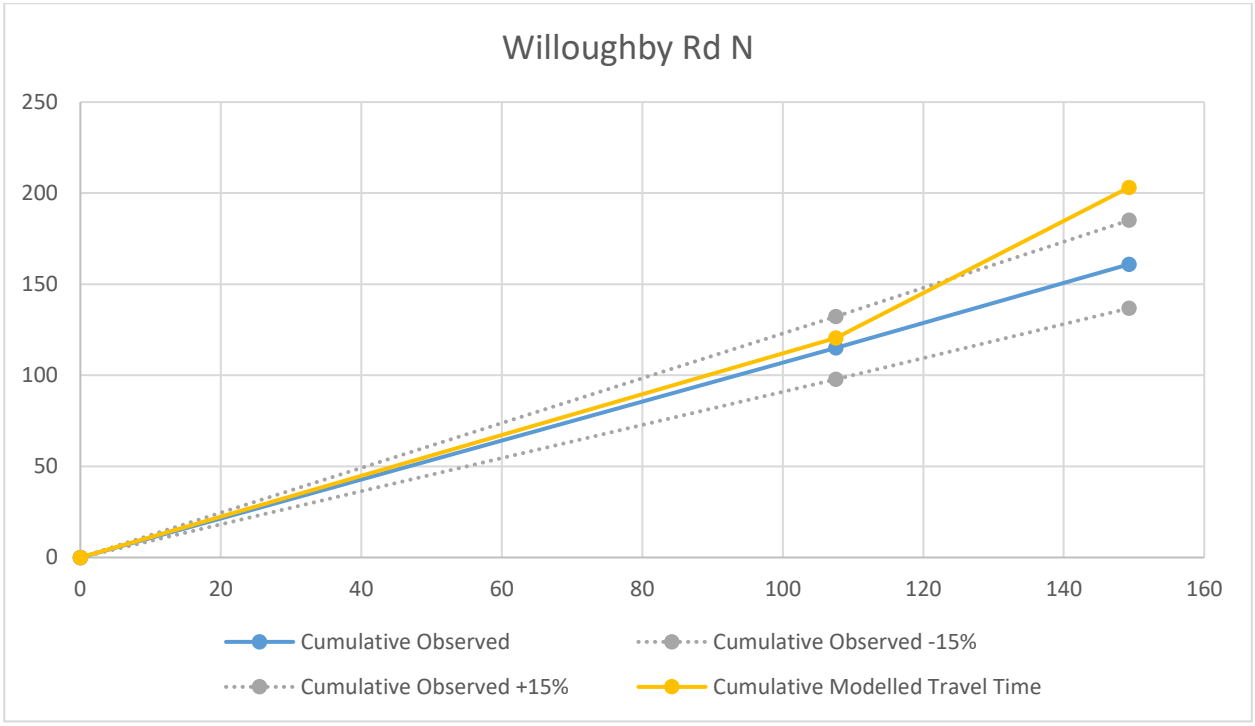

Pacific Hwy S
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

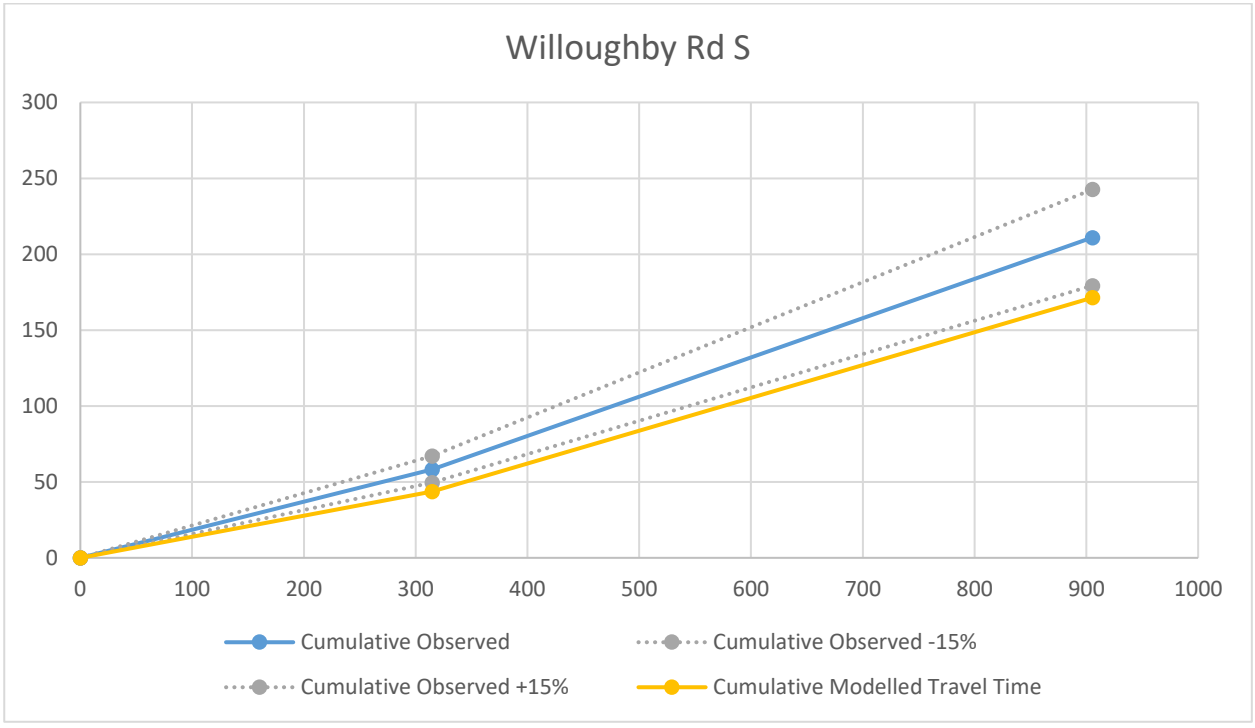

Reserve & Campbell W
250
200
150
100
50
0
0
200
400
600
800
1000
1200
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


Reserve & Campbell E
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

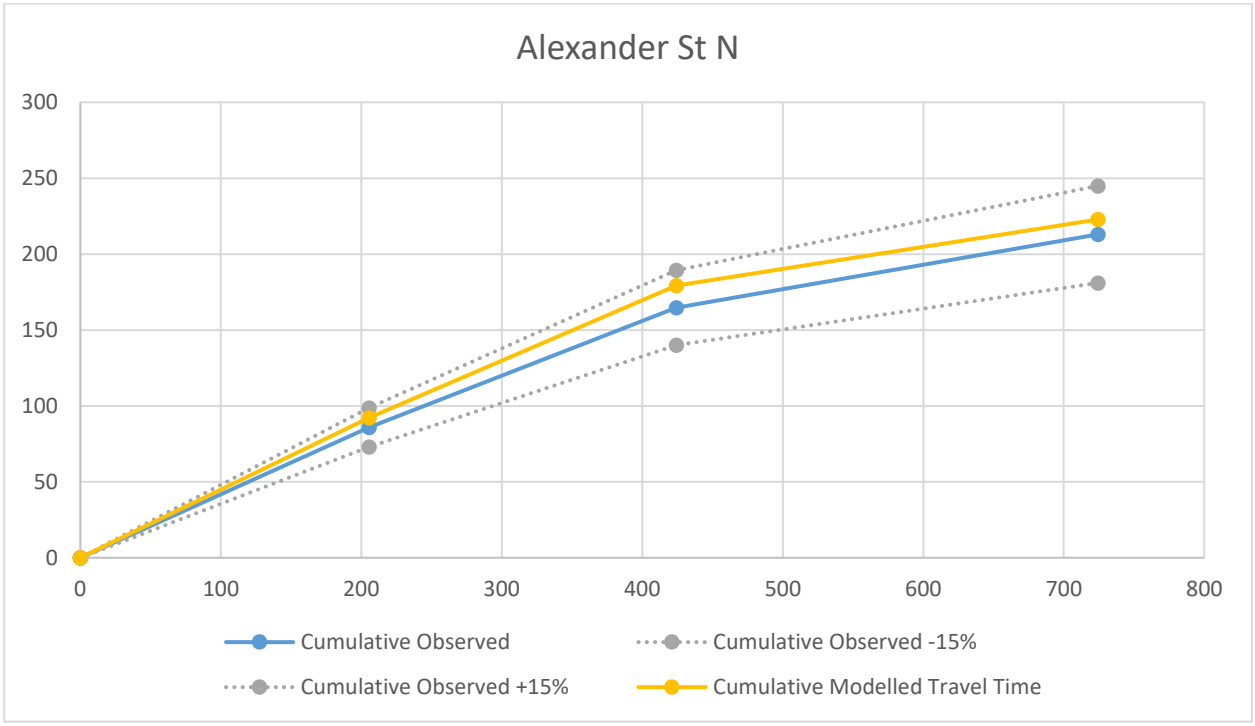

River Rd E
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

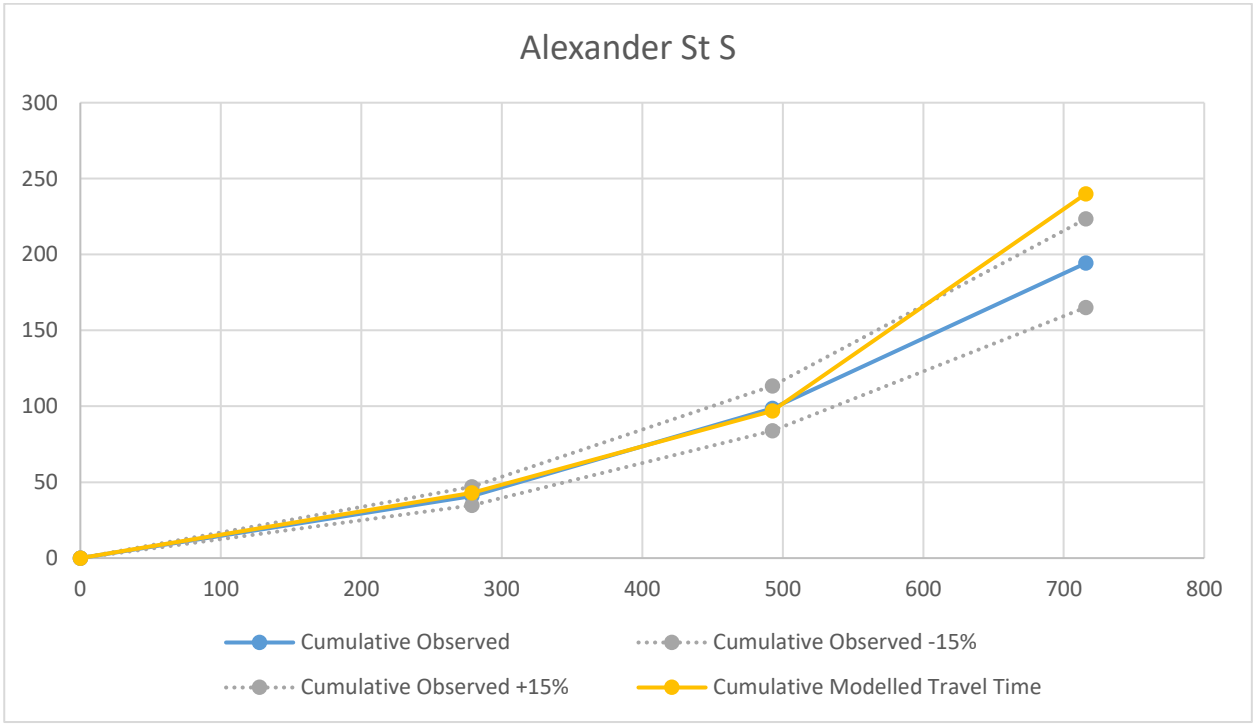

River Rd W
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

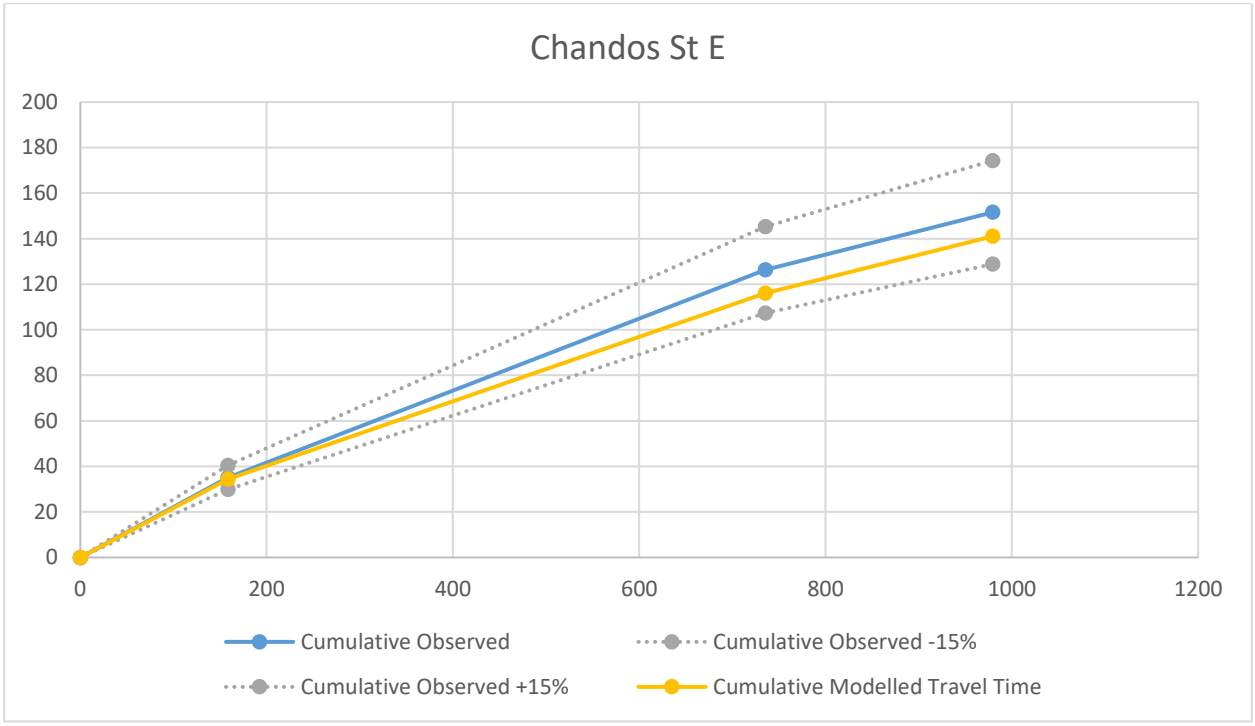

Willoughby Rd N
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

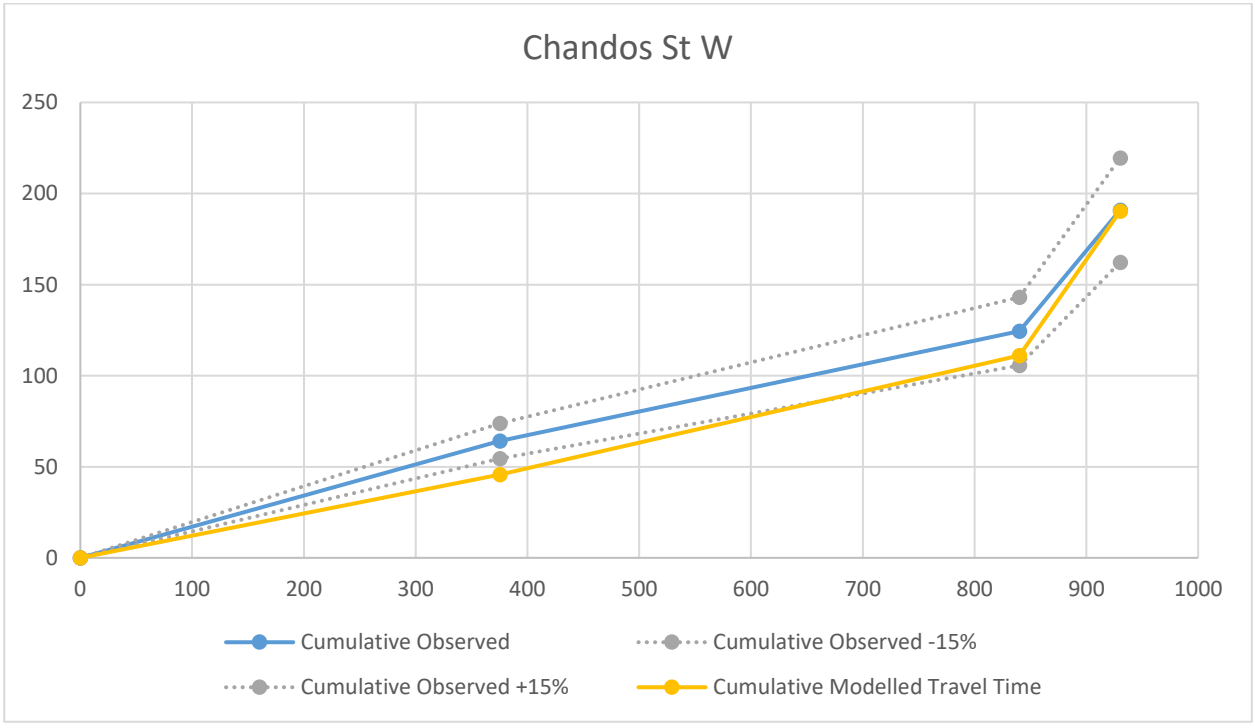

Willoughby Rd S
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

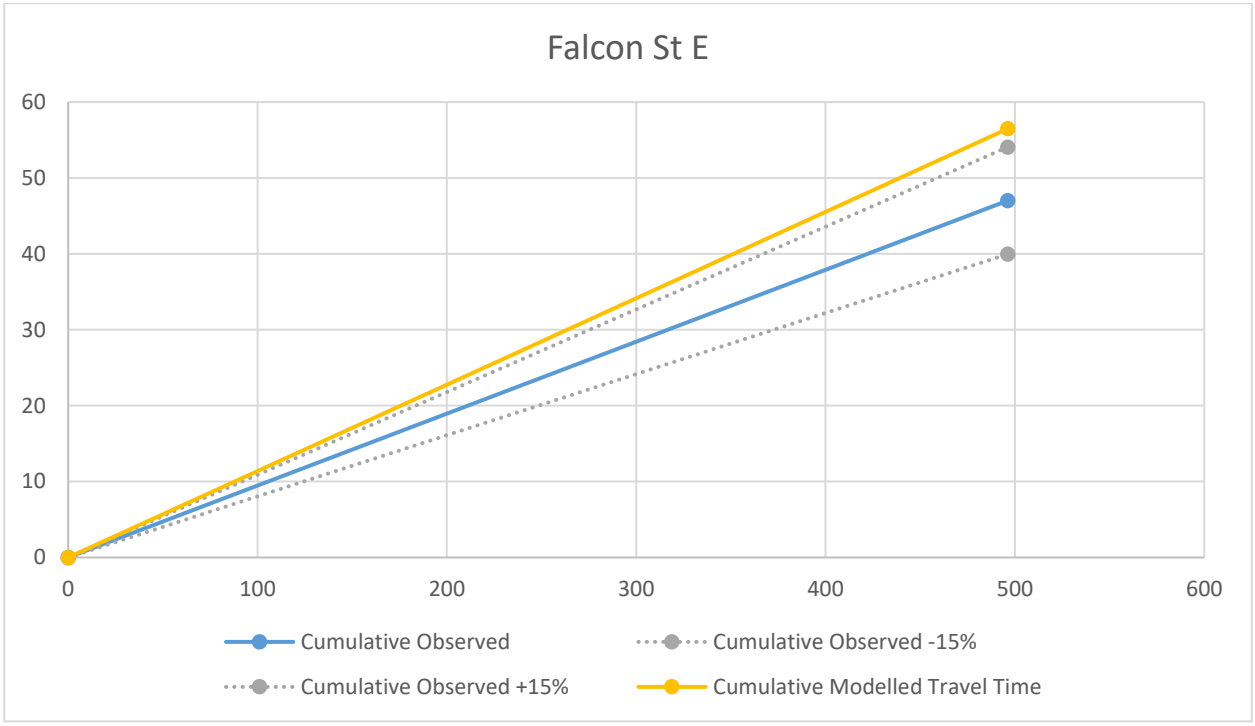
AM Peak (8:30am – 9:30am)

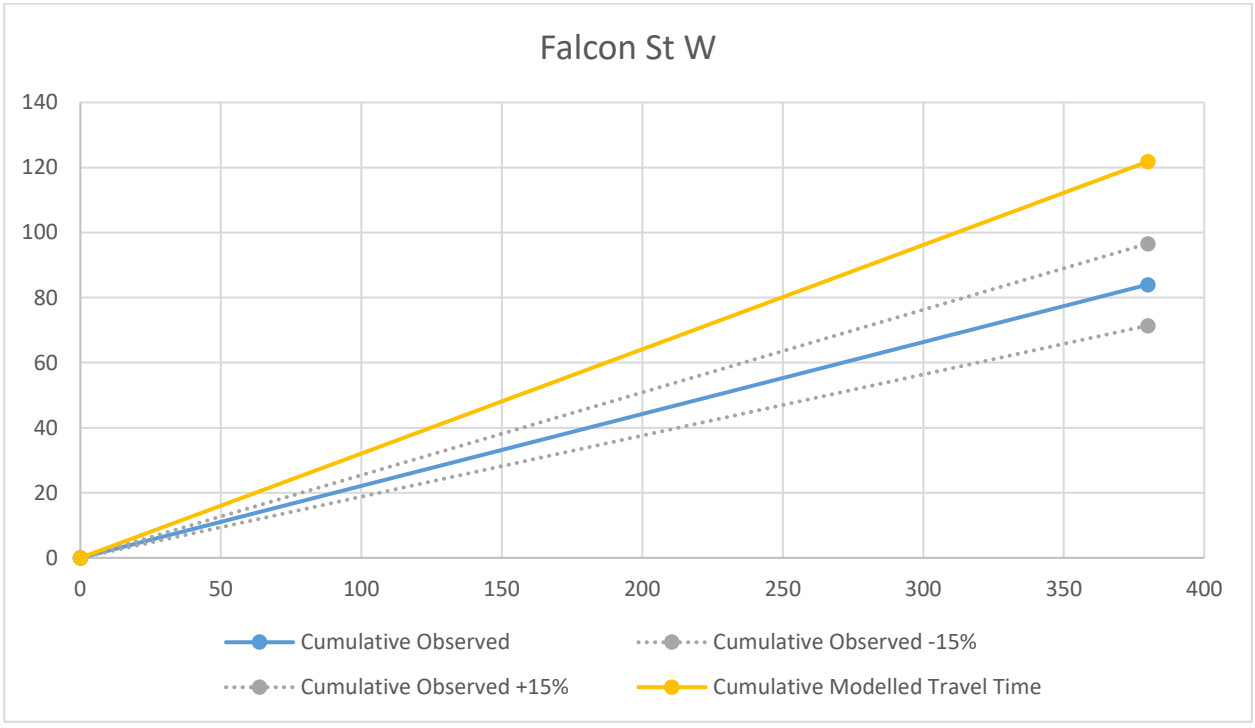


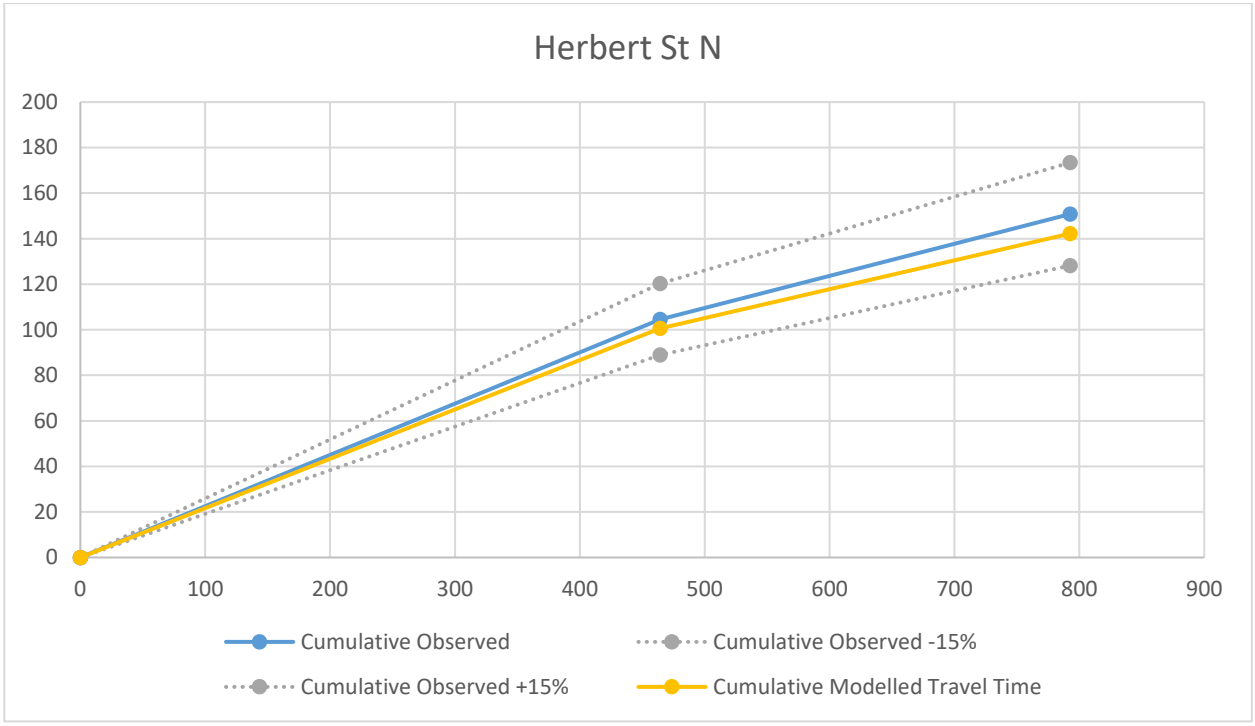


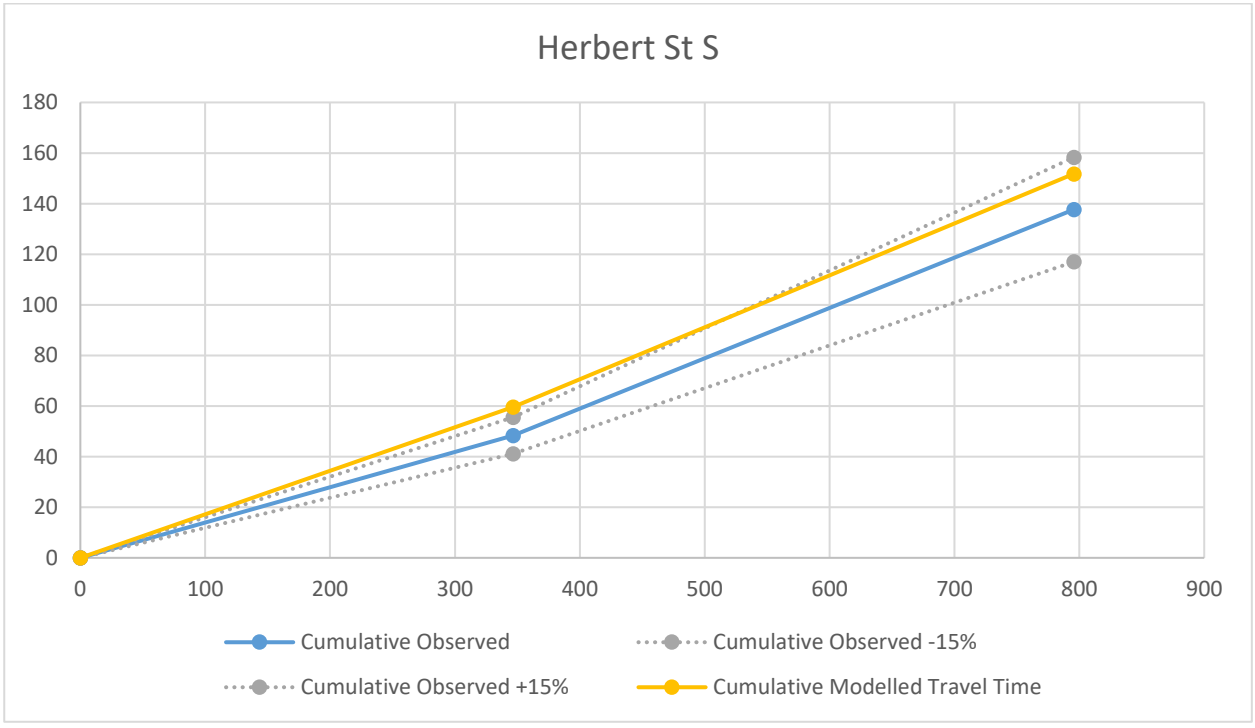

Chandos St E
200
180
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

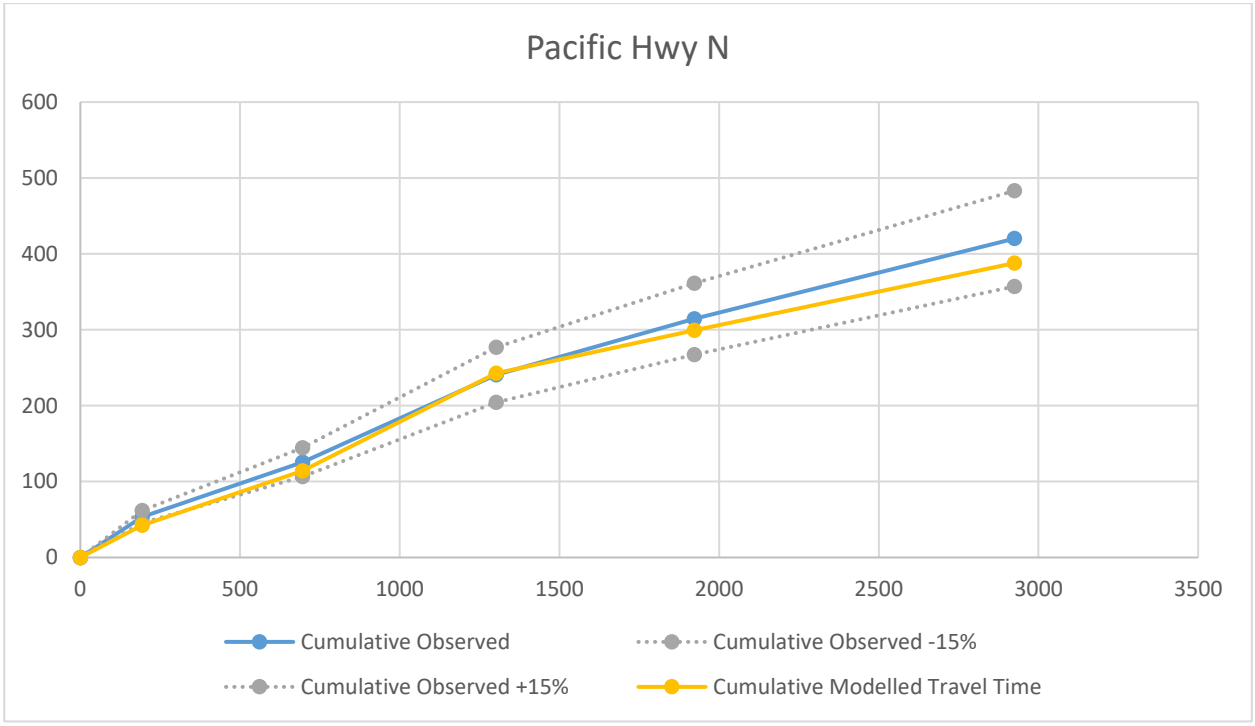

Chandos St W
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

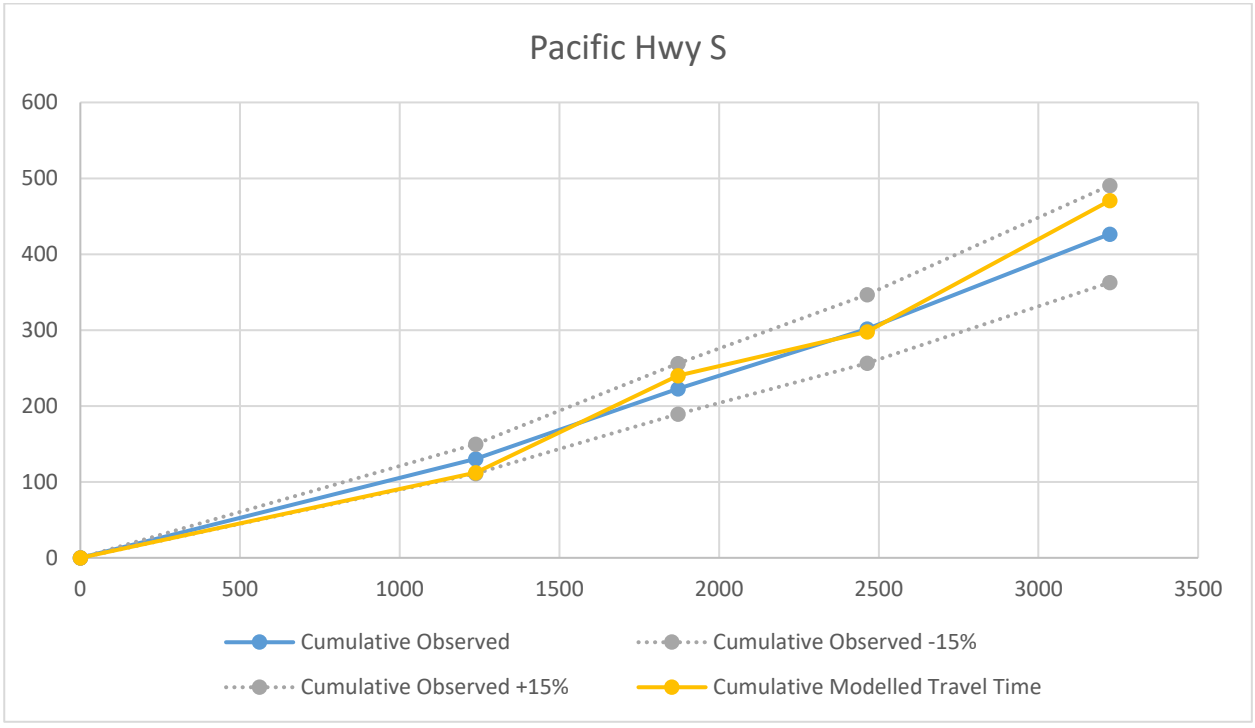

Falcon St E
60
50
40
30
20
10
0
0
100
200
300
400
500
600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

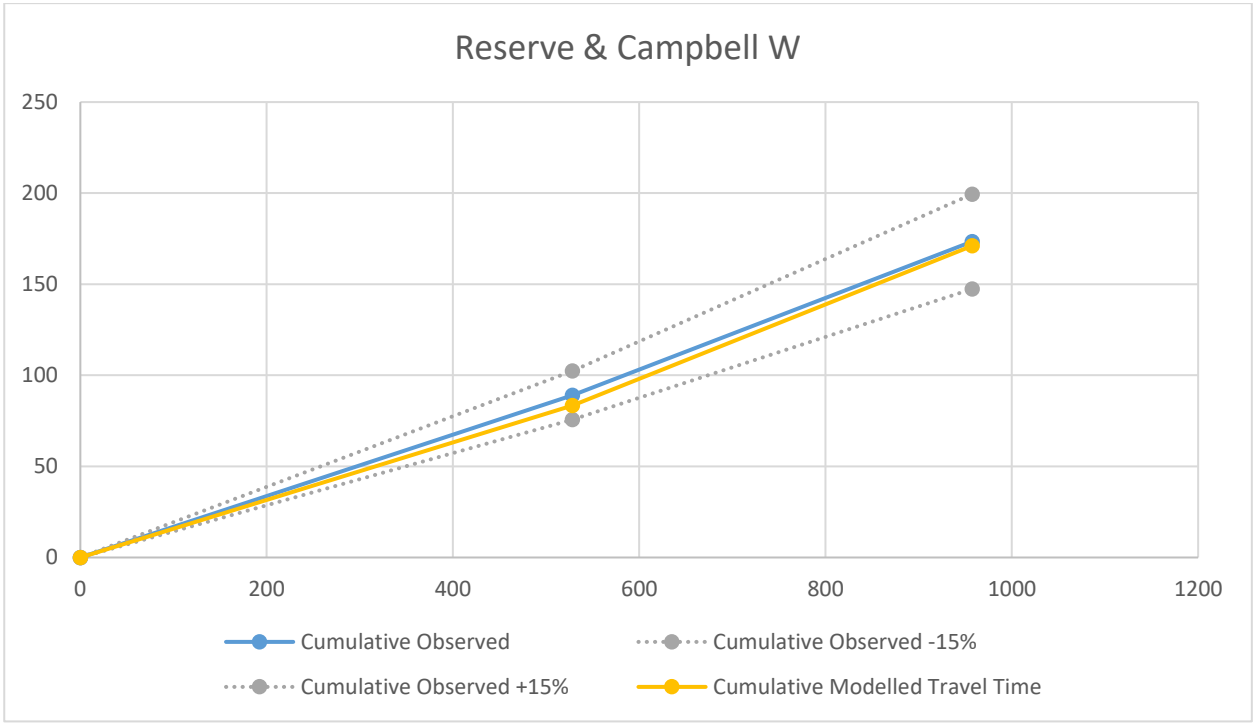

Falcon St W
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

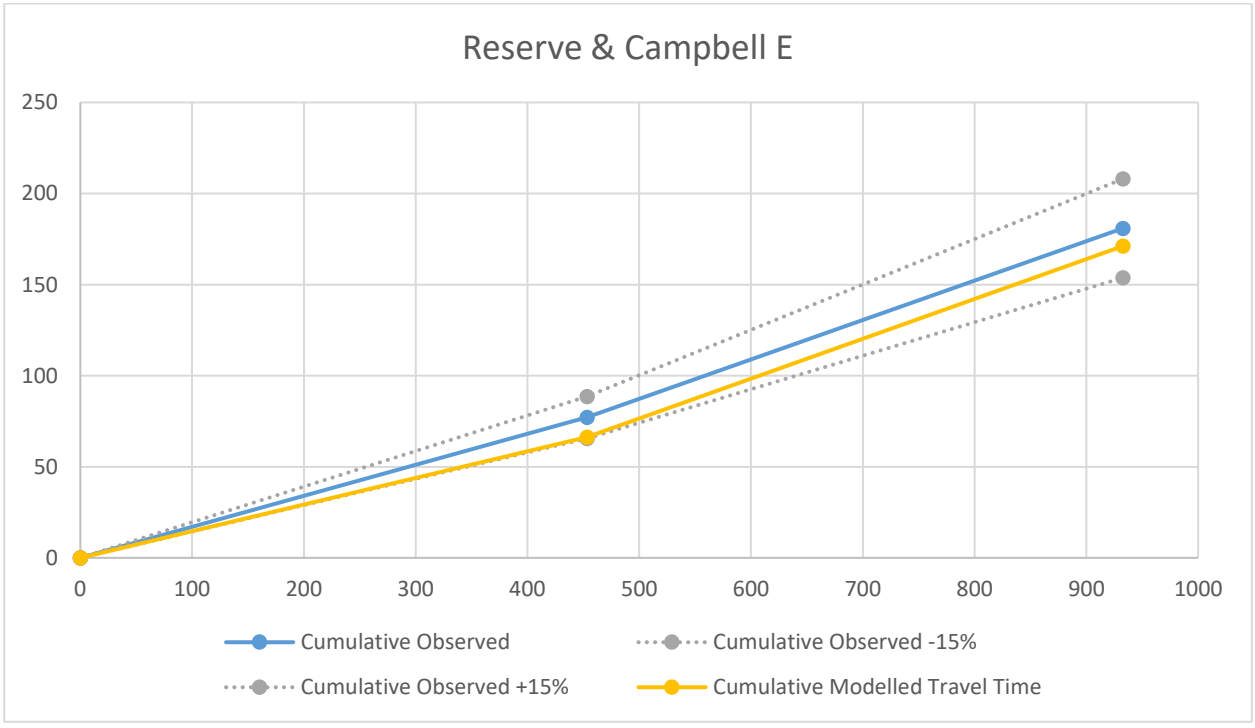

Herbert St N
200
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

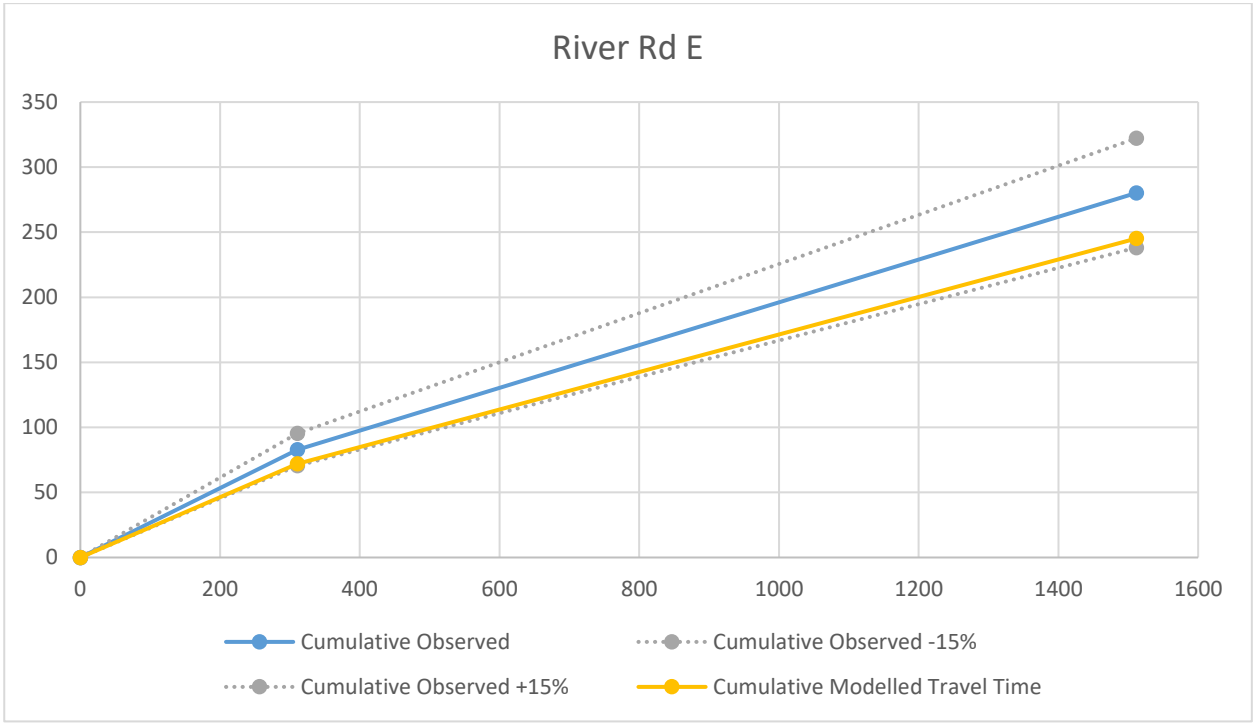

Herbert St S
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

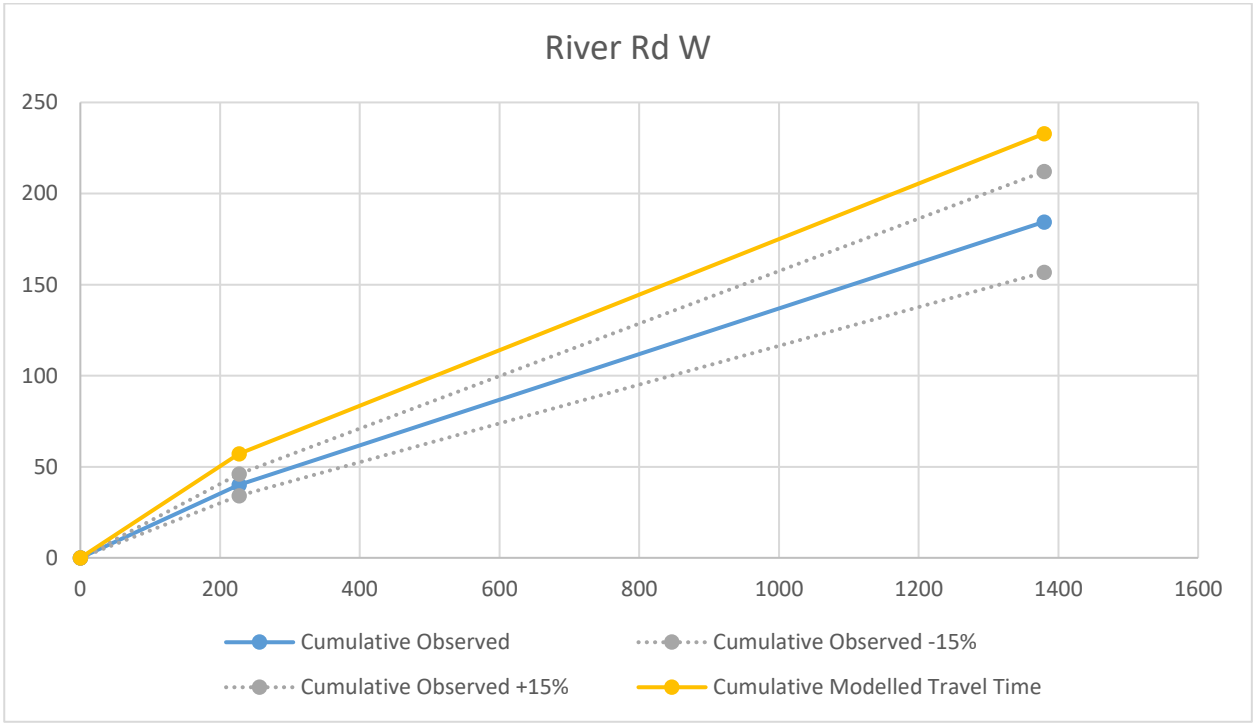

Pacific Hwy N
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

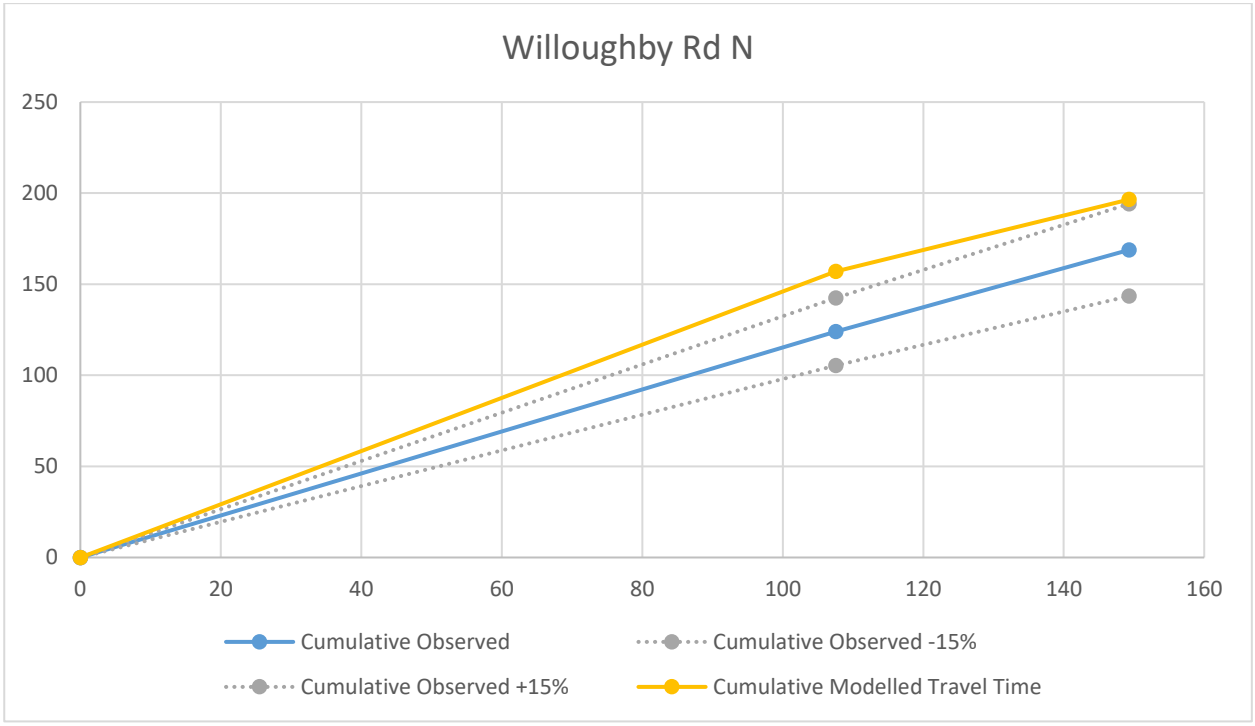

Pacific Hwy S
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

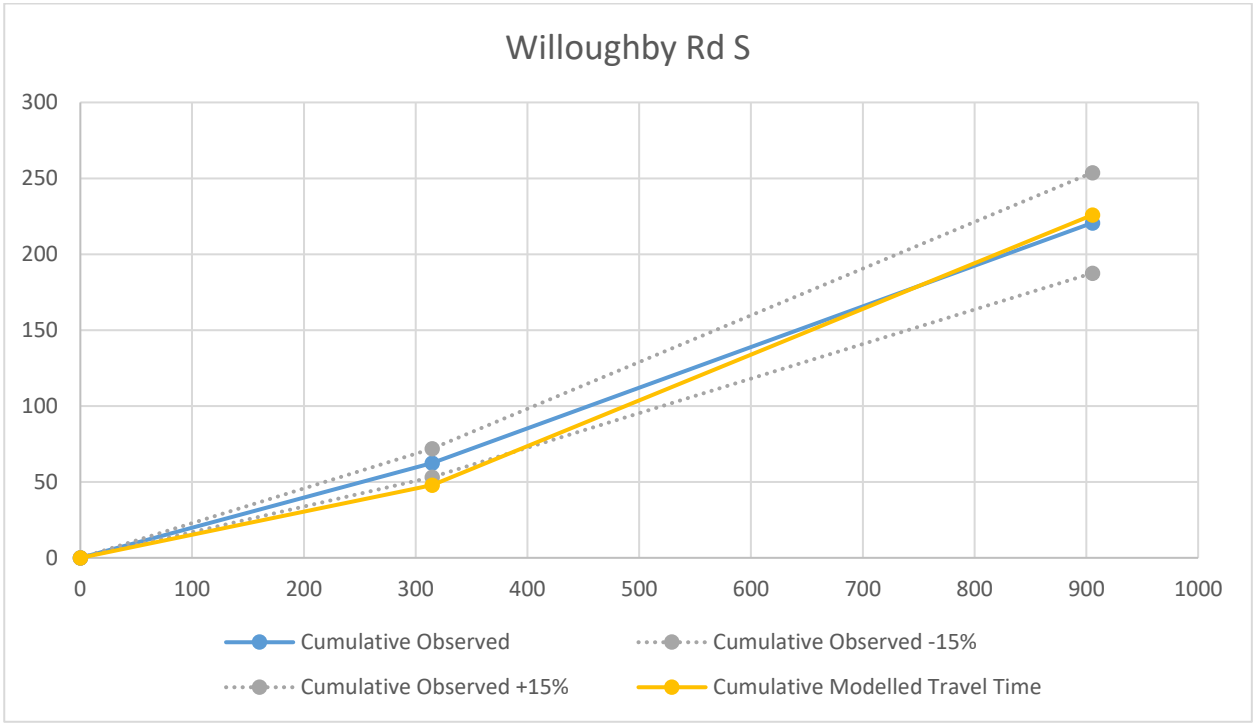

Reserve & Campbell W
250
200
150
100
50
0
0
200
400
600
800
1000
1200
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


Reserve & Campbell E
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

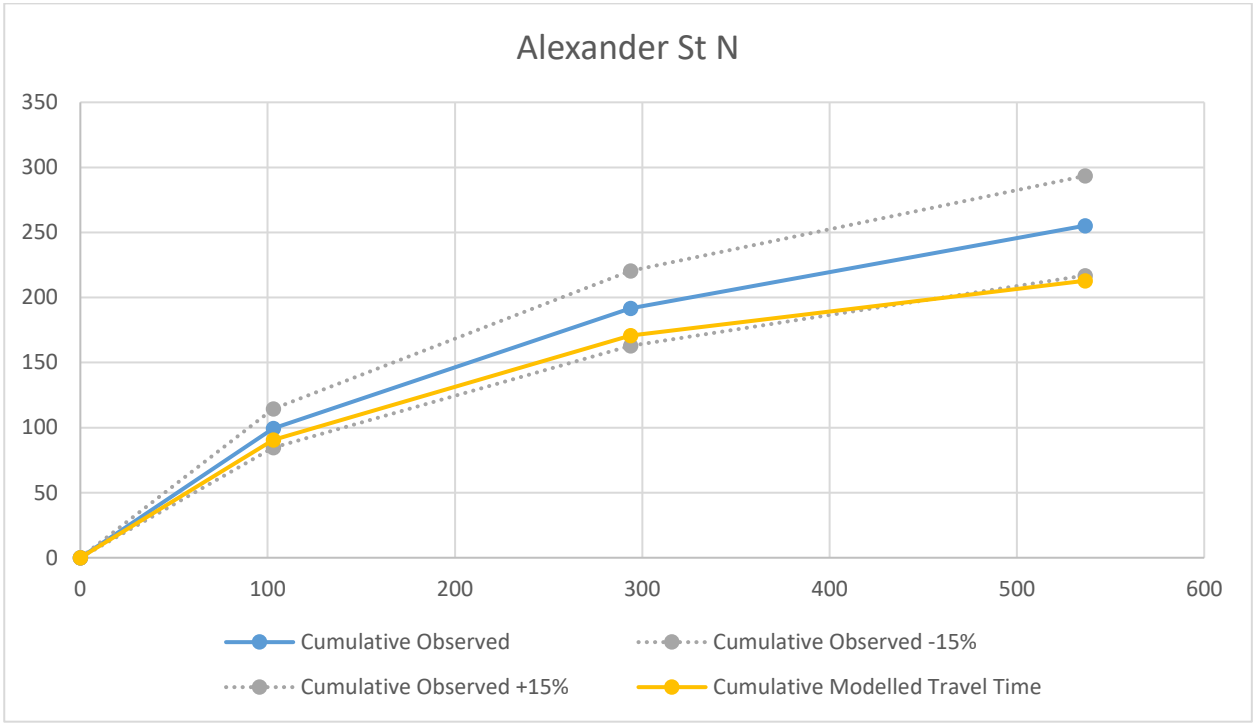

River Rd E
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

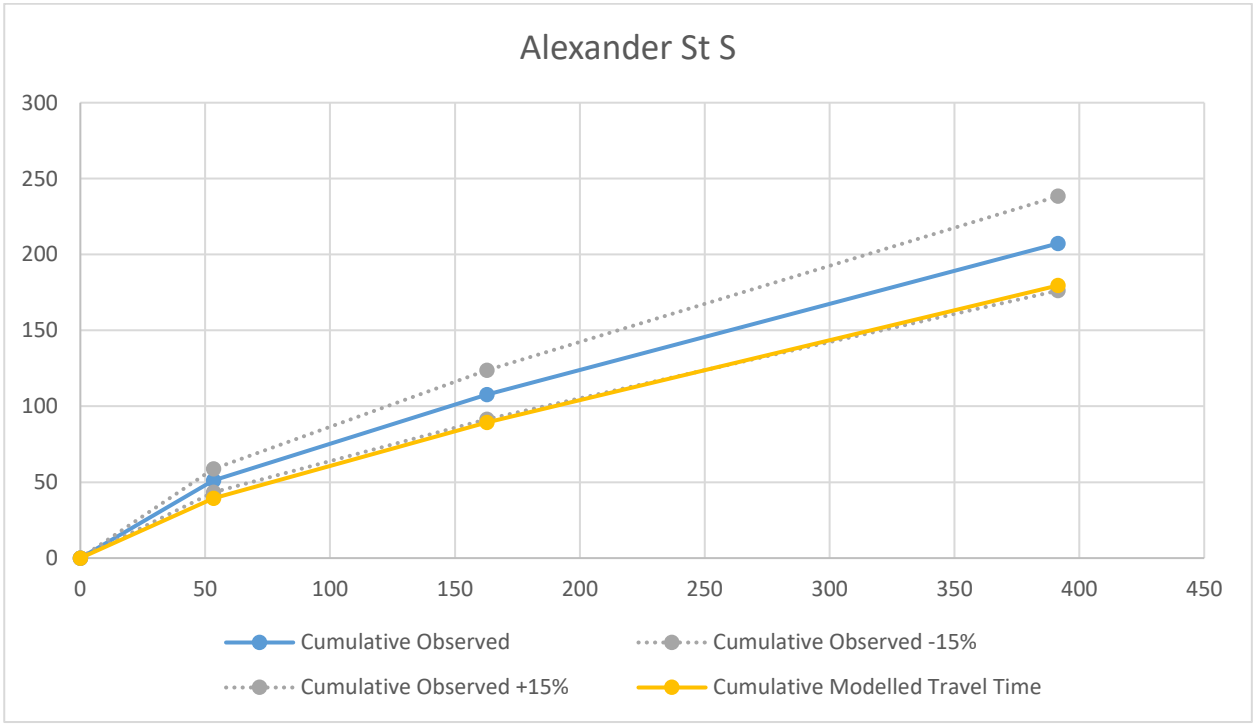

River Rd W
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

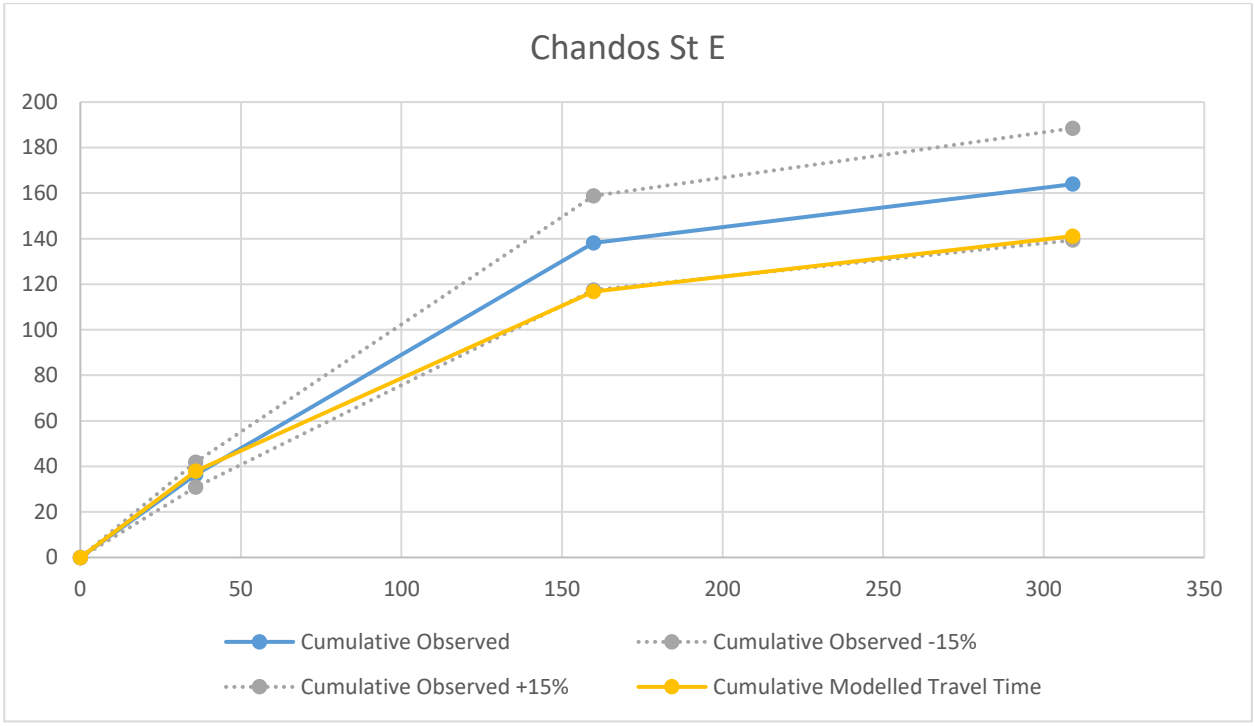

Willoughby Rd N
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

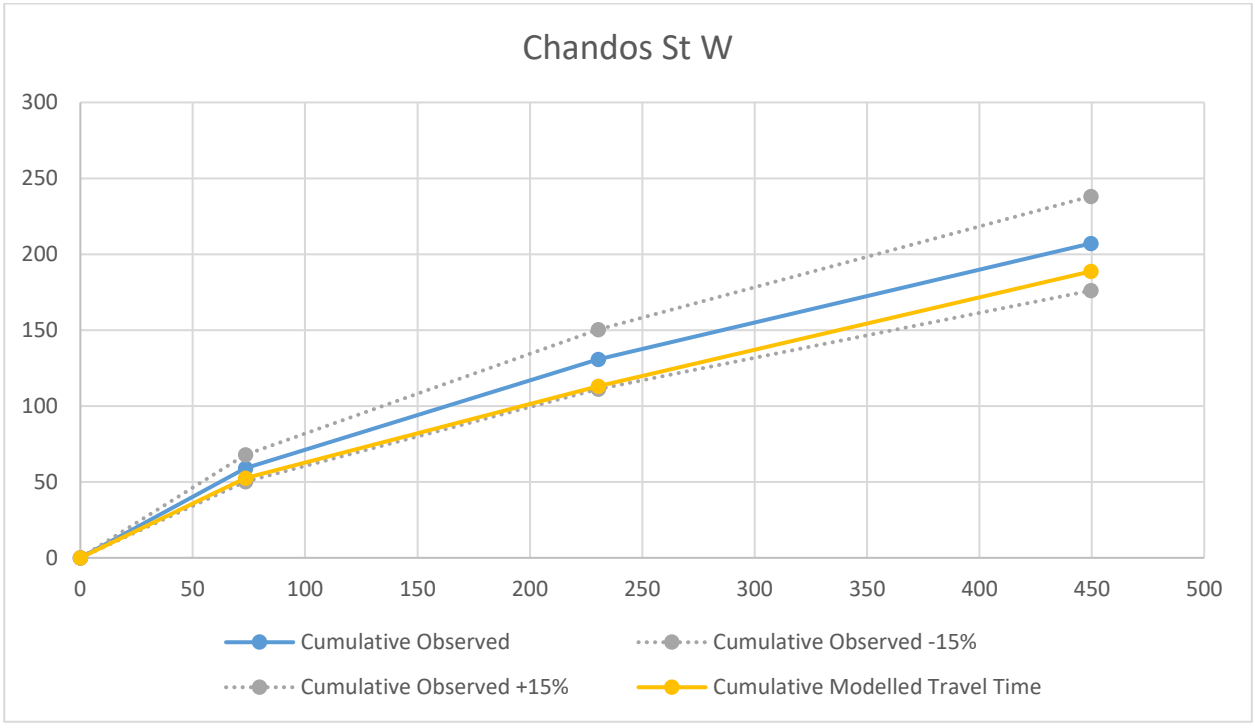

Willoughby Rd S
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

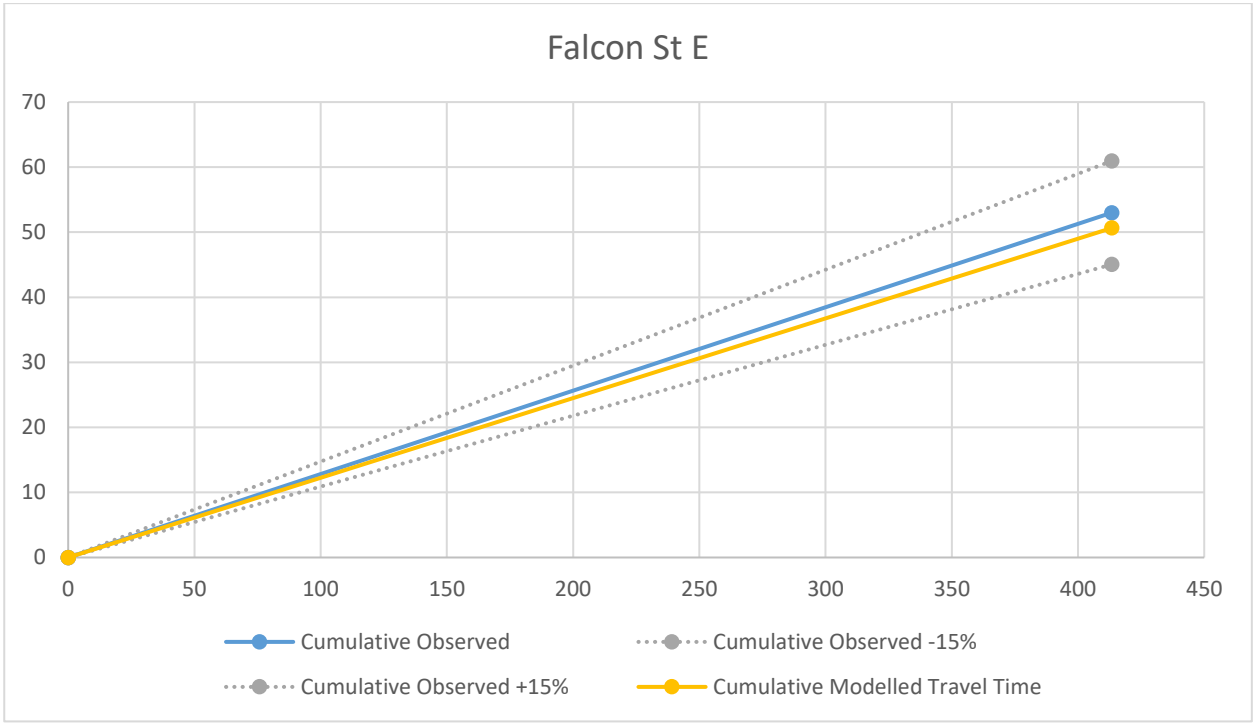
PM Peak (4:45pm – 5:45pm)

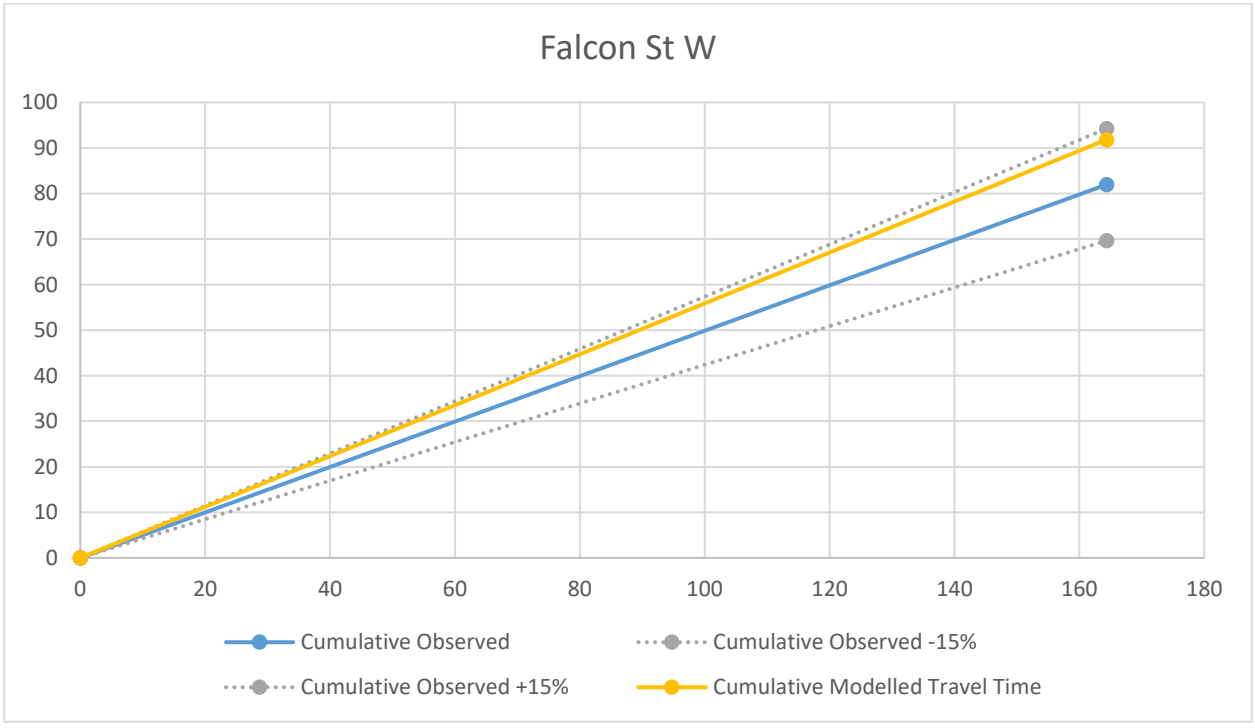


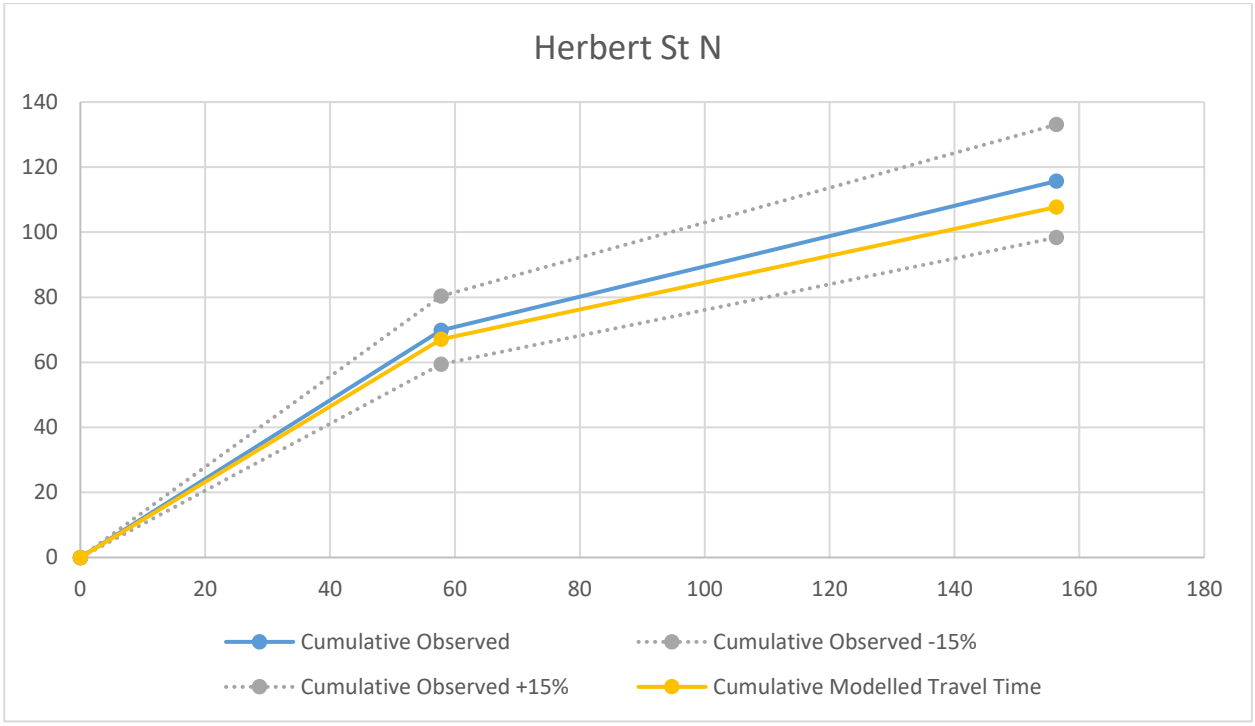


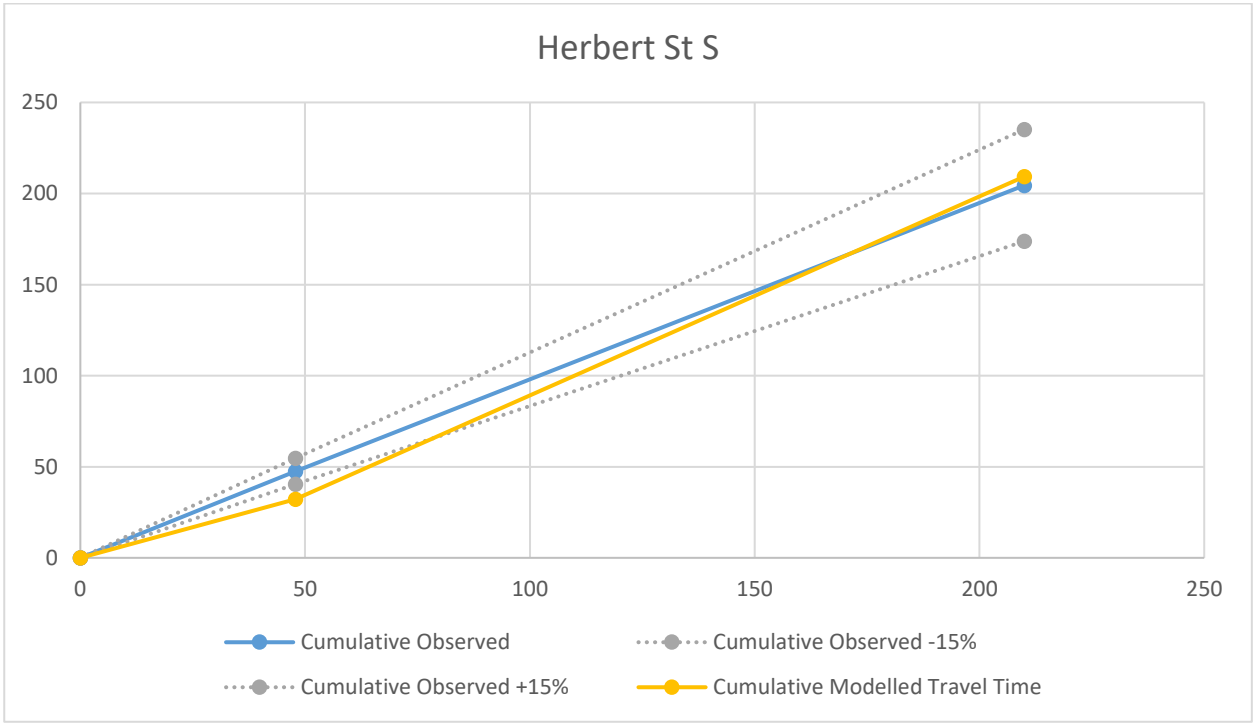

Chandos St E
200
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

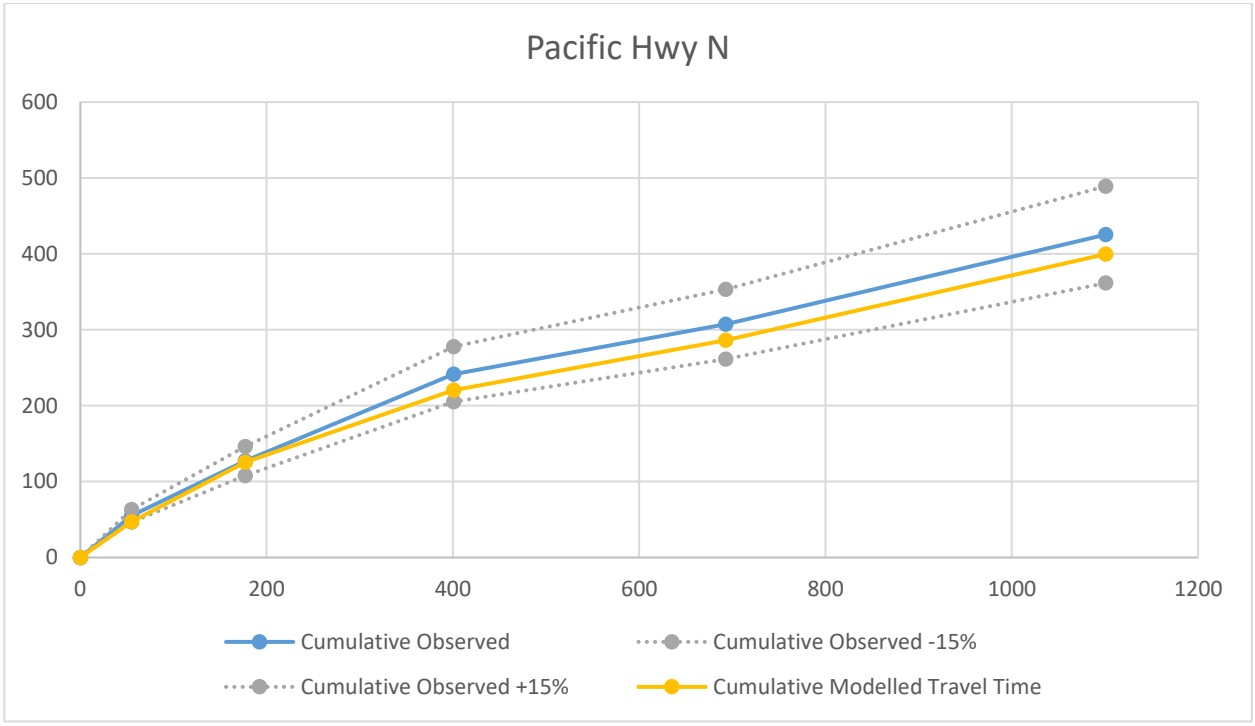

Chandos St W
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450
500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

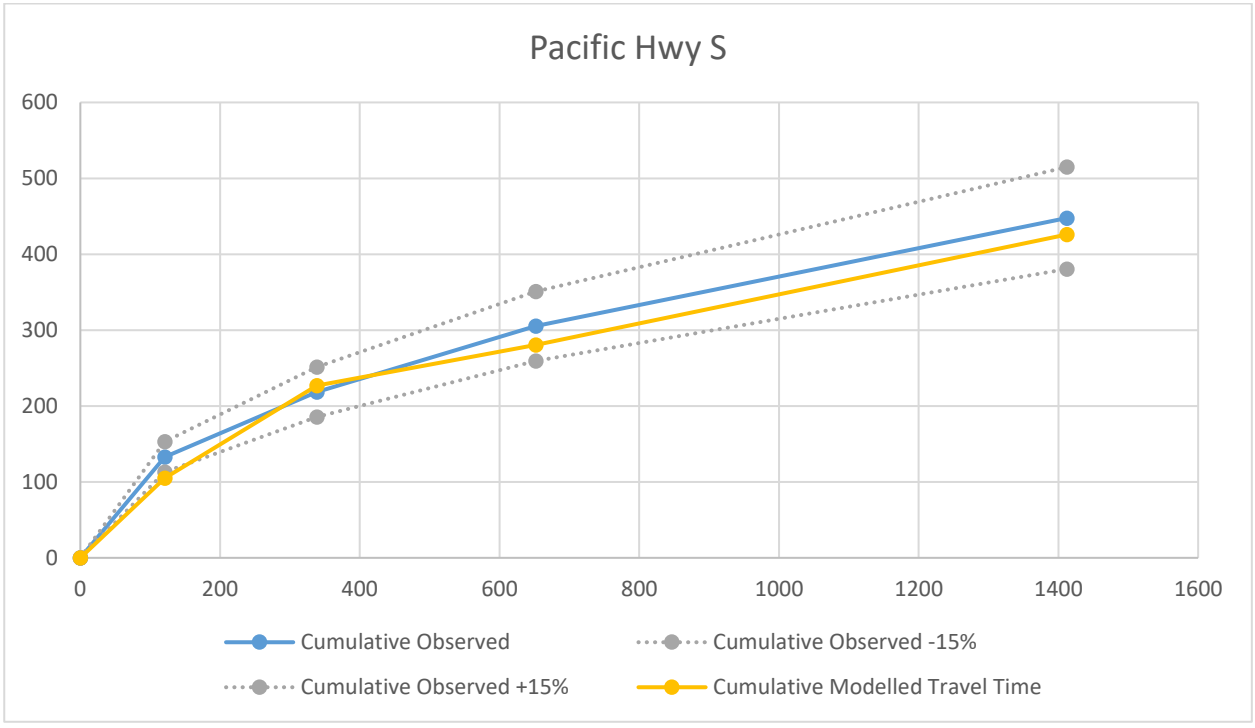

Falcon St E
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

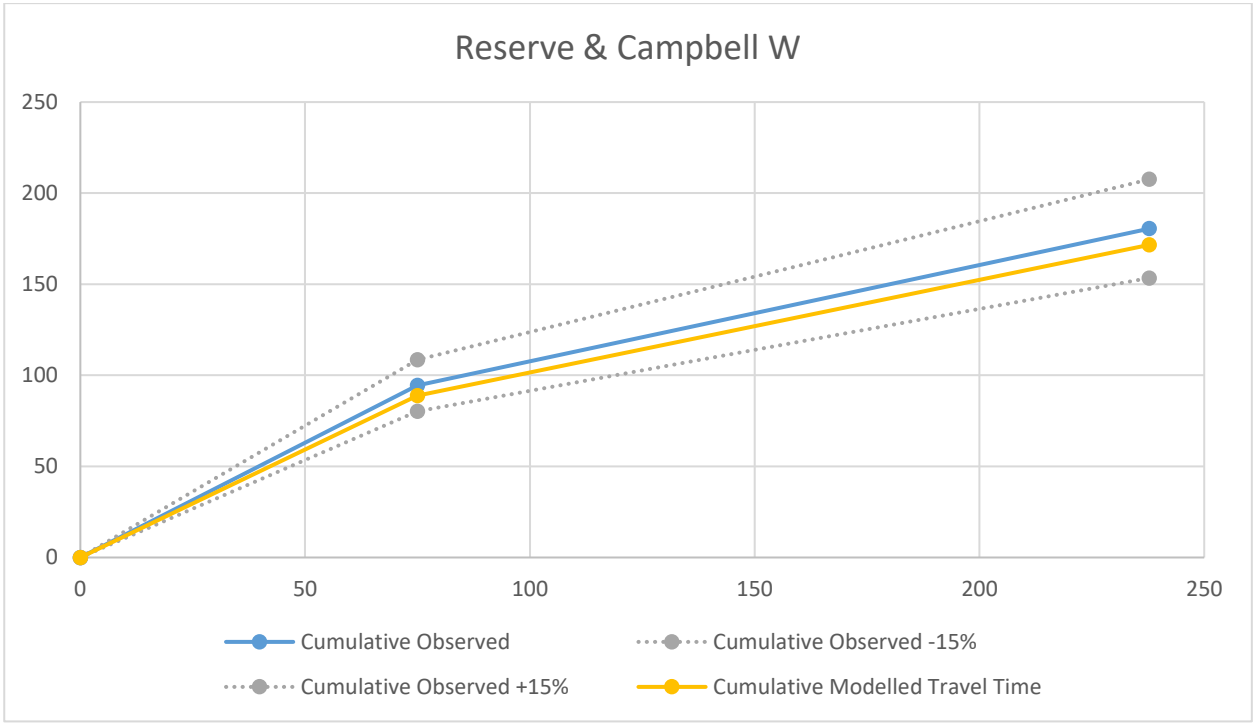

Falcon St W
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

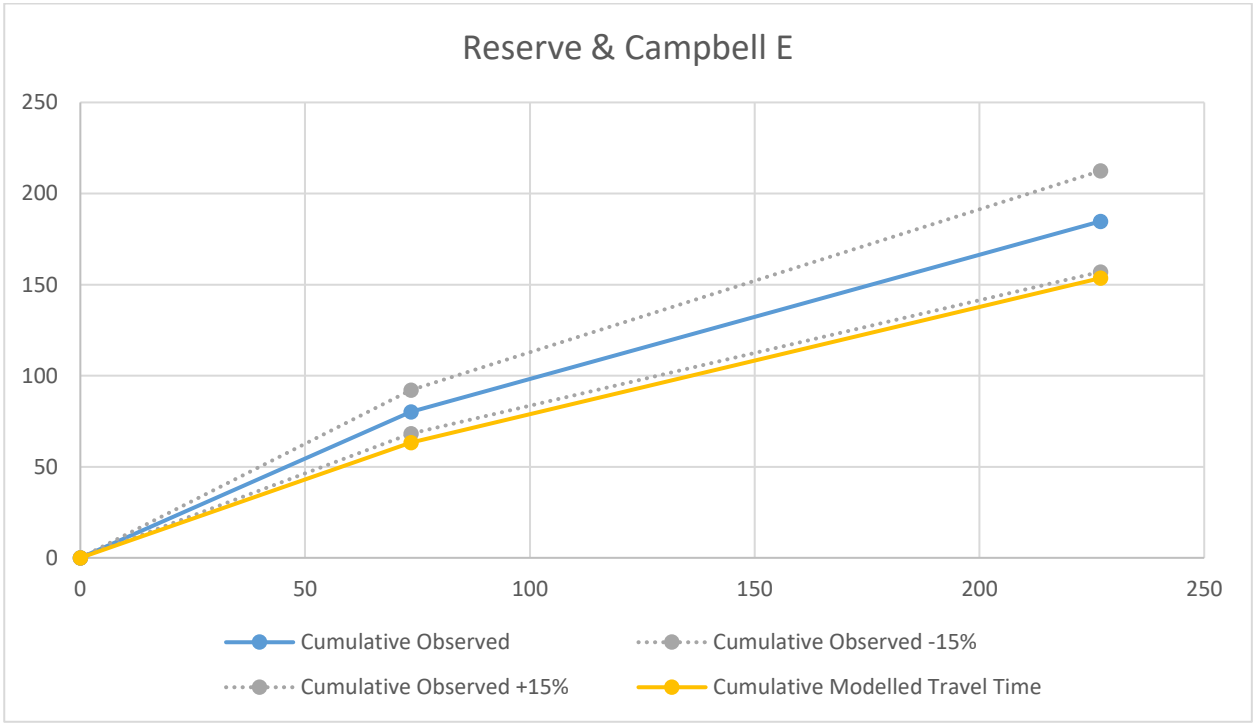

Herbert St N
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
180
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

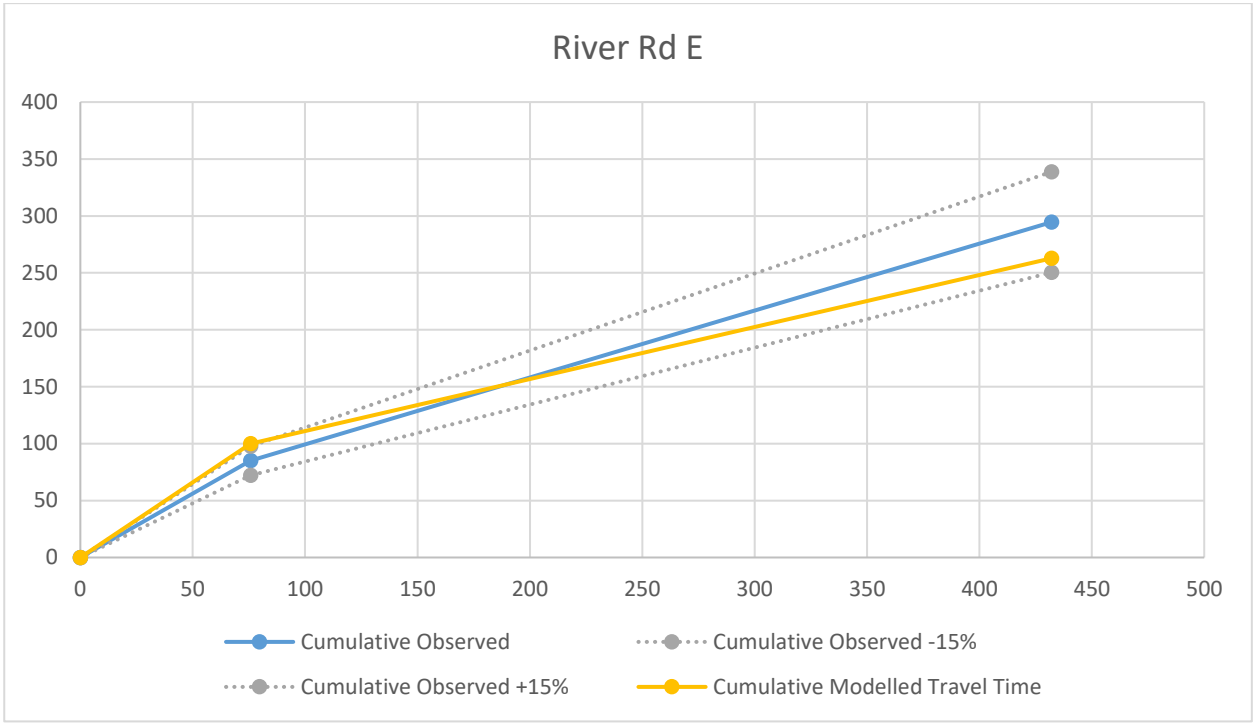

Herbert St S
250
200
150
100
50
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

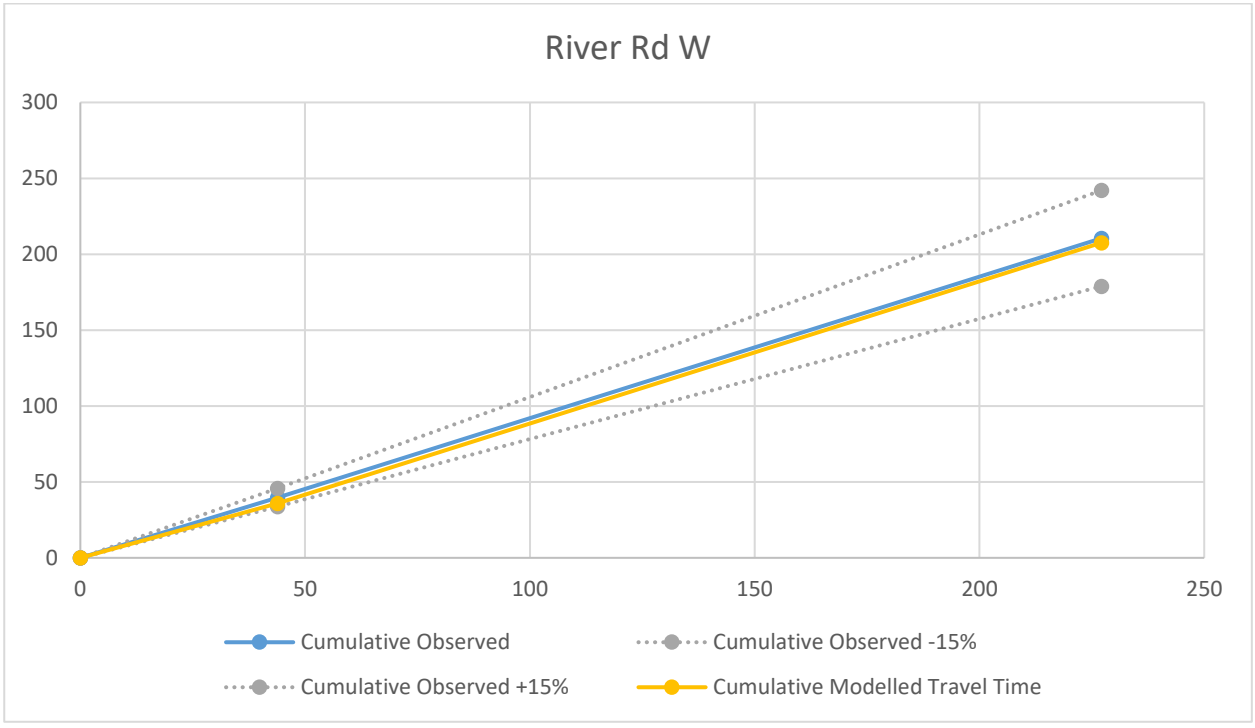

Pacific Hwy N
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

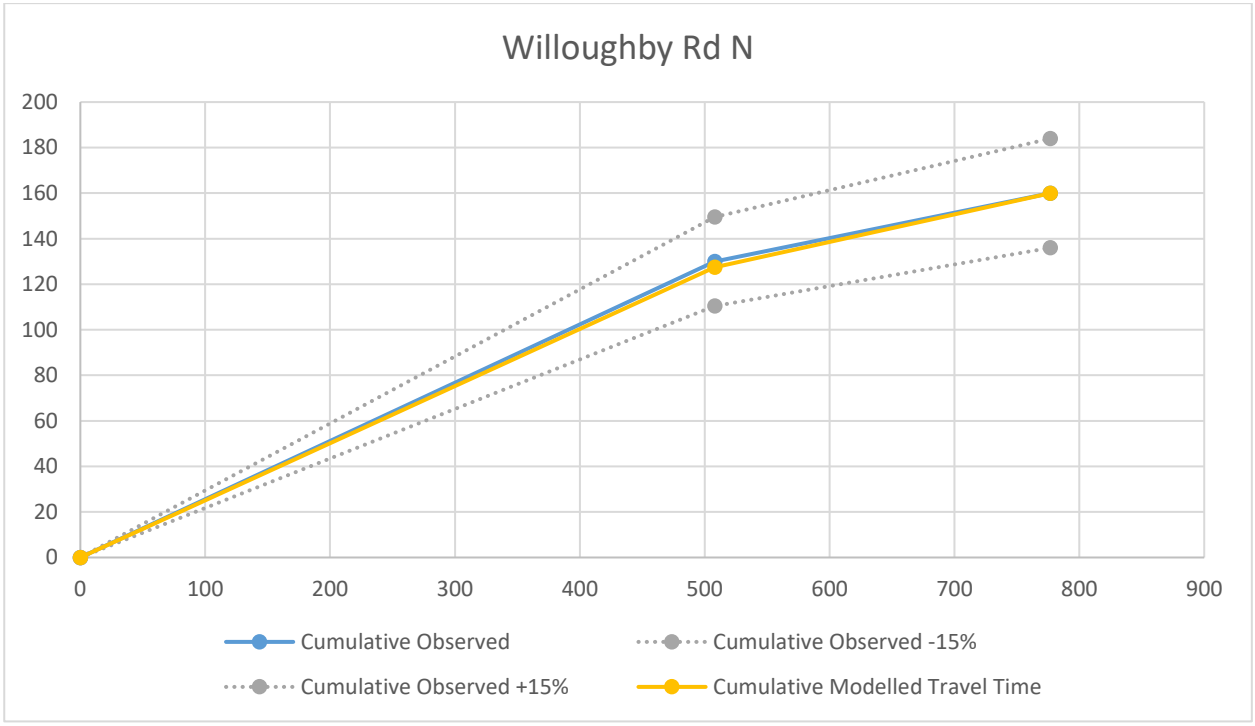

Pacific Hwy S
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

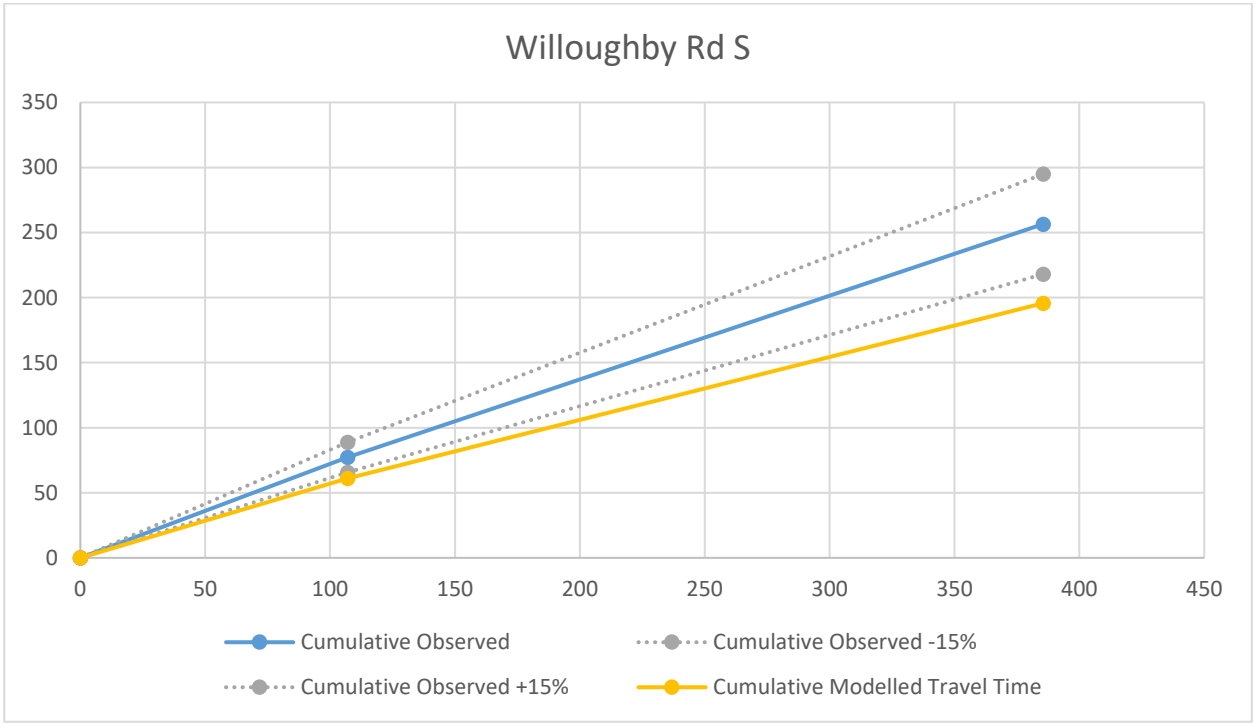

Reserve & Campbell W
250
200
150
100
50
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


Reserve & Campbell E
250
200
150
100
50
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

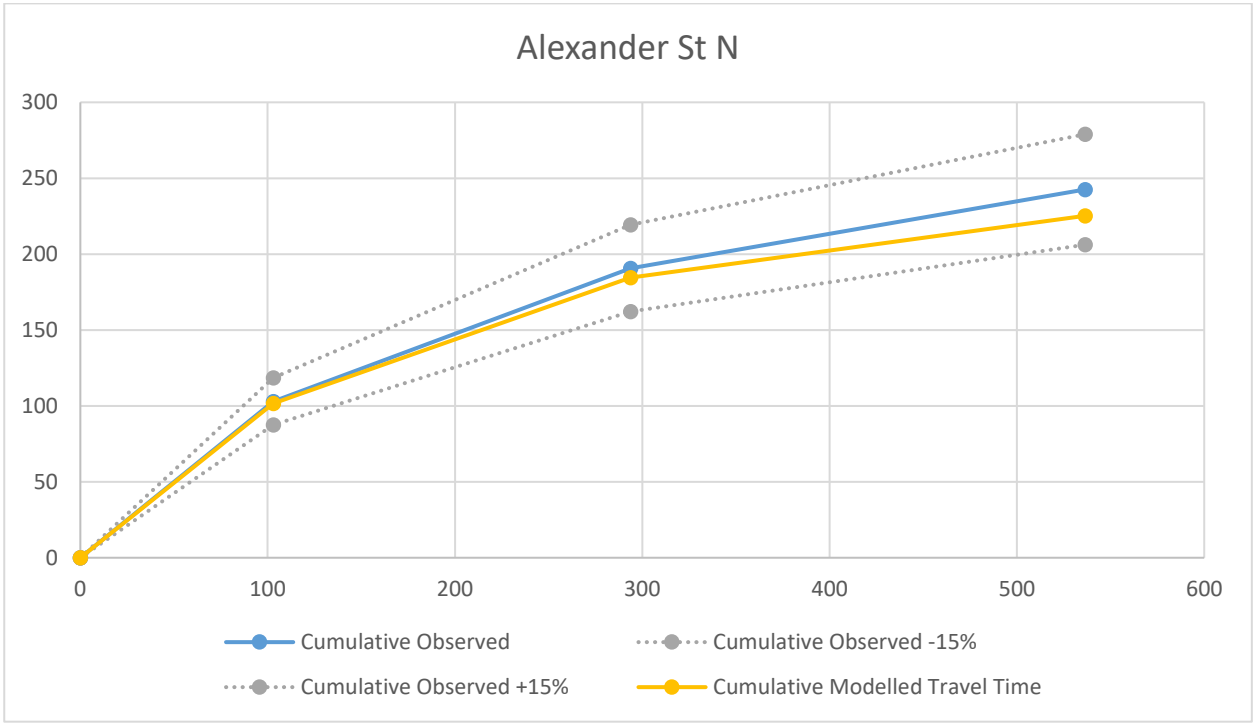

River Rd E
400
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450
500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

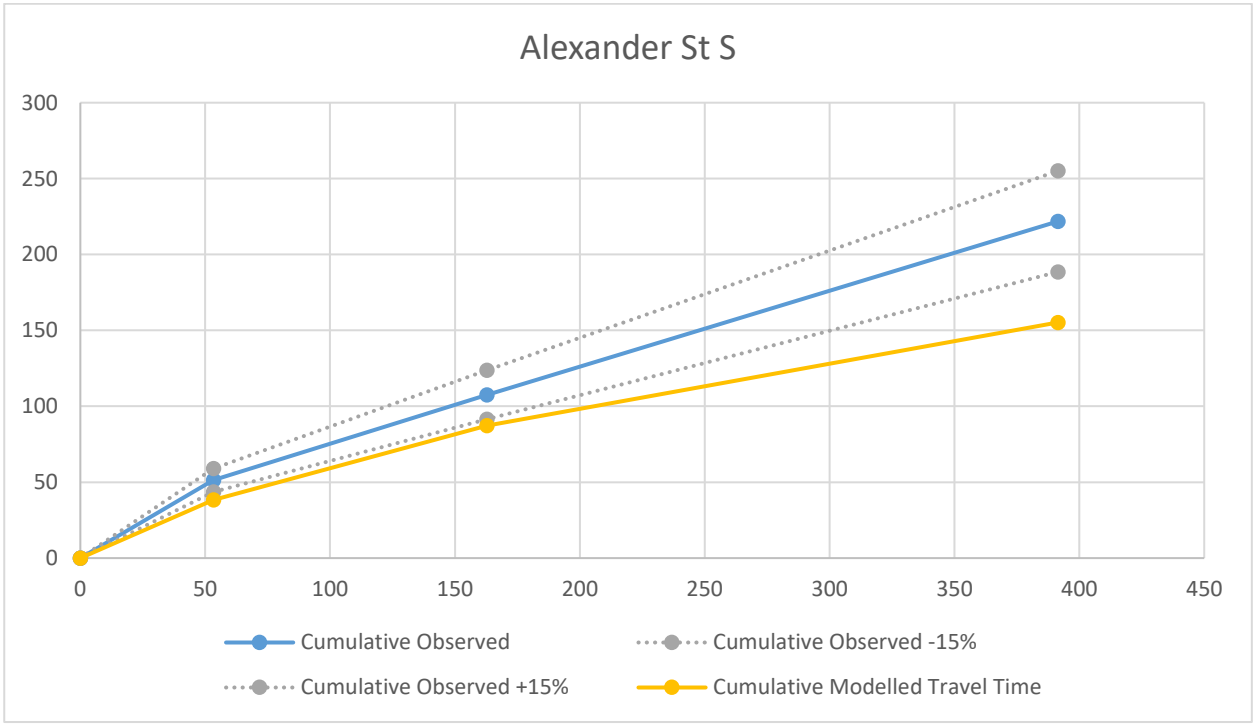

River Rd W
300
250
200
150
100
50
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

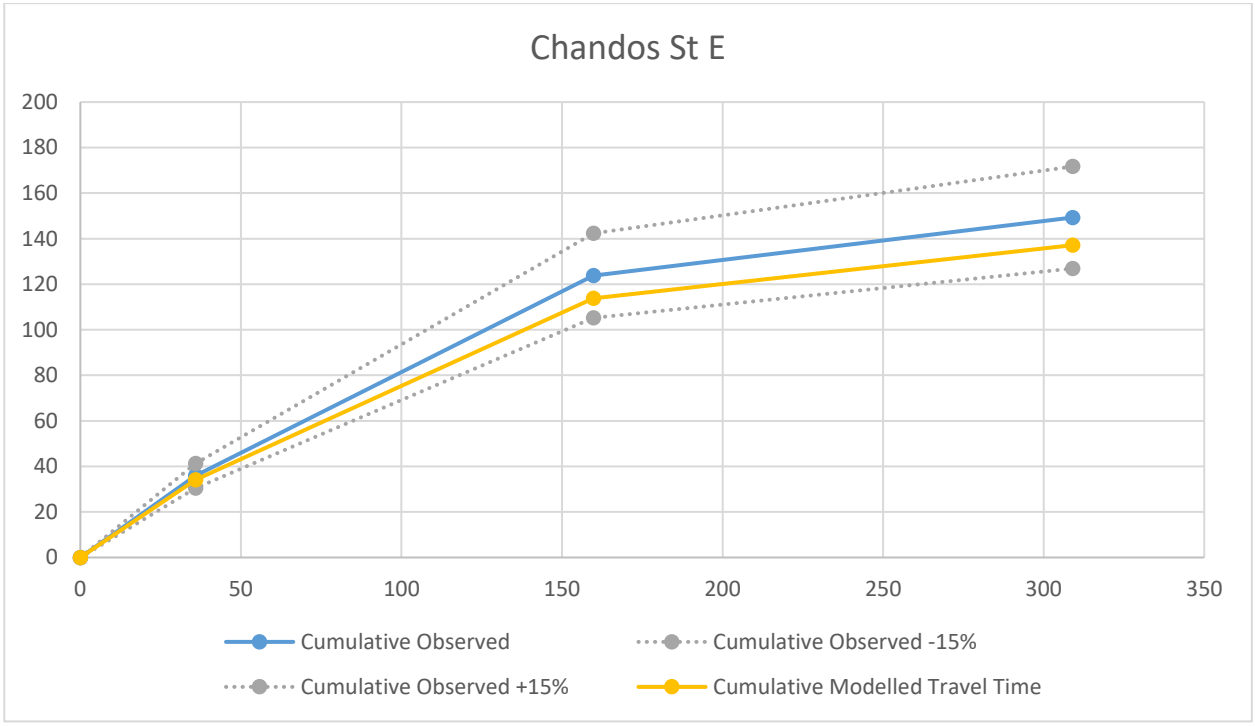

Willoughby Rd N
200
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

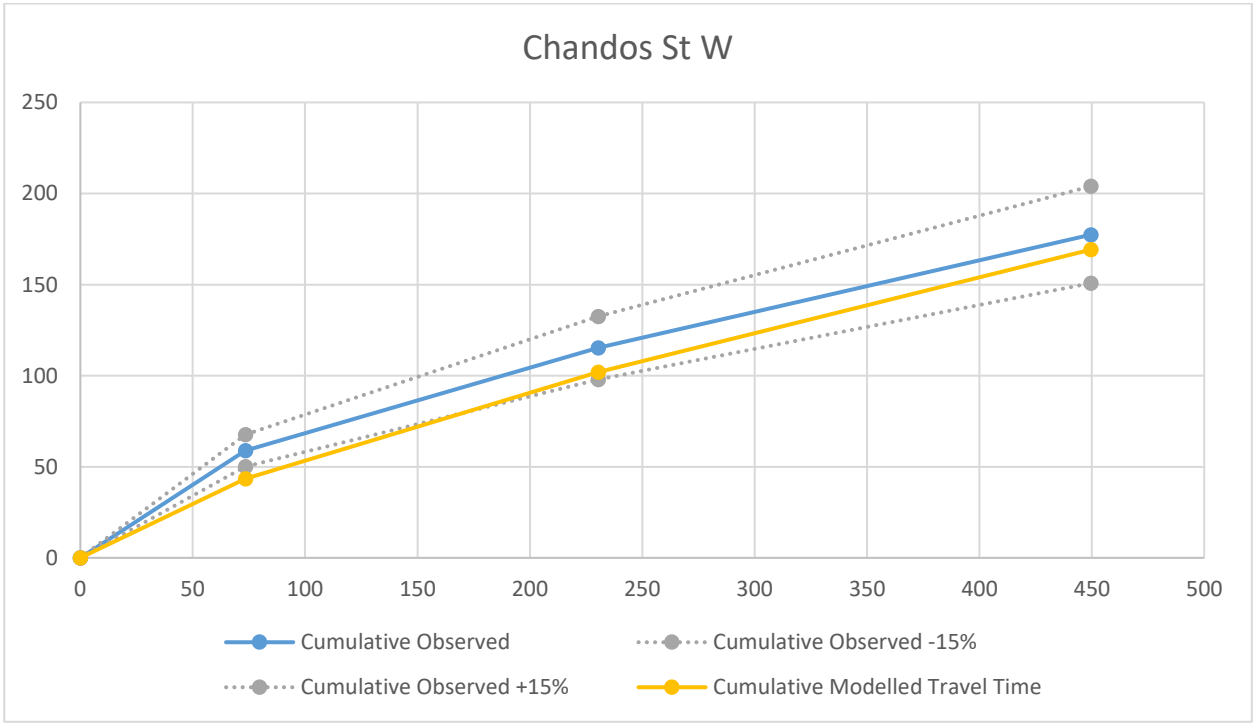

Willoughby Rd S
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

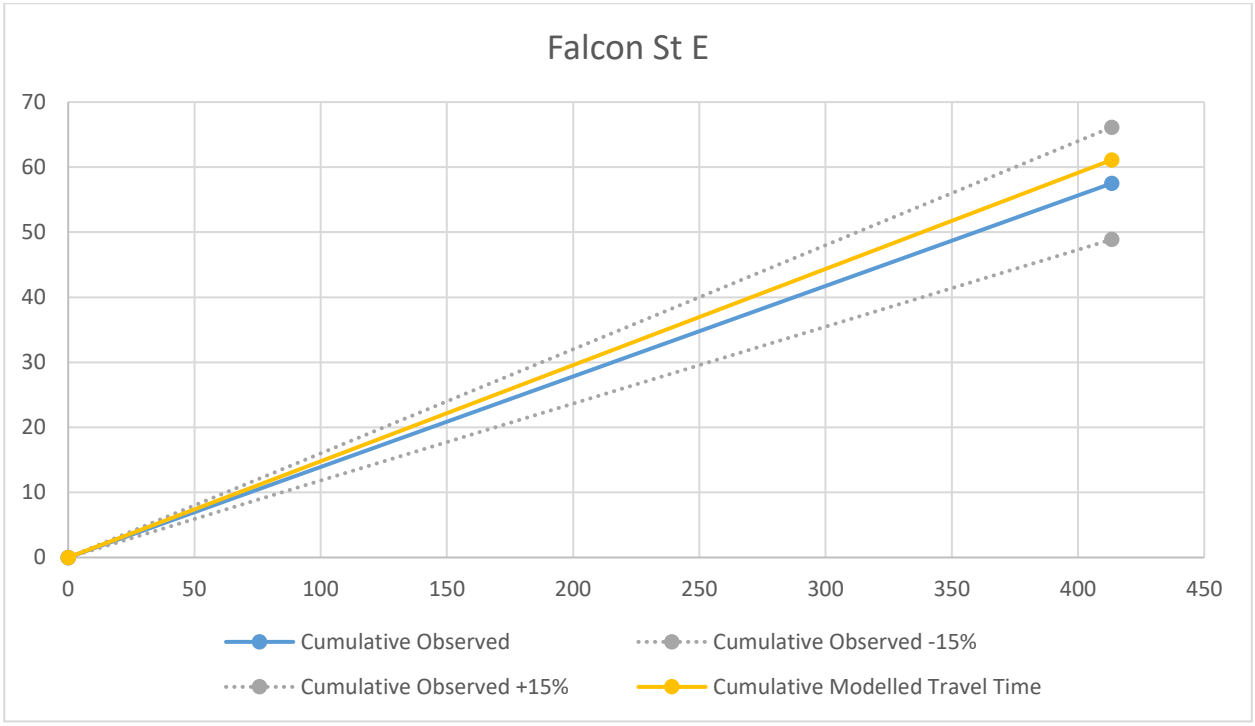
PM Peak (5:45pm – 6:45pm)

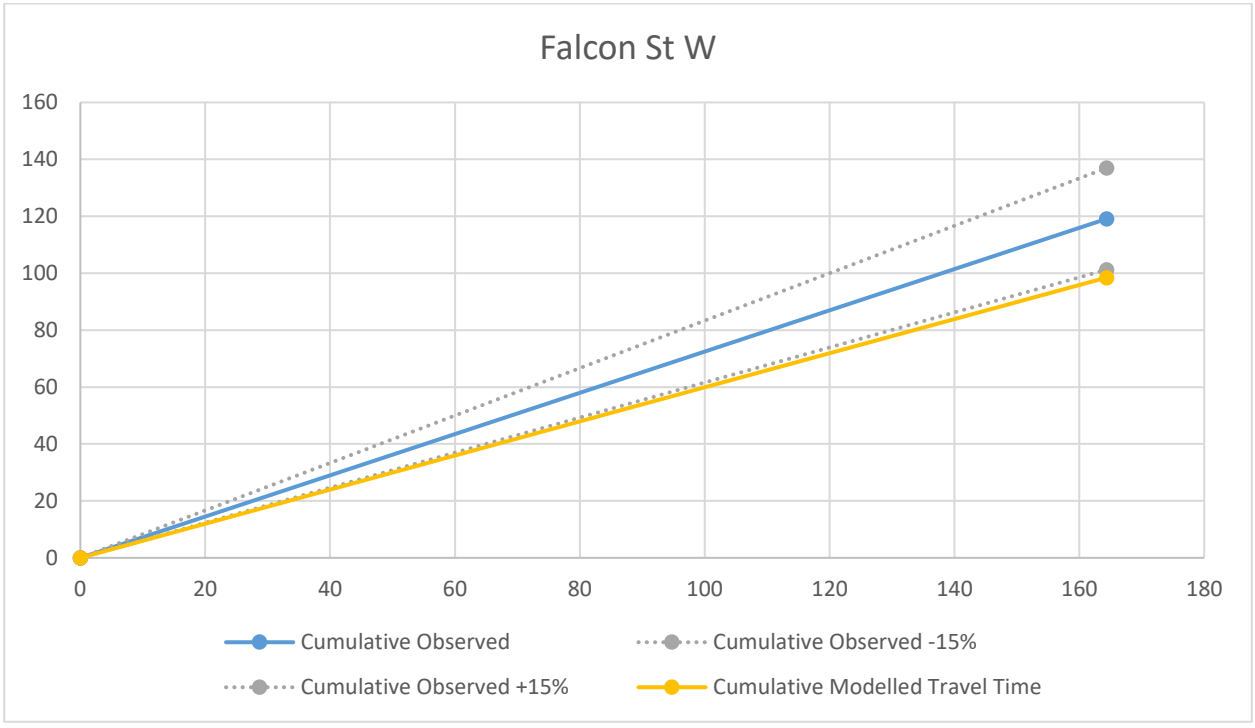


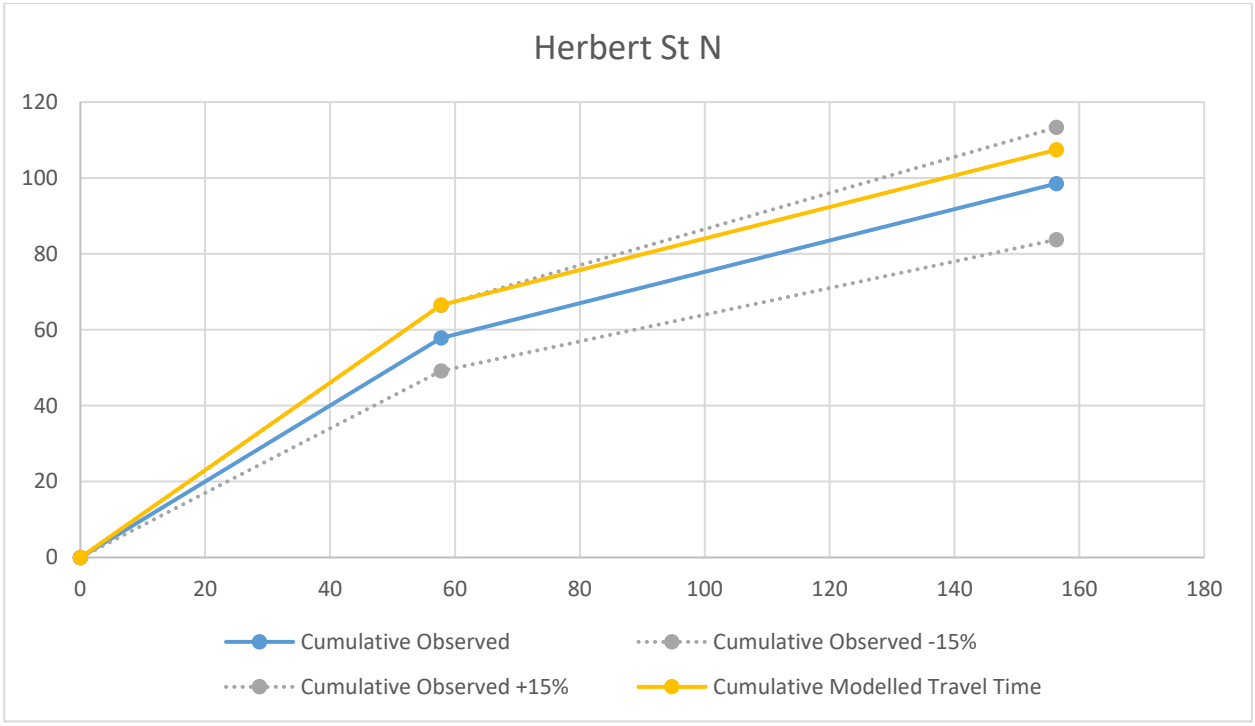


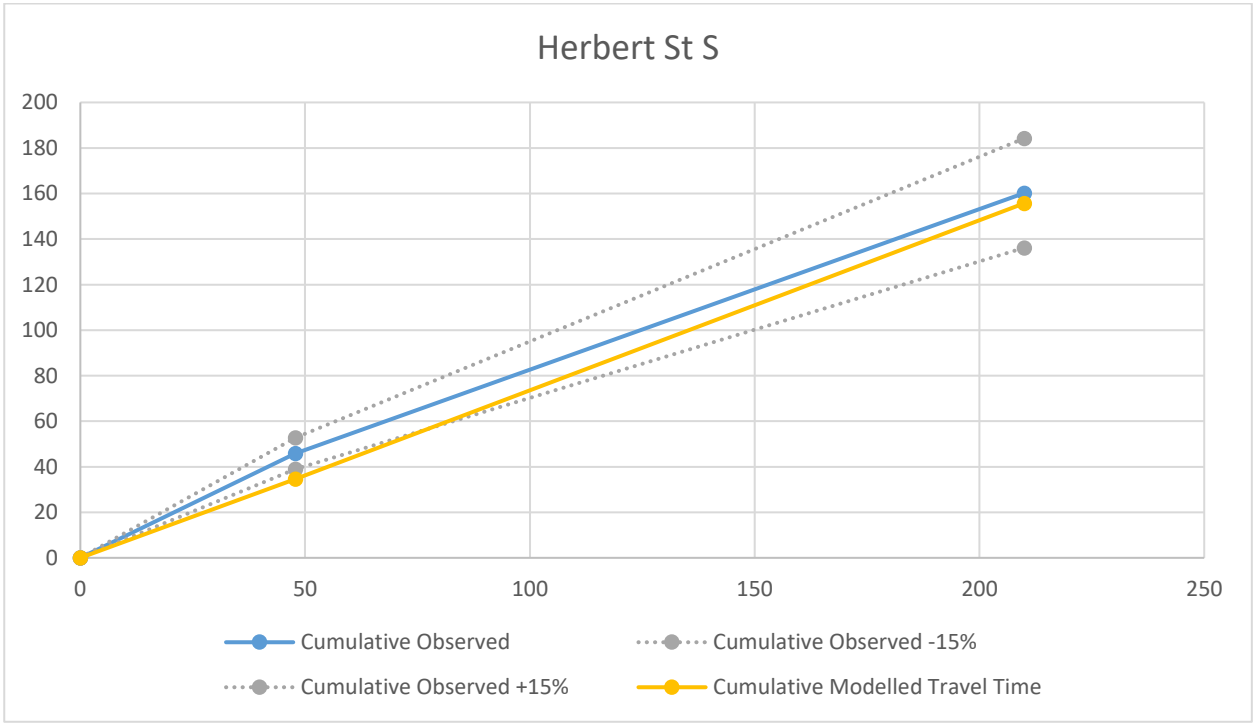

Chandos St E
200
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

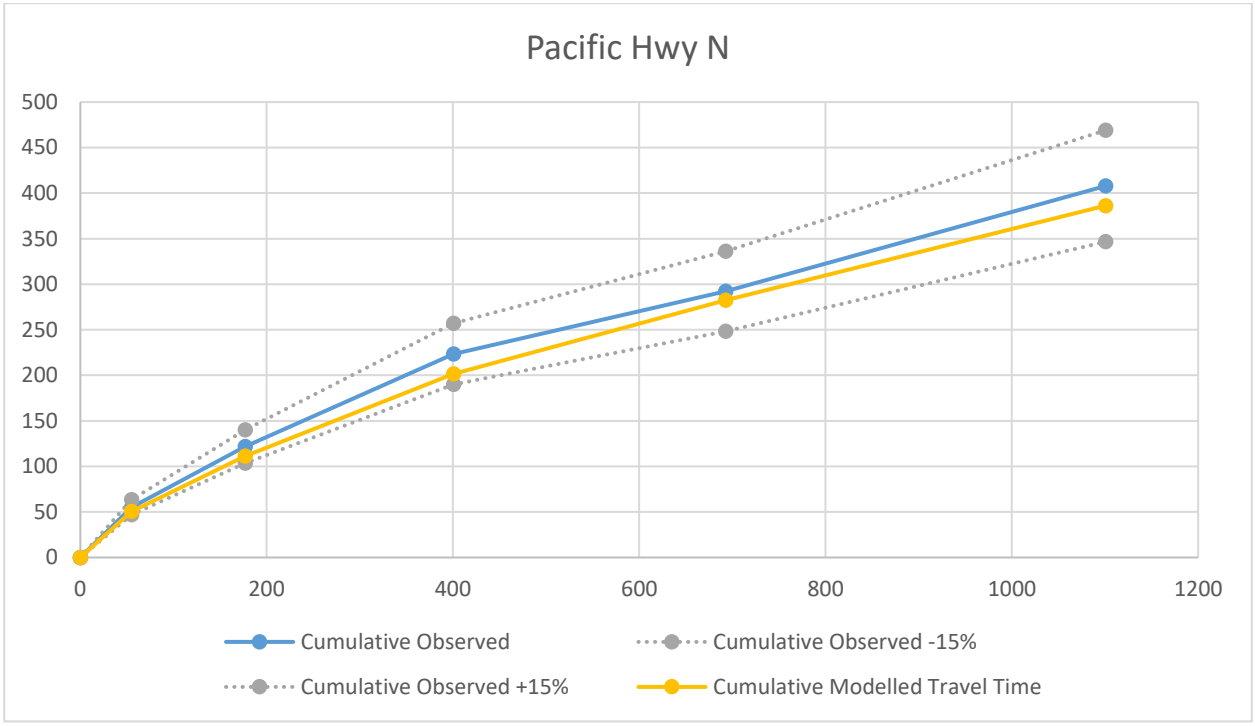

Chandos St W
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450
500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

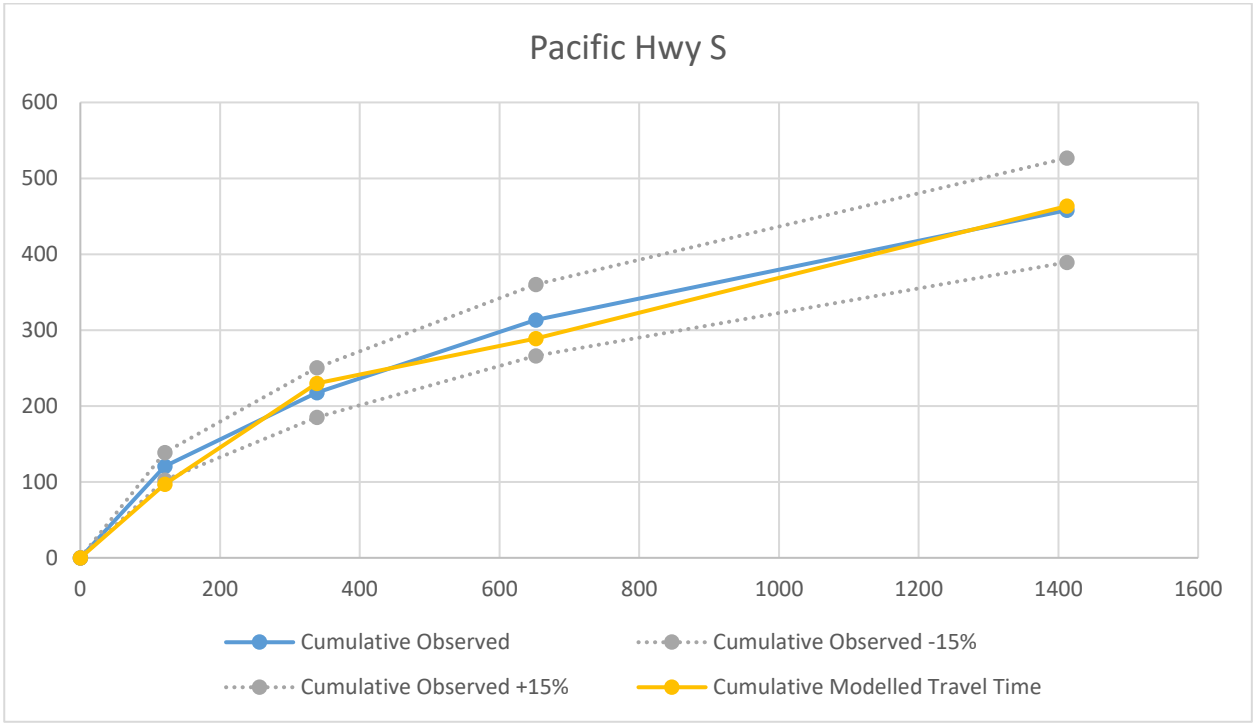

Falcon St E
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

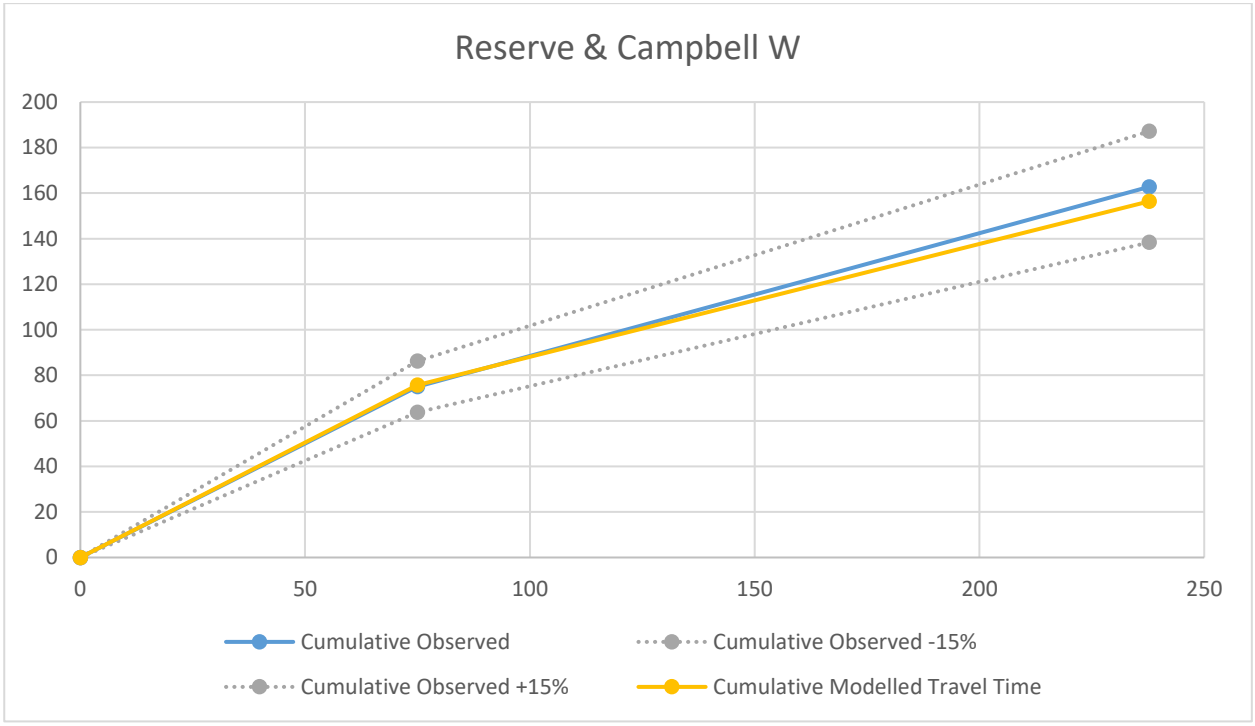

Falcon St W
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
180
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

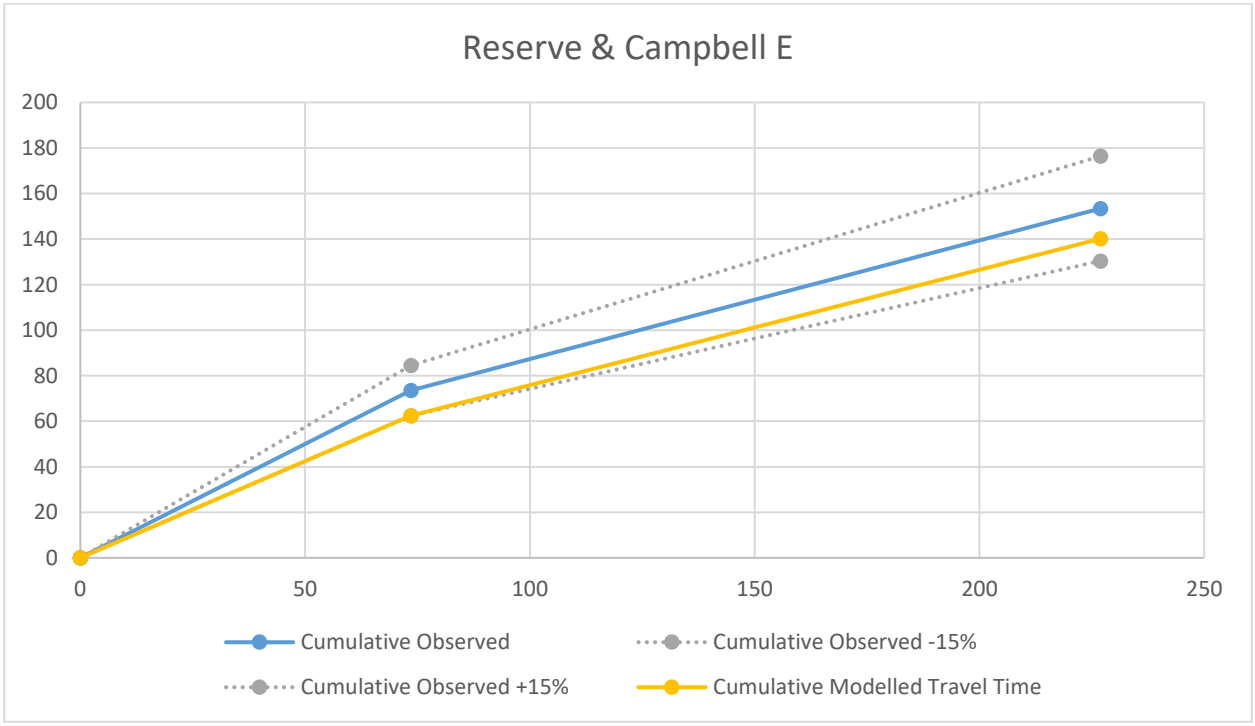

Herbert St N
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
180
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

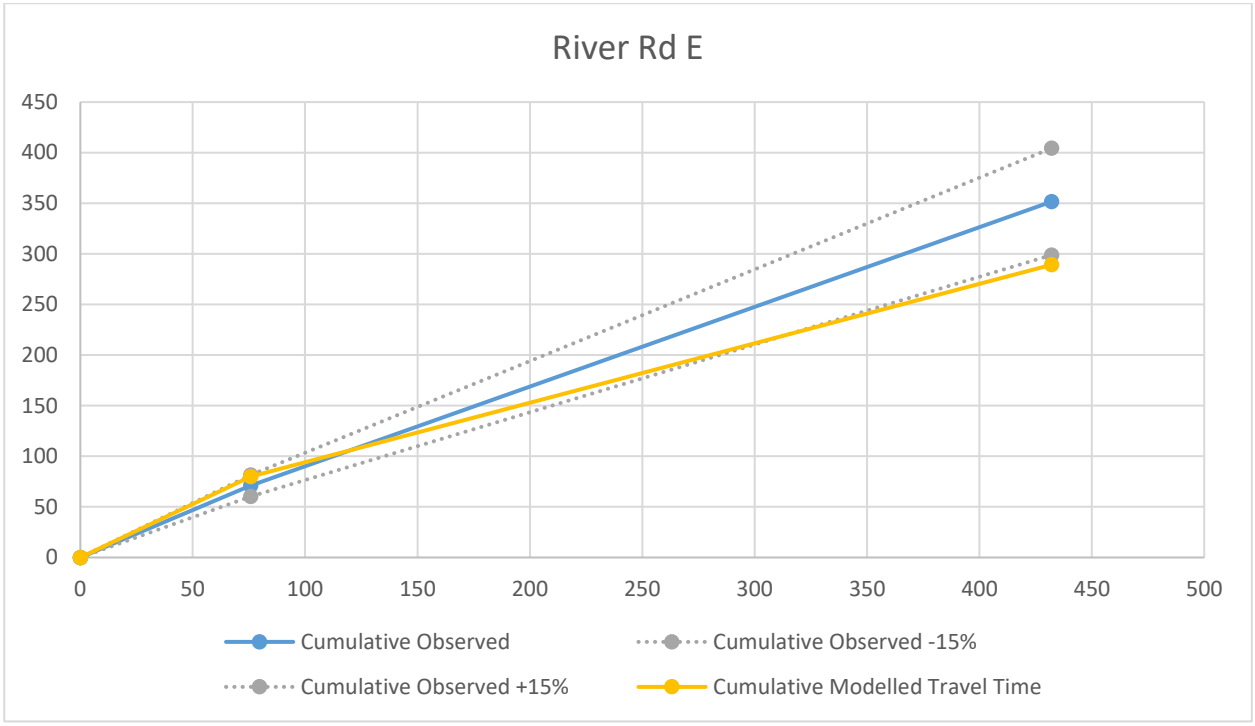

Herbert St S
200
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

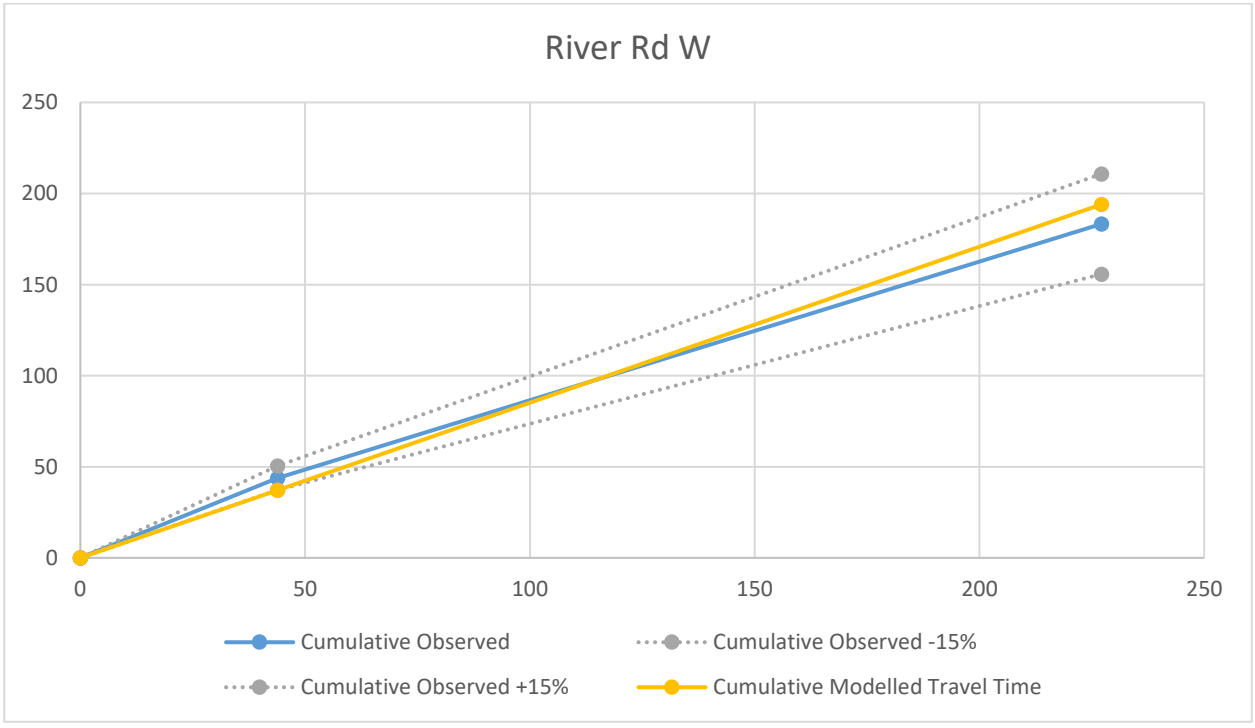

Pacific Hwy N
500
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

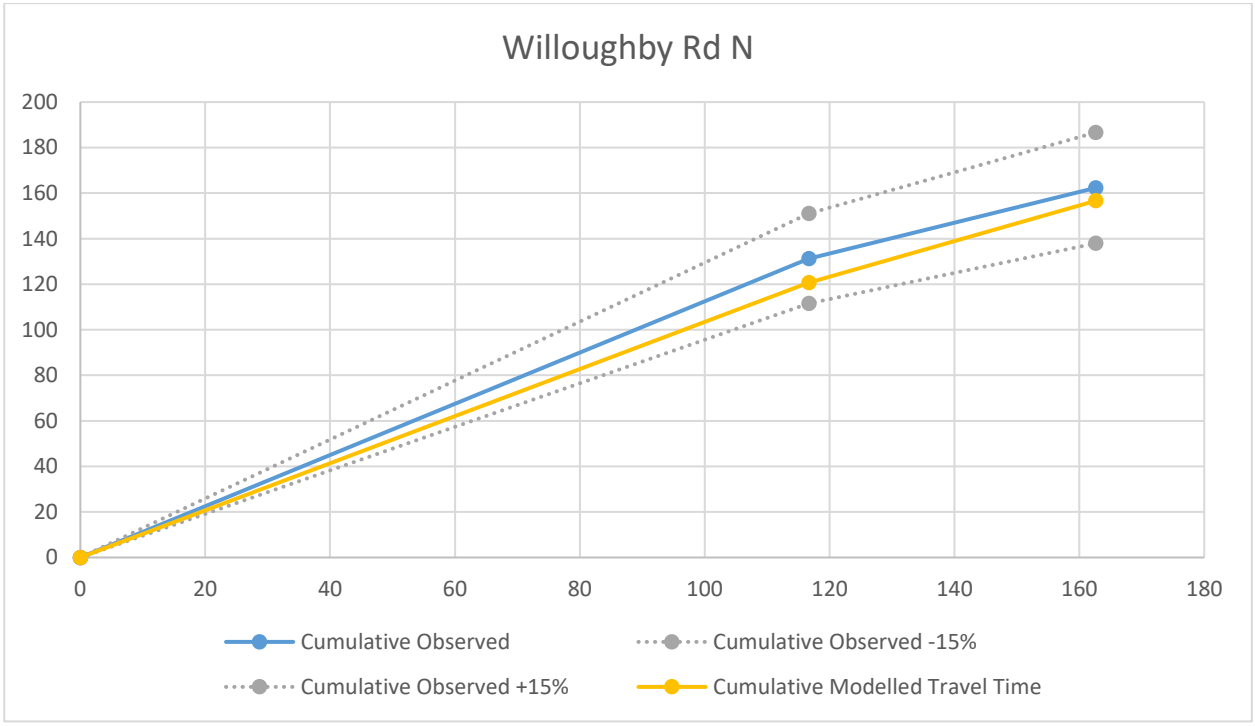

Pacific Hwy S
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time

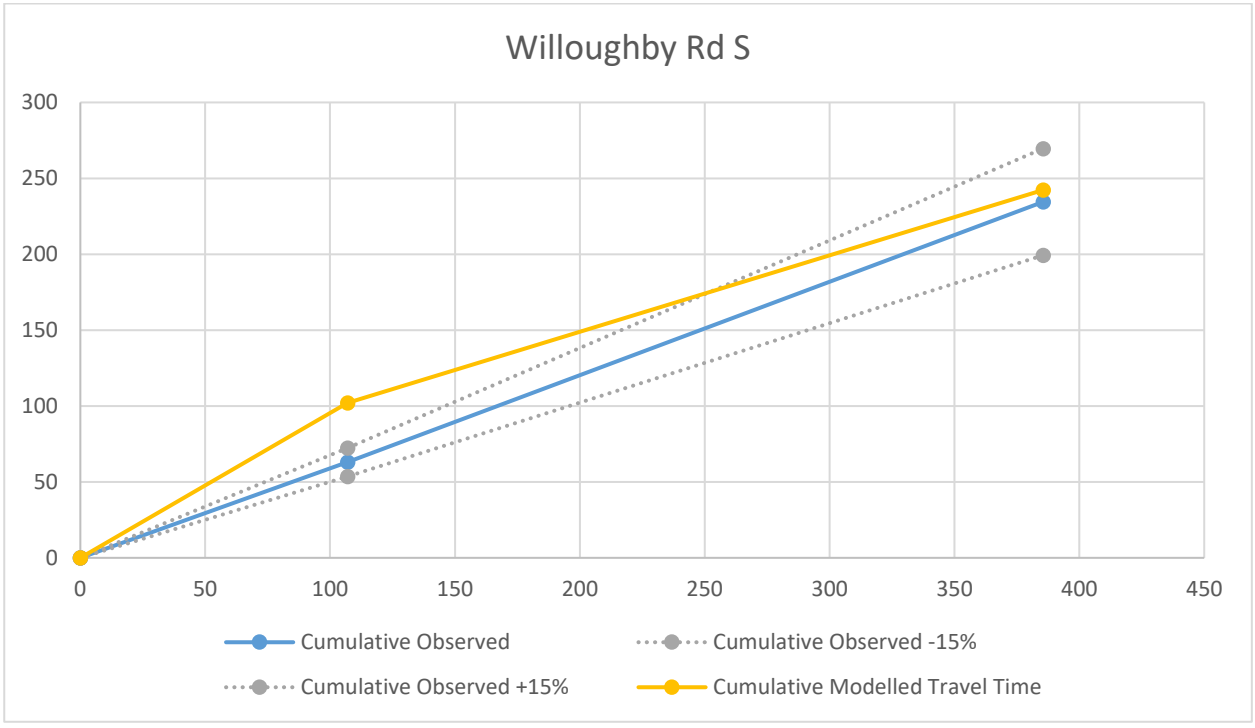

Reserve & Campbell W
200
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


Reserve & Campbell E
200
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


River Rd E
450
400
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450
500
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


River Rd W
250
200
150
100
50
0
0
50
100
150
200
250
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


Willoughby Rd N
200
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
180
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time


Willoughby Rd S
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450
Cumulative Observed
Cumulative Observed -15%
Cumulative Observed +15%
Cumulative Modelled Travel Time