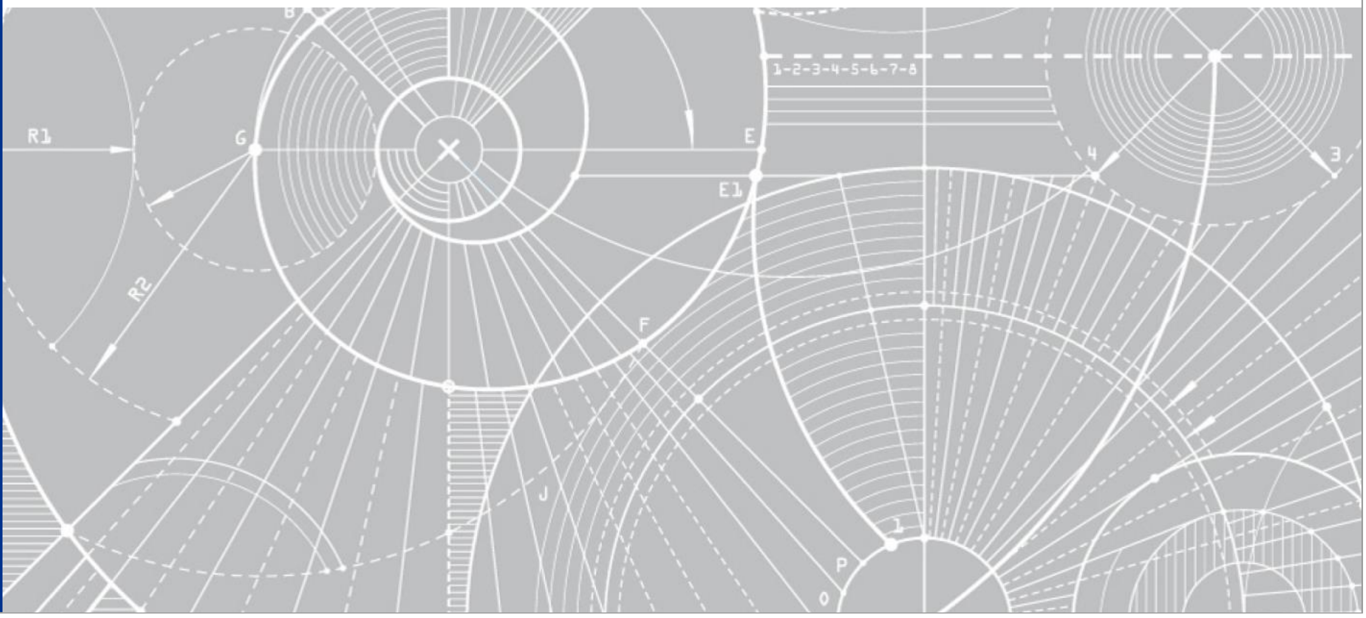
Canning City Centre

Movement, Access and Parking Strategy

Document No. | PB50671

City of Canning

30 May 2016



JACOBS®

JACOBS

Canning City Centre

Project no:	PB50671
Document title:	Canning City Centre Movement, Access and Parking Strategy
Document no:	Document No. PB50671
Revision:	Final
Date:	30 May 2016
Client name:	City of Canning
Project manager:	Richard Isted
Author:	Richard Isted
File name:	PB50671 Canning City MAPS Report.docx

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
11th Floor, Durack Centre
263 Adelaide Terrace
PO Box H615
Perth WA 6001 Australia
T +61 8 8424 3800
F +61 8 8424 3810
www.jacobs.com

Document history and status

Revision	Date	Description	By	Review	Approved
DRAFT	28/11/2014	Preliminary Draft	Richard Isted / Emmerson Richardson	Emmerson Richardson	Richard Isted
DRAFT	13/02/2015	Draft	Richard Isted / Emmerson Richardson	Emmerson Richardson	Richard Isted
DRAFT	06/10/2015	With Client Comments			
DRAFT	16/12/15	DRAFT for input (see Appendix I and K)	Richard Isted		
FINAL	30/5/2016	FINAL	Emmerson Richardson	Louise Fogarty	Richard Isted

Contents

Appendix A. List of Stakeholder Meetings

Appendix B. Modelling Strategy Report

Appendix C. Modelling Calibration Report

Appendix D. 2026 Modelling Note

Appendix E. Summary of Modelling Findings

Appendix F. Infrastructure Risk Assessment

Appendix G. Recommended Parking Requirements

Appendix H. Review of Background Information

Appendix I. Transport Contribution Methodology

Executive Summary

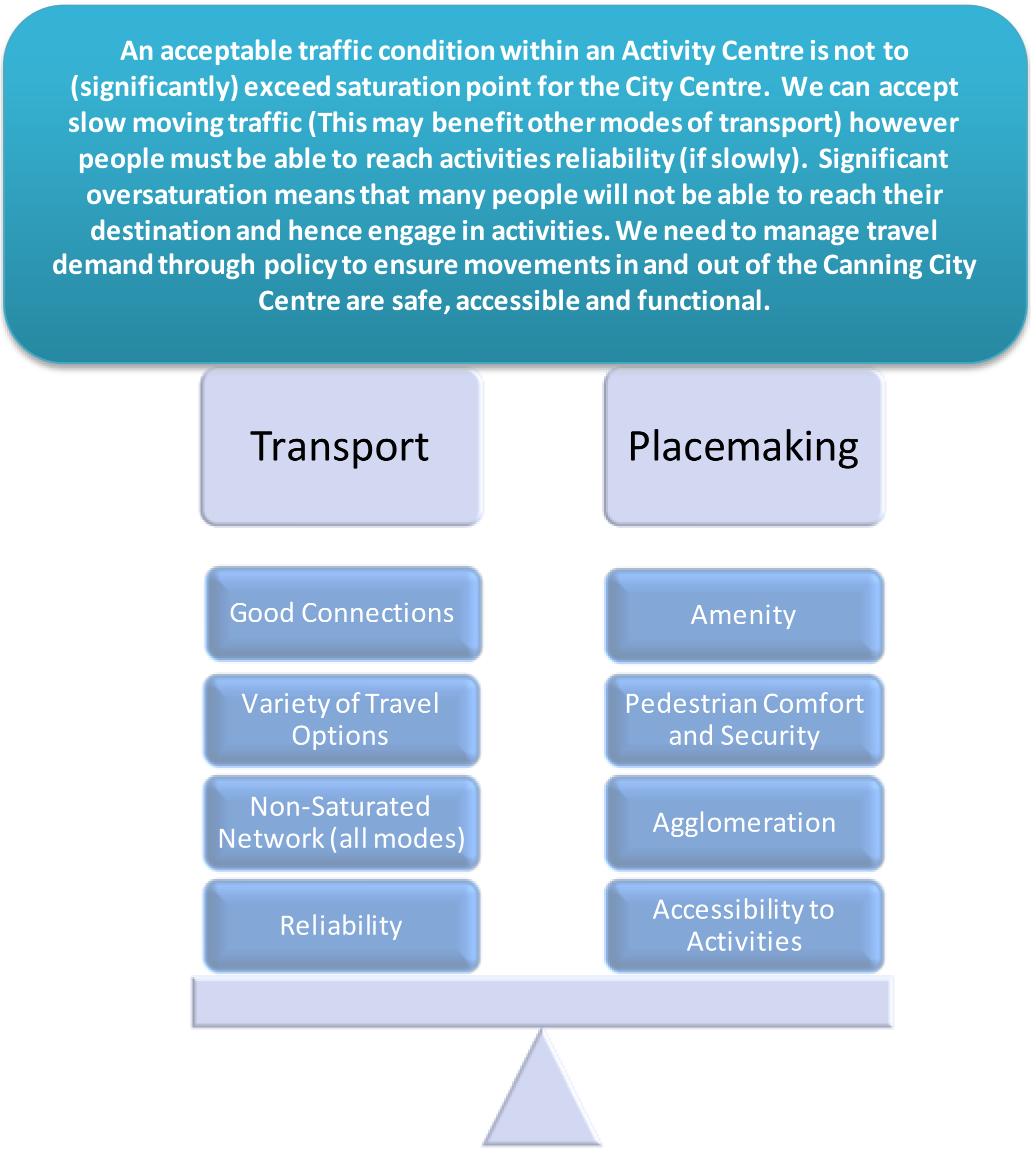
Canning City Centre is identified in Directions 2031 (WAPC, 2010) as a Strategic Metropolitan Centre within the Perth Metropolitan region. Activity Centres are identified as community focal points and provide focused activity around passenger rail and high frequency bus networks. The transport challenge for the Canning City Centre is to provide access for more than double the workers in the Canning City Centre, as well as major growth in retail and residential dwellings.

From a purely traffic perspective, there are significant challenges. Albany Highway, the main arterial road next to the Canning City Centre already operates at a low level of service, particularly if compared against typical criteria used by organizations such as Main Roads Western Australia (MRWA) for the performance of their roads. Additional land uses, without affecting the mode choices of those that access the Canning City Centre, would quickly saturate the surrounding road network and make it an inaccessible location. This in turn would create a significant disincentive for investors looking to develop in the Canning City Centre as well as affect the regional road network.

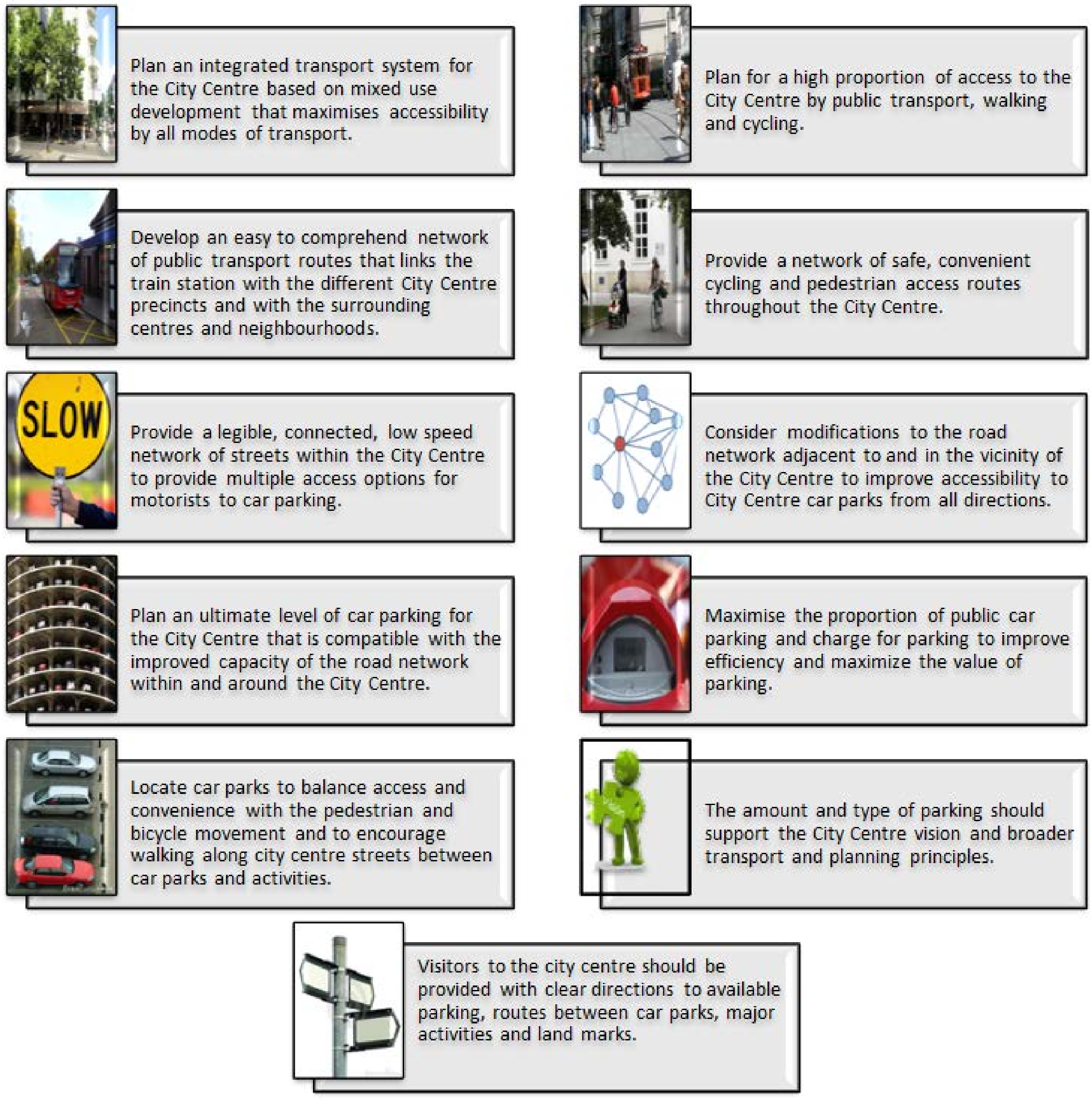
However, the Canning City Centre has a number of opportunities over other locations that could be used to offset this:

- The proposed mix of land uses at a higher density within the Canning City Centre will enable a higher proportion of people living and working in the Canning City Centre to increase their travel by walking and cycling and by improved public transport to, from and within the Canning City Centre;
- More use can be made of the nearby Cannington Rail Station for commuters and visitors travelling to Canning City Centre and for commuters and others travelling to Perth City and other locations on the rail system;
- The already extensive bus system can be expanded to provide frequent feeder service from surrounding areas including growth areas such as Southern River and high quality frequent services to link with nearby strategic regional centres such as Curtin, Murdoch and Perth airport. In the longer term a light rail system can connect Cannington through to Curtin University and to Perth City and beyond;
- The existing limited bicycle facilities can be expanded in all directions to provide a safe network of off-street paths radiating out from the Canning City Centre to provide an alternative access mode for a wide range of people; and
- The current subsidised (“free”) parking at the Canning City Centre which acts to encourage driving at the expense of other transport alternatives can be modified by providing a realistic charge for parking and reducing the rate of parking provision to a level more in keeping with a strategic regional centre.

There is also a need for a balance to be struck between transport challenges and the place-making aspects associated with this being a strategic activity centre. The figure below highlights some of the views on transport and place-making that have been expressed throughout the study and that are recognized generally.



From the background review of the issues, a number of guiding principles have been developed. These principles are:



Transport modelling has been a key part of this study and has provided an objective assessment tool for identifying key future issues and management responses. From these exercises, the following was identified:

- The Albany Highway / Liege Street intersection has been found to be the key bottleneck along Albany Highway both now and into the future. This is unsurprising as current data and modelled trends suggest that this is the access for a significant demand from the south along Nicholson Road. This demand is expected to increase with the increase in the size of the shopping centre and with it the potential throughput through this intersection. This highlights the need to reduce car traffic, and provide a more permeable road network that provides more access options.
- The modelling suggests that a significant majority of the demand on Albany Highway within the vicinity of the site appears to be relatively local traffic, rather than regional movements, and that because of existing commercial land use patterns being fairly linear along this corridor, there exists opportunities to manage demand through improved public transport services.
- The trafficable demand that the Westfield Carousel expansion will create without significant parking demand management is expected to be significant and would have a major impact on the efficiency of the network (particularly on Albany Highway). This strategy proposes a number of infrastructure improvements that can be implemented to manage the accessibility and keep traffic moving when considered alongside

the other modal and demand management strategies (these include the Sevenoaks Street Extension, the Southern Link Road and the Gerard Street extension). To accommodate the full Canning City Centre Structure Plan vision, measures designed to reduce the amount of car driving and increase the number of people accessing the Canning City Centre by walking, cycling and public transport will be required.

From consideration of the background material and policy context, the modelling exercises and stakeholder discussions, five key strategies have been formulated and refined. These strategies are:

Each of these strategies, including their objectives and guiding principles are documented within this strategy also describes how each strategy can be integrated as part of a sustainable mobility management approach to ensure positive synergy is achieved.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to develop a Movement, Access and Parking Strategy in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

1.1 Canning City Centre Structure Plan

The Canning City Centre is a designated Strategic Metropolitan Centre and as such, is expected to develop into a substantial City in its own right. Through discussion with the community, the vision for the Canning City Centre is of:

"A re-energised City Centre with a community heart that is connected, accessible, vital and resilient".

The Canning City Centre Structure Plan (refer to **Figure 1.1**) has been prepared in response to SPP4.2 and Directions 2031. The structure plan incorporates a number of precincts which include "core" and "frame" areas. A new "core" will form along Cecil Avenue, with a finer grain and intensity of activity and built form anticipated in the core area. It will become a "main street" environment, connecting Cannington Train Station to the civic precinct and the mixed use and residential precinct between Albany Highway and the Canning River. The new Canning City Centre will boast premier retail, increased commercial office space, new and diverse living options and quality recreation by the Canning River which all converge to realise Canning City Centre's potential as the investment hub of the south-east metropolitan area.

Development targets set under the Canning City Centre Structure Plan include:

- 80,500m^2 of additional Commercial Floor Space;
- 60,000m^2 additional Retail Floor Space;
- 40,000m^2 additional community/ institutional land uses; and
- 10,000 new dwellings to house almost 20,000 new residents.

It is envisaged that this additional development would occur over the next 30 to 40 years.

Figure 1.1: Canning City Centre Structure Plan

1.2 Previous Strategy

The Canning City Centre Regeneration Movement Strategy (draft, Aurecon, 2013) was developed as an accompanying strategy to the Canning City Centre Structure Plan. The key conclusions from this study were:

- Need for a balanced transport outcome through better design, including commitment to a sustainable transport solution with a high public transport mode share;
- Stringent guidelines for the management of car demand including maintaining a level of congestion of general vehicles (including their car parking supply) to provide a greater incentive for the use of other modes; and
- Working together with stakeholders including the Department of Transport, Public Transport Authority and Main Roads.

In review of the draft Structure Plan and the draft Canning City Centre Regeneration Movement Strategy, the Transport Portfolio (Main Roads WA, Department of Transport and Public Transport Authority) acknowledged the work done but could not support the Structure Plan and associated works until detailed modelling was undertaken. In response, the City of Canning worked closely with the Transport Portfolio to prepare the brief for a revised Movement, Access and Parking Strategy for the Canning City Centre as well as review and appoint the consultants.

1.3 Current Strategy Objectives

The scope of the current strategy (this document) was developed by the City of Canning in conjunction with the Department of Transport, Public Transport Authority and Main Roads WA for the development of the new strategy. The objective of the brief is to undertake the necessary studies, modelling and preparation work to revise and update the draft Movement Strategy to become the Movement, Access and Parking Strategy for the Canning City Centre. The aims are:

- To provide residents and visitors with a range of access options that is not too dependent on any particular mode of transport or street in the network;
- To improve the legibility and permeability of the urban fabric;
- To manage the demand for car travel to limit undesirable impacts from excessive levels of car travel on city streets;
- To ensure the Canning City Centre street network has a high level of amenity and is safe and comfortable for pedestrians and cyclists to use;
- To maximise access to the Canning City Centre by public transport, cycling and walking;
- To undertake on-going monitoring and compliance programs to evaluate the performance of the Movement, Access and Parking Strategy.

To assist assessment against these objectives this study provides an objective basis for assessment through the development of traffic modelling for the Canning City Centre.

1.4 Planning Philosophy

The planning philosophy used in this report seeks to develop a Canning City Centre that is attractive to business and visitors and is a great place to live. Within this context, the role of the transport system is to provide a high level of accessibility for all to jobs, education, shops and other activities as the Canning City Centre grows. Importantly, improvements to accessibility should not overly detract from the attractiveness of the place.

If people are to be attracted to live, work and invest in the Canning City Centre, the streets and public spaces must be safe, lively and comfortable. Gehl Architects in its Public Space and Public Life report for Seattle (2009) lists the following attributes of lively cities:

• LONG TERM STAYS MAKE LIVELY CITIES

The activity level will rise remarkably when pedestrians or people indoors are tempted to spend time in inviting and comfortable public spaces. The extent of staying activities has the largest impact on the activity level in a public space.

• BALANCE BETWEEN ROAD USERS CREATES LIVELY CITIES

When traffic volumes are low and traffic moves slowly there tends to be more public life and more opportunities to meet in the public spaces. A good balance between the road users can often be achieved by inviting people to walk, cycle or take public transport instead of the car.

• A VARIATION OF PLACES CREATE LIVELY CITIES

Smaller gestures inviting people to stay in nice places can tempt passers-by to linger for awhile. Informal spaces people can visit during breaks or outdoor serving areas can invite people to dwell in public spaces with possibilities for recreation and refreshments. An inviting space offers good comfort, sun, views, other people, shelter, and a respect for human scale. A balance between active and calm places is important to invite many user groups.

• A STRONG PEDESTRIAN NETWORK MAKES LIVELY CITIES

Walking should be simple and attractive. A network that connects destinations, lovely promenades, good climatic conditions, interesting things to look at, safety throughout the day all contribute to walking.

Walking activities need to be concentrated in a network of lively, attractive and safe main streets following the principle “to concentrate” as opposed to “spread out,” to ensure an active public realm.

• MANY USER GROUPS CREATE LIVELY CITIES

When a city is able to invite many different groups to use the public spaces - the elderly, disabled, children, families, young people, working people etc. - a more varied use of the city can be obtained both in terms of activities and time of day, week or year. A lively city does not rule out specific user groups to invite others, but invites a great variety of all users to get the balance right.

• PLANNING FOR OPTIONAL ACTIVITIES CREATE LIVELY CITIES

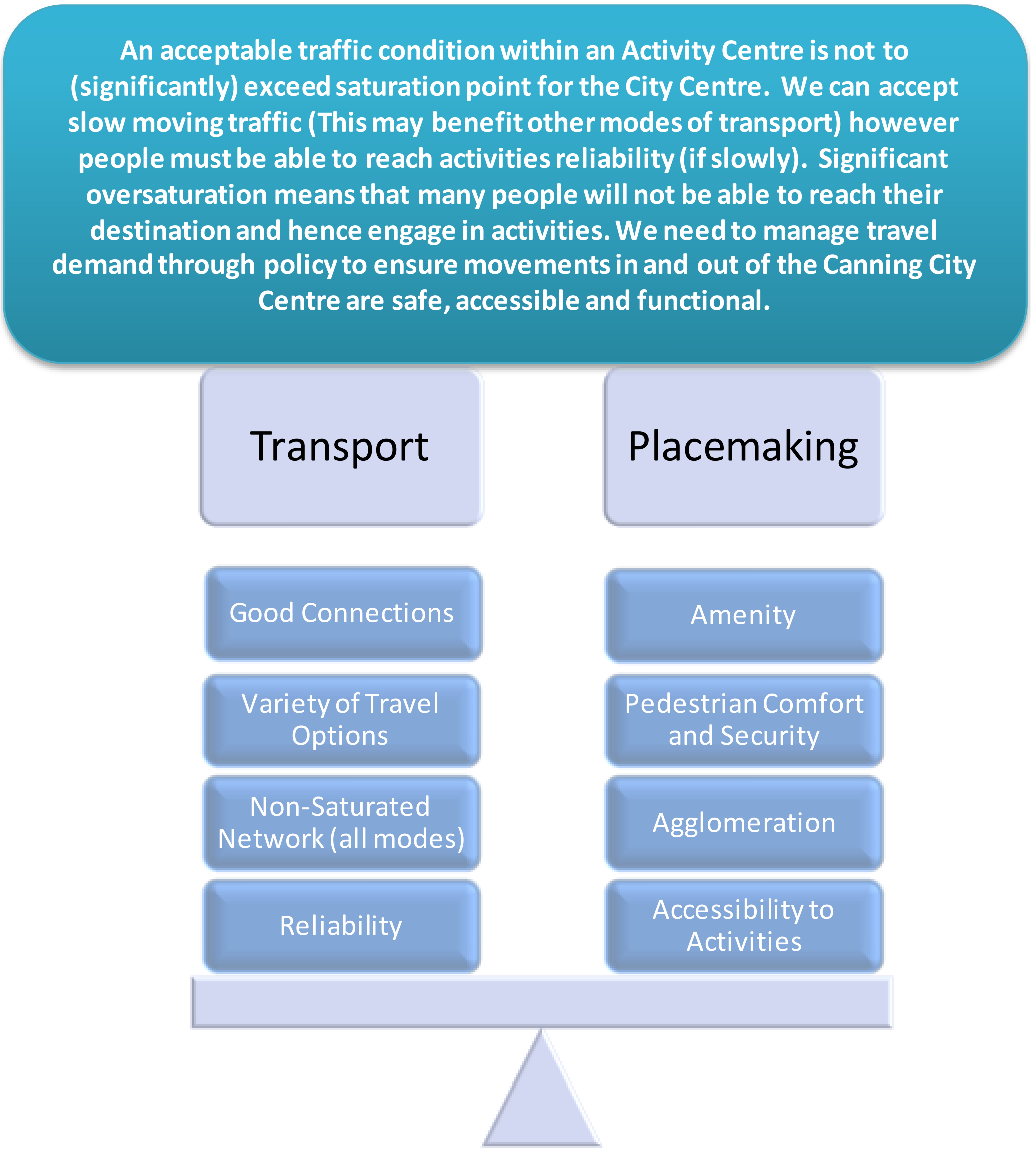
All cities, regardless of the quality of the public realm, have people engaged in necessary activities; walking to and from, waiting for the bus etc. The quality of the public realm can be measured in how many people choose to visit for optional reasons because the city offers a variety of experiences to enjoy the public realm, look at other people, meet friends and engage in urban activities.

During the preliminary stakeholder discussions that took place during the initial stages of this study, it was clear that there were different views expressed on the merits of improving transport and improving place when one was seen to impact on the other. The view taken in this study is that a high level of accessibility and connectivity and quality public streets and places are equally important and that an appropriate balance is necessary.

Taking these attributes into consideration, the following objectives and aspects are considered critical for the Canning City Centre.

Figure 1.2 outlines these key attributes of Transport (access) and Place Making that are important to consider in developing an efficient, attractive City Centre.

Figure 1.2: Philosophy



2. Long Term Access and Parking Principles

The City of Canning's vision for the Canning City Centre is *"a re-energised City Centre with a community heart that is connected, accessible, vital and resilient"*.

The connected and accessible components that are related to access and transport are further defined as follows:

- ***Connected*** – *Canning City Centre will be a connected place that celebrates its heritage as a commercial hub focussed on trade, movement, the river and people. It will be a place that puts people first, including residents, businesses and visitors.*
- ***Accessible*** – *Creating a welcoming place that is easy to get to and move through, with fresh, green and open meeting places and spaces, a revitalised train station and pedestrian and cycle ways that connect to the river.*

State Planning Policy (SPP) 4.2 - Activity Centres for Perth and Peel is the most up-to-date guidance on planning for city centres. It sets out a number of key objectives (shown below in **Figure 2.1**):

Figure 2.1: Policy Objectives (from State Planning Policy (SPP) 4.2 – Activity Centres for Perth and Peel)

Activity Centre Hierarchy

- *Distribute activity centres to meet different levels of community need and enable employment, goods and services to be accessed efficiently and equitably by the community.*
- *Apply the activity centre hierarchy as a part of a long term and integrated approach by public authorities and private stakeholders to the development of economic and social infrastructure.*
- *Plan activity centres to support a wide range of retail and commercial premises and promote competitive retail and commercial targets.*

Activity

- *Increase the range of employment in activity centres and contribute to the achievement of sub-regional employment self-sufficiency targets.*
- *Increase the density and diversity of housing in and around activity centres to improve land efficiency, housing variety and support centre facilities.*
- *Ensure activity centres provide sufficient development intensity and land use mix to support high frequency public transport.*

Movement

- *Maximize access to activity centres by walking, cycling and public transport while reducing private car trips.*

Urban Form

- *Plan activity centre development around a legible street network and quality public spaces.*

Out of Centre Development

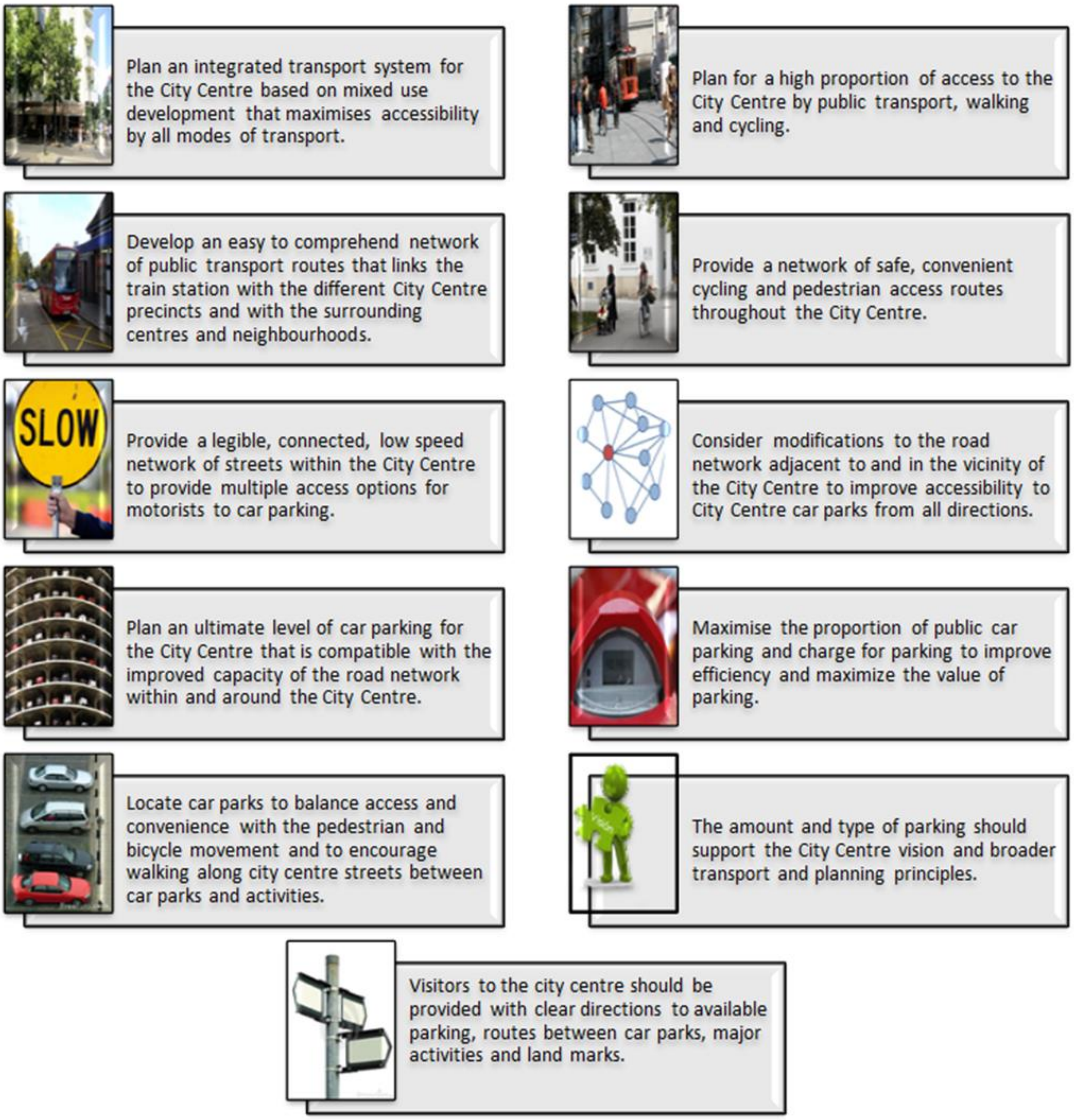
- *Concentrate activities, particularly those that generate high numbers of trips within activity centres.*

(Source: WAPC, 2010)

In addition to SPP 4.2, the WAPC policy for parking has also been used in the development of the City of Canning principles. Jacobs has developed the following long term access and parking principles to align with the City of Canning's vision, and the SPP 4.2 objectives.

The principles outlined in **Figure 2.2** below are intended to support the development of the Canning City Centre as *"a place for people"* that has great amenity, is commercially vibrant, is easily accessible and is environmentally sustainable.

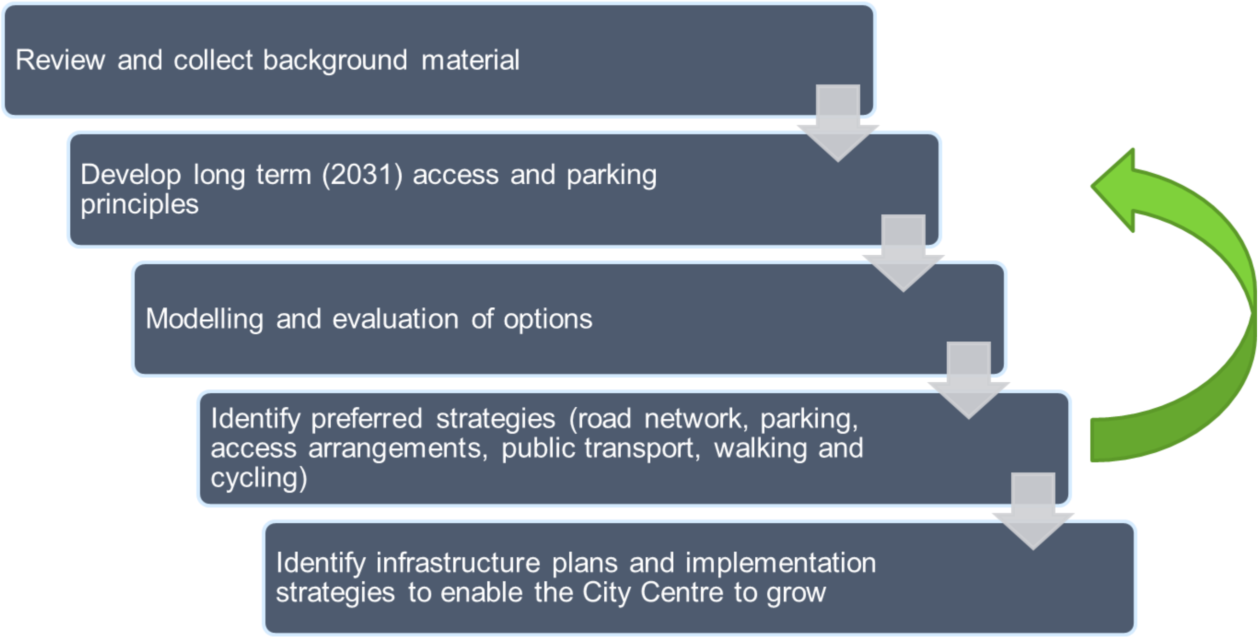
Figure 2.2: Canning City Centre Movement Access and Parking - Guiding Principles



3. Methodology

The approach to developing strategies is highlighted in **Figure 3.1**.

Figure 3.1: Methodology



3.1 Traffic Model Development

To establish an objective framework for assessing traffic impacts associated with new developments in the Canning City Centre, and the mitigating effects of infrastructure upgrades, a number of steps were undertaken:

1. Traffic data for 2014 was collected, including traffic and pedestrian counts, travel times and on-site observations;
2. The Main Roads Regional Operations Model (ROM) was used to examine spatial travel trends and traffic generation in 2011 and at 2031;
3. The information from this model was used to develop a detailed traffic model of the Canning City Centre and surrounding areas. The parameters of this model were calibrated to the observations of existing traffic; and
4. This model was then used to analyse the impacts associated with expected increases in traffic associated with Canning City Centre developments.

The traffic modelling was undertaken using a three-tiered approach. This approach utilised travel demand data from the ROM model and involved the development of a mesoscopic model of the wider network area and a microsimulation model of the Structure Plan area. The models were developed for a weekday AM and PM peak hour and a Saturday afternoon peak hour. An overview of the modelling approach is illustrated in **Figure 3.2**.

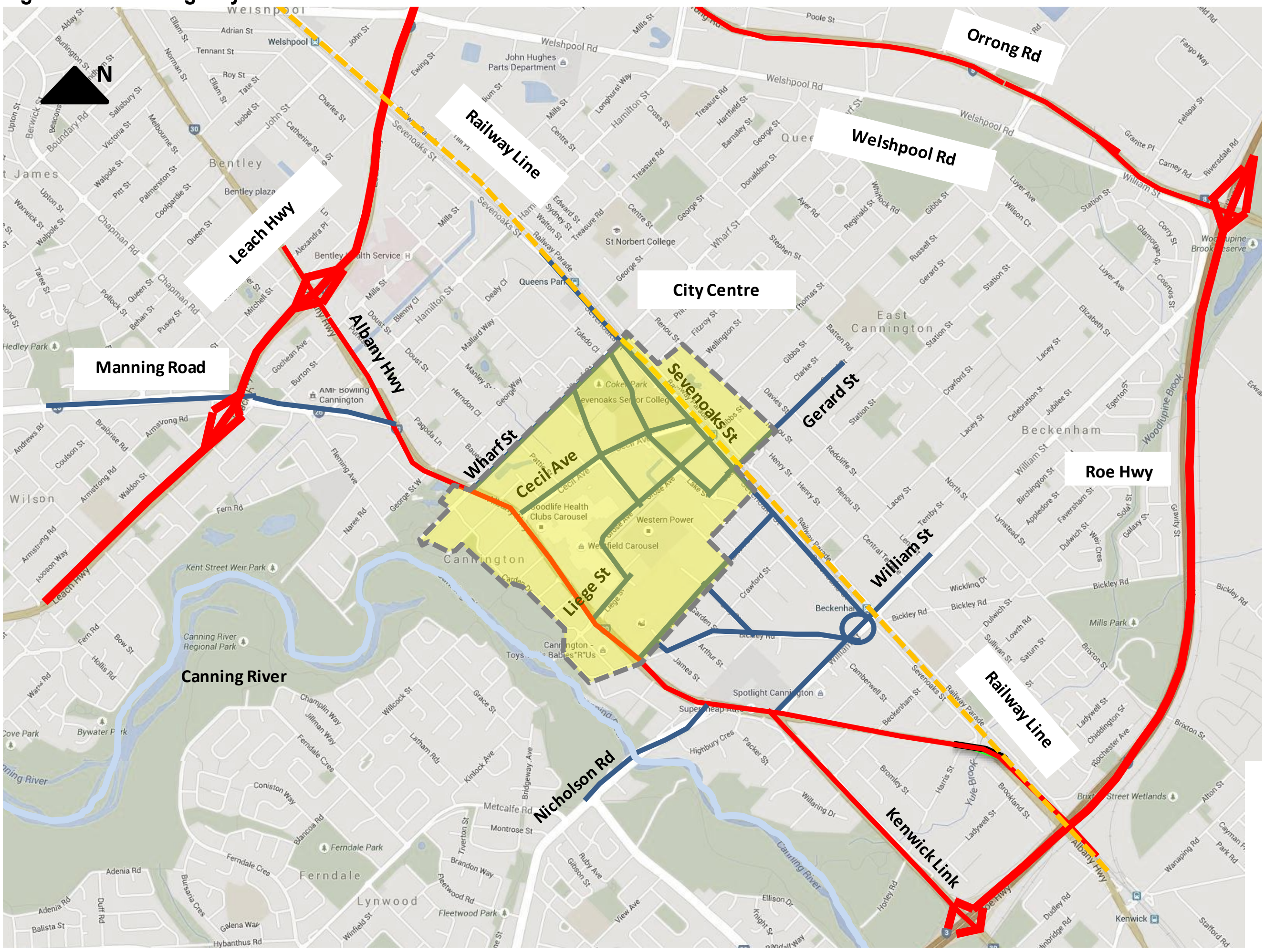
Figure 3.2: Stages of the modelling assessment

4. Challenges and Opportunities

4.1 Physical Constraints

The boundary of the Canning City Centre is defined by the Central City Area under the Metropolitan Region Scheme (MRS). **Figure 4.1** highlights the City Centre. Activities within the boundary include the Westfield Carousel Shopping Centre; retail, commercial and government areas along Albany Highway and Cecil Avenue, the Western Power substation, areas of conservation, light industrial uses along the northern side of the railway and recreational, educational and community facilities on Wharf Street.

Figure 4.1: Canning City Centre Area



Canning City Centre is bounded by the Canning River to the south and the Perth to Armadale Railway Line to the north and these form the geographic constraints of the area. The key physical constraints of the Canning City Centre can be summarised below:

- Canning River – The Canning River meanders through City of Canning suburbs including Cannington, Ferndale, Wilson, Riverton, Shelley and Rossmoyne. Nicholson Road south of the Canning City Centre is the sole connection between the Caning City Centre to suburbs south of Canning River, such as Ferndale, Lynwood, Parkwood and Canning Vale.
- Perth – Armadale/Thornlie Railway Line – The railway line runs along the northern side of Canning City Centre, between Sevenoaks Street and Railway Parade. Vehicular crossings can be made via either Wharf Street at a level crossing or the Gerard Street Bridge. Cannington Train Station is a Transperth Bus/Train Interchange located within the Canning City Centre between Cecil Avenue and Gibbs Street and within walking distance to Westfield Carousel Shopping Centre and other facilities in the Canning City Centre. In

addition, there are two pedestrian only railway crossings. One located on Crawford St, south of the Cannington Train Station, and the other, an underpass, at the Cannington Train Station.

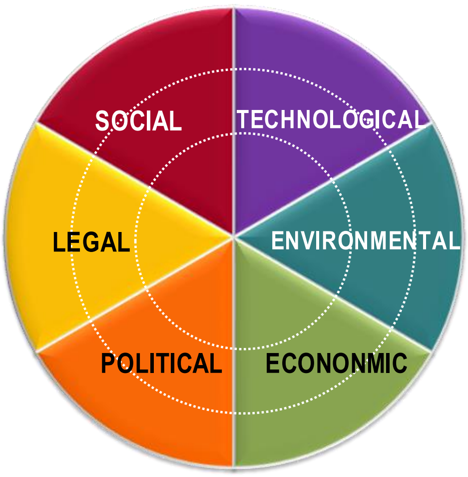
- Albany Highway – Albany Highway serves as the main route for Perth's south-east region. The section of Albany Highway within the Canning City Centre has a six-lane dual carriageway with primarily left turn lanes accessing local business within the Canning City Centre. Albany Highway currently carries approximately 65,000-70,000vpd between Manning Road and Nicholson Road. Three signalised intersections at Wharf Street, Cecil Avenue and Liege Street allow vehicles travelling to the suburbs either side of the Albany Highway to enter and exit. Vehicles may also travel from Albany Highway to Cannington Train Station, East Cannington and Queens Park via a non-signalised intersection at Station Road. Albany Highway results in significant segregation between the land uses to the south and to the main retail centre to the north.

4.2 Growth Issues

To narrow the scope of the review of background issues, an "Issues Wheel" analysis has been undertaken. As part of the issues wheel, known issues (both positive and negative) within a number of different areas have been identified and summarised from the background review. Some key points are:

- Long term, the Canning City Centre Structure Plan identifies a significant amount of employment (10,472 employees) to be located in the Canning City Centre, and also a greater number of people living in the Canning City Centre (around 25,000 people); this is in line with the overarching Strategic Planning Policy 4.2.
- The longer term worldwide trend is that retail shopping is changing, with online sales picking up a greater proportion of shopping; this is consistent with having a broader range of uses located in the Canning City Centre in the future, as outlined in the Structure Plan. However, in the short term, developers are primarily interested in developing more retail within the Canning City Centre.
- An achievement of a larger mode share to public transport, walking and cycling is a key indicator as to the success (or otherwise) of the Canning City Centre.
- Constraints which limit the extent and location of additional roads in the Canning City Centre.

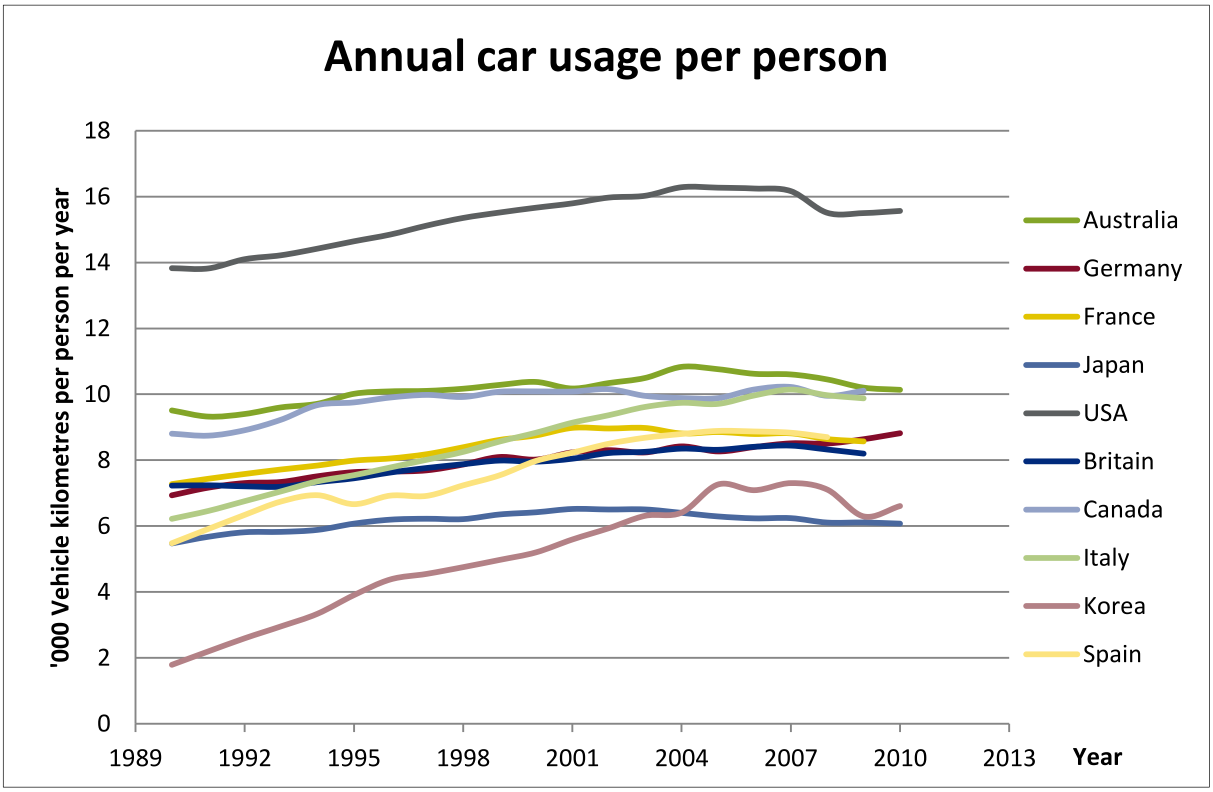
A more detailed summary of the issues is attached in **Appendix H**.



4.3 Transport Trends and Implications for Canning City Centre

For the last half of the 20th century there was a continuous increase in car driving in most OECD countries, with an associated decline in walking, cycling and public transport usage. This resulted in growing congestion on the road system. There is now strong evidence that this trend changed at the beginning of the 21st century. Over the past ten years car driver trips per person has declined in almost every OECD country (refer **Figure 4.2)**.

Figure 4.2: Annual car usage per person in OECD countries [1]



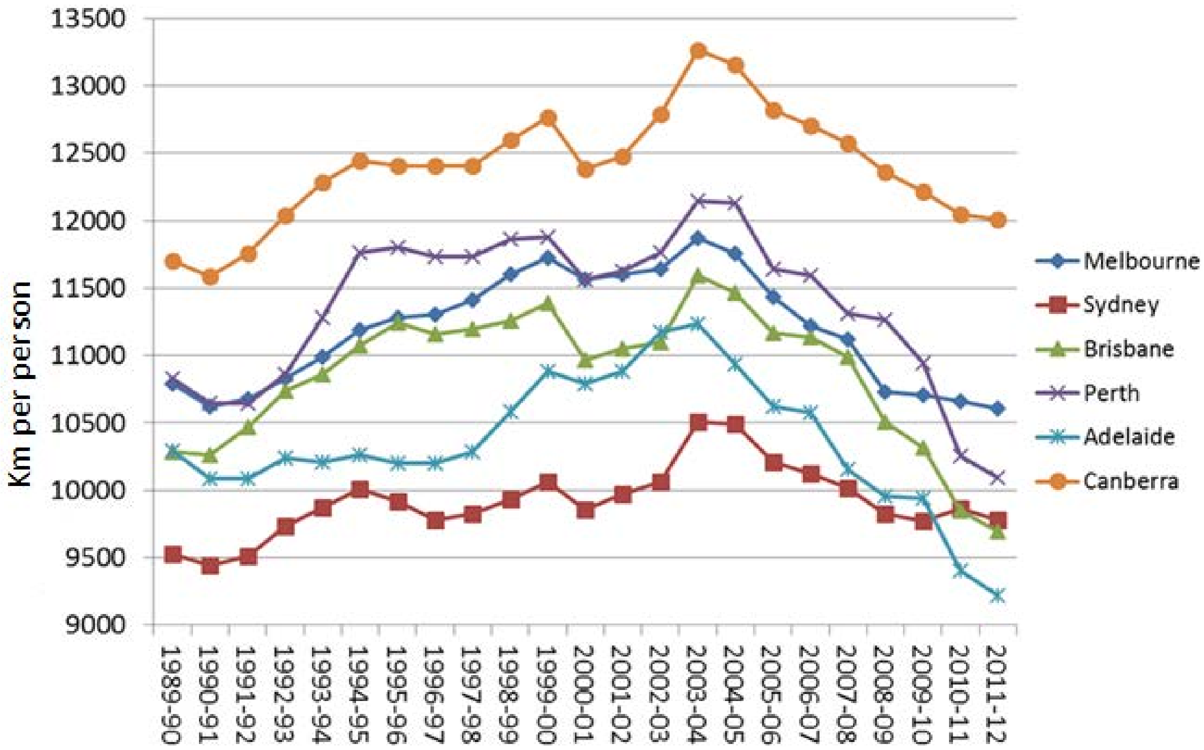
There are a wide range of factors that have caused this significant change in travel patterns that are discussed more fully in a paper presented to the AITPM conference in Perth in 2013 by Richardson and Elaurant. They include:

- Congested streets are making car driving less attractive;
- Improved public transport systems with higher frequency services along priority routes are a more attractive travel alternative for some travellers;
- Price factors including higher parking fees are influencing travel behaviour;
- Young people are driving less; they are substituting some travel for electronic communications or travelling by public transport where they can communicate en route by electronic devices; and
- Many young people appreciate the growing inconvenience of driving and owning a car and there has been a substantial decline in young people with a driving licence.

Figure 4.3 shows how car driving per person has declined in every Australian city.

[1] Source: International Transport Forum, 2011

Figure 4.3: Car driving trends in Australian cities [2]



In Perth, car driving per person declined by more than 15% between 2004/05 and 2011/12. This is broadly consistent with a reduction in car driver mode share from about 63% at its peak in the early to mid-1990s to an estimated 55% to 56% at present.

The trend to lower levels of car driving and higher levels of travel by public and active transport (walking and cycling) is collaborated by the Australian Bureau of Statistics (ABS) data for journey to work.

Table 4.1 shows that the trend to higher levels of walking, cycling and public transport commenced between 2001 and 2006, but became more pronounced between 2006 and 2011.

Table 4.1: Journey to Work Mode Change between 2001 and 2011 for Perth and Peel

	Mode Change 2001 – 2006	Mode Change 2006 – 2011	Mode Change 2001 – 2011
Car Driver	- 1.2%	- 3.9%	- 5.0%
Car Passenger	0%	- 8.7%	- 8.7%
Public Transport	+ 11.1%	+ 25.9%	+ 40.0%
Walking	+ 11.8%	+ 11.7%	+ 24.9%
Cycling	+ 4.5%	+ 11.2%	+ 16.2%

Figure 4.4 shows the longer term trends in public transport usage with a substantial upturn starting in the late 1990s after years of decline. The mode share of journey to work by public transport has grown by about 40% in

[2] Car and transit use per capita in Australian cities, Charting Transport, October 2013

the decade to 2011. However, when population growth is factored in, public transport patronage almost doubled over that period.

Figure 4.4: Public Transport in Perth Mode Share Usage (Journey to Work)[3]

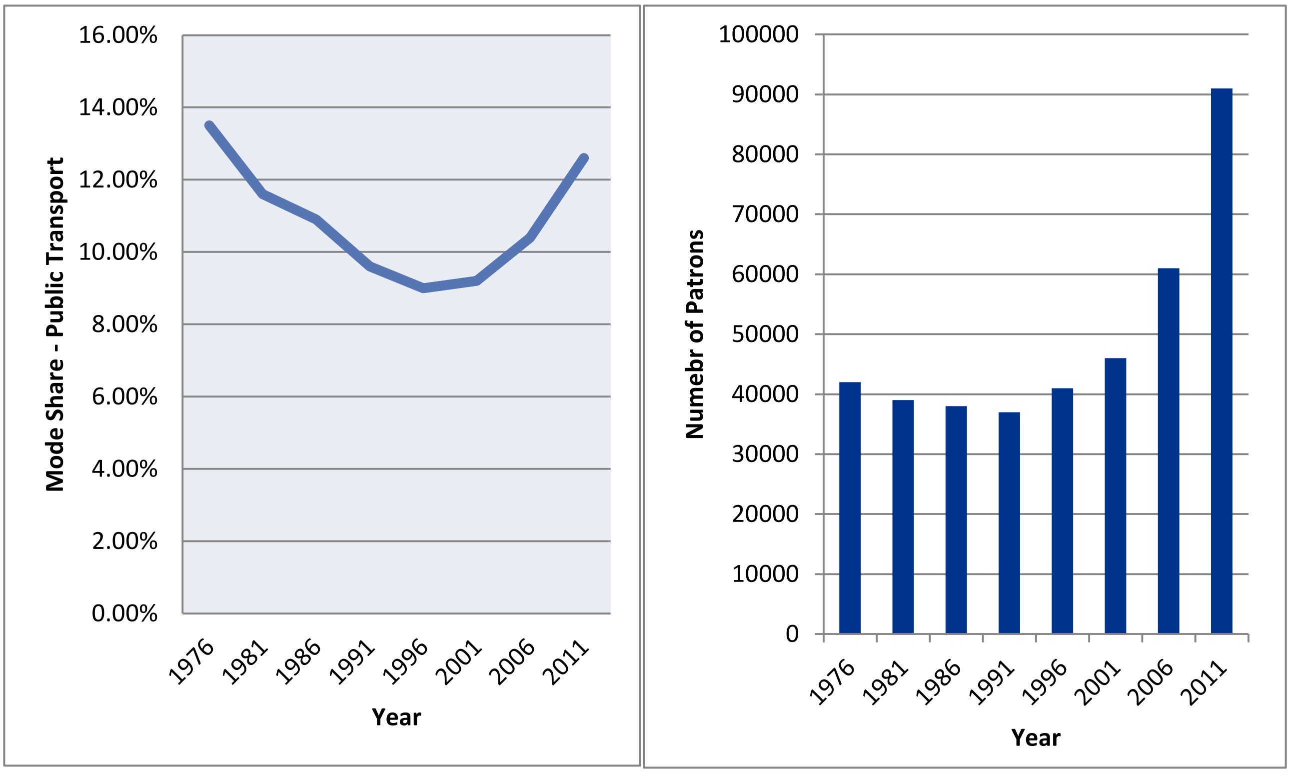


Table 4.2 shows that car driver mode share journey to work has declined more in inner areas of Perth than outer areas and cycling has increased much more in inner areas, whilst public transport mode share has increased by between 40% and 45% in all areas.

The journey to work statistics for inner councils show that places with a mix of housing and jobs in close proximity to an area well-served by public transport and with reasonable bicycle infrastructure will have quite different travel patterns than suburbs developed primarily to cater for car use.

Car driving to work in the City of Canning has declined at a faster rate than the average for middle councils, but at a slower rate than inner councils. The car driver mode share in the City of Canning remains 14% higher than the average for inner councils. Public transport mode share in the City of Canning has grown almost 50% more than the average for Perth. It is now 14% higher than the middle council average, but still 18% below the inner council average. There has been no growth in the cycling mode share in the City of Canning compared to a 25% increase for middle councils and a 50% increase in inner councils. Cycling mode share in inner councils in 2011 was 2.7 times that in the City of Canning.

The implications for these trends is that the City of Canning has performed well in the last decade in reducing travel to work per person by car and increasing use of public transport when compared to like councils. However, the City of Canning lags well behind other councils in increasing travel by bicycle.

[3] Journey to Work Statistics, Australian Bureau of Statistics, 2011

Table 4.2: Journey to work mode share changes by region[4]

	2011 Population	2001 Mode Share			2011 Mode Share (Growth for 2011)		
		Car Driver	Public Transport	Bicycle	Car Driver	Public Transport	Bicycle
Inner Councils (Vincent, South Perth, Victoria Park, Subiaco, Cambridge)	149,966	70.5%	12.6%	2.5%	63.3% (-9%)	17.8% (+43%)	3.8% (+50%)
Middle Councils (Stirling, Melville, Cockburn, Canning)	466,899	77.4%	9.1%	1.1%	73.9% (-6%)	13.2% (+45%)	1.4% (+25%)
Outer Councils (Joondalup, Kwinana, Rockingham)	285,788	78.1%	9.0%	0.6%	73.9% (-5%)	12.6% (+40%)	0.6% (0%)
Edge Councils (Mandurah, Swan, Armadale, Wanneroo)	392,737	78.2%	6.7%	0.65%	75.9% (-3%)	9.7% (+45%)	0.5% (-23%)
Perth and Peel Metro Area	1.83M	76.8%	9.0%	1.1%	72.9% (-5%)	12.6% (+40%)	1.3% (+18%)
Canning	85,814	77.9%	9.5%	1.3%	72.2% (-7.3%)	15.1% (+59%)	1.3% (0%)

[4] ABS Journey to Work Data

4.4 Regional Planning and Public Transport Planning

Perth and Peel @3.5million (WAPC, 2015)

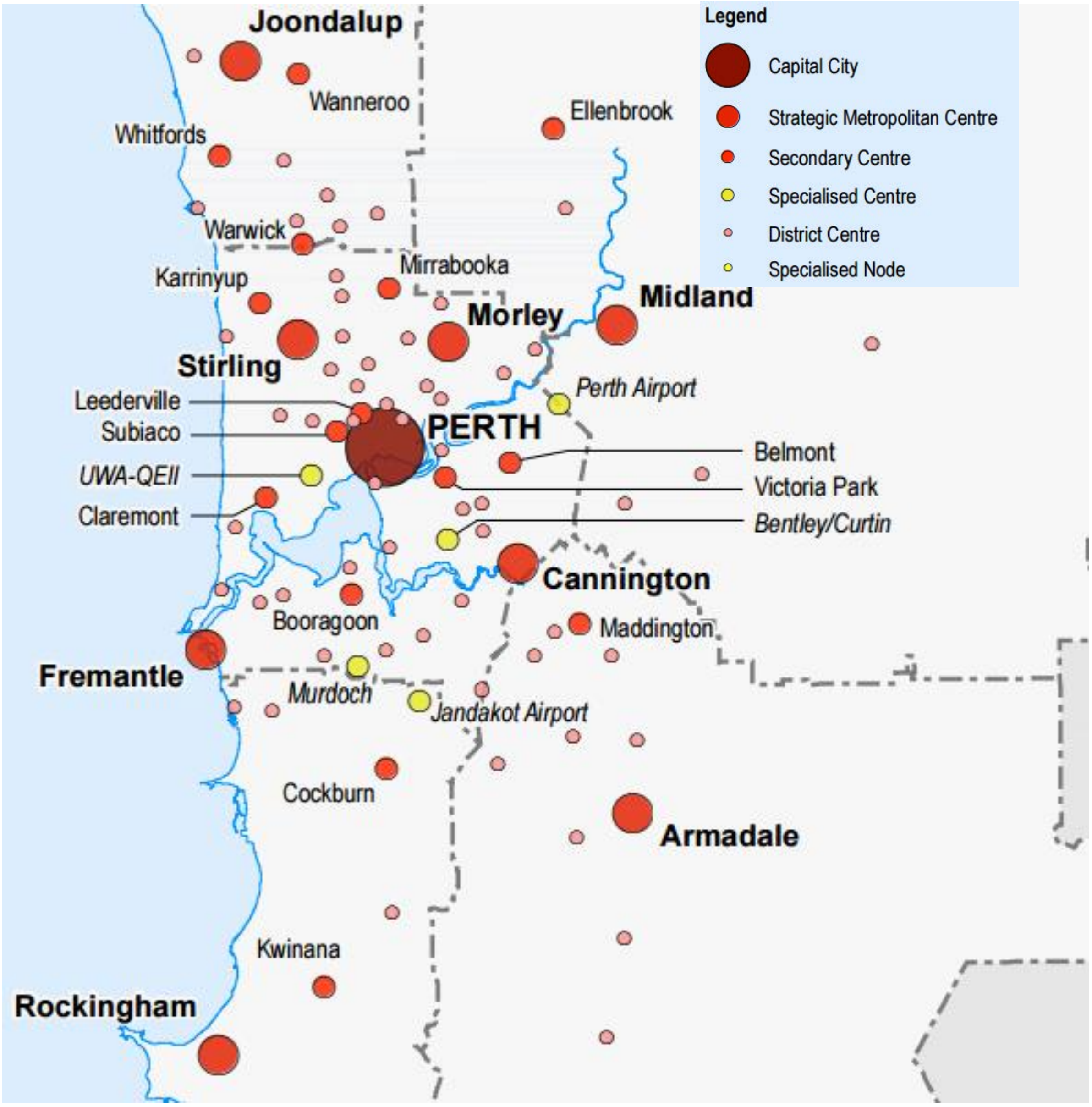
Perth and Peel @3.5million is the highest strategic land use planning document for Perth and Peel. It provides a framework for the detailed planning and delivery of housing, infrastructure and services necessary to accommodate population growth to 2050.

Cannington is one of the strategic metropolitan centres under Perth and Peel @3.5million:

"Strategic metropolitan centres are multi-purpose centres that provide a mix of retail, office, community, entertainment, residential and employment activities, and are well serviced by high frequency public transport."

Figure 4.5 shows how the City of Canning is positioned spatially in relation to Perth City and other strategic metropolitan centres. The City of Canning is well positioned to create improved access to/from other specialised centres such as Bentley (Curtin University), Murdoch (University and Fiona Stanley Hospital) and Perth Airport.

Figure 4.5: Combined sub-region activity centres Perth and Peel @3.5million



Public Transport for Perth in 2031 (Draft, 2011)

The draft Public Transport for Perth in 2031 plan identifies the public transport network needed to support Perth's growing population. As shown in **Figure 4.6** it recommends bus rapid transit (BRT) links between Cannington and Curtin and Murdoch, noting that some BRT routes could be upgraded to light rail in the longer term. It also shows an extension of the metropolitan rail system from Thornlie to Cockburn Central providing a direct rail link between Cannington and Rockingham and Mandurah.

One obvious gap in the strategic public transport network outlined in the plan is a strategic public transport route connecting Cannington with Perth Airport.

JACOBS

Figure 4.6: Public Transport Masterplan – Ultimate Network for 3.5 Million

4.5 Key Stakeholder Issues

A number of discussions with respect to the Movement, Access and Parking Strategy have been held with a range of stakeholder groups as part of the project from March 2014 to November 2014. Stakeholders include:

- Department of Transport;
- Main Roads Western Australia;
- Public Transport Authority;
- Department of Planning;
- Western Power;
- Scentre (formerly Westfield);
- Bunnings; Canning Agricultural, Horticultural & Recreational Society (CAHRS); and Greyhounds WA.

A list of all the meetings held and their attendance is attached in **Appendix A**. It is acknowledged that certain stakeholders have responsibilities for key uses and not surprisingly they present a bias in what they are seeking to achieve. The City of Canning and Jacobs have taken into account of all the views expressed and developed a balanced set of strategies with the aim of in providing overall accessibility in a safe and affordable manner. A summary of the positions by each organization as understood by Jacobs is listed below in **Table 4.3**.

Table 4.3 : Interpretation of positions expressed by stakeholders

Organization	Position expressed (with respect to transport issues)
Department of Transport	• Provide a balanced outcome for walking, cycling, public transport and private motor-vehicles. • Generally maintain or improve road efficiency and safety along roads for all road users (including cyclists and pedestrians). • Manage demand through parking demand management (including parking caps / parking maximums, parking pricing, parking levies / contribution plans).
Main Roads Western Australia	• New development should maintain or improve road efficiency along Albany Highway for all vehicles through road infrastructure improvement. • Traffic signal cycle times above 120 seconds should be maintained to provide as good as possible level of service for vehicles on Albany Highway.
Public Transport Authority	• Maintain or improve public transport efficiency, relate to travel by other modes. • Where possible provide public transport priority.
Department of Planning	• Develop Scentre based upon Transit Oriented Development principles. • Grade separations should not be provided where they lead to an inferior urban outcome.
Scentre	• Provide vehicular access to shopping centre from Albany Highway (Cockram Street intersection). • Willing to contribute to infrastructure improvements provided it is fair. • Increase car parking within Liege Street car park.
CAHRS / Bunnings / Greyhounds	• Provide access to new Bunnings Site off Liege Street. • Do not provide a new street link through the CAHRS site.

4.6 Transport Modelling and Assessment

There has been a range of modelling documentation and results generated that are attached in **Appendices B through to G**. The key points that the three levels of modelling raise are:

- The Albany Highway / Liege Street intersection is shown to be the key bottleneck along Albany Highway both now and into the future. This is unsurprising as current data and modelled trends suggest that this is the access for a significant demand to/from the south along Nicholson Road that tries to access / egress the shopping centre. This demand is expected to increase with the increased expansion of the shopping centre and with it the potential throughput through this intersection. This highlights the need to reduce car traffic, and provide a more permeable road network that provides more options.
- The modelling suggests that a significant amount of the demand on Albany Highway within the vicinity of the Canning City Centre appears to be relatively local traffic, rather than regional movements, and that because of existing commercial land use patterns being fairly linear along this corridor, there exists opportunities to manage demand through improved public transport services.
- The trafficable demand that the Westfield Carousel expansion would create without significant parking demand management is expected to be significant and would have a major impact on the efficiency of the network (particularly on Albany Highway). There appears to be a number of infrastructure improvements that can be done that can manage the accessibility such that traffic can continue to move (these include the Sevenoaks Street Extension, the Southern Link Road, Gerard Street extension), but this would result in degradation of the travel times along Albany Highway, which may be unacceptable to some agencies. To accommodate the proposed Westfield Carousel expansion in the context of the full Canning City Centre Structure Plan vision, management of car travel (through interventions such as paid car parking), improved public transport infrastructure, improvements to encourage walking and cycling, and improved mix of uses is more critical.

It is considered that these points identified from the modelling are the critical issues that the strategy needs to monitor and manage. The actions around these points have been developed in an iterative process from principles through to strategy development.

It should be noted that the intent of the modelling is not to “predict and provide” but rather to assist in developing strategies to manage demand for car travel by increasing travel by other modes, implementing parking policies and creating a more diverse range of access opportunities.

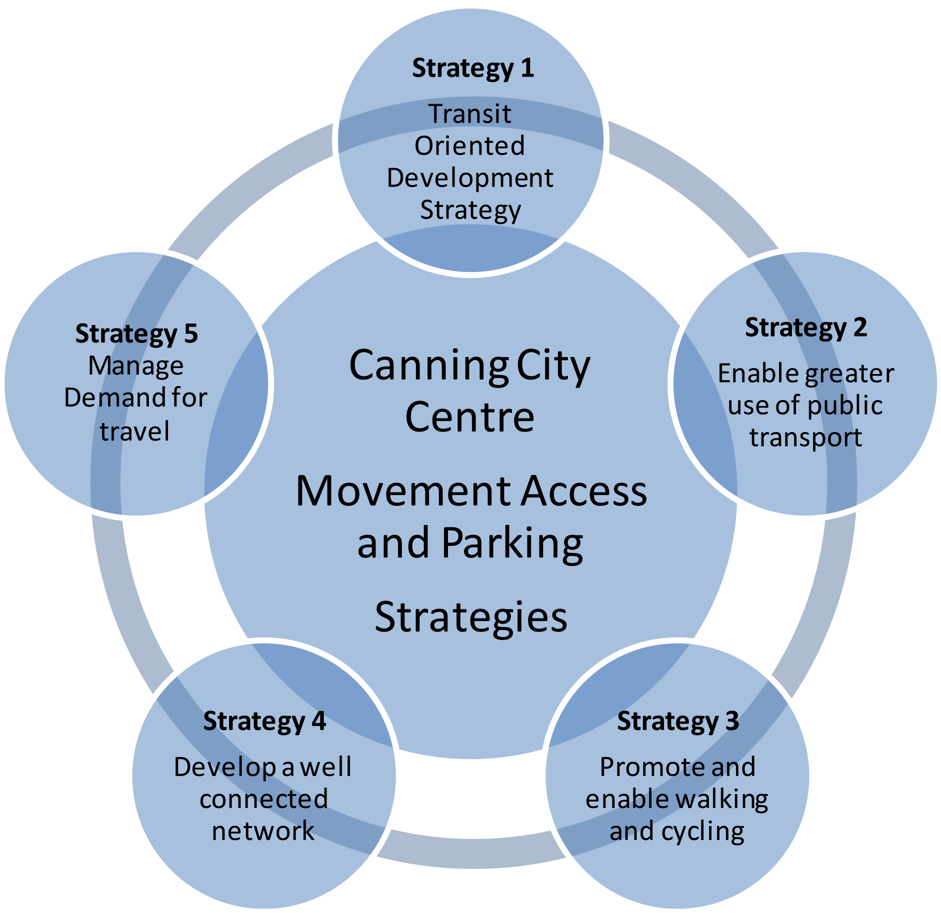
5. Strategies

In developing a Movement, Access and Parking Strategy for a major city centre such as Canning City Centre it is important to:

- Include both demand management and supply measures;
- Fully integrate transport and land use planning, incorporating Transit Oriented Development (TOD) principles; and
- Develop modal strategies designed to significantly increase the proportion of travel by walking, cycling and public transport.

Five key movement, access and parking strategies have been developed to guide transport planning and the on-going development of the Canning City Centre, as shown in **Figure 5.1**:

Figure 5.1: Key Strategies



Each of the five core strategies are described more fully in Sections 5.2 to 5.6 including:

- Objectives of the strategy;
- Guiding principles for the strategy; and
- Outline and descriptions of key strategy components.

5.1 Strategy Integration – A Sustainable Mobility Management Approach

In 1996, the Institution of Engineers (Australia) published a position paper on Travel Demand Management (TDM) in which it was defined as follows:

"Travel Demand Management is intervention (excluding provision of major infrastructure) to modify travel decisions so that more desirable transport, social, economic and/or environmental objectives can be achieved and the adverse impacts of travel can be reduced".

The above definition recognises that demand management must be considered much more broadly than reducing the demand for travel. Indeed, as is the case in the Canning City Centre, it is much more about modifying the way people travel to mitigate the most undesirable impacts of car travel, including congestion, whilst maintaining or improving overall accessibility.

In major cities around the world, it is now recognised that a broad suite of strategies is required to manage and shape the demand for travel in a way that will improve the liveability of the city, protect and enhance the environment and provide good accessibility for residents, business and visitors. The prevailing view is that congestion in cities needs to be tackled in a comprehensive way that will result in less driving per person and more people using public transport, walking and cycling. The need to make a distinction between traditional demand management measures, network management and service delivery is becoming less important. Indeed it may be more productive to present a holistic plan where the various parts are dependent upon one another and where synergies exist making the benefits of the whole greater than its constituent parts.

Sustainable mobility management (SMM) is a term used to describe a strategy that incorporates demand management, but also includes transport network management and service delivery improvements with a view to delivering a high level of overall accessibility. A sustainable mobility management strategy for the Canning City Centre differs from some more traditional strategies in that, instead of accepting car growth at the expense of other modes, it provides more options for travel and provides some disincentives to driving in certain circumstances and along certain streets to encourage greater use of alternative modes- walking, cycling and public transport.

While some major investment in transport infrastructure will be required as the Canning City Centre grows, an objective of SMM is to maximise benefits with a reduced level of expenditure. Reduced levels of traffic on the road network, as a result of SMM strategies will improve amenity for pedestrians and cyclists, reduce congestion, improve traffic conditions for public transport and delivery vehicles and delay the need for major road construction, including possibly bypass tunnels or grade separation.

An important advantage of SMM is that it adopts a positive strategic approach that focuses on overall benefits rather than a narrower approach based on restraint on movement of private vehicles. A major advantage of SMM is that it can use supply measures for public transport and cycling in combination with integrated demand management measures to induce greater use of public transport, walking and cycling and less use of cars.

The following strategies have been designed to work together in an integrated manner to create a positive synergy by reducing car travel to a level that can be accommodated on the proposed improved street network. The long term mode share targets for the greater Canning City Centre are:

Mode	2011	Long Term Mode Share
Car Driver	58%	40%
Car Passenger	23%	15%
Public Transport	7%	16%
Cycling	2%	12%
Walking	9%	15%
Other	1%	2%

5.2 Strategy One – Transit Oriented Development (TOD) Strategy

Strategy One – Transit Oriented Development Strategy	
Objective	An important objective of TOD is to create an urban form that enables both residents and visitors to enjoy a more sustainable lifestyle. Furthermore, through development of a more compact and mixed use centre with both residential and non-residential uses, more people will live in proximity to one another and to business, retail and other opportunities. An intended outcome is that many trips that would otherwise be made by car will be made by walking and cycling. Similarly close proximity to the Cannington Rail Station and to high frequency bus services along Albany Highway will create enormous opportunities to reduce car travel and replace it with increased public transport for access to the Canning City Centre. Research on TODs from around the world[5] has shown that: • People in TOD households can be twice as likely not to own a car as people in non-TOD households; • Commuters to TODs typically use public transport between two and five times more than non-TOD commuters; • TOD development can produce up to 50% fewer peak period vehicle trips; • TOD commuters walk and cycle three to four times more than non-TOD commuters; • Subject to maximizing the level of public car or shared parking, the level of parking required can be reduced by 50% compared to more traditional requirements. A TOD strategy as proposed is much more than a development strategy. It integrates with all the other strategies to reduce the level of car driving and maximise walking, cycling and public transport usage. Furthermore the objectives of the TOD strategy are closely aligned to SPP4.2 Activity Centres for Perth and Peel, which has the following policy objectives: ***1) Distribute activity centres to meet different levels of community need and enable employment, goods and services to be accessed efficiently and equitably by the community.*** ***2) Apply the activity centre hierarchy as part of a long term and integrated approach by public authorities and private stakeholders to the development of economic and social infrastructure.*** ***3) Plan activity centres to support a wide range of retail and commercial premises and promote a competitive retail and commercial market.*** ***4) Increase the range of employment in activity centres and contribute to the achievement of sub-regional employment self-sufficiency targets.*** ***5) Increase the density and diversity of housing in and around activity centres to improve land efficiency, housing variety and support centre facilities.*** ***6) Ensure activity centres by walking, cycling and public transport while reducing private vehicle trips.*** ***7) Maximize access to activity centres by walking, cycling and public transport while reducing private car trips.*** ***8) Plan activity centre development around a legible street network and quality public spaces.*** 9) ***Concentrate activities, particularly those that generate high numbers of trips, within activity centres.***

[5] Effects on TOD on Housing, Parking and Travel – Arrington and Cervero, 2008 and Transit Oriented Development: Measuring Benefits, Analysing Trends and Evaluating Policy – Renne 2005

Strategy One – Transit Oriented Development Strategy		
Guiding Principles	(1) Plan a mixed use development that includes an integrated transport system for the Canning City Centre that maximizes accessibility by all modes. (2) Provide a network of safe, convenient cycling and pedestrian access routes throughout the Canning City Centre. (3) Plan an ultimate level of car parking for the Canning City Centre that is compatible with improved capacity of the road network within and around the Canning City Centre. (4) Develop an easy to comprehend network of public transport routes that links the train station with the different Canning City Centre precincts and with the surrounding centres and neighbourhoods. (5) Provide a legible, connected, low speed network of streets within the Canning City Centre to enable multiple access options for motorists to car parking and shared streets	
Strategic Actions and Directions		**Timeframe**
1.	Provide a generous amount and diversity of housing in the Canning City Centre.	Medium to Long Term
2.	Provide a variety of destination uses (commercial, health, education) not just retail.	Medium Term
3.	Introduce maximum levels of car parking for non-residential parking as part of development approval and introduce parking charges for both off-street and on-street parking.	Short Term
4.	Provide a range of public car parks distributed around the Canning City Centre.	Short to Medium Term
5.	Introduce minimum levels of bicycle parking for both residential and non-residential uses as part of development approval.	Short Term
6.	Unbundle parking from sale of residential apartments.[6]	Short to Medium Term
7.	Create safe, grade separated crossings of Albany Highway for pedestrians and cyclists to link the riverside precinct with the main centre.	Short to Medium Term
8.	Create at least one additional signalised intersection on Albany Highway to improve access for crossing traffic and traffic entering and leaving from Albany Highway.	Short to Medium Term

[6] Unbundled car parking can reduce car parking requirements by 10-30%. There are various options when it comes to the unbundling of car parking that have been used in industry. These include:

- Parking being bought or rented separately when the apartment is bought or leased;
- A discount being offered to renters who don't use all of their allocated spaces;
- Apartments having one bay included, with the option to rent or purchase additional bays; and
- Excess parking bays being rented to others.

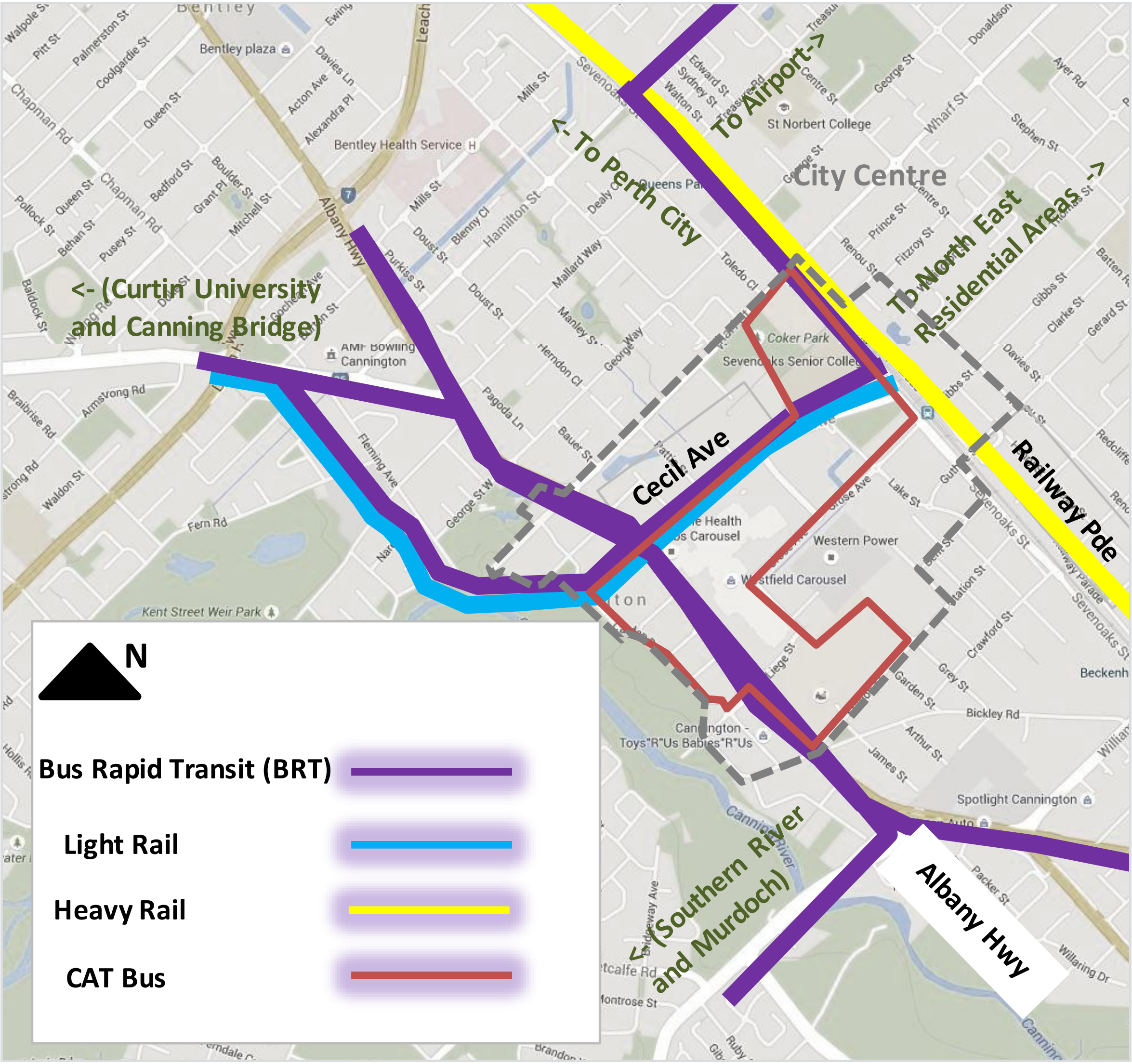
It is recommended the City consider the advantages and disadvantages of each of the options with respect to economic, social and environmental constraints.

5.3 Strategy Two – Promote and Enable Greater Use of Public Transport

Strategy Two – Promote and Enable Greater Use of Public Transport		
Objective	The objective of this strategy is to increase the amount of travel to/from the strategic Canning City Centre and adjacent areas by public transport and decrease the proportion of travel by private car. The strategy sets out a mode share target of travel by public transport of 16% to the Canning City Centre within 20 years. In conjunction with other strategies this should enable the proportion of travel by car drivers to be reduced from 65% to 40% in the longer term.	
Guiding Principles	(1) Plan an integrated transport system for the Canning City Centre based on mixed use development that maximizes accessibility by all modes. (2) Plan for a high proportion of access to the Canning City Centre by public transport. (3) Develop an easy to comprehend network of public transport routes that links the train station with the surrounding centres and neighbourhoods. (4) Prioritise public transport access over private vehicles. (5) Create attractive, safe and well-designed bus stops that support comfortable public transport access.	
Strategic Actions and Directions		**Timeframe**
1.	Provide a Bus Rapid Transit (BRT) link from Curtin University, Victoria Park, Perth City, Southern River (Ranford Road and South Street) and Murdoch – this would consist of Bus Queue Jumps at signalised intersections in the short term as well as improved frequency. In the longer term full bus priority could be considered.	Short Term / Medium Term
2	Provide bus priority lanes along Albany Highway between Cecil Avenue and Leige Street.	Short to Medium Term
3.	Upgrade Cecil Avenue to provide for priority movement for buses in the short term with the potential to upgrade to Light Rail in the long term.	Short Term / Medium Term
4.	Create a light rail connection between Cannington Rail Station and the proposed light rail network that links Curtin University to Perth City and beyond. The proposed light rail should be provided with full priority along Cecil Avenue and link through the civic precinct and Fleming Avenue to Manning Road.	Long Term
5.	Provide a Central Area Transit (CAT) bus service linking key activities within the Canning City Centre including the rail station, main retail centre and the civic centre and other activities south of Albany Highway. A potential CAT route is shown in **Figure 5.2**.	Short Term / Medium Term
6.	Increase the frequency of service along the Armadale and Thornlie rail lines.	Short Term / Ongoing
7.	Provide a rail connection from Cannington to Cockburn Central and Rockingham by extension of the Thornlie rail line.	Long Term
8.	Provide a BRT line from Cannington to Perth Airport to connect to the new rail terminal at the airport.	Medium Term

JACOBS

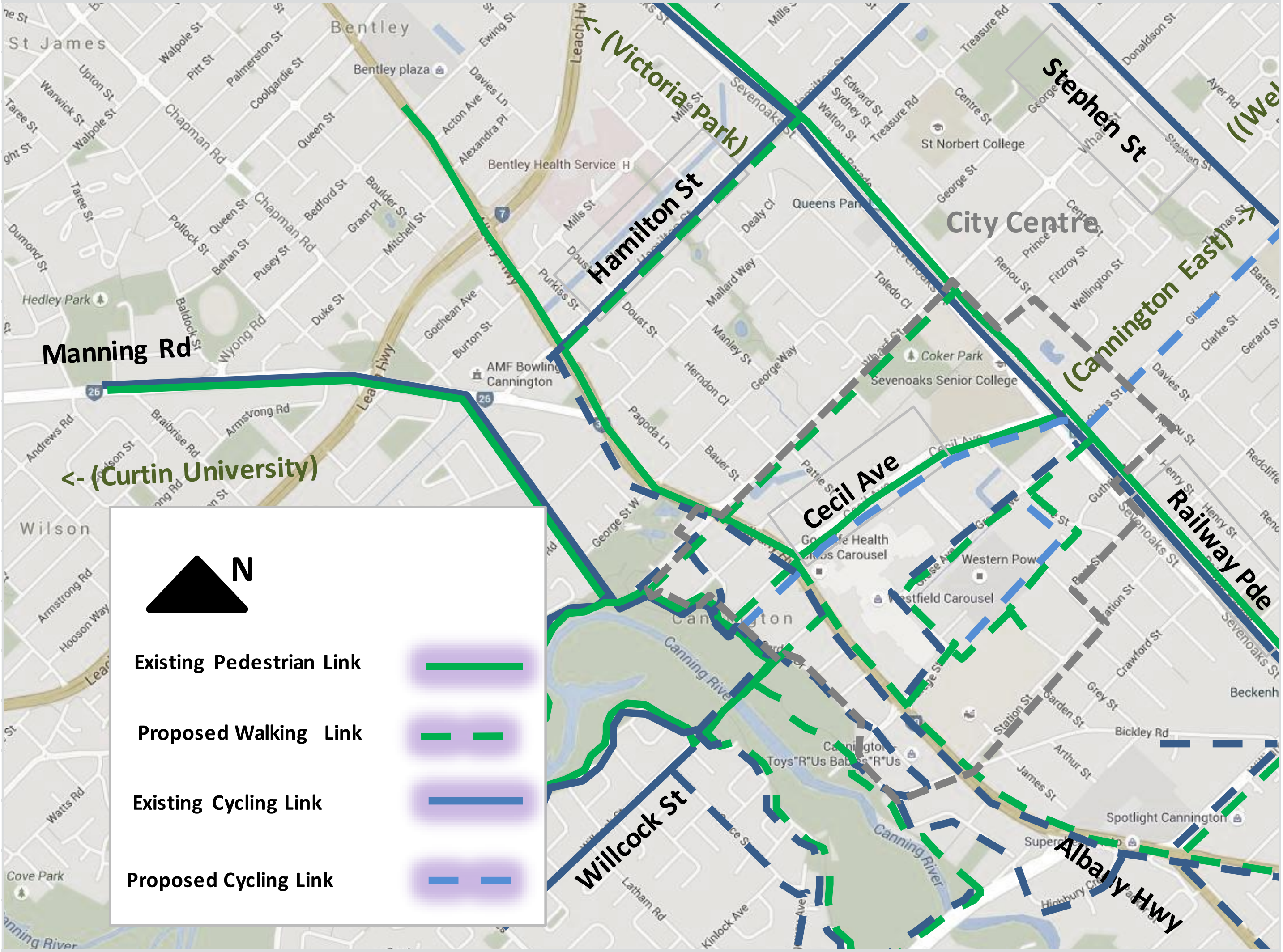
Figure 5.2: Strategy Two - Promote and enable greater use of Public Transport



5.4 Strategy Three – Promote and Enable More Walking and Cycling

Strategy Three – Promote and Enable More Walking and Cycling		
Objective	The objective of this strategy is to increase the amount of travel to/from the strategic Canning City Centre by walking and cycling and to decrease the proportion of travel by private car. The strategy sets out a mode share target for walking and cycling within the Canning City Centre of 27% (walking 15%, cycling 12%) as the Canning City Centre approaches full development.	
Guiding Principles	(1) Plan an integrated transport system for the Canning City Centre based on mixed use development that maximizes accessibility by all modes. (2) Plan for a high proportion of access to the Canning City Centre by walking and cycling. (3) Provide a network of safe, convenient cycling and pedestrian access routes throughout the City Centre.	
Action / Direction		**Timeframe**
1.	Provide 2.5m wide footpaths on both sides of all city streets.	Short Term
2.	Provide fine grained links of slow moving streets in the Canning City Centre with a speed limit of 40kmph or less with footpaths on both sides and on-street bicycle lanes, where necessary.	Medium Term
3.	Create a network of off-street (Copenhagen Style) bicycle paths on all major streets linkages with a 5 kilometre distance from the City Centre, including Sevenoaks Street, Cecil Avenue, Albany Highway, Nicholson Road, Manning Road, Gerard Street and Wharf Street.	Medium Term
4.	Provide footpaths and off-street (Copenhagen Style) bicycle lanes along the proposed Cecil Avenue “Main Street”.	Short Term
5.	Provide a mixture of bike lanes, paths and shared use with traffic on slow speed streets within the Canning City Centre to provide safe bicycle access to the heart of the centre and bike parking (**refer to Figure 5.3**).	Short Term
6.	Provide minimum levels of bicycle parking for residential and non-residential uses in the City Centre (minimum of one bicycle bay per apartment, 0.5 per 100sqm retail and 0.6 per 100sqm office) and minimum levels of end of trip facilities (lockers and showers).	Short Term
7.	Provide secure bicycle parking at the Cannington Rail Station to meet immediate and on-going demand for bicycle parking and Westfield.	Short Term
8.	Provide generous level of public bicycle parking spread throughout the Canning City Centre (500 bicycle bays in the short term, increasing to up to 2,000 bicycle bays as dictated by demand in the longer term).	Short Term to Long Term
9.	Link Carousel bicycle parking facilities to the river and railway bicycle paths, with safe off-street links. This includes a grade separated connection into Carousel from the southern side of Albany Highway enabling a safe movement across the highway.	Short Term

Figure 5.3: Strategy Two – Promote and enable walking and cycling

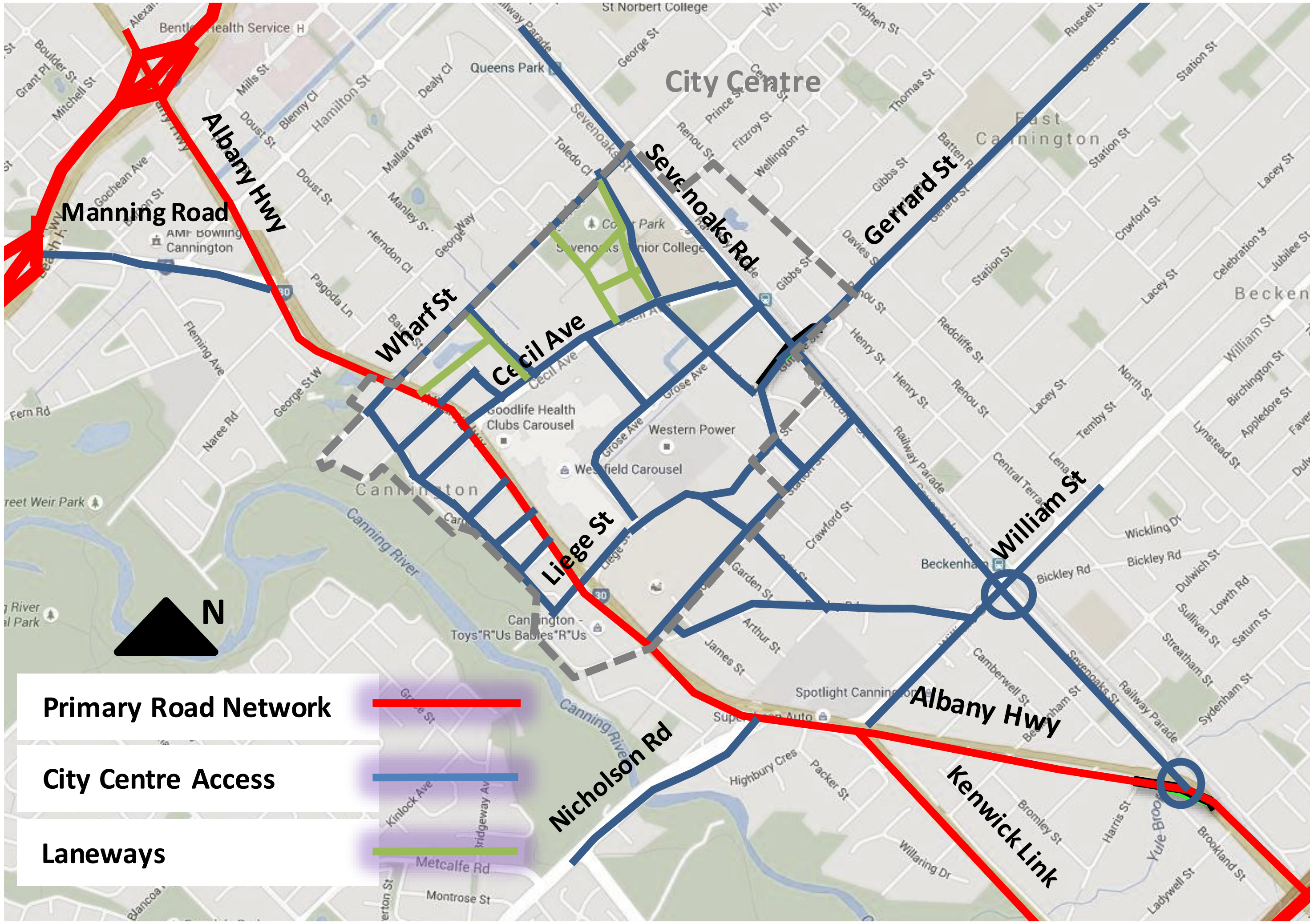


5.5 Strategy Four – Develop a Well-Connected Street Network

Strategy Four – Develop a Well-Connected Street Network	
Objective	The objective of this strategy is to: (a) Provide improved access to/from the strategic centre from the surrounding road network to create alternatives to Albany Highway. (b) Provide a well-connected network of slow speed public transport within the strategic centre to provide access for all road users - pedestrians, cyclists, motorists, service vehicles etc. (c) Provide route options for traffic and spread demand to help reduce bottlenecks and reduce congestion. Note that other strategies will help to reduce car driver mode share to the City Centre to a target of 40%. However, additional development (retail and other uses) will increase overall travel needs (all modes) leading to an increase in car driving over the longer term.
Guiding Principles	(1) Plan an integrated transport system for the City Centre based on mixed use development that maximizes accessibility by all modes. (2) Provide a legible, connected, low speed network of streets within the City Centre to provide multiple access options for motorist to car parks and for walking and cycling (refer to **Figure 5.4**). (3) Consider modifications to the road network adjacent to and in the vicinity of the City Centre to improve accessibility to City Centre car parks from all directions around the City Centre.

Action / Direction		**Timeframe**
1.	Sevenoaks Street connection to Albany Highway with traffic signals and signalisation of William Street / Sevenoaks Street.	Short Term
2.	Southern Link Road connection from Grose Avenue to Bent Street.	Short Term
3.	Signalisation of Station Street with Albany Highway	Short Term
4.	Gerard Street connection to Welshpool Road.	Short Term
5.	Signalisation of Cockram Street / Albany Highway.	Short Term
6.	Carousel Street extension from Wharf Street to Cecil Avenue.	Short Term
7.	Construct roundabouts on Liege Street and Grose Avenue.	Short Term
8.	Lake Street extension from Wharf Street to Cecil Avenue.	Medium Term
9.	Southern Link Road connection from Bent Street to Guthrie Street.	Medium Term
10.	Create a network of laneways and access streets to improve the permeability and accessibility throughout the Canning City Centre based on a 100 x 100m grid.	Long Term

Figure 5.4: Strategy Three – Develop a well-connected street network



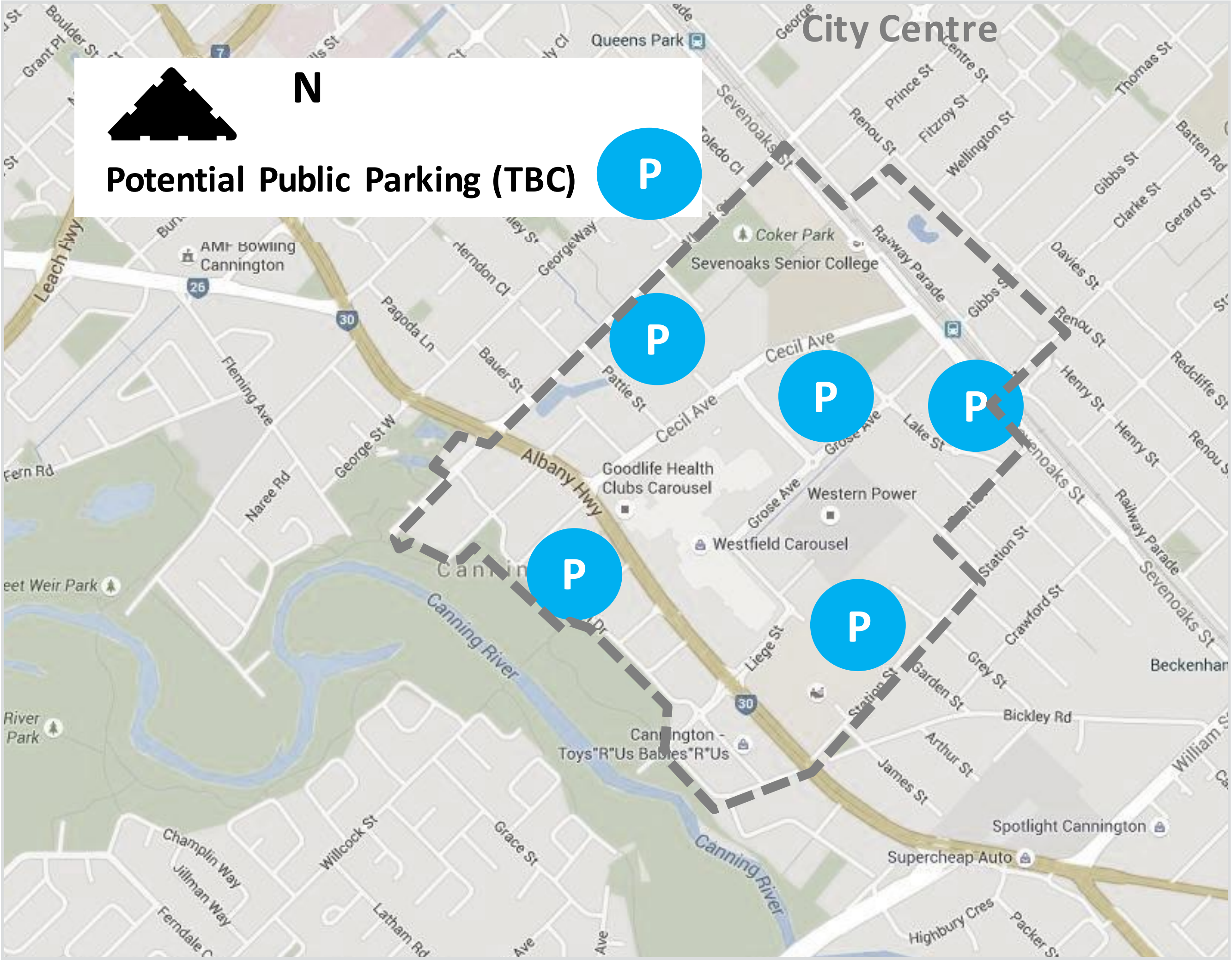
5.6 Strategy Five – Manage Demand for Travel

Strategy Five – Manage Demand for Travel	
Objective	The objective of this strategy is to manage the demand for travel in a way that results in a lower proportion of people travelling as a car driver, with more people walking, cycling and using public transport. This enables the size of the centre to grow without the roads within and approaching the centre exceeding capacity.
Guiding Principles	(1) Plan an integrated transport system with the Canning City Centre based on mixed use development that maximizes accessibility by all modes. (2) Plan an ultimate level of car parking for the Canning City Centre that is compatible with improved capacity of the road network within and around the Canning City Centre. (3) Maximize the proportion of public car parking to improve the efficiency and maximize the value of parking. (4) Locate car parks to balance access and convenience with the pedestrian and bicycle movement and to encourage walking along City Centre streets between car parks and activities. (5) The amount and type of parking should support the Canning City Centre vision and broader transport and planning principles. (6) Visitors to the Canning City Centre should be provided with clear directions to available parking and between car parks and major activities and land marks.

Action / Direction		**Timeframe**
1.	Undertake a workplace TravelSmart plan for major City Centre employers. Work with Scentre and other retailers to develop travel plans for retail employees.	Short Term
2.	Introduce pricing for parking in conjunction with retailers.	Short Term
3.	Engage a TravelSmart Officer to encourage sustainable modes of transport throughout the Canning City Centre.	Short Term
4.	Implement an integrated parking and demand management policy designed to assist in the management for travel to the City Centre. Specifically the policy would propose: (a) A maximum level of parking permitted for non-residential developments. (b) Maximize the proportion of public and short term parking and reduce long term tenant parking (refer to **Figure 5.5**). (c) Introduce a charge for all public on-street and off-street parking. (d) The payment of cash-in-lieu of on-site parking where appropriate to be used for provision of public parking for cars, motorcycles and bicycles, derived from rates specified in **Appendix GG**. (e) Introduce a transport contribution fund on development to be used to fund public transport, cycling, pedestrian and road infrastructure improvements, the application of which is discussed in **Appendix I**. (f) Introduce an annual licence fee on all non-residential parking in an area within and around the City Centre to assist in funding enhanced transport services.	Medium Term Short term Ongoing Short Term Short Term Short / Medium Term Short / Medium Term

Strategy Five – Manage Demand for Travel		
5.	Require a significant level of residential development to be introduced into the City Centre, along with office development so that the City Centre becomes a mixed use development based on Transit Oriented Development (TOD) principles.	Medium to long term
6.	Implement a household TravelSmart programme as residential becomes a significant use in the Canning City Centre.	Medium to long term
7.	Implement signage and wayfinding within Canning City Centre to facilitate ease of access.	Short term

Figure 5.5: Strategy Four – Manage Demand for Travel



6. Guidance for Development Applications

This section provides guidance on Development Applications (DAs) for new developments within the City Centre with respect to addressing the assessment requirements and calculating contribution amounts.

As part of each DA, a Transport Assessment or Statement is required that covers all appropriate elements documented in Transport Assessment Guidelines for Developments (WAPC, 2006).

As part of this, it is expected that this report would document at minimum:

- Expected traffic generation of the proposed development; and
- Proposed parking supply.

The City of Canning would review this assessment, and consider whether it was representative of the proposed situation.

If this assessment is considered adequate by the City, then the applicant should expect the following contributions to be requested:

(1) Transport infrastructure contributions for the development of items identified in this plan as being required to accommodate the growth, the basis for assessing contributions would be based upon as per the methodology outlined in **Appendix II**; and

(2) Cash-in-lieu contributions for car, bicycle and motorcycle parking not provided up to the required amount (as specified in **Appendix G**).

7. Implementation Plan

A Preliminary Implementation Plan outlining the actions and recommended timing can be found in **Table 7.1**.

With respect to infrastructure, an assessment of usage of each item by Westfield Carousel and Bunnings traffic based upon the mesoscopic modelling was derived and is attached in **Appendix EE**.

A risk assessment was also undertaken for a number of infrastructure items considered and is attached in **Appendix F**.

Parking Strategic material associated with Strategy 4 is attached in **Appendix G**.

Table 7.1: Preliminary Implementation Plan

Action	Description	Year																			
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Strategy One - Transit Oriented Development (TOD) Strategy																					
1.1	Provide a generous amount and diversity of housing in the City Centre.																				
1.2	Provide a variety of destination uses not just retail.																				
1.3	Introduce maximum levels of car parking for non-residential parking as part of development approval and introduce parking charges for both off street and on-street parking.																				
1.4	Provide a range of medium sized public car parks distributed around the City Centre.																				
1.5	Introduce minimum levels of bicycle parking for both residential and non-residential uses as part of development approval.																				
1.6	Unbundle parking from sale of residential apartments.																				
1.7	Create safe, grade separated crossing of Albany Highway for pedestrians and cyclists to link the Riverside precinct with the main centre.																				
1.8	Create at least one additional signalised intersection on Albany Highway to improve access for crossing traffic and traffic entering and leaving from Albany Highway.																				
Strategy Two - Promote and enable greater use of public transport																					
2.1	Provide a Bus Rapid Transit (BRT) link from Curtin University, Victoria Park, Perth City, Southern River (Ranford Road and South Street) and Murdoch – this would probably consist of Bus Queue Jumps at signalised intersections in the short term as well as improved frequency. In the longer term full bus priority could be considered.																				
2.2	Create a light rail connection between Canning City Centre and the proposed light rail network that links Curtin University to Perth City and beyond. The proposed light rail should be provided with full proximity along Cecil Avenue and link through the civic precinct and Fleming Road to Manning Road.																				
2.3	Provide a Central Area Transit (CAT) bus service linking key activities within the centre including the Rail Station, Main Retail Centre and Council Offices and other activities south of Albany Highway.																				
2.4	Increase the frequency of service along the Armadale and Thornlie Rail lines.																				
2.5	Upgrade Cecil Avenue to provide for priority movement for buses in the short term with the potential to upgrade to Light Rail in the long term.																				
2.6	Provide a rail connection form Cannington to Cockburn Central and Rockingham by extension of the Thornlie Line.																				
2.7	Provide a BRT line from Cannington to Perth Airport to connect to the new rail terminal.																				

		Year																			
Action	**Description**	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Strategy Three - Promote and enable walking and cycling																					
3.1	Provide footpaths on all City streets.																				
3.2	Provide fine grained links of slow moving streets in the City Centre with a speed limit of 40kmph or less with footpaths on both sides and on-street bicycle lanes.																				
3.3	Create a network of off-street (Copenhagen Style) bicycle paths on all major streets linkages with a 5 kilometre distance from the City Centre, including Sevenoaks Street, Albany Highway, Nicholson Road, Manning Road, Gerard Street, Wharf Street and Spencer Road.																				
3.4	Provide a mixture of bike lanes, paths and shared use with traffic on slow speed streets within the city centre to provide safe bicycle access to the heart of the centre and bike parking.																				
3.5	Provide minimum levels of bicycle parking for residential and non-residential uses in the city centre (minimum of one bicycle bay per apartment, 0.5 per 100sqm retail and 0.6 per 100sqm office) and minimum levels of end of trip facilities (lockers and showers).																				
3.6	Provide secure bicycle parking at the Cannington rail station to meet immediate and on-going demand for bicycle parking.																				
3.7	Provide a generous level of public bicycle parking well dispersed throughout the city centre (500 bicycle bays in the short term, increasing to up to 2000 bicycle bays as dictated by demand in the longer term).																				
3.8	Link Carousel bicycle parking facilities to the river and railway bicycle paths with safe off-street links, including a grade separated connection into Carousel from the southern side of Albany Highway.																				
3.9	Provide quality footpaths and off-street (Copenhagen Style) bicycle lanes along the proposed Cecil Avenue "Main Street".																				
Strategy Four - Develop a well-connected street network																					
3.1	Sevenoaks Street connection to Albany Highway and signalisation of William Street / Sevenoaks Street.																				
3.2	Southern Link Road connection to Grey Street.																				
3.3	Signalisation of Station Street with Albany Highway.																				
3.4	Gerrard Street connection to Welshpool Road.																				
3.5	Signalisation of Cockram Street / Albany Highway.																				
3.6	Carousel Street extension from Wharf Street to Cecil Avenue.																				
3.7	Construct roundabouts on Sevenoaks Street at Station Street and Grose Avenue.																				
3.8	Southern Link Road connection from Bent Street to Guthrie Street.																				
3.9	Southern Link Road connection from Bent Street to Guthrie Street.																				
Strategy Five - Manage demand for travel																					
4.1	Undertake a workplace TravelSmart plan for major city centre employers. Work with SCentre and other retailers to develop travel plans for retail employees.																				
4.2	Introduce pricing for parking in conjunction with retailers.																				
4.3	Engage a TravelSmart Officer with specific responsibilitites for the Canning City Centre.																				
4.4	Implement an integrated parking and demand management policy designed to assist in the management for travel to the city centre. Specifically the policy would propose:																				
	A maximum level of parking permitted for non-residential developments.																				
	Maximize public and short term parking and reduce long term tenant parking.																				
	Charge for all public on-street and off-street parking.																				
	The payment of cash-in-lieu of on-site parking where appropriate to be used for provision of public parking for cars, motorcycles and bicycles.																				
	A transport contribution fund to be used to fund public transport, cycling and pedestrian infrastructure improvements.																				
	An annual licence fee on all non-residential parking in an area within and around the city centre to assist in funding enhanced transport services .																				
4.5	Require a significant level of residential development to be introduced into the City centre, along with office development so that the city centre becomes a mixed use development based on TOD principles.																				
4.6	Implement workplace TravelSmart and require office developers to work with tenants to develop plans for employees as a condition of development approval.																				

Appendix A. List of Stakeholder Meetings

Meeting Date	Attendees	General Discussion
28th of February 2014	Jacobs City of Canning Main Roads (Lindsay Broadhurst) Department of Transport (David Igglesden)	Inception and discussion on the modelling strategy
17th of March 2014	Jacobs Main Roads Modelling Team (Wes Soet, Ming Jin)	Discussion on the modelling strategy
21th of March 2014	Jacobs City of Canning Main Roads (Lindsay Broadhurst)	Discussion on the modelling strategy
3rd of June 2014	Jacobs City of Canning Scentre (Brad Osborne, Shane Healey)	Discussion on Westfield Carousel development
11th of July	Jacobs City of Canning Scentre (Ray Haeren, Shane Healey, Megan Gammon)	Discussion on Westfield Carousel development and preliminary modelling results
14th of July	Jacobs City of Canning Scentre (Ray Haeren) CAHRS (Dianne Begg), Bunnings (Stuart Devenish)	Roundtable Discussion 1 Discussion on Westfield Carousel and Bunnings development
11th of July	Jacobs City of Canning Scentre (Ray Haeren, Megan Gammon) CAHRS (Dianne Begg) Department of Transport (David Igglesden) Public Transport Authority (Simon Cox) Western Power (Jarrad Morskate) Department of Planning (Matt Selby) Bunnings (Grant Pickford, Jason Eden, Stuart Devenish) *Main Roads were invited but did not attend	Roundtable Discussion 2 Discussion on issues and proposed mesoscopic modelling for 2014 scenarios with Westfield Carousel and Bunnings developments.

Meeting Date	Attendees	General Discussion
25th of August	Jacobs City of Canning Scentre (Ray Haeren) CAHRS (Dianne Begg) Bunnings (Stuart Devenish) Department of Transport (David Igglesden) Western Power (Jared Morskate) Department of Planning (Matthew Selby) *Main Roads were invited but did not attend	Discussion on mesoscopic modelling results for 2014 scenarios with Westfield Carousel and Bunnings developments.
3rd of September	Jacobs City of Canning Scentre (Brad Osborne, Ray Haeren) Department of Planning (Matthew Selby)	Carousel Working Group Meeting
9th of October	Jacobs City of Canning Scentre (Brad Osborne, Ry Haeren) Main Roads (David Van Den Dries) Department of Transport (David Igglesden, Craig Wooldridge) PTA (Lom Piggott, Simon Cox)	Westfield DA – Traffic Access and Parking Meeting
9th of October	Jacobs City of Canning Worley Parsons (Steve Piotrowski)	Meeting to discuss findings of City of Canning Integrated Transport Strategy
16th of October	Jacobs City of Canning	Briefing to the City of Canning Commissioners
23 October	Jacobs City of Canning Department of Transport (David Igglesden)	Discussion of Car Parking Strategy
29th of October	Jacobs City of Canning Scentre (Brad Osborne, Shane Healey) Main Roads (David Van Den Dries) Department of Transport (Craig Wooldridge, David Igglesden)	Presentation of microsimulation modelling results and discussion on DA microsimulation modelling
3rd November	Jacobs City of Canning Scentre (Brad Osborne, Kris Nolan, Ray Haeren, Jeff Baczynski, Shane Healey)	Discussion on DA microsimulation modelling options

Meeting Date	Attendees	General Discussion
20th of November	Jacobs City of Canning Scentre (Ray Haeren, Brad Osborne, Jeff Baczynski) Department of Transport (Craig Wooldridge, David Igglesden) Main Roads Western Australia (Lindsay Broadhurst, Ashis Parajuli) Department of Planning (Matt Selby) *PTA were invited but did not attend.	Discussion on DA microsimulation modelling options modelled by Cardno

Appendix B. Modelling Strategy Report

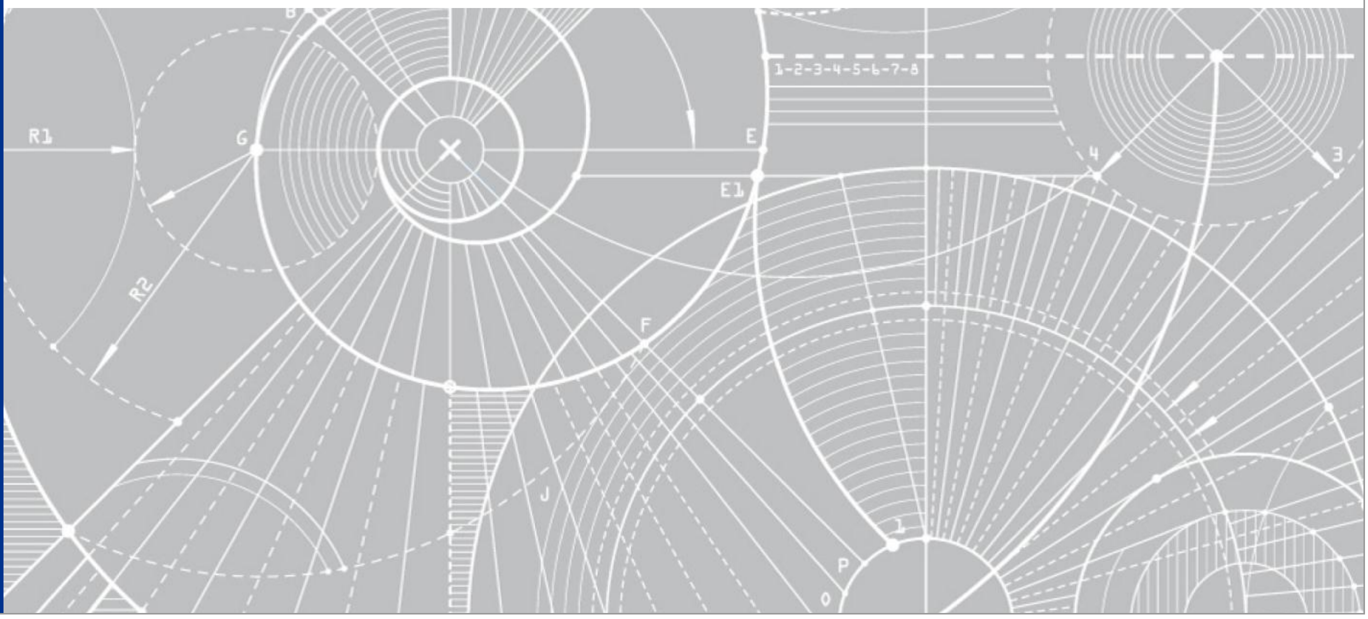
City of Canning Movement, Access and Parking Strategy

CITY OF CANNING

Modelling Strategy Report

Preliminary Draft | Rev B

05 Mar 2014



JACOBS SKM

City of Canning Movement, Access and Parking Strategy

Project no: PB50671
Document title: Modelling Strategy Report
Document no: Draft
Revision: Rev A
Date: 05 Mar 2014
Client name: City of Canning
Client no: Client Reference
Project manager: Richard Isted
Author: John Bennett
File name: C:\Users\jbbennett\Desktop\Modelling Strategy Report Rev A.docx

Document history and status

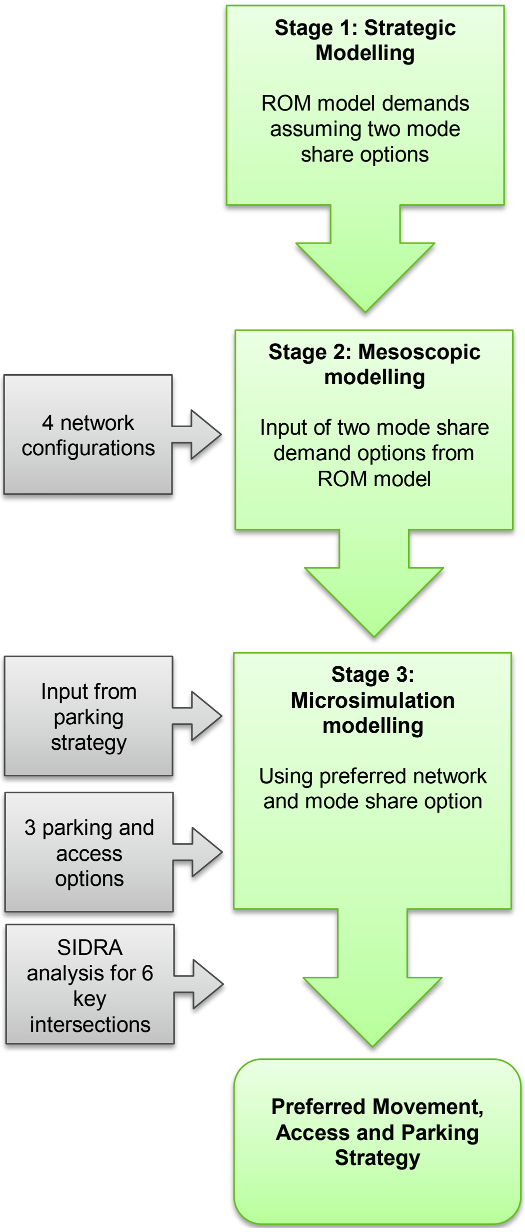
Revision	Date	Description	By	Review	Approved
Rev A	05/03/2014	Preliminary Draft Report	J Bennett	R Isted	K Weaver
Rev B	20/03/2014	Draft Report	J Bennett	R Isted	K Weaver

Contents

1. Introduction

Jacobs SKM was commissioned by the City of Canning to produce a Movement, Access and Parking Strategy for the proposed City of Canning Structure Plan. As part of the study Jacobs SKM will undertake traffic modelling for the City Centre and surrounding area to assess the locations and design of future transport upgrades, the preferred locations of multi-storey car parks and the operation of the network at ultimate development of the Structure Plan for all modes of transport.

The traffic modelling will be undertaken using a three-tiered approach. This approach will utilise travel demand data from the Main Roads Western Australia (MRWA) ROM model, a mesoscopic model of the wider area surrounding the City Centre and a microsimulation model of the Structure Plan area. SIDRA analysis will also be undertaken for six key intersections within the Structure Plan area. An overview of this approach is illustrated below:



This report provides detailed of the modelling methodology, data collection and assumptions for agreement with the City of Canning and key stakeholders.

2. Model development

2.1 Overview

The traffic modelling assessment will involve the development of calibrated/ validated 2013 Base Year models and forecast 2031 year models at the mesoscopic and microscopic level, with demand inputs from the MRWA ROM model. The models will be developed to cover the morning and evening weekday peak hours and for the Saturday afternoon peak hour. These peak hours will be determined from local traffic count data. Details of the proposed methodology for each of the modelling stages are described in the following sections.

2.2 Stage 1 – ROM modelling

Stage 1 of the modelling assessment will require the provision of peak hour modelling outputs (sub-area matrices) from the MRWA ROM model for an area covering the Structure Plan and surrounding area. This sub-area of the ROM model will correspond with the Stage 2 mesoscopic model area. Details of the mesoscopic model are provided in **Section 2.3**. The ROM demand outputs will be required for the 2011 Base Year and the forecast year of 2031. Jacobs SKM will liaise directly with MRWA to obtain the necessary information and data.

The 2011 Base Year ROM outputs will provide travel demand 'pattern' matrices that will be used as a starting point for input into the mesoscopic modelling in Stage 2. The 2031 ROM demand outputs will provide forecast travel demand patterns that would be used to calculate future travel growth for input into the mesoscopic modelling.

A key input into the ROM model will be the proposed land use data for the Structure Plan and surrounding area in 2031; this information is being prepared by the City of Canning. Jacobs SKM will provide MRWA with details of the land uses for input into the ROM model. This would be adjusted for zones 802 – 8015 as shown in Figure 2-1.

Jacobs SKM has developed modified mode share inputs (shown in **Table 1**) for the same zones for two different ROM scenarios based upon the following:

- Option 1 would assume a car driver mode share that represents more traditional levels of traffic and parking in centres outside Perth City, with some improvement in public transport and services and some improvement to the road network for walking and cycling.
- Option 2 would assume a car driver mode share that reflects more constrained levels of traffic and parking, with a major increase in public transport capacity and services and a fine grained network of bicycle paths.

It is recognised that the mode share for travel to the City Centre will be different for each of the proposed land uses. For example, the mode share of car driver to the Westfield shopping centre may be much higher than that of proposed TOD related development around the Cannington train station. Jacobs SKM would therefore use a weighted average mode share for input into the modelling for each of the zones that are modified.

Once Jacobs SKM has obtained these land use inputs and derived these mode share scenarios, this report would be updated to summarise and record these inputs.

The key outputs that would be sort from the ROM modelling are:

- AM and PM peak hour subarea matrices for use in the next stages of modelling;
- Degree of saturation plots; and
- Select Link Analysis (SLA) plots for key roads such as Albany Highway and Cecil Avenue.

Figure 2-1 Zones within city centre region

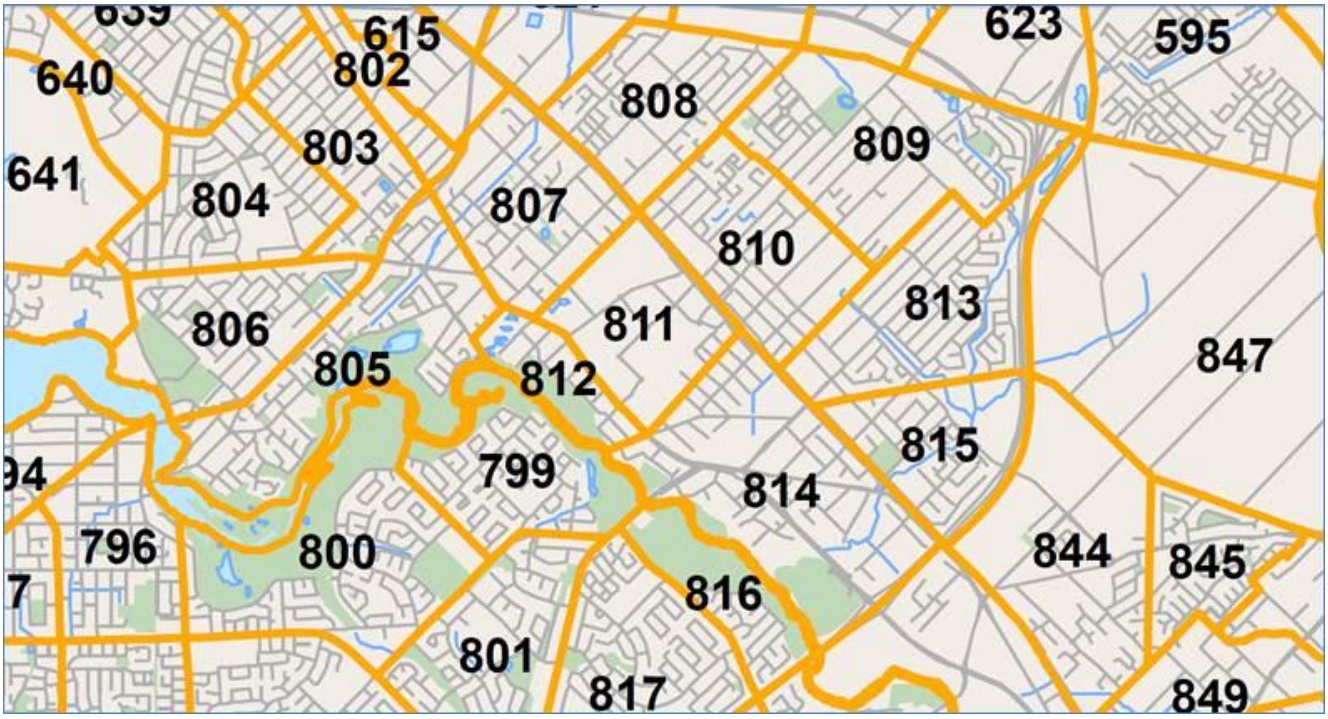


Table 1 Mode Shares for Car Driver Assumptions

	Mode Share% to Car Driver Assumptions			
Zone	**2011 Base Case**	**2031 ROM Base Case**	**2031 Option 1 (50 -55%)**	**2031 Option 2 (40 – 45%)**
803	64%	69%	54%	49%
804	63%	69%	54%	49%
805	64%	71%	56%	51%
806	64%	70%	55%	50%
807	67%	72%	56%	51%
808	62%	71%	56%	51%
809	62%	71%	55%	50%
810	62%	71%	55%	50%
811	66%	73%	50%	43%
812	69%	74%	50%	43%
813	65%	70%	55%	50%
814	68%	73%	50%	43%
815	64%	70%	55%	50%

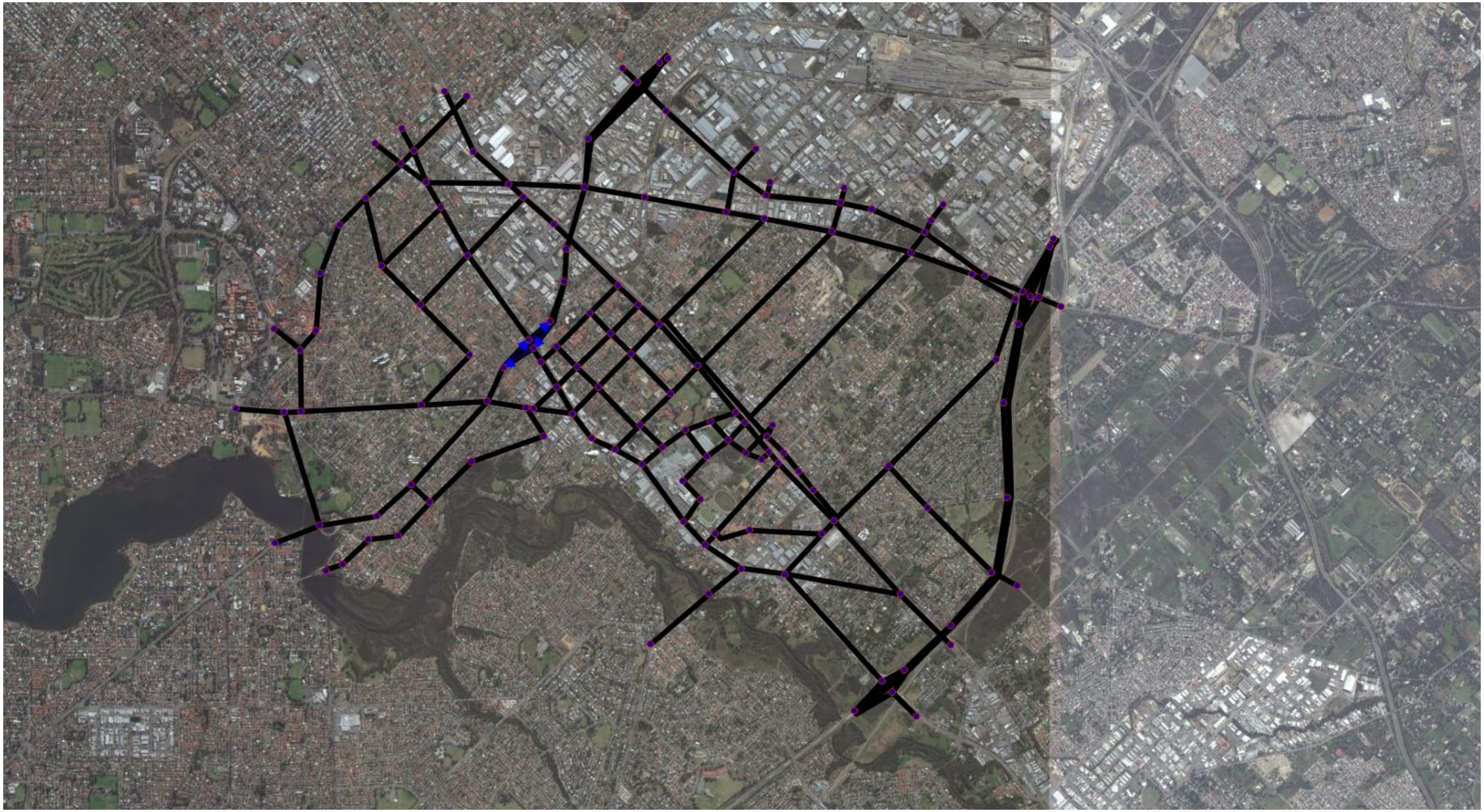
2.3 Stage 2 – Mesoscopic modelling

Stage 2 would involve the development of a multi-modal mesoscopic model that would cover the Structure Plan and surrounding area. The model will be developed using VISUM software and would model the AM and PM peak hours[1]. The mesoscopic model would facilitate a detailed wider area assessment of the existing and future transport network operation and would provide demand inputs into the microsimulation modelling in Stage 3. Importantly, the mesoscopic modelling would capture impacts of through traffic and forecast changes in traffic travel patterns in the wider area.

The coverage of the model would include the area bounded by Roe Highway to the east, Orrong Road to the north, Oats Street/ Hill View Terrace/ Lawson Street/ Centenary Avenue to the west and the Canning River to the south. The coverage of the mesoscopic model is shown in **Figure 2-2**. It should be noted that this highlights only the major roads; additional roads will be included as required to get a good reflection of base observed volumes.

[1] Examination of the 33 SCATS count data files indicates that the peak hours consist of a morning peak from 7:30am-8:30am, an evening peak of 4:30-5:30pm and a weekend peak hour of 11:30am-12:30am.

Figure 2-2 – Mesoscopic base model coverage



The mesoscopic model will include the key strategic roads and major connectors through the wider area. A larger number of the minor streets within the City Centre area will be included in the mesoscopic model to facilitate easier transfer of data between the mesoscopic model and the microscopic model in Stage 3.

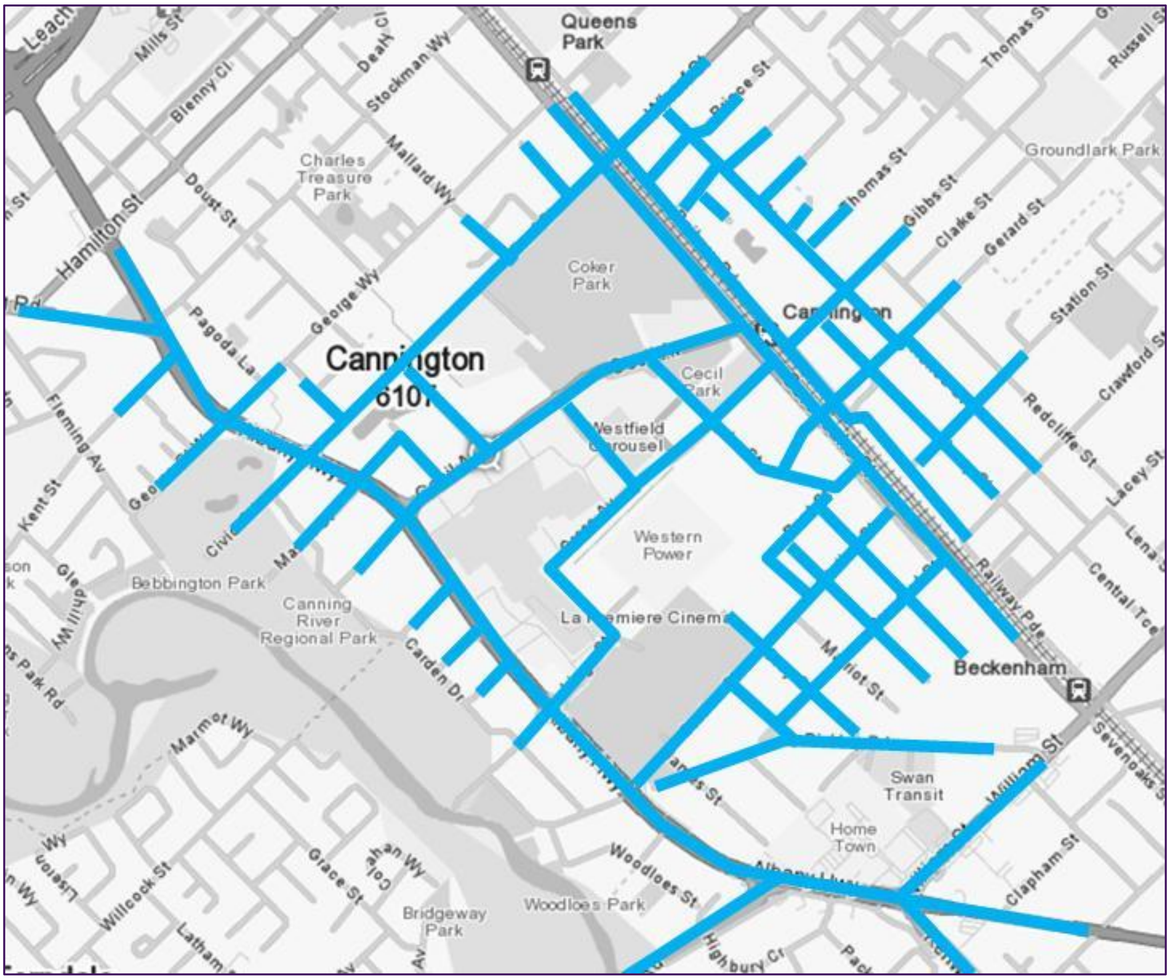
The Base Year mesoscopic demands would be developed using outputs from the 2011 ROM model as a starting point, with refinements to calibrate the demands to 2013 traffic count data. The mesoscopic model would include a finer level of detail than the ROM model, so it is likely that there would be some differences between the 2011 ROM demands and the final calibrated/ validated 2013 mesoscopic model demands. The model calibration/ validation process would be undertaken in accordance with NSW RMS and UK DMRB guidelines.

Travel demands for the 2031 scenarios would be calculated by applying growth factors derived from the ROM model. These growth factors would represent the calculated change in travel demand in the ROM model between the 2011 and 2031 for the two strategic mode share options.

2.4 Stage 3 – Microsimulation modelling

Stage 3 of the modelling will involve the development of a microsimulation model that will cover the Structure Plan area in more detail. The coverage of the microsimulation model is shown in **Figure 2-3**.

Figure 2-3 – Microsimulation base model coverage



The microsimulation model will be developed using VISSIM software.

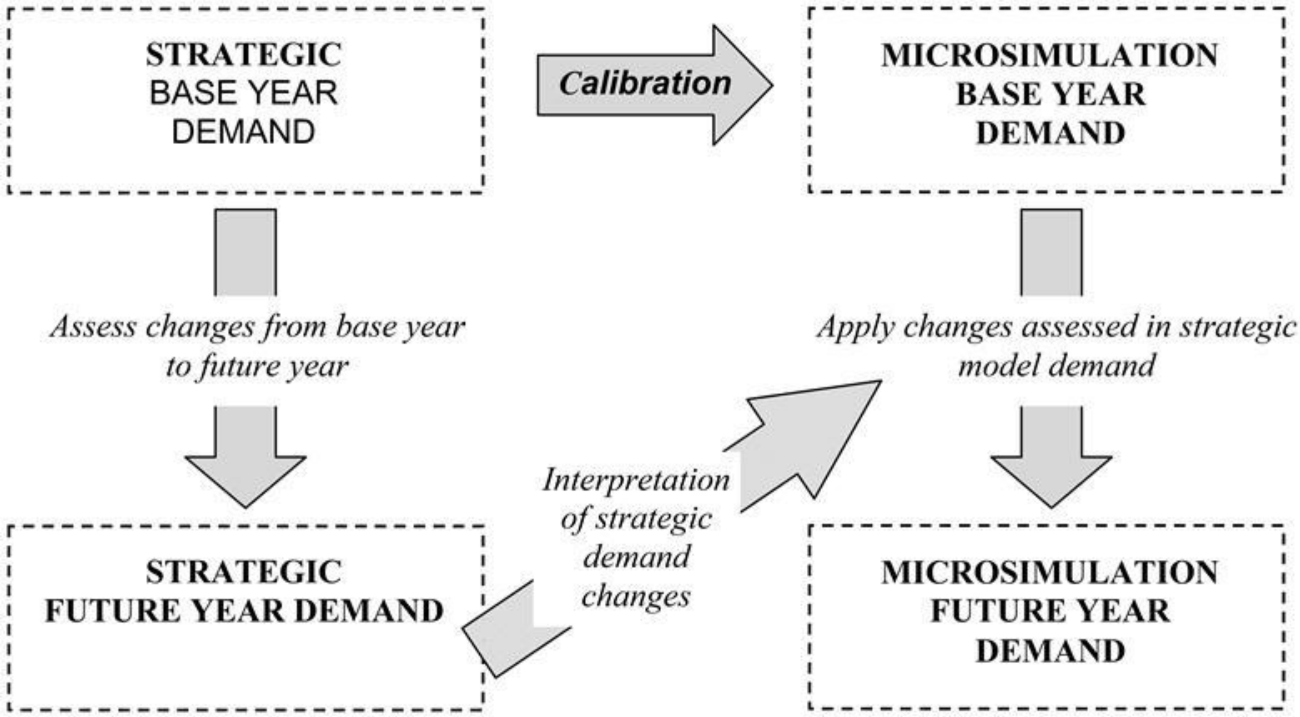
The microsimulation model will include private vehicles (cars and commercial vehicles), public transport services (including Bus Rapid Transit and Light Rail as advised by DoT and City of Canning), pedestrians and cyclists and will be able to model the interaction between all of these different modes of travel. Specifically, the model will include the simulation of pedestrian movements between Cannington train station, bus stops along Albany Highway and the Carousel Shopping Centre.

The 2013 Base Year microsimulation model demands will be developed using the 2013 mesoscopic model demands as a starting point. The microsimulation model will provide the 'next level' in terms of modelling the finer details of the transport system. As such, it is likely that the demands taken from the mesoscopic model will need some level of refinement prior to use in the microsimulation model. This view is reflected in the current NSW RMS modelling guidelines:

"Strategic level models are generally calibrated using screenlines and as such it is common to find that the demand from a calibrated strategic model is not sufficiently accurate to immediately calibrate within a microsimulation model. It may therefore be necessary to make further adjustments to the demand to ensure that the microsimulation model is fit for purpose'.

The 2013 Base Year microsimulation model will be calibrated/ validated to 2013 traffic data in accordance with NSW RMS and UK DMRB guidelines. Travel demands for 2031 would be calculated by applying growth factors derived from the 2031 mesoscopic model. This approach has been used by Jacobs SKM in previous large scale modelling for the Perth CBD and is recommended by the NSW RMS modelling guidelines. The process is illustrated in **Figure 2-4**.

Figure 2-4 – Mesoscopic and microsimulation model interaction



Source: NSW Transport Roads and Maritime Research

The above approach would also be used to make any necessary demand adjustments between the ROM model and the mesoscopic model as part of the calibration process.

2.5 Base model calibration and validation

As part of the 2013 base models development it will be necessary to calibrate the models to existing traffic data.

The mesoscopic model will be calibrated to the following:

- A scaled background image;
- Existing road network geometries and configurations;
- SCATS signal timing data and phasing;
- Demand outputs from the ROM model; and
- SCATS count data and loop count data.

The calibrated base model will be validated to travel time survey data for Albany Highway and Leach Highway.

The microsimulation model will be calibrated to the following:

- A scaled background image;
- Existing road geometries and configurations;
- SCATS signal timing data (IDM signal timings) and phasing;
- Demand outputs from the mesoscopic modelling;
- SCATS count data, loop count data and manual counts intersection counts; and
- Pedestrian counts at Cannington train station and key bus stops along Albany Highway.

The calibrated base model will be validated to travel time survey data for Albany Highway, Wharf Street, Sevenoaks Street and Station Street.

The model calibration exercise will involve comparisons between modelled and observed traffic count data. The GEH statistic will be used during the calibration of the models to compare the difference between observed flow and assigned flow on a link and is defined as follows:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Where **E** is the modelled flow and **V** is the observed flow.

The reason for using the GEH statistic rather than an absolute or relative flow difference is that it can cope with a wide range of traffic flows; for example where an absolute difference of 100 vehicles per hour can be significant in a flow of 200 vehicles per hour, it is largely irrelevant in a flow of several thousand vehicles per hour.

The criteria used to measure the success of the model calibration will be adopted from the NSW TRMR and UK Design Manual for Roads and Bridges (DMRB). These standards recommend that 85% of the modelled flows should be within 5 GEH of the observed flows. Modelled flows within 10 GEH of the observed flows are considered to be satisfactory, conversely modelled flows not within 10 GEH of the observed flows are considered to be unsatisfactory.

NSW TRMR and DMRB standards recommend that average modelled travel times should be within 15% of average observed travel times, along 85% of travel time routes, for a model to be considered sufficiently validated.

3. Traffic data

As part of the base models development process it will be necessary to calibrate the models to existing traffic data. Jacobs SKM will undertake a data collection exercise that will allow for a sufficient coverage of traffic data across the study area. A summary of the traffic data that will be collected is provided in **Table 3-1**.

Table 3-1 – Data types and sources

Type of data	Proposed source
Loop count data	MRWA/ City of Canning
SCATS count data	MRWA
SCATS signal data	MRWA
Travel time surveys	Jacobs SKM/ MRWA
Manual traffic counts of shared lanes at signals	Jacobs SKM
Manual traffic counts at key un-signalised intersections	Jacobs SKM
Traffic counts at key car park entrances/ exits	Jacobs SKM
Pedestrian/ cycle counts	Jacobs SKM
Public transport information	PTA/ Transperth

A total of 33 signalised intersections are located within the mesoscopic model study area. SCATS traffic count data will be available for all of these intersections, providing a good level of data coverage for the wider area model. It is also anticipated that loop counts will be available for some of the major strategic routes.

The microscopic model of the structure plan area will simulate the operation of the network in finer detail and will require a more extensive coverage of traffic data. The data collection exercise will therefore focus on the structure plan area to facilitate a high level of data coverage.

The Carousel Shopping Centre is the major trip generator in the City Centre so it will be important to survey the amount of traffic entering and exiting the shopping centre car parks during the peak hours. Surveys of pedestrian flows between Cannington train station/ bus stops along Albany Highway and the City Centre will also be important. The proposed locations of traffic counts are shown in **Figure 3-1**, **Figure 3-2** and **Figure 3-3**.

Travel time surveys for the Structure Plan area will be undertaken by Jacobs SKM during the peak hours. The surveys will be undertaken along a route following Albany Highway, Wharf Street/ Sevenoaks Street and Station Street. The proposed route for the travel time surveys is shown in **Figure 3-4**. Travel time for the length of Albany Highway between Kenwick Link and Shepperton Road are also available from MRWA and will be utilised in the model validation process.

Figure 3-1 – SCATS data locations (including manual counts of un-signalised/ shared lanes)

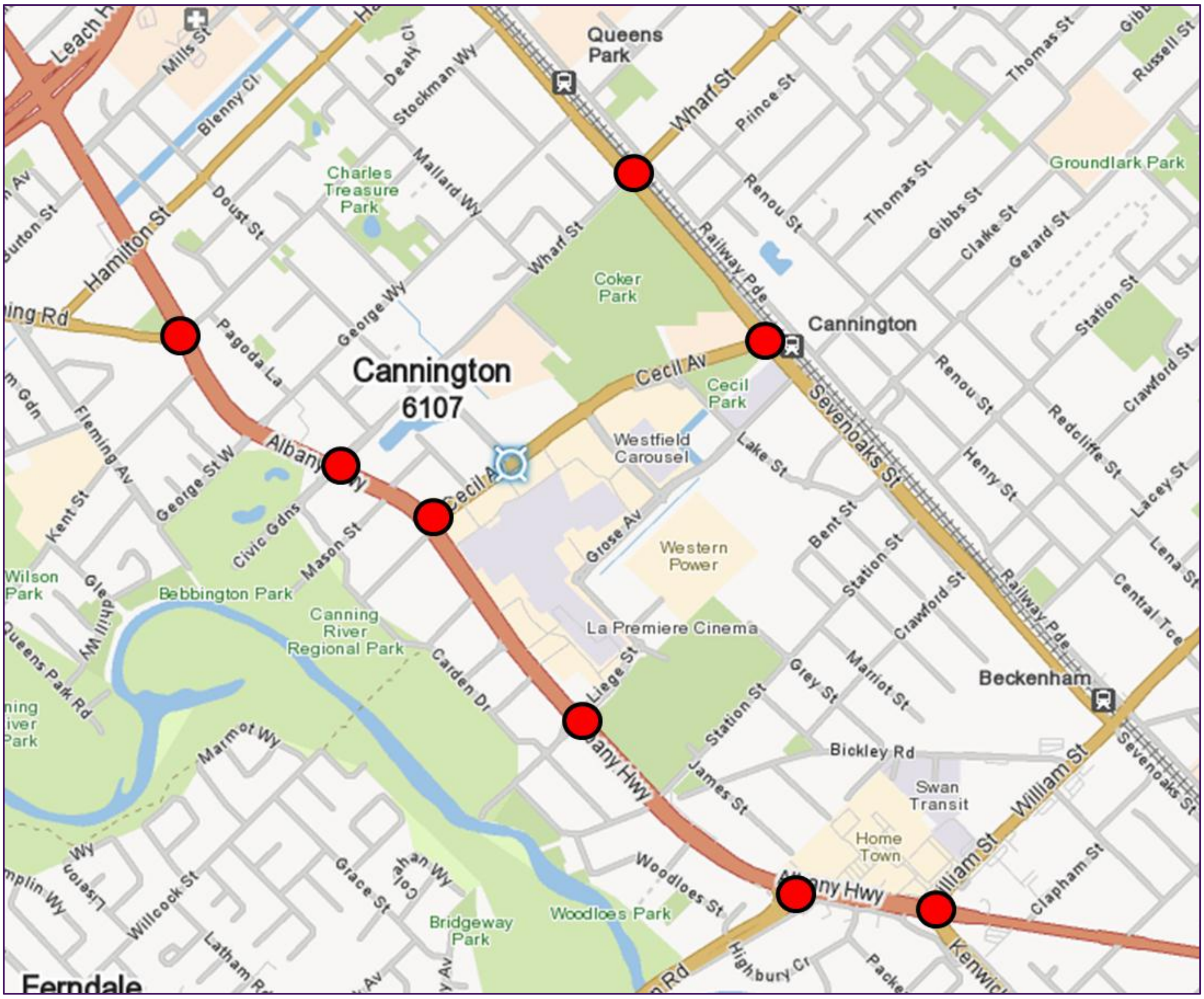


Figure 3-2 – Dedicated pedestrian/ bicycle count locations

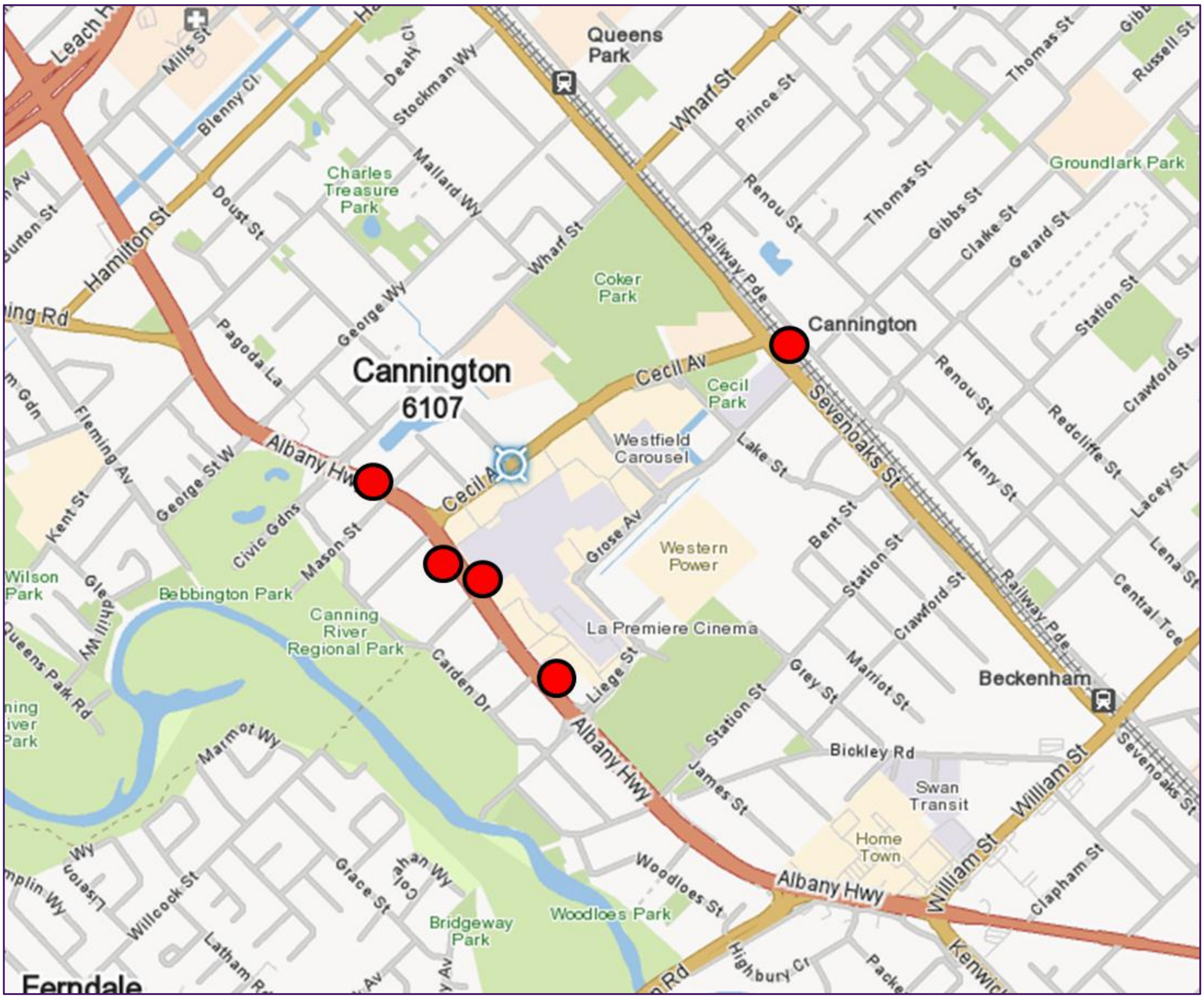


Figure 3-3 – Loop count and manual turning count (including pedestrian and bicycles) locations

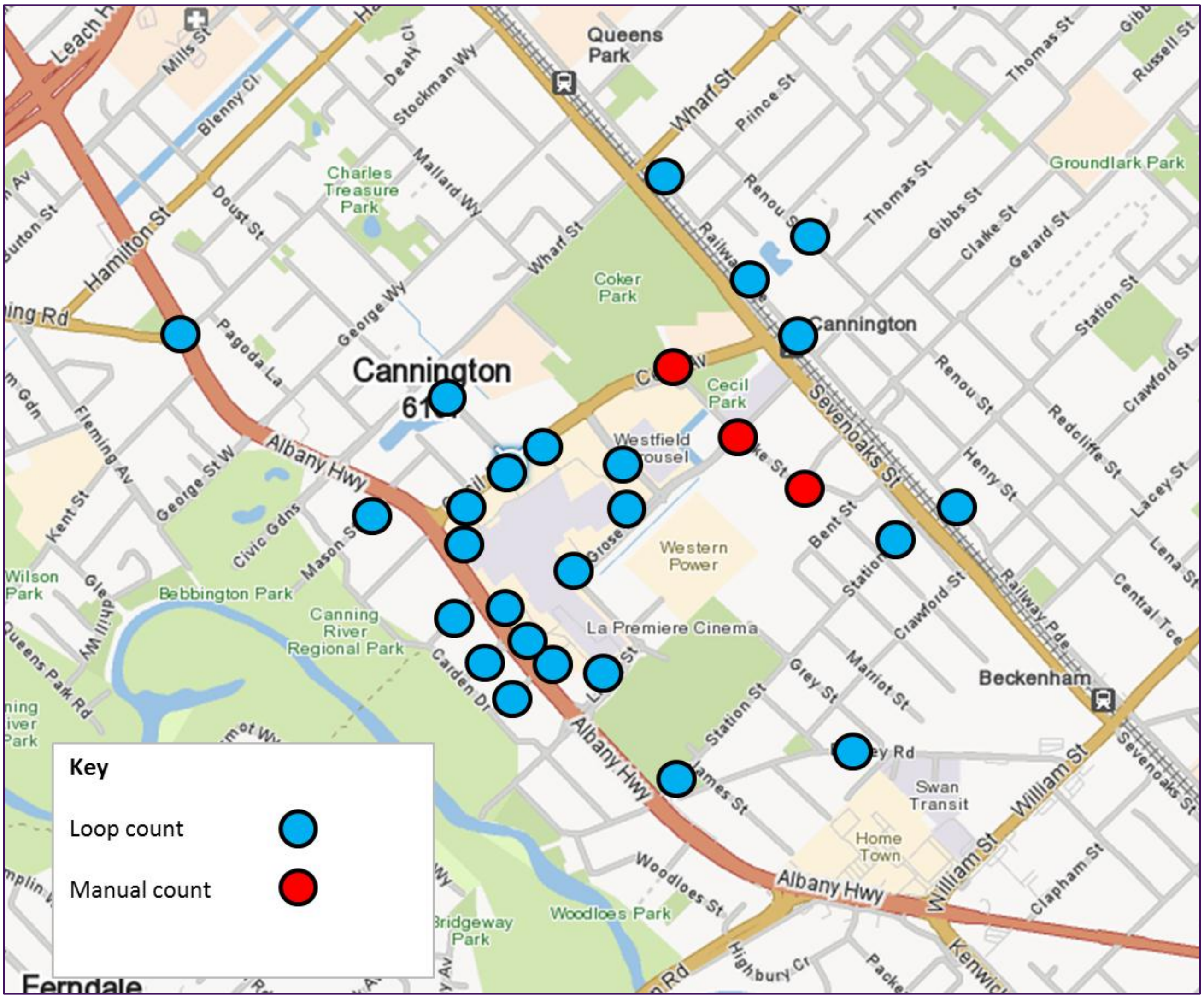
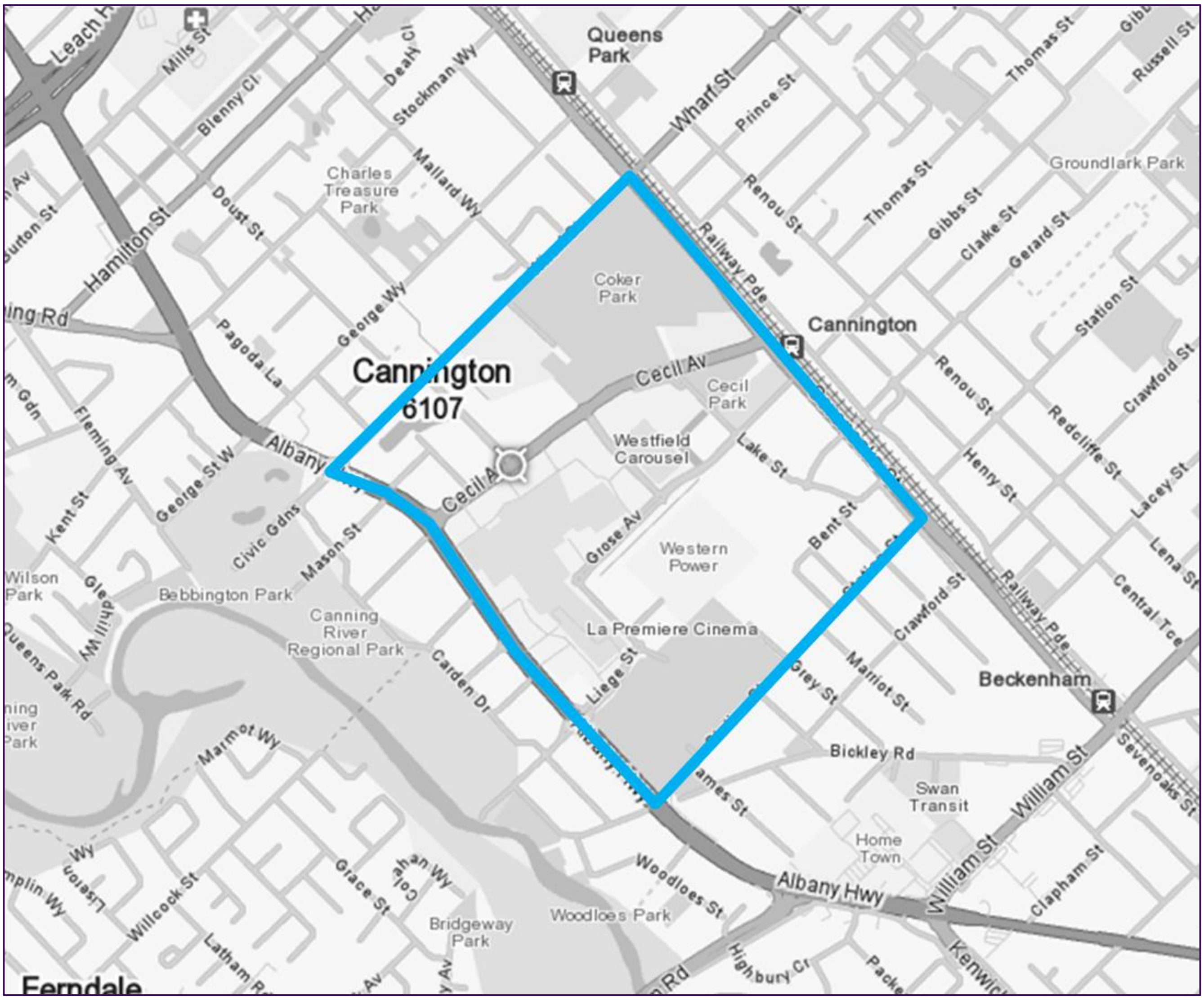


Figure 3-4 – Travel time survey route



4. Option testing

4.1 2031 assessment scenarios

The 2031 future year assessment scenarios will be developed to determine appropriate configurations for the ultimate movement network and to assist in the development of the access and parking strategy.

It is proposed that four road network configurations are assessed in Stage 2 to identify a preferred road network configuration for more detailed microsimulation modelling in Stage 3. These options may include the following changes to the network, which will be agreed with the City of Canning prior to commencement of the modelling:

- Capacity changes along Roe Highway;
- Capacity Changes along Sevenoaks Street through Beckenham;
- Capacity changes along Gerard Street;
- Extension of Gerard Street north and south;
- Re-alignment of Kewdale Road along Mills Street; and
- Grade separation at the Armadale Railway Line at Welshpool Road, Hamilton Street and William Street.

It is anticipated that some level of iteration will be required as part of the road configuration option testing to reach a preferred solution for input into Stage 3 of the modelling. The four network options will be assessed against the two mode share scenarios discussed in **Section 2.2**.

In Stage 3 of the modelling assessment, the preferred road layout and mode share option identified in Stage 2 will be incorporated into the 2031 microsimulation model, with up to three options tested for alternative car parking sites and access arrangements. These options will be identified as part of the parking and access strategy. Again, it is likely there will be some level of iteration between the modelling and the access and parking strategy to reach a preferred solution.

Once a preferred option has been identified for Stage 3, SIDRA analysis will be carried out for six key signalised intersections located within the Structure Plan area using the 2031 traffic volumes. The intersections that will be subject to SIDRA analysis will be identified through discussions with the City of Canning once the microsimulation modelling is complete.

4.2 Modelling outputs

The following outputs will be provided as part of the traffic modelling assessment for use in comparisons between the 2013 Base Year and the 2031 future year scenarios; and for comparisons between each of the 2031 scenario options:

- Travel times along key routes for private vehicles, public transport, pedestrians and cyclists
- Average vehicle/ pedestrian/ cyclist delay across the network
- Changes in traffic volumes along key routes
- Level of service for key intersections
- Identification of congestion hotspots

Appendix C. Modelling Calibration Report

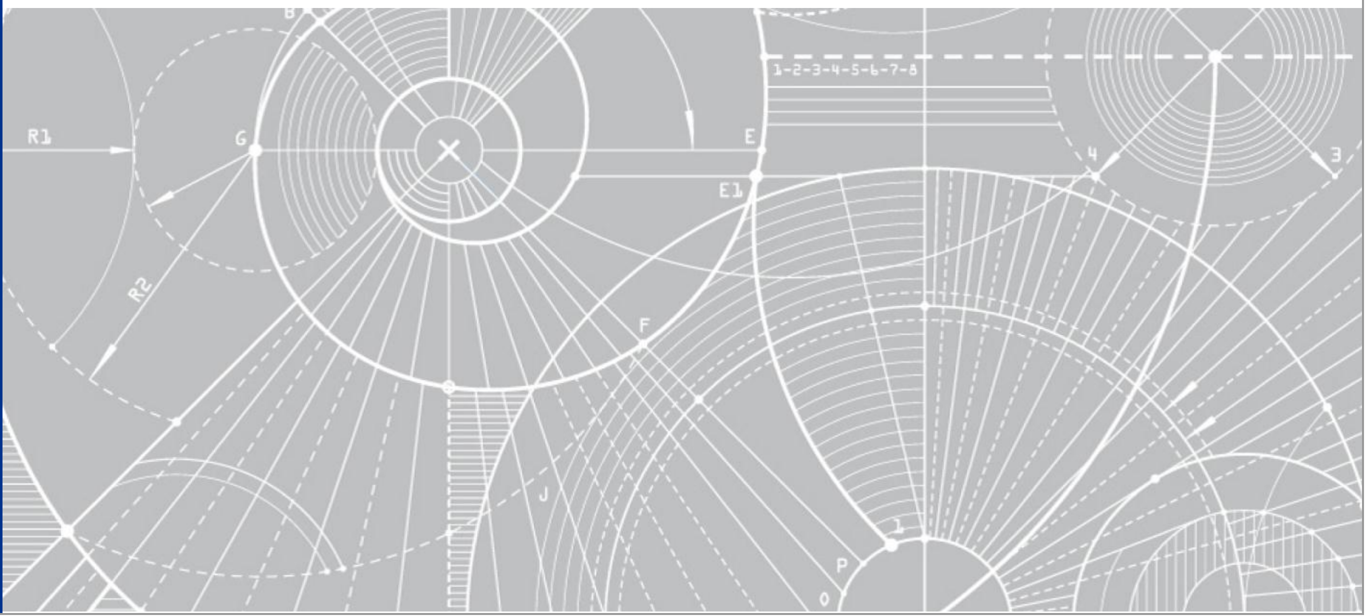
City of Canning Movement Access and Parking Strategy

CITY OF CANNING

Local Model Calibration Report

Rev A | Draft

8 Oct 2014



JACOBS®

City of Canning Movement Access and Parking Strategy

Project no: IW033900 (PB50671)
Document title: Local Model Calibration Report
Document no: Rev A
Revision: Draft
Date: 25 November 2014
Client name: City of Canning
Project manager: Richard Isted
Author: John Bennett and Richard Isted
File name: Canning MAPS Modelling Calibration Report.docx

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
11th Floor, Durack Centre
263 Adelaide Terrace
PO Box H615
T +61 8 9469 4400
F +61 8 9469 4488
www.jacobs.com

Document history and status

Revision	Date	Description	By	Review	Approved
Rev A	07/10/2014	Draft report	John Bennett	Susan Kreemer Pickford	Susan Kreemer Pickford
Rev B	14/11/2014	Draft report	John Bennett	Susan Kreemer Pickford	Richard Isted

Contents

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to develop traffic models to assist in the development of a Movement, Access and Parking Strategy for the City of Canning in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party

1. Introduction

1.1 Background

Jacobs was commissioned by the City of Canning to produce a Movement, Access and Parking Strategy (MAP) for the City of Canning Structure Plan and City Centre areas. As part of the study, Jacobs has undertaken traffic modelling for the Structure Plan and surrounding area to determine the locations and design of future transport upgrades, the preferred locations of multi-storey car parks and the forecast operation of the network at ultimate development of the Structure Plan, for all modes of transport.

The traffic modelling was undertaken using a three-tiered approach. This approach utilised travel demand data from the Main Roads Western Australia (MRWA) ROM model and involved the development of a mesoscopic model of the wider network area and a microsimulation model of the Structure Plan area. The models were developed for a weekday AM and PM peak hour and a Saturday afternoon peak hour. An overview of the modelling approach is illustrated in **Figure 1.1.** The extents of the study area are shown in **Figure 1.2**.

Figure 1.1 : Overall modelling approach

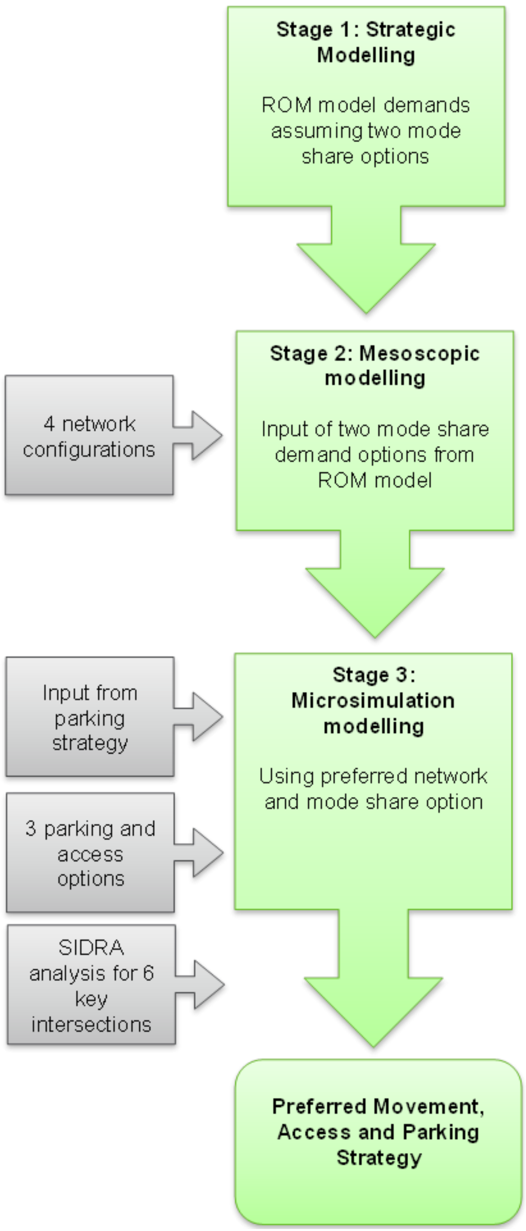
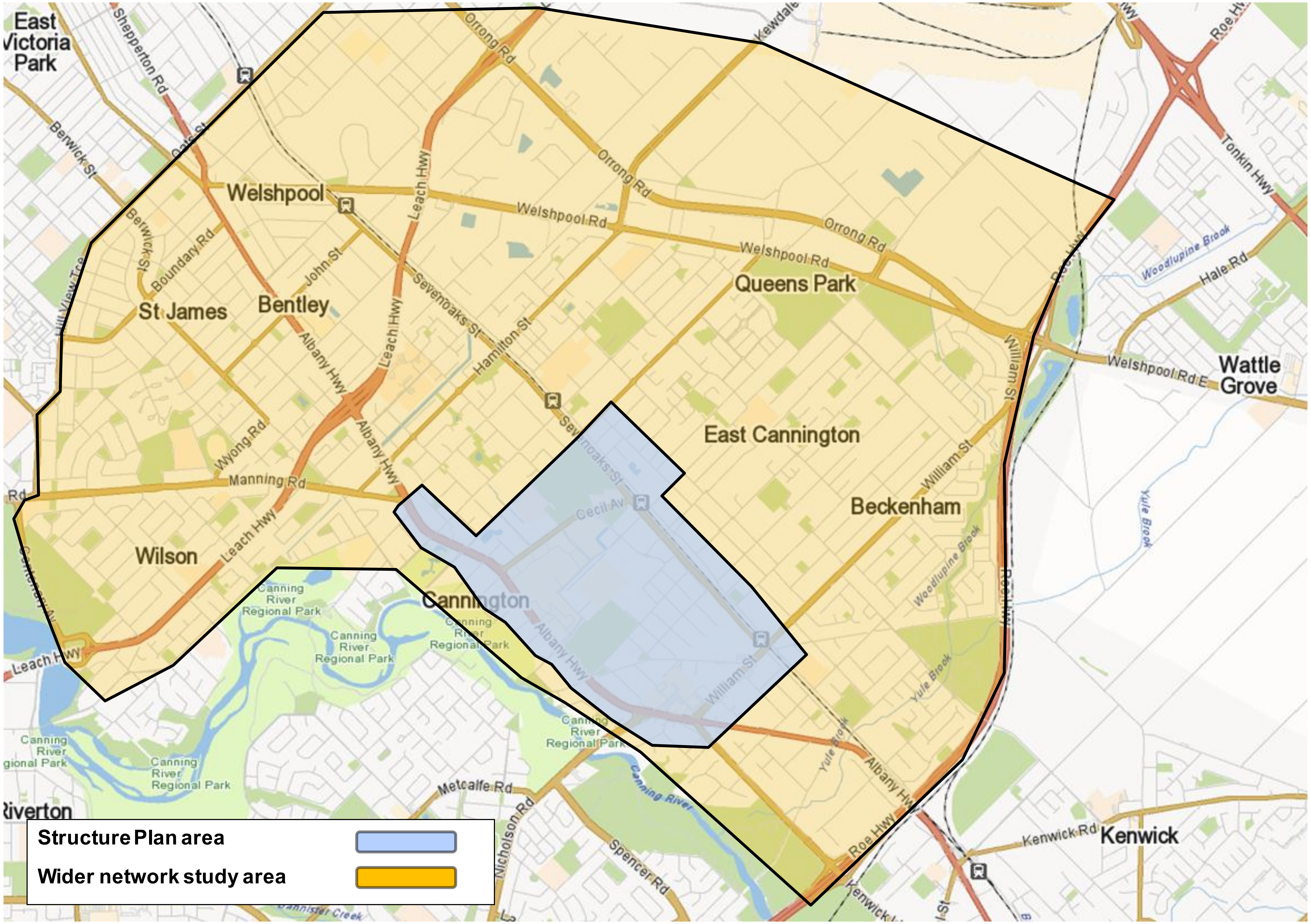


Figure 1.2 : Study area and model coverage



1.2 Purpose of this report

To form the basis for the modelling assessment, separate base year models were developed for the wider area network and Structure Plan area to provide a starting point for comparative purposes and to make sure that the models reflected the existing operation of the road network to within a suitable level. This report describes the Base Year models' development, calibration and validation.

At an early stage in the project, Jacobs met with representatives from the City of Canning, MRWA and the Department of Transport (DoT) to explain (and reach broad agreement on) the modelling methodology and assumptions. This consultation included details of assumptions such as the extents of the model networks, choice of modelling software packages, traffic data input and calibration/ validation criteria. Details of the modelling methodology presented during this consultation are provided in the March 2014 Jacobs report '*City of Canning Movement, Access and Parking Strategy Modelling Strategy Report*'.

1.3 Model audit

Following development of the base year models and production of a draft version of this report (REV A), the City of Canning appointed Transport Modellers Alliance (TMA) to undertake an audit of the modelling methodology and outcomes. The modelling and this report were subsequently updated to take account of the medium and high priority recommendations and comments made by TMA as part of the audit.

The major change made to the modelling following the audit included the coding of average weighted green times at the signalised intersections (rather than pure average timings).

A copy of the audit report and reference to the changes made to the modelling and this report following the audit is provided in **Appendix E**.

1.4 Report structure

The remainder of this report will take the following structure:

Chapter 2 – Traffic data collection

Chapter 3 – Mesoscopic model development

Chapter 4 – Microsimulation model development

2. Traffic data collection

2.1 Overview

To assist in the calibration of the Base Year models, an extensive data collection exercise was undertaken across the wider area network and Structure Plan area (refer **Figure 1.2**). The following sections provide details of the traffic surveys that were undertaken for use in the Base Year models calibration and validation.

2.2 Traffic counts

Traffic count data for the study area was sourced from SCATS and from a number of new surveys commissioned within the Structure Plan area, including manual classified turning counts and classified loop counts. The newly commissioned surveys were undertaken between Thursday 3 April and Wednesday 9 April 2014, a period which fell outside of the school holidays and represented typical network conditions.

A summary of the traffic count data used in the model calibration process is provided in **Table 2.1**. The locations of traffic counts surveyed for the Structure Plan area are shown in **Figure 2.1** and **Figure 2.2**.

A limited budget was available for the collection of new traffic count surveys, so the location of new surveys was chosen based on number of shared lanes at signalised intersections (where turning movements cannot be determined from SCATS) and important non-signalised intersections (which cannot provide SCATS data).

The counts were collated into a network diagram spreadsheet to check for inconsistencies and balancing between intersections. The SCATS data utilised in the study was generally sound, with a low level of faulty detectors.

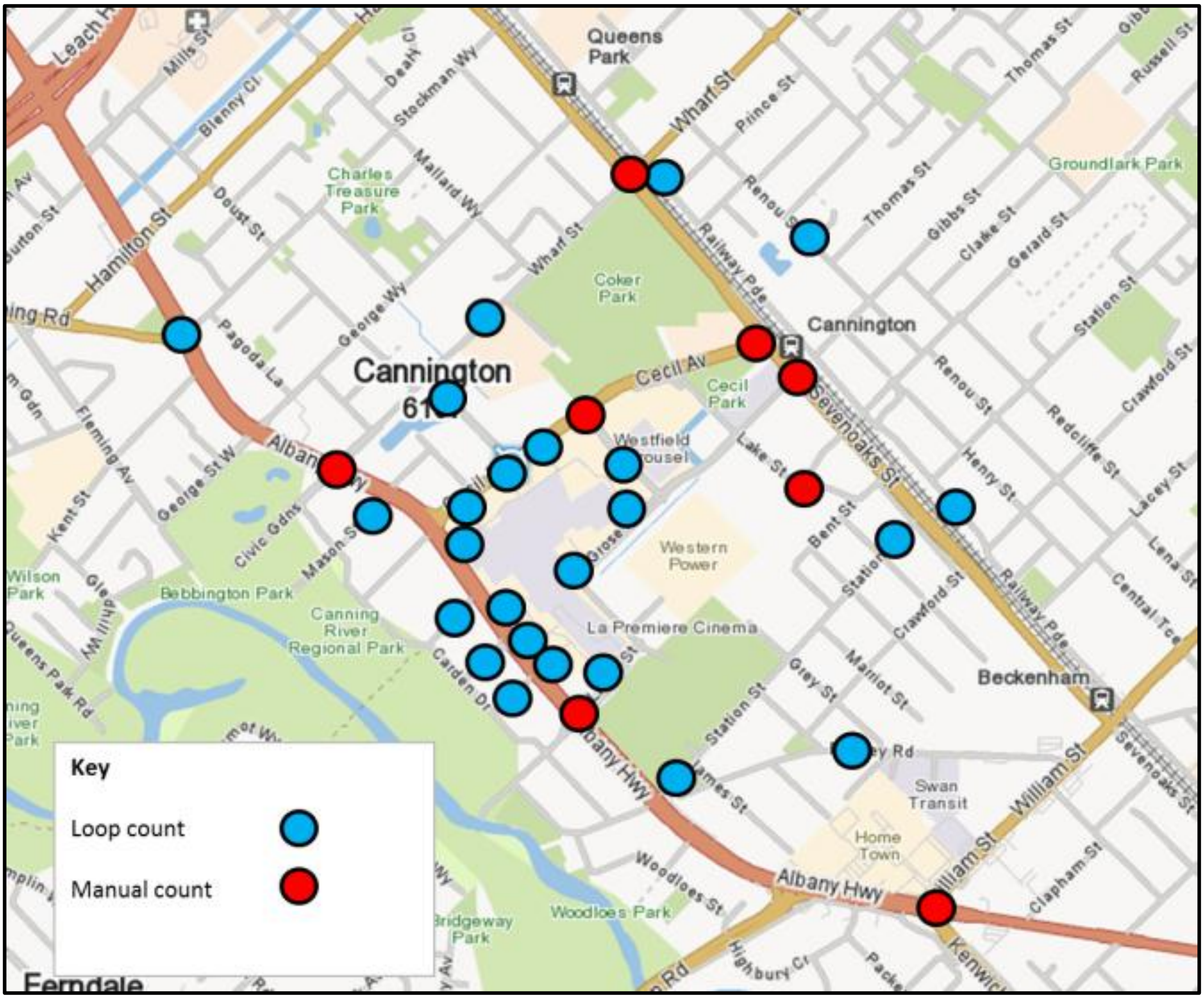
Table 2.1 : Traffic count data summary

Count site	Source	Date
Albany Highway/ Manning Road	SCATS	October 2013
Albany Highway/ Wharf Street	Manual turn count	April 2014
Albany Highway/ Cecil Avenue	SCATS	October 2013
Albany Highway/ Liege Street	Manual turn count	April 2014
Albany Highway/ Nicholson Road	SCATS	October 2013
Albany Highway/ William Street	Manual turn count	April 2014
Sevenoaks Street/ Wharf Street	Manual turn count	April 2014
Sevenoaks Street/ Cecil Avenue	Manual turn count	April 2014
Sevenoaks Street/ Grose Avenue	Manual turn count	April 2014
Cecil Avenue/ Carousel Road	Manual turn count	April 2014
Lake Street/ Guthrie Street/ Jameson Street	Manual turn count	April 2014
Sevenoaks Street/ Bus Station Exit	SCATS	October 2013
Carousel Shopping Centre Accesses (12 accesses)	Loop counts	April 2014
Left turn slip from Albany Highway to Manning Road	Loop count	April 2014
Bickley Road south of Nicholson Road	Loop count	April 2014
Cockram Street south of Albany Highway	Loop count	April 2014
Greenfield Street south of Albany Highway	Loop count	April 2014

Count site	Source	Date
Mason Street south of Albany Highway	Loop count	April 2014
Oak Street south of Albany Highway	Loop count	April 2014
Pattie Street	Loop count	April 2014
Railway Parade south of Wharf Street	Loop count	April 2014
Railway Parade south of Station Street	Loop count	April 2014
Renou Street south of Cunningham Way	Loop count	April 2014
Station Street north of Albany Highway	Loop count	April 2014
Station Street south of Sevenoaks Street	Loop count	April 2014
Wharf Street north of Pattie Street	Loop count	April 2014
Albany Highway/ John Street	SCATS	October 2013
Welshpool Road/ Kewdale Road	SCATS	October 2013
Albany Highway/ Hamilton Street	SCATS	October 2013
Manning Road/ Hamilton Road	SCATS	October 2013
Welshpool Road/ Leach Highway	SCATS	October 2013
Albany Highway/ Leach Highway	SCATS	October 2013
Manning Road/ Leach Highway	SCATS	October 2013
Orrong Road/ Oats Street	SCATS	October 2013
Leach Highway/ Bungaree Road	SCATS	October 2013
Orrong Road/ Kewdale Road	SCATS	October 2013
Leach Highway/ Centenary Avenue	SCATS	October 2013
Centenary Avenue/ Leach Highway Off-ramp	SCATS	October 2013
Welshpool Road/ McDowell Street	SCATS	October 2013
Orrong Road/ Roe Highway Off-ramp	SCATS	October 2013
Sevenoaks Street/ Hamilton Road	SCATS	October 2013
Orrong Road/ McDowell Street	SCATS	October 2013
Albany Highway/ Ewing Street	SCATS	October 2013
Albany Highway/ Royal Street	SCATS	October 2013
Kenwick Link/ Roe Highway	SCATS	October 2013
Albany Highway/ Welshpool Road	SCATS	October 2013
Berwick Street/ Hill View Terrace	SCATS	October 2013
Albany Highway/ Hill View Terrace	SCATS	October 2013
Hill View Terrace/ Jarrah Road	SCATS	October 2013
Berwick Street/ Boundary Road	SCATS	October 2013
Manning Road/ Lawson Street	SCATS	October 2013

Figure 2.1 : SCATS count data locations

Figure 2.2 : Manual and loop count locations

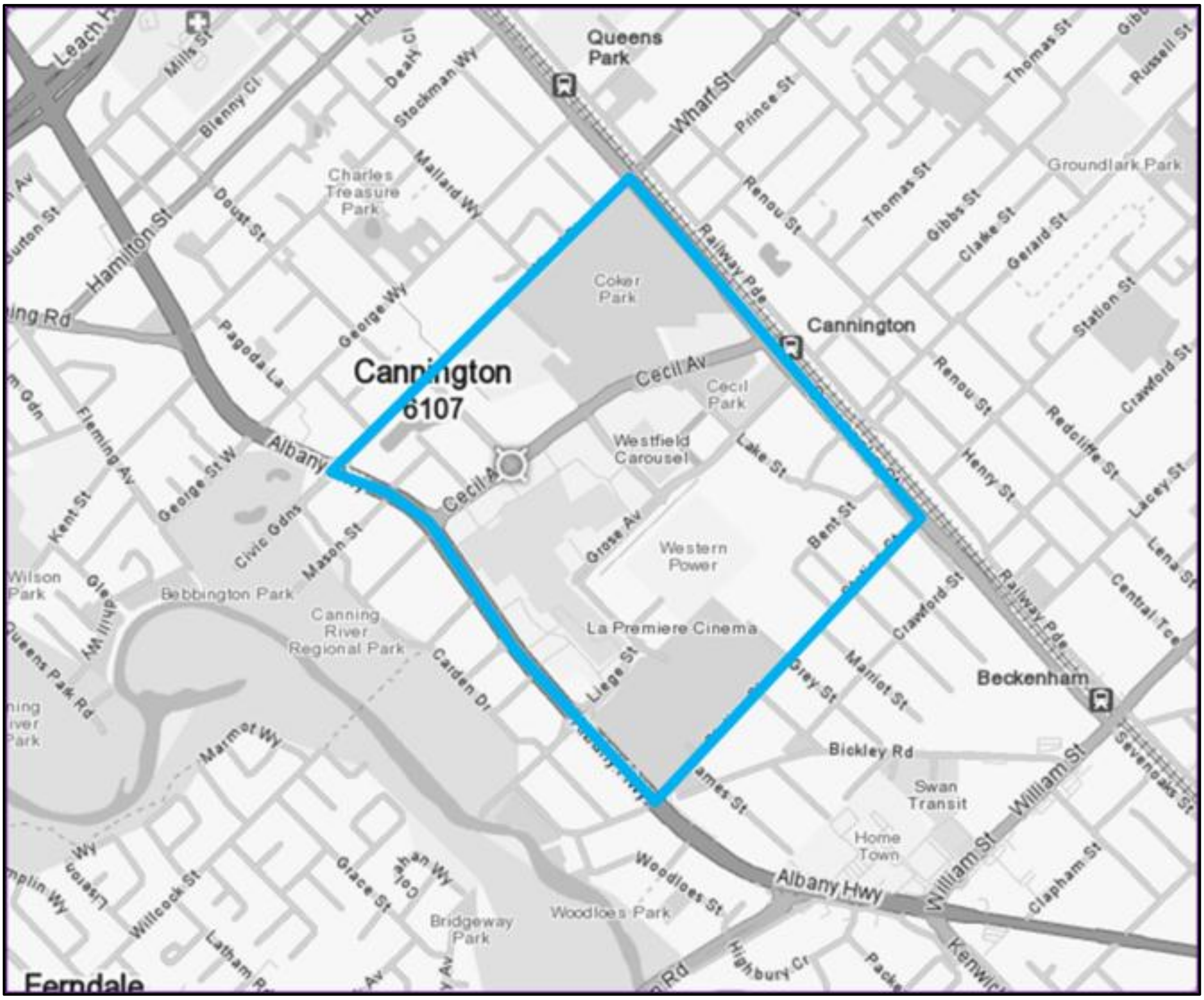


2.3 Travel time data

Travel time data was collected for key routes within the Structure Plan area during the AM (7.30am – 8.30am) and PM (4.30pm – 5.30pm) peak hour on Thursday 3 April 2014 and during the afternoon peak hour (11.30am – 12.30pm) on Saturday 5 April 2014.

The travel time data was collected for use in validation checks of the Base Year microsimulation model. The travel time routes surveyed are illustrated in **Figure 2.3**. These routes were chosen for the surveys as they provided the provided a measurement of travel time in the core of the study area, which is the main focus of the microsimulation modelling.

Figure 2.3 : Travel time survey routes



2.4 Signal data

Phase timings for the signalised intersections within the Structure Plan area were provided by MRWA in the form of IDM recordings. The IDM recordings were undertaken on Thursday 3 April and Saturday 5 April to maintain consistency with the majority of the traffic count surveys and travel time surveys.

Signal phasing, inter-stage timings and off-set timings were also provided by MRWA for use in the modelling. Manual observations were undertaken during peak hour site visits to verify the data provided and in particular to establish the typical timings and operation of the train crossing at Sevenoaks Street/ Wharf Street.

A summary of the average phase times, inter-stage times and off-sets for each intersection is provided in **Appendix A**.

2.5 Public transport data

Information on bus and train routes and service frequencies was obtained from the Transperth website for use in the model development. A summary of the bus/ train routes and timetable information used in the modelling is provided in **Table 2.2**.

Table 2.2 : Public transport service frequencies

Service	Weekday AM peak frequency per hour	Weekday PM peak frequency per hour	Saturday peak frequency per hour
220 H Inbound	0	1	1
220 Outbound	2	3	1
210 Inbound	1	1	1
210 Outbound	2	2	1
211 Inbound	1	2	0
211 Outbound	2	1	0
212 Inbound	2	4	1
212 Outbound	5	3	1
229 Inbound	3	2	1
229 Outbound	2	3	1
508 Inbound	2	6	2
508 Outbound	4	3	2
509 Inbound	2	3	1
509 Outbound	0	2	1
72 Inbound	1	2	1
72 Outbound	2	2	1
34 Inbound	2	4	2
34 Outbound	4	2	2
294 Inbound	0	2	1
294 Outbound	1	3	1
507 Inbound	4	4	4
507 Outbound	4	4	4
202 Inbound	2	2	1
202 Outbound	2	3	1
203 Inbound	2	2	1
203 Outbound	3	2	1
206 Inbound	4	3	1
206 Outbound	4	4	1
208 Inbound	3	3	0
208 Outbound	3	3	0
Trains Inbound (to Perth	12	8	8
Trains Outbound (from Perth)	6	11	8

3. Mesoscopic model development

3.1 Background

As discussed in **Section 1.1**, the overall modelling approach involved the development of a VISUM[1] mesoscopic model to assess the operation of the wider area network. The key objectives of the VISUM modelling are as follows:

- To facilitate a wide area assessment of network changes that may impact on the amount of traffic travelling through the Structure Plan area.
- To provide a strategic level assessment of road network operation within the Structure Plan, including forecast changes in travel patterns within the City Centre as a result of future development and network changes.
- To bridge the gap between ROM and the microsimulation modelling – the mesoscopic model will provide refined demand information for input into the microsimulation model of the Structure Plan area.

The model was developed for the AM (7.30am – 8.30am), PM (4.30pm – 5.30pm) Saturday (11.30am – 12.30pm) peak hours. The peak hour for assessment were derived from SCATS data by analysing volumes across the study area for 15 minute time intervals. The following sections describe the Base Year VISUM model development and calibration.

3.2 Network calibration

3.2.1 Network coding

Coding of the network was undertaken using Bing Maps, which is incorporated within VISUM and is automatically scaled. The imagery in Bing Maps provided a reference point for coding of link geometries in terms of lane numbers and capacities. Link geometries were verified through the use of additional aerial imagery provided by the City of Canning and site visits. The extents of the VISUM model network are shown in **Figure 3.1**.

3.2.2 Link types

A series of link types was developed within the model for use in reflecting the road hierarchy in the network. This was achieved by applying different levels of link capacities to different types of road to reflect the difference in attractiveness between primary routes, secondary routes and minor routes. A summary of the general link types applied in the model are provided in Table 3.

Table 3 Generic Link Types

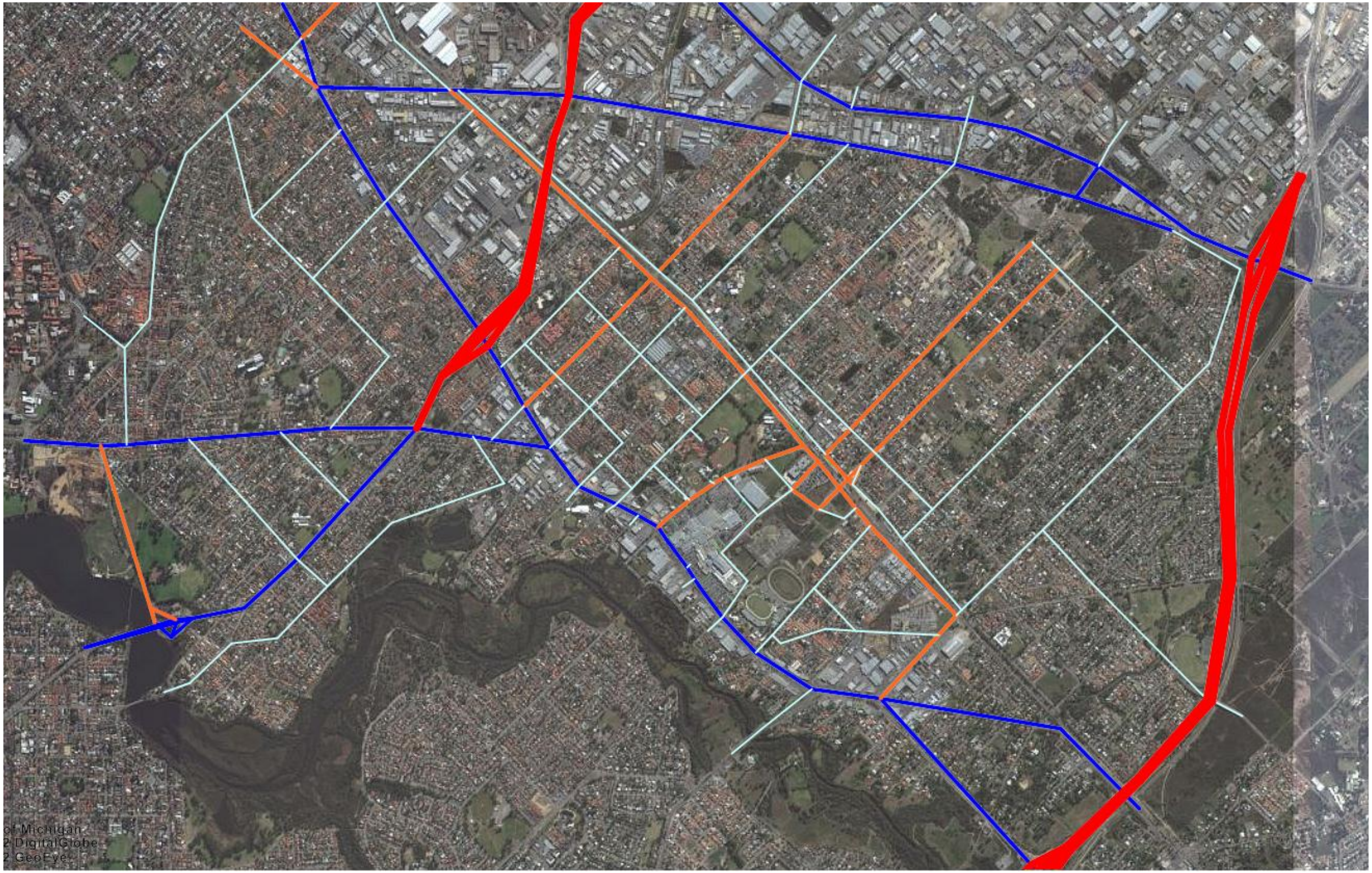
Type of Road	Representative Free Flow Speed	Typical Capacity Per Lane
Access Controlled Highway	80Km/h	2100
Urban Highway	70km/h	1200
Main Street	50km/h	1800
Residential Road	50km/h	900

The purpose of the VISUM model is to provide a level of assessment of re-routing and input into the more detailed microsimulation modelling. The model uses the static equilibrium assignment method with only basic junction delay and the use of Bureau of Public Roads (BPR) congestion function. Complex signal coding was

[1] VISUM is a transport modelling software package developed by German company PTV. VISUM provides tools to manipulate matrices and mathematically assign traffic to networks, and assess midblock and intersection performance using a variety of both worldwide standard and bespoke traffic methods. VISUM has tools to import key material to and from the software package VISSIM, which is also used for the other component.

not explicitly inputted into the VISUM model, however link delay and congestion is reflected through the use of link capacities and the road hierarchy.

Figure 3.1 : Mesoscopic model network extents



3.3 Demand calibration

3.3.1 Matrix estimation

The Base Year mesoscopic demands were developed using AM and PM Peak Hour subarea matrices from the 2011 ROM model as a starting point. The demand zoning system contained within ROM, for the study area, is relatively coarse and required disaggregation into the finer grained zone system used within the VISUM model. This was particularly the case for zones within the Structure Plan area, which is the key focus for the study and was modelled in finer detail.

Once the initial ROM demands were disaggregated for the VISUM zoning system they were then refined using matrix estimation to calibrate the model volumes to observed volumes for 2014. It should be noted that for the Saturday Peak Hour, the weekday was used as a prior matrix for this time period prior to matrix estimation being undertaken.

3.3.2 Flow comparisons

The model calibration exercise involved comparisons between modelled and observed traffic count data. The GEH statistic was used during the calibration of the model to compare the difference between observed flow and assigned flow on a link and is defined as follows:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Where:

E is the modelled flow

V is the observed flow

The reason for using the GEH statistic rather than an absolute or relative flow difference is that it can cope with a wide range of traffic flows; for example where an absolute difference of 100 vehicles per hour can be significant in a flow of 200 vehicles per hour, it is largely irrelevant in a flow of several thousand vehicles per hour.

Comparisons have been made between the modelled and observed counts used in the matrix estimation process for the AM and PM peak hours. The criteria used to measure the success of the model calibration were adopted from the NSW TRMS guidelines. These guidelines recommend that 85% of the modelled flows should be within 5 GEH of the observed flows. Modelled flows within 10 GEH of the observed flows are considered to be satisfactory, conversely modelled flows not within 10 GEH of the observed flows are considered to be unsatisfactory. The 2014 Base Year model demands were calibrated to the observed turn and link count data surveyed across the study area. A summary of the calibration results is provided in **Table 3.4**. It should be noted that the number of counts that was used in the calibration of different time periods – this is primarily due to two factors:

- Some counts that had not properly recorded in one peak hour were available in another peak hour; and
- A number of link counts that had been available for the weekday period had no equivalent weekend count.

Table 3.4 : Calibration results summary

Time period	Number of Counts (Turn Counts used)	Modelled flows within 5 GEH	Modelled flows within 10 GEH	Modelled flows not within 10 GEH
AM peak hour	174 (89)	90%	97%	3%
PM peak hour	162 (89)	86%	95%	5%

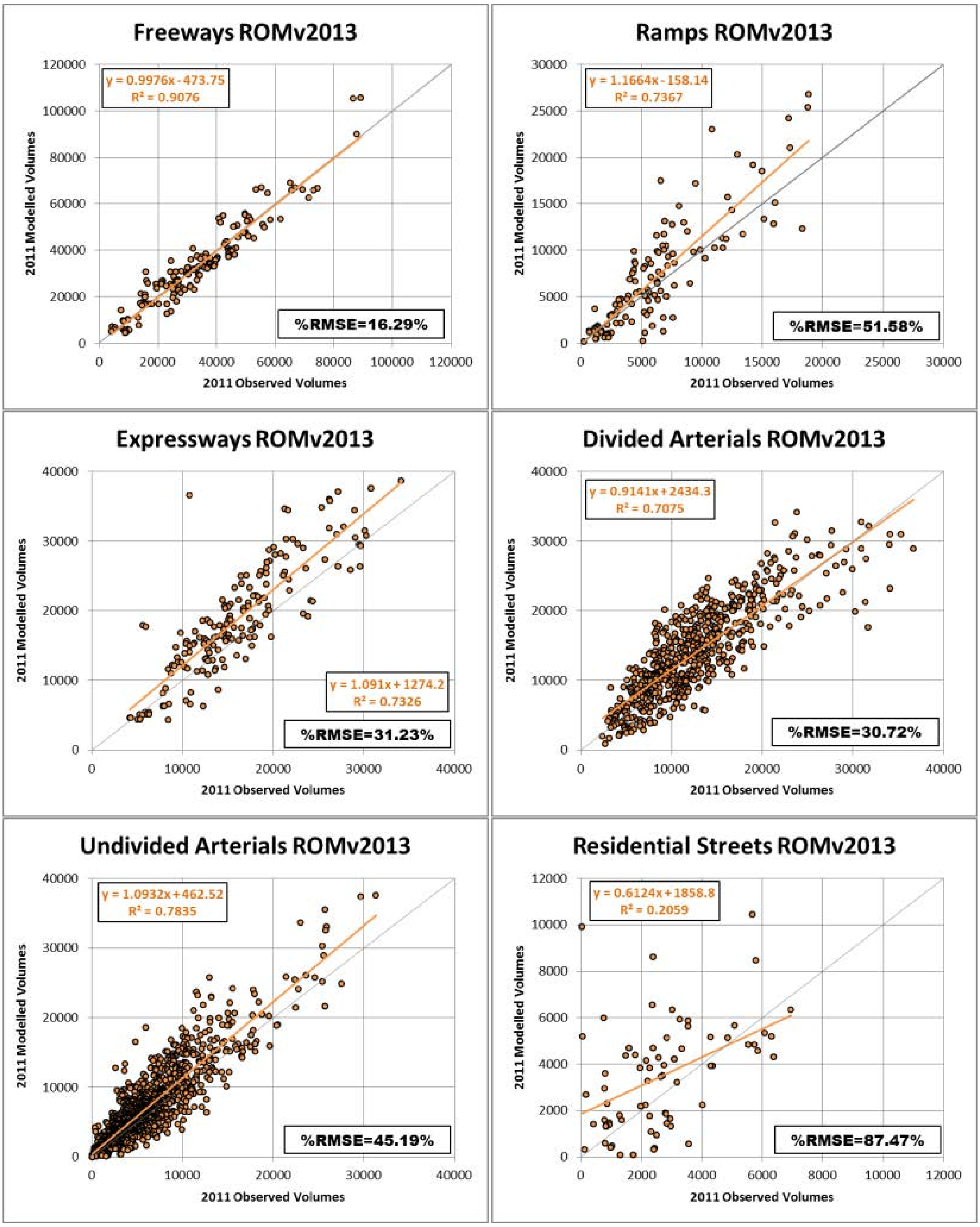
Time period	Number of Counts (Turn Counts used)	Modelled flows within 5 GEH	Modelled flows within 10 GEH	Modelled flows not within 10 GEH
Saturday peak hour	91 (89)	90%	99%	1%

It should be noted that matrix estimation takes a prior matrix and mathematically adjusts it "minimally" from this prior position to arrive at a revised Origin Destination pairs. Ideally there is some faith that the underlying pattern in the prior matrix is reflective of the actual patterns that may be observed. To this end a large amount of adjustment from the prior matrix may be considered a concern. Table 3.3 summarises and compares the totals from each of the matrices. It should be noted it is expected that the ROM totals would be larger because in general from the 2011 validation plot, the projected values on the boundary roads are higher than observed 2011 values – Figure 3.2 highlights the validation plots for different link types in the ROM.

Table 3.5 : Comparison of Prior and ME Traffic Totals

	AM Peak Hour Total	PM Peak Hour Total	Saturday Peak Hour Total
2011 ROM Prior Matrices	42202	41245	
2014 VISUM Matrix adjusted Base matrices	31680	37486	38690

Figure 3.2 : ROM Validation Plots for Different Link Types



3.4 Summary

A calibration exercise was completed for the mesoscopic modelling. Whilst this has occurred and meets the criteria set out in typical transport modelling guidance, the following practical considerations should be borne in mind:

- The calibration approach (i.e. use of matrix estimation) is highly dependent on the initial traffic distribution patterns available in the prior sub area matrices from the ROM being representative of the actual distribution. It is noted that comparisons for the distribution to/from the Canning City Centre zone was compared by Cardno with credit card data for the Westfield Carousel shopping centre, and that these had similar patterns.

- Matrix estimation is a mathematical optimization process that essentially changes matrices to match in close detail counts with minimal change from the prior sub area matrix. The traffic counts in themselves also have "error" or rather anomalies that are often inherent in small sample surveys and in congested situations; these errors typically also influence the development of the matrix. For example, there is a risk in this instance is that Albany Highway counts may not actually represent the demand because the level of congestion limits the number of vehicles passing across a count point.
- Whilst the vast majority of turning and midblock movements compared against counts are within an acceptable margin of difference, some movements are still significantly different from the observed value. Where one of these movements is being used as part of analysis, this should be noted and (where appropriate) adjusted for in an appropriate manner.
- No travel time validation of the mesoscopic model has been undertaken the reason being it is not the explicit purpose of this model to estimate travel times within the City Centre (This is the purpose of the microsimulation modelling and SIDRA modelling). The purpose of this model is to reflect changes in traffic demands in the area; that is – if a network element is added or removed, how will this change the number of vehicles travelling on it.
- Not every road or property access is modelled. This is mainly due to the fact the level the zone system is still somewhat coarse in parts. Again, at the microsimulation modelling level, roads and most accesses are modelled in some form or another. In general, more detail is modelled around the City Centre where better spatial resolution of traffic count data can better inform likely movement and where it is needed for more examining more specific issues.

3.5 Future year matrix development methodology

At the time of this report, nominal future years have been generated for:

- 2016 (Year of Opening of Westfields)
- 2026

The approach to the future year modelling for 2016 has been to apply scale factors to Carousel access zones as provided to Jacobs by Cardno (representing Westfield).

With respect to change in matrices for the 2026, Traffic growth for Westfield Carousel and Bunnings has been based upon the submitted information associated with each Developer Application (DA). In particular:

Table 3.6 : Comparison of Prior and ME Traffic Totals

	Thursday PM Peak Hour	Saturday Peak Hour
Westfield additional trips	+1132vph	+1630vph
Bunnings additional trips	+374vph	+625vph

The external distribution of been generally maintained as per the base calibrated 2014 scenario, with some slight change in future pattern due to the furnessing approach (also known as frataring) that alters the pattern with respect to changes in growth on boundary locations. The furnessing method is an industry standard method that is often applied by Main Roads engineers to derive future traffic volumes for SIDRA analysis.

- As part of the refinement of the scenarios by Jacobs to reach assessment criteria (discussed later in this technical note), consideration will also be given to reductions in these rates based upon changes in parking locations and parking demand management.

With respect to zonal traffic growth for all other zones

- Zonal growth has been derived from ROM24 plots and the changes in proposed land use within the City Centre from the ratio of volume at 2031 over that at 2011, then adjusted down to reflect 2026. Ideally growth factors should have been calculated from equivalent subarea ROM24 matrices, however these were not available.

- For the growth associated with the Canning City Centre (Not associated with the proposed developments with defined trips), it is noted that the estimate of the average growth across all the areas has been based upon the total land uses. The use of an area wide average across a range of zones has been used to reflect the likely distribution of car parking to promote an avoidance concentrating parking and hence potentially traffic issues to particular locations. It is expected that this would reflect a move towards a greater amount of public parking. This is based on "ultimate" land uses identified in the structure plan and hence may be considered likely to be an overestimate, due to the perhaps ambitious nature of this plan.

Zone / External Network Point	Mesoscopic Model Zone Number/s	% Increase
City Centre (Excluding Westfield and Bunnings)	10,15,55,56,57,58,59,60, 61, 52, 63, 64	22%
Albany Highway East	22	28%
Nicholson Road	23	21%
Welshpool	24	23%
Albany Highway West	26	24%
Shepparton Road	27	20%
Leach Highway East	30	21%
Manning Road West	31	21%
Hayman Road (Curtin University)	33	56%
Kenwick Link	34	26%
Leach Highway West	35	25%
Kewdale Road	38	27%
Roe Highway North	39	70%
Roe Highway South	40, 42	53%
Orrong Road	44	45%

These growth numbers are incorporated within the model by furnessing / frataring the existing matrix to represent these increased totals.

4. Microsimulation model development

4.1 Background

The final stage of the modelling process involved the development of a VISSIM[2] microsimulation model of the Structure Plan area. The extents of the microsimulation model are shown **Figure 4.1**.

Figure 4.1 : Microsimulation model extents

The key objectives of the VISSIM modelling are as follows:

- To provide a detailed assessment of network operation for the Structure Plan area that takes account of vehicle queuing and delay.
- Identify the impacts of future development and infrastructure changes on network performance and intersection operation.

[2] VISSIM is a traffic microsimulation package developed by PTV. It uses bespoke simulation techniques to simulate traffic traversing a network and can be used to analyse travel times, queueing and complex vehicle interaction. VISSIM is a software package which Main Roads Western Australia has used for a variety of projects.

The model was developed for the AM, PM and Saturday peak hours, consistent with the periods developed for the mesoscopic model (**see Section 3.1**), with 45 minute warm-up period also developed for the period prior to the peak hours.

The coverage of the VISSIM model network was chosen in respect of the Structure Plan boundary, project brief and key area for assessment, which includes the six signalised intersections along Albany Highway and streets surrounding the city centre and Carousel shopping centre. Impacts of future re-routing of traffic outside of the VISSIM model area will be reflected in demand growth forecast by the VISUM model, which covers the wider area.

The streets internal to the Carousel shopping centre (bounded by Albany Highway, Cecil Avenue, Carousel Road and Liege Street) were not included in the model as these streets represent slow, traffic-calmed laneways between parking areas rather than genuine through routes.

Model calibration is the process that develops and adjusts model parameters to adequately reflect observed traffic behaviour and data. In microsimulation models calibration involves the coding of network coding parameters (such as signal timings), route choice calibration and demand matrix definition. The following sections describe the process that was undertaken to calibrate the Base Year model to 2014 traffic data.

4.2 Network calibration

4.2.1 Network coding

The model network was coded using the Bing Maps scaled background imagery within VISSIM. This imagery provided adequate information for the coding road lengths, kerb points, intersection configurations and lane numbers. The network geometry was also cross-checked against aerial imagery provided to Jacobs by the City of Canning and during site visits.

4.2.2 Road hierarchy

The Base Year model road hierarchy was developed using a range of link categories so that vehicles choose realistic routes through the model between origins and destinations. This reflects signposting of major and primary routes and drivers perceived costs of route attractiveness, with respect to observed traffic volume data.

In general, primary routes were coded with a cost of 1.0 per link km. Secondary routes were coded with a cost per km of between 1.2 and 1.8, whilst less desirable routes were coded with a cost per km of over 2.0. These costs were developed and refined during the model demand calibration process.

4.2.3 Speed limits

Speed limits throughout the model were coded as per current signposted speed limits using desired speed points at suitable locations.

4.2.4 Public transport

The locations of bus stops, bus routes and bus timetables were coded according to information provided on the Transperth website. Each bus service was coded individually to allow greater flexibility in the adjustment of services in future option scenarios.

The train services operating through Cannington train station were also coded into the model according to Transperth information. The timetable used for the train operation was taken during the same period as the other traffic count and travel time surveys to maintain consistency in the calibration process.

4.2.5 Non-signalised intersection operation

The operation of non-signalised movements was coded using conflict areas at un-signalised intersections. Priority rules were used for opposed movements at signalised intersections. This coding method is consistent with recommended practice.

4.2.6 Lane change parameters

Lane change parameters on link connectors were adjusted as necessary from the default of 200 metres so that vehicles merge into the correct lane early enough on approach to a turn.

4.2.7 Reduced speed areas

VISSIM does not automatically calculate speed decreases associated with geometry or curved movements. Reduced speed areas were used on all curved movements where decreases in vehicle speed are apparent. The maximum speed setting for reduced speed areas was based on peak hour observations and calculations of saturation flows at intersections.

4.2.8 Signal operation

All of the signalised intersections within the model were coded with average fixed time cycle lengths and weighted average phase lengths. The timings were based on IDM data recording provided by MRWA for Thursday 3 April and Saturday 5 April 2014, which were taken on the same days as the majority of the traffic count surveys for consistency.

Small changes to signal timings were made at a number of intersections where it was found that the average weighted timings did not replicate observed operation in terms of queuing and delay. The requirement for these minor changes likely reflects the difference between fixed time and SCATS signal operation and is considered acceptable in the NSW RMS guidelines:

'Limited adjustment from the observed hourly (signal timings) is allowable to account for variability across the hour'.

Inter-stage times and offsets between signals along Albany Highway were also coded according to data supplied by MRWA. The link plans for each of the intersections, which indicate the offsets, are provided in **Appendix A**. The link plans show that each of the signalised intersections along Albany Highway is linked by off-sets, with the Wharf Street intersection being the 'master' controller. The signalised intersections along Sevenoaks street run independently.

The signals at Sevenoaks Street/ Wharf Street presented a more challenging situation in terms of the model coding due to the complex operation in co-ordination with the rail crossing. The signal at this intersection were coded with actuation that reflects average cycle and phase times (as per the IDM files) and on-site measurements of the average length of time it takes for a train to pass through the intersection once the rail crossing gates are activated.

4.2.9 Demand zoning system

The model demand zoning system was coded in a fine level of detail to include external load-in points to the network and access points for significant trip generators. The model contains 101 zones in total, of which 44 zones represent external entry/ exit points to the network and 65 zones represent internal origins/ destinations within the Structure Plan area.

4.3 Route choice calibration

The routes that vehicles take through the model are influenced by a number of parameters which have been defined using observed traffic data, local knowledge of the study area and an analysis of routes between key origins and destinations in the model. The following sections describe each of the parameters that have been used to calibrate route choice in the model.

4.3.1 Generalised cost equation (GCE)

The GCE is used to determine the perceived cost of a route. In VISSIM, the GCE is calculated using the following formula:

Cost = (a x T) + (b x D) + (c x P)

Where:

a is converting travel time to cost (cost per minute)

b is converting travel distance to cost (minutes per kilometre)

c is converting tolls to cost (minute per unit of monetary cost)

T is the travel time (minutes)

D is the length of the link (km)

P is the price of the toll units (monetary cost)

Analysis of routes between key origins and destinations in the model suggested that vehicles base route selection predominantly on the time, rather than distance. Based on this analysis the generalised cost equation was assigned a time weighting of 0.8 and a distance weighting of 0.2. There are currently no toll roads within the study area, so the toll element of the equation is not applicable in this case.

4.3.2 Dynamic assignment parameters

The vehicle demands were assigned to the model network using the Dynamic Assignment module within VISSIM. Using this methodology, the assignment of vehicles along routes between origins and destinations are calculated over a number of simulation iterations until a converged assignment is reached, whereby the difference in travel times along each route is within an acceptable level of difference between iterations.

VISSIM takes into consideration in searching for routes to destinations that not every driver chooses the best route. Some drivers will use less attractive routes. That means that not only the best routes must be known for each origin-destination relation but also a set of routes. For the routes found an evaluation is calculated, on which the drivers base their route choice. In VISSIM, the generalised costs are computed for the routes (**see Section 4.3.1**). Once the assignment reaches a suitable level of convergence, the demands are check for calibration against observed volumes and set as fixed for the simulation if a suitable level of calibration is achieved.

During the development of the model, the following parameters were applied within the Dynamic Assignment module to minimise unrealistic routes being chosen through the network:

- Reject routes with a too high total cost – this parameter was set so that routes with a cost over 5-10% of the shortest cost route were rejected.
- Correction of overlapping routes – so that routes that overlap themselves are not chosen.
- Avoid long detours – routes that are 1.5 to 2.5 times longer than the shortest route were rejected.

4.3.3 Individual link cost factors

In a small number of locations, individual link cost factors (termed surcharges in VISSIM) were applied to aid in route choice calibration and minimise unrealistic routing through the network. The cost factors were applied to links and turn connectors where appropriate. Locations where link cost factors were applied include:

- Pattie Street – it was found that vehicles were routing along Pattie Street unrealistically to avoid delay along Albany Highway, particularly during the PM peak period.
- Guthrie Street bridge over Sevenoaks Street – it was found that vehicles were unrealistically routing along the bridge to avoid delay at the Sevenoaks Street/ Wharf Street signals.
- Carousel Road westbound – to prevent an unrealistic number of vehicles travelling in this direction along Carousel Road.

- Bent Street and Hogarth Street, Morgan Street west of Station Street – to prevent unrealistic rat-running along these streets.

These cost factors were used as a last resort to calibrate the model and will be reviewed for suitability in future scenario testing.

4.4 Demand calibration

4.4.1 Demand release profiles

Demand release profiles control the rate of release of vehicles from the demand matrix into the model network over the course of the model period. The demand release profiles were developed for 15 minute intervals for each zone in the model using traffic count data for the study area by dividing the peak hour and warm-up period matrices into 15 minute time-slices.

4.4.2 Vehicle type proportions

Separate matrices were developed for light vehicles and heavy vehicles based on classified turn count surveys undertaken within the study area. The observed data showed that there are a relatively low number of heavy vehicles travelling along the network during peak hours. The heavy vehicle demands are predominantly along Albany Highway and Sevenoaks Street.

A single heavy vehicle type with a length of 10.125 metres was used to represent the small number of heavy vehicles in the model demands. Loop count data for Albany Highway suggests that the majority of heavy vehicles in the area are of class type 3-5 of the Austroads vehicle classification system, which includes vehicles with lengths ranging between 5.5 and 14.5 metres. The chosen default heavy vehicle length of 10.125 metres generally represents an average heavy vehicle length of the observed vehicles lengths according to the loop count data.

4.4.3 Demand matrix calibration

The demand matrices for the VISSIM model were developed using the calibrated VISUM Base Year model demands as a starting point (in the form of sub-area matrices). The VISUM model contains fewer internal zones for the study area than the VISSIM model. The VISUM sub-area matrices were therefore disaggregated into the VISSIM zoning system, which involved splitting some of the larger VISUM zones into a number of smaller VISSIM zones. This process was undertaken in respect of observed traffic count data and local knowledge of the study area.

Following disaggregation, the initial demands were refined using matrix estimation to calibrate the model volumes to the observed count data. This was achieved by exporting the VISSIM model network into VISUM, which includes a matrix estimation module.

A summary of the changes in matrix totals before (VISUM prior matrix) and after (calibrated VISSIM matrix) the matrix estimation process is provided in **Table 4.1**. The changes have been summarised for the following different movement types:

- External to external (E-E) – trips between origins and destinations external to the model area (through traffic).
- Internal to external (I-E) – trips between internal and external origins and destinations.
- External to internal (E-I) – trips between external and internal origins and destinations.
- Internal to internal (I-I) – trips between internal origins and destinations.

Table 4.1 : Matrix estimation matrix total changes

Time period	E-E	I-E	E-I	I-I	Total (% diff)
AM peak hour	923	428	691	-124	1,918 (22%)
PM peak hour	1,059	1,407	1,220	27	3,713 (35%)
Saturday peak hour	317	1,470	2,126	148	4,061 (42%)

The numbers show that an increase in total trips was required for all of the peak hours to calibrate the matrix demands. The largest change in demand was required for the Saturday peak hour. This was expected, as the VISUM matrix was developed using a weekday matrix as a starting point (ROM24 does not currently provide weekend matrices).

Although the matrix estimation process resulted in a reasonable level of change between the meso and micro demands, the changes were considered necessary to provide a good level of model calibration. The changes are most likely due to the change in network coverage and zoning system between the meso and micro levels, with the micro network and zoning system represented in much finer detail.

The model calibration exercise involved comparisons between modelled and observed traffic count data. The GEH statistic was used during the calibration of the model to compare the difference between observed flow and assigned flow on a link (see **Section 3.3** for a detailed explanation of the GEH statistic).

To reflect the impact of daily traffic variation, VISSIM randomises the release of vehicles into the network using different seed values. A run of the model using a single seed value may produce a random event that increases delays in a certain area of the model, leading to unrepresentative results. An example would be the simultaneous arrival of HGVs at a certain intersection. It is therefore recommended practice to run the model using a range of seed values to compare an average of the model results to the observed data.

The base model was calibrated and validated over an average of 5 model seeds values, in line with NSW TRMS guidelines.

4.4.4 Convergence

As discussed in **Section 4.3.2**, the model demands were assigned to the network using VISSIM's Dynamic Assignment module until a converged solution was reached. Convergence was deemed to have been achieved once the following criteria had been met:

- 95% of all route traffic volumes change by less than 5% over four consecutive iterations.
- 95% of travel times along all paths change by less than 20% for at least four consecutive iterations.

Summaries of the convergence results over four consecutive iterations for each of the peak hours are provided in **Table 4.2**,

Table 4.3 and **Table 4.4**.

Table 4.2 : AM peak hour path convergence results

Iteration	% volumes with change less than 5%	% travel time with change less than 20%
1	99%	99%
2	99%	99%
3	99%	100%
4	99%	99%

Table 4.3 : PM peak hour path convergence results

Iteration	% volumes with change less than 5%	% travel time with change less than 20%
1	99%	99%
2	99%	99%
3	99%	100%
4	99%	99%

Table 4.4 : Saturday peak hour path convergence results

Iteration	% volumes with change less than 5%	% travel time with change less than 20%
1	99%	99%
2	99%	99%
3	99%	99%
4	99%	99%

The results show that the model converges to a high level in each peak hour.

4.5 Flow comparisons

4.5.1 Turn and link counts

The Base Year model demands were calibrated to 127 observed turn and link count movements across the study area for each peak hour. A summary of the demand matrix calibration results is provided in **Table 4.5**.

Table 4.5 : Peak hour modelled versus observed flow comparisons

Time period	Modelled flows within 5 GEH	Modelled flows within 10 GEH	Modelled flows not within 10 GEH
AM peak	93%	100%	0%
PM peak	94%	100%	0%
Saturday peak	94%	100%	0%

The results show that over 85% of the average modelled flows are within 5 GEH of the observed flows, with all flows within 10 GEH during each peak hour.

4.5.2 Screenlines and outer cordon

To provide a conservative assessment of the model calibration an analysis of flow comparisons at the screenline and outer cordon level was undertaken. The locations of the screenlines are shown in **Figure 4.2**.

Figure 4.2 : Calibration screenlines

In addition to the screenlines shown in **Figure 4.2**, a comparison was also made for the total volume of traffic entering and exiting the Carousel Shopping Centre accesses. Summaries of the screenline calibration for each of the peak hours are provided in **Table 4.6**, **Table 4.7** and **Table 4.8**.

Table 4.6 : AM peak hour screenline comparisons

Screenline	Observed total	Modelled total	GEH
East-West 1	5,890	5,739	2.0
East-West 2	6,182	6,003	2.3
North-South 1	2,045	2,174	2.7
North-South 2	1,953	1,891	1.4
Carousel Shopping Centre	1,231	1,165	1.9
Outer cordon	14,983	14,790	1.6

Table 4.7 : PM peak hour screenline comparisons

Screenline	Observed total	Modelled total	GEH
East-West 1	6,612	6,528	1.0
East-West 2	6,816	6,723	1.1
North-South 1	3,818	3,938	1.9
North-South 2	2,733	2,552	3.5
Carousel Shopping Centre	4,865	4,748	1.7
Outer cordon	17,437	17,292	1.1

Table 4.8 : Saturday peak hour screenline comparisons

Screenline	Observed total	Modelled total	GEH
East-West 1	6,264	6,085	2.3
East-West 2	6,302	6,350	0.6
North-South 1	4,124	4,159	0.5
North-South 2	2,521	2,415	2.1
Carousel Shopping Centre	6,257	5,906	4.5
Outer cordon	16,295	16,222	0.6

UK DMRB and NSW TRMS guidelines recommend that modelled screenline totals are calibrated to within 3-4 GEH of the observed totals. The results show that the all of the screenline totals in each of the peak hours are within 4 GEH of the observed.

A list of the flow comparisons for each traffic count used in the demand calibration process is provided in **Appendix B**.

4.6 Model validation

Model validation is the term used to describe an independent verification process used to demonstrate that a model has been calibrated to a sufficient extent to accurately reproduce on-street conditions. This process involves a comparison of model outputs using data that has not been used in the model calibration.

The 2014 Base Year model demands were calibrated to traffic count data. An independent set of data, in the form of travel time surveys, was used for model validation purposes.

Average modelled travel times have been compared to average observed travel times along the following routes, in both directions:

- Albany Highway – between Station Street and Wharf Street.
- Wharf Street – between Albany Highway and Sevenoaks Street.
- Sevenoaks Street – between Wharf Street and Station Street.
- Station Street – between Sevenoaks Street and Albany Highway.

NSW TRMS guidelines recommend that average modelled travel times should be within 15% of average observed travel times or one minute (whichever is the highest), along 85% of travel time routes, for a model to be considered sufficiently validated.

A summary of the AM peak hour travel time validation results is provided in **Table 4.9** and **Table 4.10**.

Table 4.9 : AM peak hour clockwise travel time comparisons (m:ss)

Route	Observed time	Modelled time	% Difference
Albany Highway WB	3:17	2:57	-10%
Wharf Street NB	2:58	3:08	6%
Sevenoaks Street EB	1:44	1:33	-11%
Station Street SB	3:05	2:18	-26%
Total	**11:04**	**9:55**	**-10%**

Table 4.10 : AM peak hour anti-clockwise travel time comparisons (m:ss)

Route	Observed time	Modelled time	% Difference
Station Street NB	1:30	1:08	-24%
Sevenoaks Street WB	2:33	2:34	0%
Wharf Street SB	2:21	2:39	13%
Albany Highway EB	2:05	2:06	0%
Total	**8:29**	**8:27**	**0%**

The comparisons show that the modelled travel times along both routes are within 15% of the observed travel times. It was therefore considered that the AM peak hour model was sufficiently validated.

A summary of the PM peak hour travel time validation results is provided in

Table 4.11 and **Table 4.12**.

Table 4.11 : PM peak hour clockwise travel time comparisons (m:ss)

Route	Observed time	Modelled time	% Difference
Albany Highway WB	3:53	3:50	-1%
Wharf Street NB	3:24	2:53	-16%
Sevenoaks Street EB	1:36	1:37	1%
Station Street SB	3:23	2:09	-37%
Total	**12:16**	**10:28**	**-15%**

Table 4.12 : PM peak hour anti-clockwise travel time comparisons (m:ss)

Route	Observed time	Modelled time	% Difference
Station Street NB	1:16	1:06	-13%
Sevenoaks Street WB	2:17	2:10	-5%
Wharf Street SB	2:34	2:44	7%
Albany Highway EB	6:32	7:51	20%
Total	**12:39**	**13:52**	**10%**

The comparisons show that the modelled travel times along both routes are within 15% of the observed travel times. It was therefore considered that the PM peak hour model was sufficiently validated.

A summary of the Saturday peak hour travel time validation results is provided in **Table 4.13** and **Table 4.14**.

Table 4.13 : Saturday peak hour clockwise travel time comparisons (m:ss)

Route	Observed time	Modelled time	% Difference
Albany Highway WB	4:37	3:59	-14%
Wharf Street NB	2:35	2:02	-21%
Sevenoaks Street EB	1:51	1:32	-17%
Station Street SB	2:18	1:44	-24%
Total	**11:20**	**9:17**	**-18%**

Table 4.14 : Saturday peak hour anti-clockwise travel time comparisons (m:ss)

Route	Observed time	Modelled time	% Difference
Station Street NB	1:20	1:07	-17%
Sevenoaks Street WB	2:23	2:07	-11%
Wharf Street SB	2:40	2:10	-19%
Albany Highway EB	2:53	3:21	16%
Total	**9:16**	**8:44**	**-6%**

The comparisons show that the modelled travel times in the anti-clockwise direction are within 15% of the observed times, however the travel times in the opposite direction are only within 18% of the observed. This difference may be due to the nature of the observed surveys that were undertaken and the lanes used along Albany Highway during the surveys.

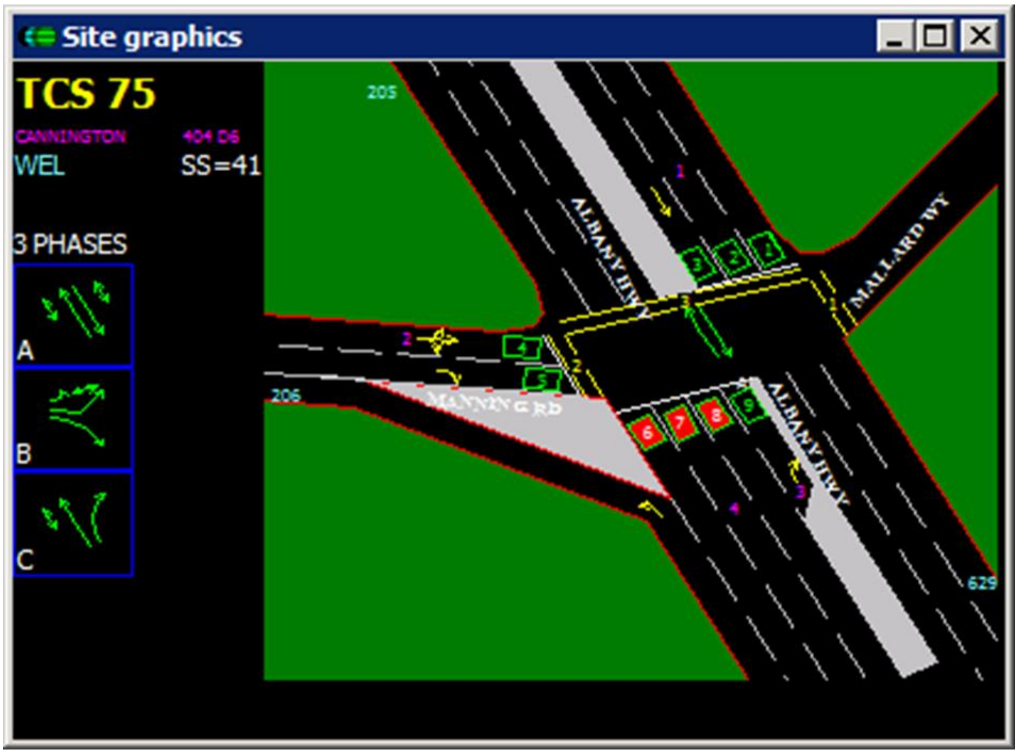
During the travel time surveys, the survey driver tended to drive in the median side lane, which experiences more delay due to right turners at the Liege Street intersection. The VISSIM model calculates the average travel times across all three lanes, which in combination may experience less delay on average.

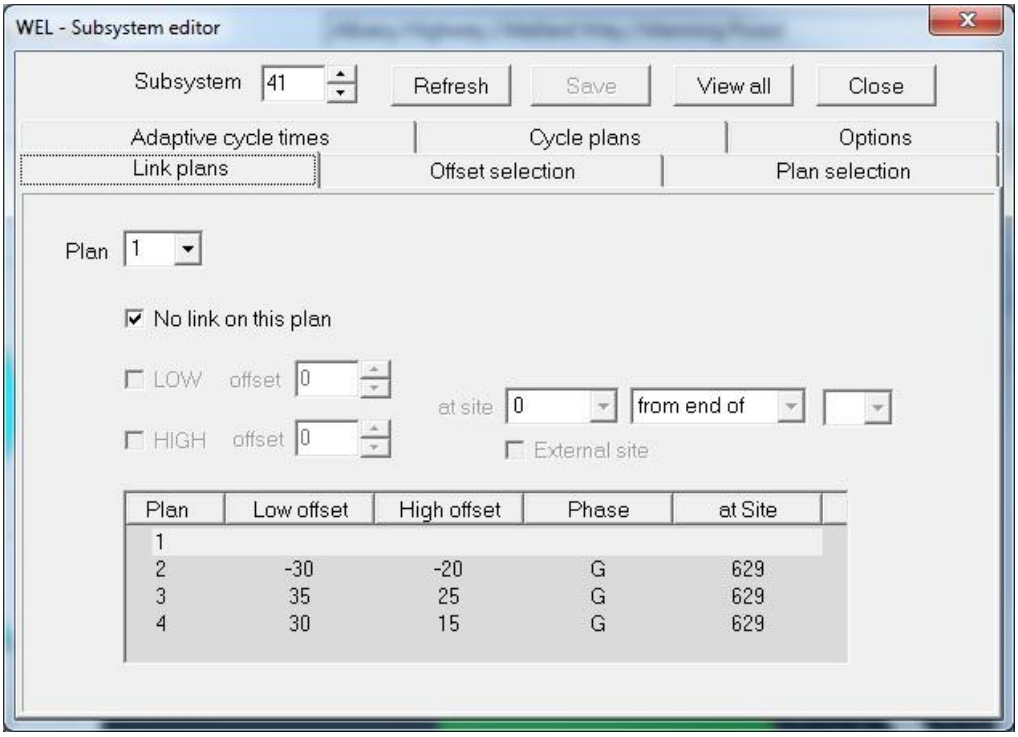
Graphical representations of the modelled and observed travel time comparisons are provided in **Appendix C**.

Appendix A. Signal timing data

Albany Highway/ Manning Road

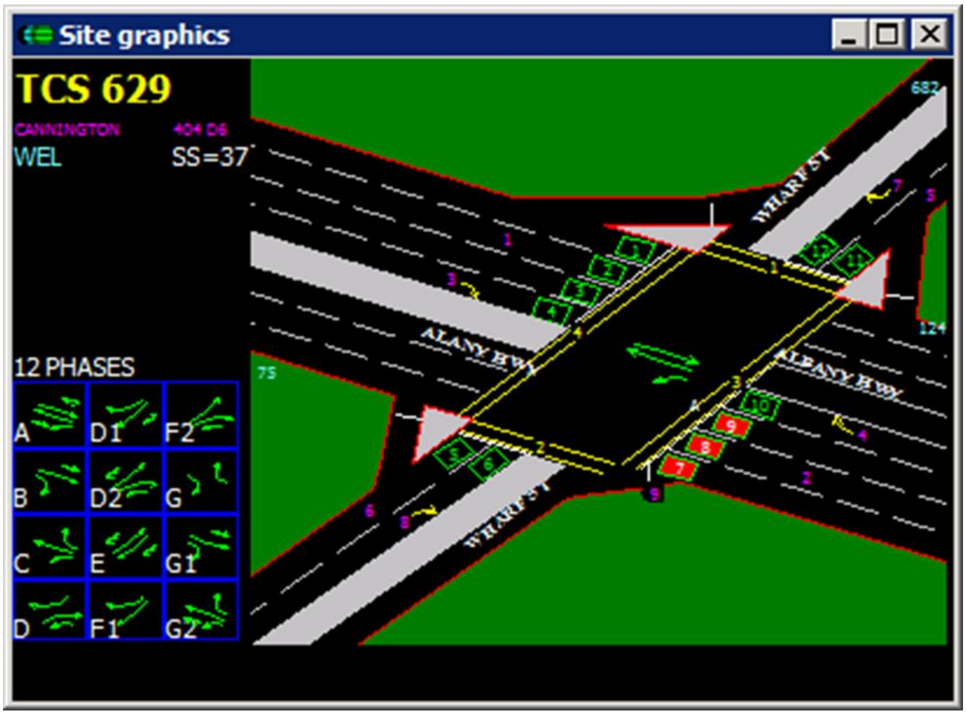
Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	83	91	80	6
B	35	38	44	6.5
C	10	13	14	6

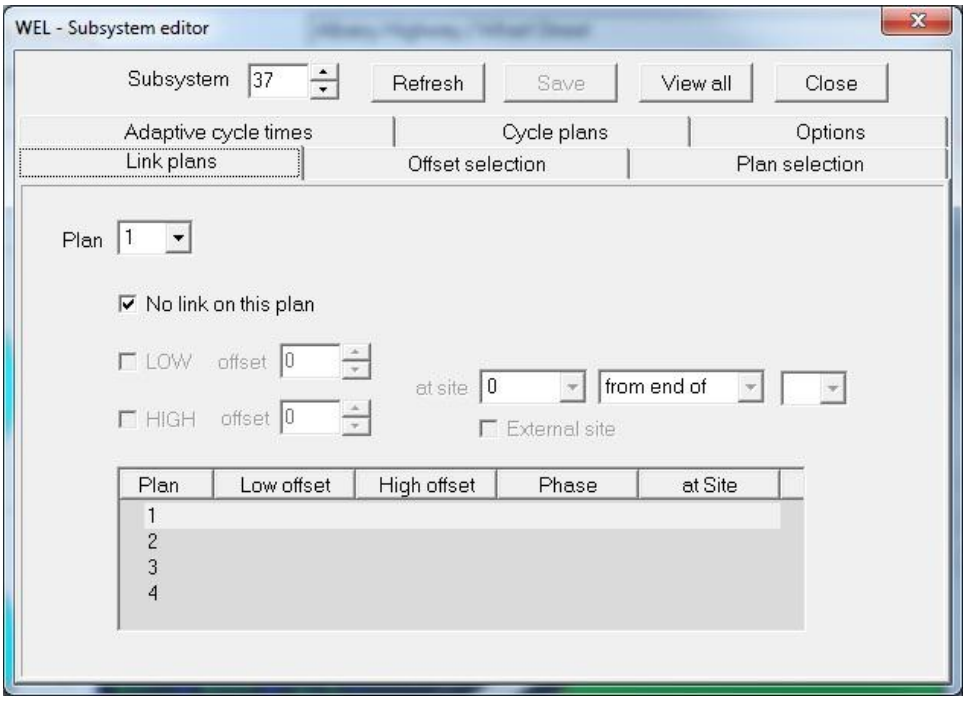




Albany Highway/ Wharf Street

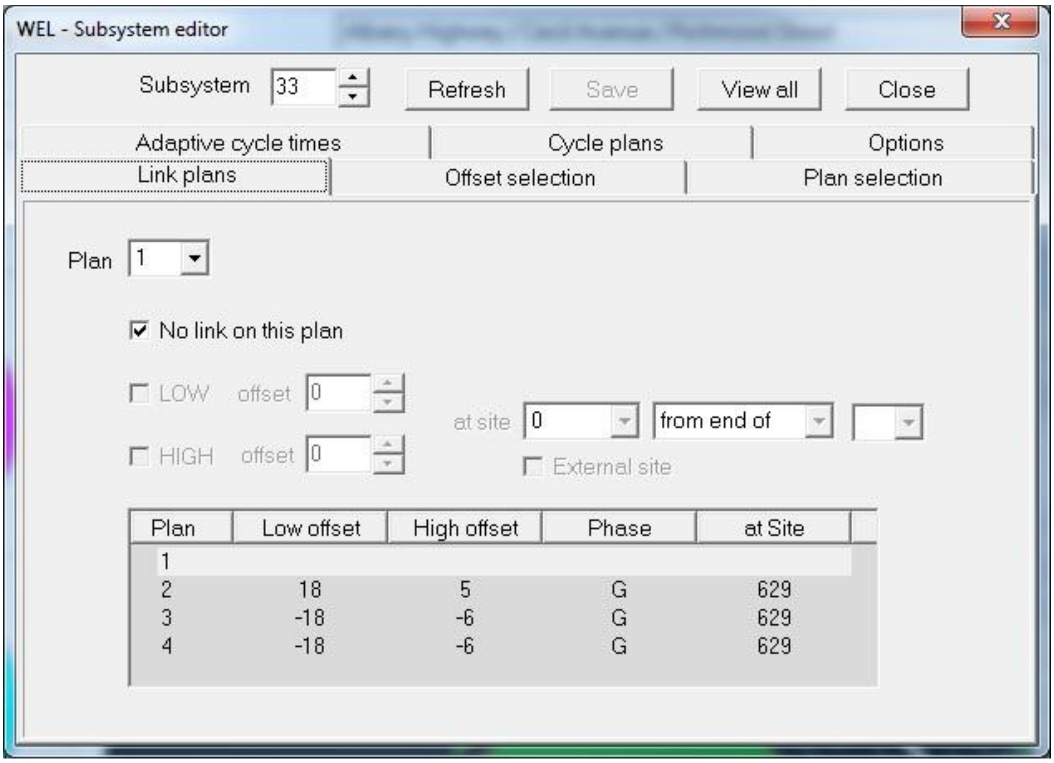
Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	71	80	81	6
C	11			6.5
D	14	18	19	7.5
E	18	19	14	7
G	11	19	20	6.5





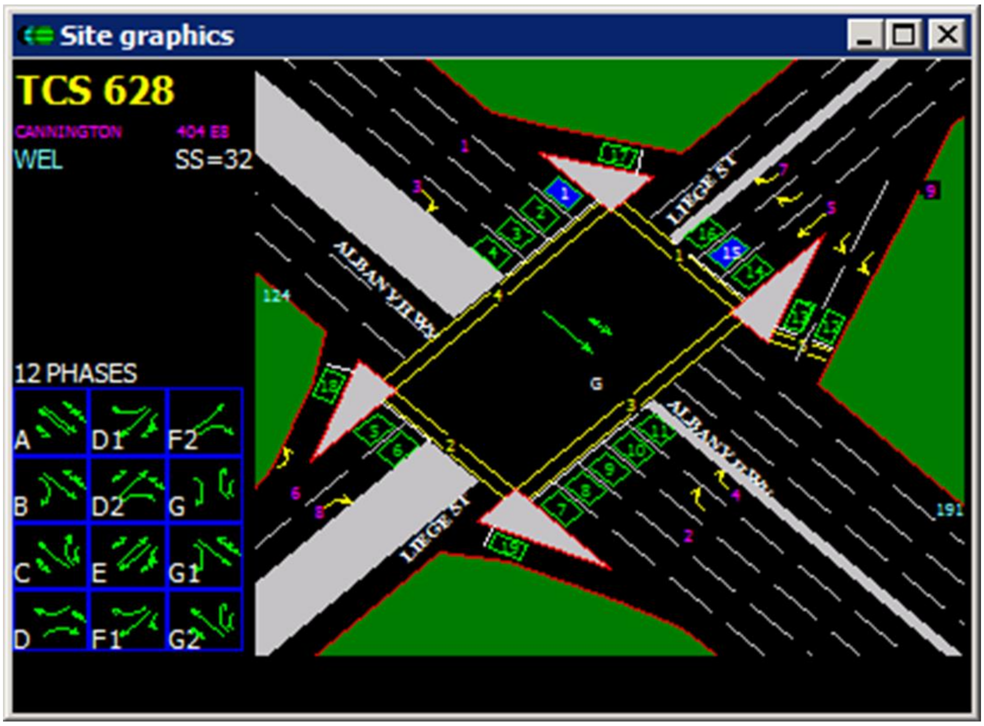
Albany Highway/ Cecil Avenue

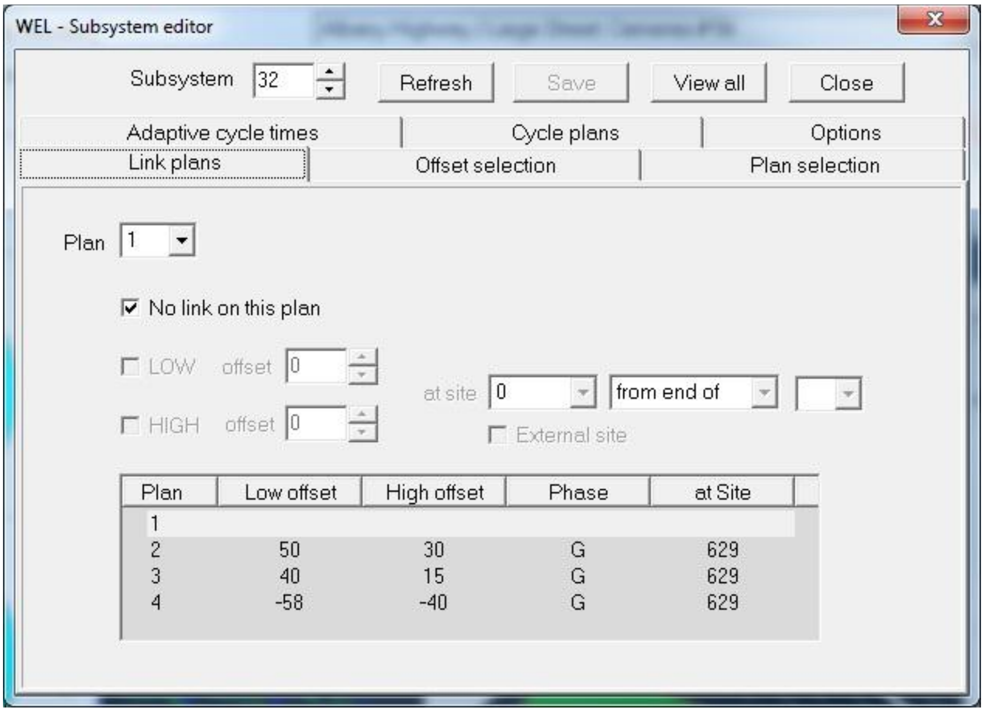
Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	87	90	66	6
B	21	29	31	7
C	16	22	38	6



Albany Highway/ Liege Street

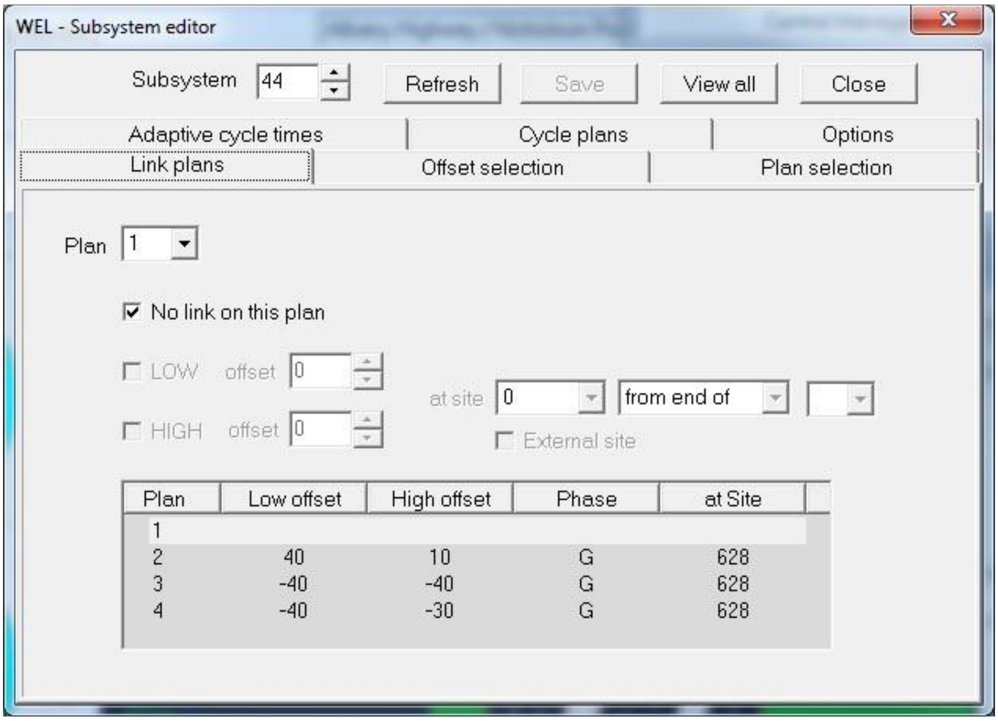
Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	66	55	49	6.5
C	17	17	17	7
D	10	24	25	7
E	16	23	27	7
G	11	10	8	7





Albany Highway/ Nicholson Road

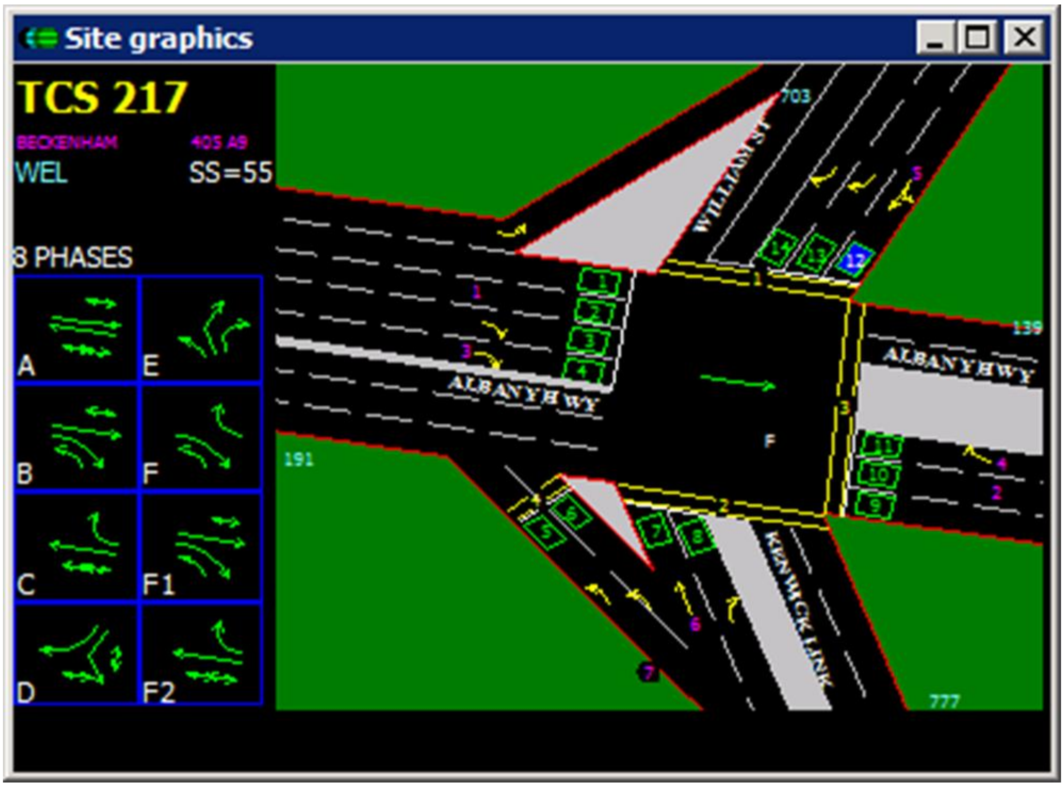
Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	49	36	44	6.5
B		39	30	7
C	25	25	25	7
D	49	33	32	7

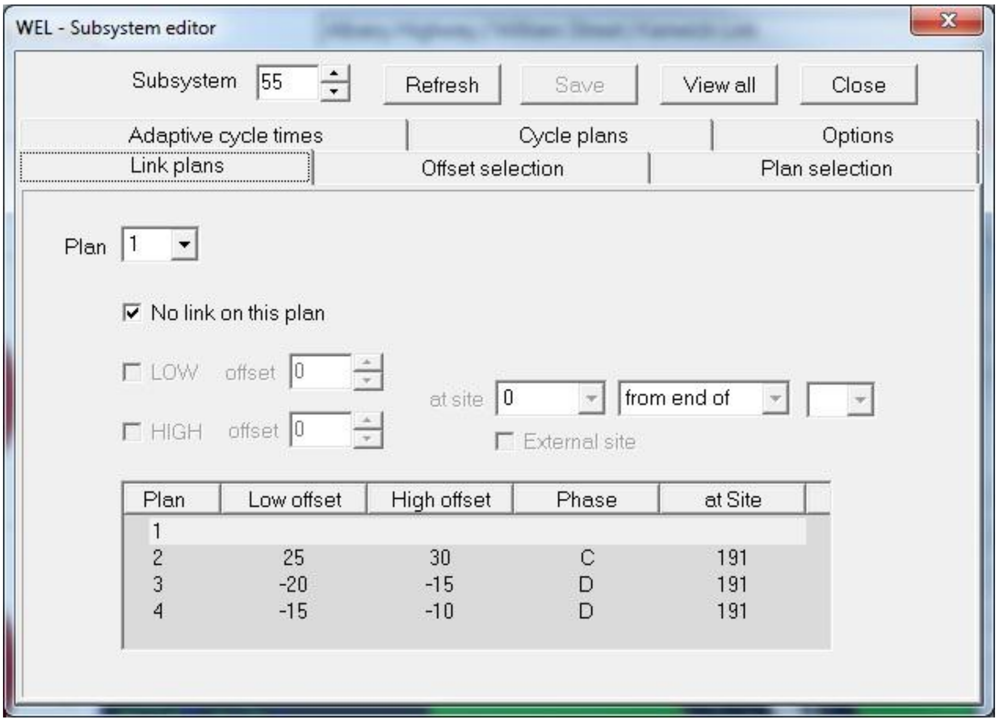


Albany Highway/ William Street

Phase	AM peak green time	Sat peak green time	Inter-stage time
A	38	33	7
D	22	31	7
E	33	23	7
F	23	31	7

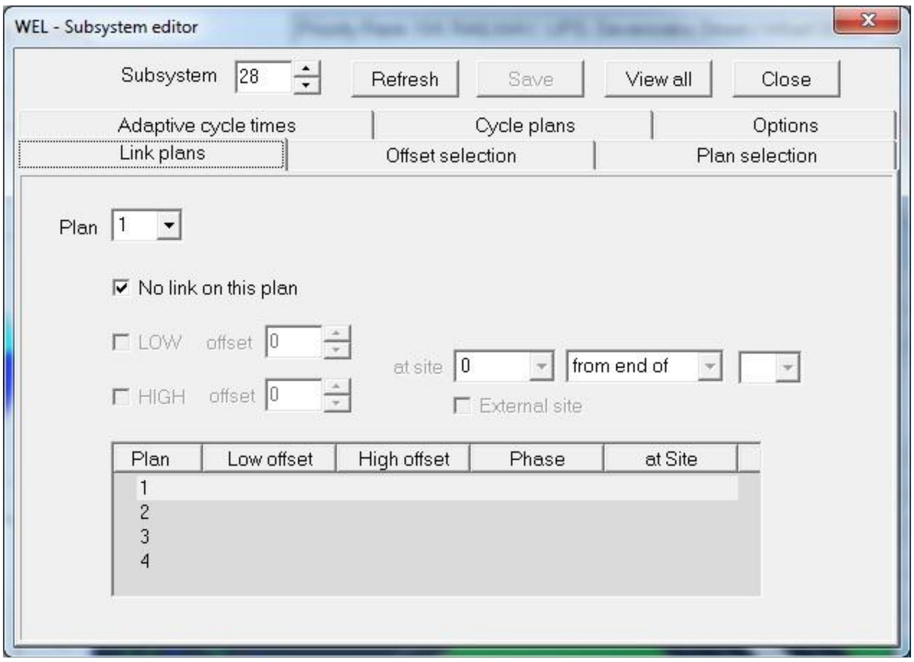
Phase	PM peak green time	Inter-stage time
B	24	7
D	29	7
E	18	7
F	20	7
A	21	7




WEL - Subsystem editor
Subsystem 55
Refresh
Save
View all
Close
Adaptive cycle times
Cycle plans
Options
Link plans
Offset selection
Plan selection
Plan 1
No link on this plan
LOW offset 0
HIGH offset 0
at site 0
from end of
External site
Plan Low offset High offset Phase at Site
1
2 25 30 C 191
3 -20 -15 D 191
4 -15 -10 D 191

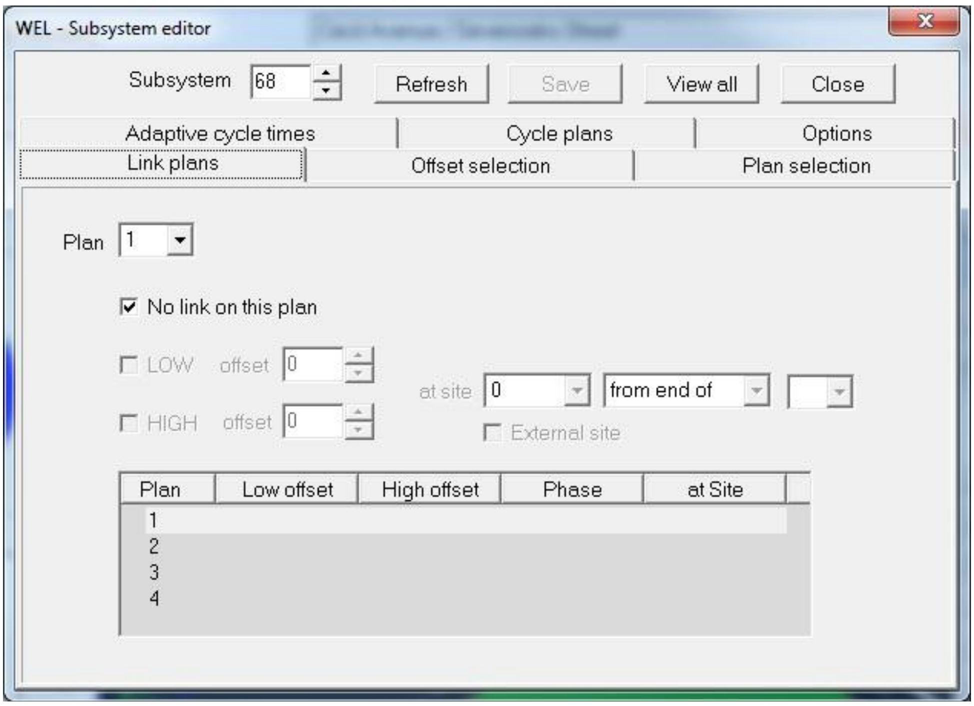
Sevenoaks Street/ Wharf Street

Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	16	22	23	5.5
B	16	16	18	6
C	17	16	16	6
D	13	16	15	6
E	18	19	19	5.5
F	38	25	48	5.5
G	12	14	12	6



Sevenoaks Street/ Cecil Avenue

Phase	AM peak green time	PM peak green time	Sat peak green time	Inter-stage time
A	29	23	17	5
B	13	13	12	5
C	25	25	25	5
D	14	21	15	5



Appendix B. Model calibration outputs

JACOBS

AM peak hour

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Turn Counts						
Albany Highway/ Manning Road						
Manning Rd left	47	48	1	0	OK	OK
Manning Rd ahead	16	15	-1	0	OK	OK
Manning Rd right	576	541	-35	1	OK	OK
Albany Hwy W left	16	16	0	0	OK	OK
Albany Hwy W ahead	797	793	-4	0	OK	OK
Albany Hwy E left	752	706	-46	2	OK	OK
Albany Hwy E ahead	2295	2184	-111	2	OK	OK
Albany Hwy E right	35	29	-6	1	OK	OK
Albany Highway/ Wharf Street						
Albany Hwy W left	136	115	-21	2	OK	OK
Albany Hwy W ahead	1207	1201	-6	0	OK	OK
Albany Hwy W right	51	57	6	1	OK	OK
Wharf St N left	73	141	68	7	Failed	OK
Wharf St N ahead	22	22	0	0	OK	OK
Wharf St N right	141	144	3	0	OK	OK
Albany Hwy E left	9	8	-1	0	OK	OK
Albany Hwy E ahead	2984	2800	-184	3	OK	OK
Albany Hwy E right	115	128	13	1	OK	OK
Wharf St S left	96	95	-1	0	OK	OK
Wharf St S ahead	18	16	-2	0	OK	OK
Wharf St S right	10	10	0	0	OK	OK
Albany Highway/ Cecil Avenue						
Albany Hwy N left	214	283	69	4	OK	OK
Albany Hwy N ahead	1048	1026	-22	1	OK	OK
Cecil Ave left	50	56	6	1	OK	OK
Cecil Ave right	182	236	54	4	OK	OK
Albany Hwy S ahead	2921	2800	-121	2	OK	OK
Albany Hwy S right	138	80	-58	6	Failed	OK
Albany Highway/ Liege Street						
Albany Hwy W left	21	24	3	1	OK	OK
Albany Hwy W ahead	1053	1039	-14	0	OK	OK
Albany Hwy W right	5	4	-1	0	OK	OK
Liege St N Left	80	81	1	0	OK	OK
Liege St N ahead	7	0	-7	4	OK	OK
Liege St N right	21	15	-6	1	OK	OK
Albany Hwy E left	60	51	-9	1	OK	OK
Albany Hwy E ahead	3326	3140	-186	3	OK	OK
Albany Hwy E right	272	265	-7	0	OK	OK
Liege St S left	3	1	-2	1	OK	OK
Liege St S ahead	17	17	0	0	OK	OK

Liege St S right	48	44	-4	1	OK	OK
Albany Highway/ Nicholson Road						
Albany Hwy W ahead	576	555	-21	1	OK	OK
Albany Hwy W right	651	646	-5	0	OK	OK
Albany Hwy E left	171	158	-13	1	OK	OK
Albany Hwy E ahead	1326	1319	-7	0	OK	OK
Nicholson Rd left	2294	2288	-6	0	OK	OK
Nicholson Rd right	326	328	2	0	OK	OK
Albany Highway/ William Street						
Albany Hwy W left	370	348	-22	1	OK	OK
Albany Hwy W ahead	344	333	-11	1	OK	OK
Albany Hwy W right	209	186	-23	2	OK	OK
William St left	33	31	-2	0	OK	OK
William St ahead	200	194	-6	0	OK	OK
William St right	212	215	3	0	OK	OK
Albany Hwy E left	4	4	0	0	OK	OK
Albany Hwy E ahead	490	517	27	1	OK	OK
Albany Hwy E right	220	220	0	0	OK	OK
Kenwick Link left	685	683	-2	0	OK	OK
Kenwick Link ahead	457	430	-27	1	OK	OK
Kenwick Link right	4	4	0	0	OK	OK
Sevenoaks Street/ Wharf Street						
Sevenoaks St W left	44	40	-4	1	OK	OK
Sevenoaks St W ahead	223	251	28	2	OK	OK
Sevenoaks St W right	40	10	-30	6	Failed	OK
Wharf St N left	70	89	19	2	OK	OK
Wharf St N ahead	139	161	22	2	OK	OK
Wharf St N right	181	159	-22	2	OK	OK
Sevenoaks St E left	56	57	1	0	OK	OK
Sevenoaks St E ahead	713	716	3	0	OK	OK
Sevenoaks St E right	48	39	-9	1	OK	OK
Wharf St S left	66	38	-28	4	OK	OK
Wharf St S ahead	81	49	-32	4	OK	OK
Wharf St S right	14	22	8	2	OK	OK
Sevenoaks/ Cecil Avenue						
Sevenoaks W ahead	170	163	-7	1	OK	OK
Sevenoaks W right	118	153	35	3	OK	OK
Sevenoaks E left	73	46	-27	4	OK	OK
Sevenoaks E ahead	717	702	-15	1	OK	OK
Cecil Ave left	126	91	-35	3	OK	OK
Cecil Ave right	29	17	-12	3	OK	OK
Sevenoaks/ Grose Avenue						
Sevenoaks W ahead	198	180	-18	1	OK	OK
Sevenoaks E left	60	92	32	4	OK	OK

Sevenoaks E ahead	741	707	-34	1	OK	OK
Grose Ave left	67	50	-17	2	OK	OK
Link Counts						
Lake EB	56	90	34	4	OK	OK
Lake WB	476	493	17	1	OK	OK
Guthrie NB	199	241	42	3	OK	OK
Guthrie SB	474	459	-15	1	OK	OK
Jameson St EB	131	176	45	4	OK	OK
Jameson St WB	276	360	84	5	OK	OK
Cecil Ave S NB	245	302	57	3	OK	OK
Cecil Ave S SB	350	434	84	4	OK	OK
Cecil Ave N NB	230	219	-11	1	OK	OK
Cecil Ave N SB	343	373	30	2	OK	OK
Carousel Rd EB	115	120	5	0	OK	OK
Carousel Rd WB	107	98	-9	1	OK	OK
Wharf St NB	182	154	-28	2	OK	OK
Wharf St SB	213	204	-9	1	OK	OK
Station St (Albany) NB	346	381	35	2	OK	OK
Station St (Albany) SB	192	166	-26	2	OK	OK
Station St (Sevenoaks) NB	214	295	81	5	Failed	OK
Station St (Sevenoaks) SB	52	92	40	5	OK	OK
Carousel 1 In	135	135	0	0	OK	OK
Carousel 1 Out	15	12	-3	1	OK	OK
Carousel 2 In	11	12	1	0	OK	OK
Carousel 3 In	27	26	-1	0	OK	OK
Carousel 3 Out	6	5	-1	0	OK	OK
Carousel 4 In	64	58	-6	1	OK	OK
Carousel 4 Out	9	9	0	0	OK	OK
Carousel 5 In	21	22	1	0	OK	OK
Carousel 5 Out	84	84	0	0	OK	OK
Carousel 6 In	96	99	3	0	OK	OK
Carousel 6 Out	174	161	-13	1	OK	OK
Carousel 7 In	66	67	1	0	OK	OK
Carousel 7 Out	24	17	-7	2	OK	OK
Carousel 8 In	87	85	-2	0	OK	OK
Carousel 8 Out	68	58	-10	1	OK	OK
Carousel 9 In	112	106	-6	1	OK	OK
Carousel 9 Out	51	50	-1	0	OK	OK
Carousel 10 In	64	57	-7	1	OK	OK
Carousel 10 Out	14	8	-6	2	OK	OK
Carousel 11 In	13	12	-1	0	OK	OK
Carousel 11 Out	16	12	-4	1	OK	OK
Carousel 12 In	45	44	-1	0	OK	OK
Carousel 12 Out	29	26	-3	1	OK	OK

Railway West EB	24	8	-16	4	OK	OK
Railway West WB	55	120	65	7	Failed	OK
Railway East EB	90	96	6	1	OK	OK
Railway East WB	333	339	6	0	OK	OK
Renou EB	183	186	3	0	OK	OK
Renou WB	409	426	17	1	OK	OK
Pattie EB	138	58	-80	8	Failed	Failed
Pattie WB	151	91	-60	5	Failed	OK

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Screenlines						
East-West Screenline 1						
Albany Hwy EB	1290	1352	62	1.7	OK	OK
Albany Hwy WB	3108	2936	-172	3.1	OK	OK
Pattie St EB	138	58	-80	8.1	Failed	Failed
Pattie St WB	151	91	-60	5.5	Failed	OK
Sevenoaks St EB	307	362	55	3.0	OK	OK
Sevenoaks St WB	817	812	-5	0.2	OK	OK
Railway Pde EB	24	8	-16	4.0	OK	OK
Railway Pde WB	55	120	65	6.9	Failed	OK
Total	**5890**	**5739**	**-151**	**2.0**	**OK**	**OK**
East-West Screenline 2						
Albany Hwy EB	1079	1067	-12	0.4	OK	OK
Albany Hwy WB	3350	3156	-194	3.4	OK	OK
Carousel Rd EB	115	120	5	0.5	OK	OK
Carousel Rd WB	107	98	-9	0.9	OK	OK
Lake St EB	56	90	34	4.0	OK	OK
Lake St WB	476	493	17	0.8	OK	OK
Sevenoaks St EB	198	180	-18	1.3	OK	OK
Sevenoaks St WB	801	799	-2	0.1	OK	OK
Total	**6182**	**6003**	**-179**	**2.3**	**OK**	**OK**
North-South Screenline 1						
Wharf St NB	269	259	-10	0.6	OK	OK
Wharf St NB	236	307	71	4.3	OK	OK
Cecil Ave NB	352	363	11	0.6	OK	OK
Cecil Ave NB	232	292	60	3.7	OK	OK
Liege St NB	310	306	-4	0.2	OK	OK
Liege St NB	108	96	-12	1.2	OK	OK
Station St NB	346	381	35	1.8	OK	OK
Station St NB	192	166	-26	1.9	OK	OK
Total	**2045**	**2170**	**125**	**2.7**	**OK**	**OK**
North-South Screenline 2						
Wharf St NB	161	109	-52	4.5	OK	OK
Wharf St NB	235	228	-7	0.5	OK	OK

Cecil Ave NB	155	108	-47	4.1	OK	OK
Cecil Ave NB	191	199	8	0.6	OK	OK
Guthrie St NB	199	241	42	2.8	OK	OK
Guthrie St NB	474	459	-15	0.7	OK	OK
Station St NB	346	381	35	1.8	OK	OK
Station St NB	192	166	-26	1.9	OK	OK
Total	**1953**	**1891**	**-62**	**1.4**	**OK**	**OK**
Carousel Shopping Centre						
In	741	723	-18	0.7	OK	OK
Out	490	442	-48	2.2	OK	OK
Total	**1231**	**1165**	**-66**	**1.9**	**OK**	**OK**

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Outer Cordon Volumes In						
Albany Hwy N	813	809	-4	0.1	OK	OK
Sevenoaks St N	307	301	-6	0.3	OK	OK
Wharf St N	390	409	19	1.0	OK	OK
Guthrie St	474	459	-15	0.7	OK	OK
William St	445	635	190	8.2	Failed	Failed
Albany Hwy S	714	741	27	1.0	OK	OK
Kenwick Link	1146	1117	-29	0.9	OK	OK
Nicholson Rd	2620	2616	-4	0.1	OK	OK
Liege St	68	62	-6	0.7	OK	OK
Wharf St S	124	121	-3	0.3	OK	OK
Manning Rd	639	604	-35	1.4	OK	OK
Total	**7740**	**7874**	**134**	**1.5**	**OK**	**OK**
Outer Cordon Volumes Out						
Albany Hwy N	2342	2232	-110	2.3	OK	OK
Sevenoaks St N	960	913	-47	1.5	OK	OK
Wharf St N	173	128	-45	3.7	OK	OK
Guthrie St	199	241	42	2.8	OK	OK
William St	1047	998	-49	1.5	OK	OK
Albany Hwy S	381	368	-13	0.7	OK	OK
Kenwick Link	413	384	-29	1.5	OK	OK
Nicholson Rd	822	804	-18	0.6	OK	OK
Liege St	72	55	-17	2.1	OK	OK
Wharf St S	82	87	5	0.5	OK	OK
Manning Rd	752	706	-46	1.7	OK	OK
Total	**7243**	**6916**	**-327**	**3.9**	**OK**	**OK**
Total in and Out	**14983**	**14790**	**-193**	**1.6**	**OK**	**OK**

PM peak hour

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Turn Counts						
Albany Highway/ Manning Road						
Manning Rd left	31	22	-9	1.7	OK	OK
Manning Rd ahead	15	12	-3	0.9	OK	OK
Manning Rd right	623	495	-128	5.4	Failed	OK
Albany Hwy W left	36	36	0	0.1	OK	OK
Albany Hwy W ahead	1749	1909	160	3.7	OK	OK
Albany Hwy E left	933	872	-61	2.0	OK	OK
Albany Hwy E ahead	1345	1303	-42	1.2	OK	OK
Albany Hwy E right	97	81	-16	1.7	OK	OK
Albany Highway/ Wharf Street						
Albany Hwy W left	90	187	97	8.2	Failed	Failed
Albany Hwy W ahead	2230	2061	-169	3.6	OK	OK
Albany Hwy W right	145	126	-19	1.6	OK	OK
Wharf St N left	138	220	82	6.1	Failed	OK
Wharf St N ahead	70	40	-30	4.0	OK	OK
Wharf St N right	200	204	4	0.3	OK	OK
Albany Hwy E left	15	23	8	1.8	OK	OK
Albany Hwy E ahead	1852	1821	-31	0.7	OK	OK
Albany Hwy E right	95	101	6	0.6	OK	OK
Wharf St S left	117	127	10	0.9	OK	OK
Wharf St S ahead	24	23	-1	0.2	OK	OK
Wharf St S right	22	10	-12	3.0	OK	OK
Albany Highway/ Cecil Avenue						
Albany Hwy N left	425	360	-65	3.3	OK	OK
Albany Hwy N ahead	1864	1868	4	0.1	OK	OK
Cecil Ave left	151	126	-25	2.1	OK	OK
Cecil Ave right	490	519	29	1.3	OK	OK
Albany Hwy S ahead	1506	1499	-7	0.2	OK	OK
Albany Hwy S right	180	150	-30	2.3	OK	OK
Albany Highway/ Liege Street						
Albany Hwy W left	23	57	34	5.4	Failed	OK
Albany Hwy W ahead	1790	1890	100	2.3	OK	OK
Albany Hwy W right	22	31	9	1.7	OK	OK
Liege St N Left	800	839	39	1.4	OK	OK
Liege St N ahead	29	21	-8	1.6	OK	OK
Liege St N right	161	155	-6	0.5	OK	OK
Albany Hwy E left	30	30	0	0.0	OK	OK
Albany Hwy E ahead	1749	1696	-53	1.3	OK	OK
Albany Hwy E right	458	515	57	2.6	OK	OK
Liege St S left	19	15	-4	1.0	OK	OK
Liege St S ahead	58	49	-9	1.2	OK	OK

Liege St S right	289	297	8	0.5	OK	OK
Albany Highway/ Nicholson Road						
Albany Hwy W ahead	1734	1681	-53	1.3	OK	OK
Albany Hwy W right	1575	1635	60	1.5	OK	OK
Albany Hwy E left	528	471	-57	2.6	OK	OK
Albany Hwy E ahead	1100	1040	-60	1.8	OK	OK
Nicholson Rd left	1186	1192	6	0.2	OK	OK
Nicholson Rd right	285	253	-32	2.0	OK	OK
Albany Highway/ William Street						
Albany Hwy W left	355	359	4	0.2	OK	OK
Albany Hwy W ahead	682	697	15	0.6	OK	OK
Albany Hwy W right	691	723	32	1.2	OK	OK
William St left	66	64	-2	0.2	OK	OK
William St ahead	414	404	-10	0.5	OK	OK
William St right	466	488	22	1.0	OK	OK
Albany Hwy E left	6	8	2	0.8	OK	OK
Albany Hwy E ahead	353	375	22	1.2	OK	OK
Albany Hwy E right	128	124	-4	0.4	OK	OK
Kenwick Link left	514	534	20	0.9	OK	OK
Kenwick Link ahead	251	234	-17	1.1	OK	OK
Kenwick Link right	7	8	1	0.4	OK	OK
Sevenoaks Street/ Wharf Street						
Sevenoaks St W left	98	97	-1	0.1	OK	OK
Sevenoaks St W ahead	944	962	18	0.6	OK	OK
Sevenoaks St W right	88	81	-7	0.8	OK	OK
Wharf St N left	153	118	-35	3.0	OK	OK
Wharf St N ahead	221	214	-7	0.5	OK	OK
Wharf St N right	104	104	0	0.0	OK	OK
Sevenoaks St E left	35	26	-9	1.6	OK	OK
Sevenoaks St E ahead	350	378	28	1.5	OK	OK
Sevenoaks St E right	81	89	8	0.9	OK	OK
Wharf St S left	45	33	-12	1.9	OK	OK
Wharf St S ahead	130	92	-38	3.6	OK	OK
Wharf St S right	33	25	-8	1.5	OK	OK
Sevenoaks/ Cecil Avenue						
Sevenoaks W ahead	784	758	-26	0.9	OK	OK
Sevenoaks W right	404	394	-10	0.5	OK	OK
Sevenoaks E left	88	89	1	0.1	OK	OK
Sevenoaks E ahead	320	302	-18	1.0	OK	OK
Cecil Ave left	152	157	5	0.4	OK	OK
Cecil Ave right	72	20	-52	7.7	Failed	Failed
Sevenoaks/ Grose Avenue						
Sevenoaks W ahead	845	779	-66	2.3	OK	OK
Sevenoaks E left	26	23	-3	0.6	OK	OK

Sevenoaks E ahead	313	287	-26	1.5	OK	OK
Grose Ave left	104	103	-1	0.1	OK	OK
Link Counts						
Lake EB	623	659	36	1.4	OK	OK
Lake WB	496	469	-27	1.2	OK	OK
Guthrie NB	559	548	-11	0.5	OK	OK
Guthrie SB	480	501	21	0.9	OK	OK
Jameson St EB	233	305	72	4.4	OK	OK
Jameson St WB	185	162	-23	1.7	OK	OK
Cecil Ave S NB	596	661	65	2.6	OK	OK
Cecil Ave S SB	474	586	112	4.9	OK	OK
Cecil Ave N NB	423	404	-19	0.9	OK	OK
Cecil Ave N SB	606	549	-57	2.4	OK	OK
Carousel Rd EB	527	441	-86	3.9	OK	OK
Carousel Rd WB	222	221	-1	0.1	OK	OK
Wharf St NB	193	137	-56	4.4	OK	OK
Wharf St SB	325	354	29	1.6	OK	OK
Station St (Albany) NB	99	67	-32	3.5	OK	OK
Station St (Albany) SB	327	305	-22	1.2	OK	OK
Station St (Sevenoaks) NB	84	102	18	1.9	OK	OK
Station St (Sevenoaks) SB	252	272	20	1.2	OK	OK
Carousel 1 In	382	388	6	0.3	OK	OK
Carousel 1 Out	108	110	2	0.2	OK	OK
Carousel 2 In	187	191	4	0.3	OK	OK
Carousel 3 In	39	43	4	0.6	OK	OK
Carousel 3 Out	73	49	-24	3.1	OK	OK
Carousel 4 In	269	262	-7	0.4	OK	OK
Carousel 4 Out	79	61	-18	2.2	OK	OK
Carousel 5 In	53	55	2	0.3	OK	OK
Carousel 5 Out	271	253	-18	1.1	OK	OK
Carousel 6 In	273	255	-18	1.1	OK	OK
Carousel 6 Out	300	274	-26	1.5	OK	OK
Carousel 7 In	231	217	-14	0.9	OK	OK
Carousel 7 Out	148	140	-8	0.7	OK	OK
Carousel 8 In	249	242	-7	0.4	OK	OK
Carousel 8 Out	292	284	-8	0.5	OK	OK
Carousel 9 In	231	232	1	0.1	OK	OK
Carousel 9 Out	497	495	-2	0.1	OK	OK
Carousel 10 In	119	123	4	0.4	OK	OK
Carousel 10 Out	140	141	1	0.1	OK	OK
Carousel 11 In	132	134	2	0.2	OK	OK
Carousel 11 Out	262	261	-1	0.1	OK	OK
Carousel 12 In	228	241	13	0.8	OK	OK
Carousel 12 Out	302	297	-5	0.3	OK	OK

JACOBS

Railway West EB	24	12	-12	2.8	OK	OK
Railway West WB	65	134	69	6.9	Failed	OK
Railway East EB	286	261	-25	1.5	OK	OK
Railway East WB	213	218	5	0.3	OK	OK
Renou EB	416	391	-25	1.2	OK	OK
Renou WB	191	257	66	4.4	OK	OK
Pattie EB	408	442	34	1.6	OK	OK
Pattie WB	167	106	-61	5.2	Failed	OK

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Screenlines						
East-West Screenline 1						
Albany Hwy EB	2390	2291	-99	2.0	OK	OK
Albany Hwy WB	1962	1945	-17	0.4	OK	OK
Pattie St EB	408	442	34	1.6	OK	OK
Pattie St WB	167	106	-61	5.2	Failed	OK
Sevenoaks St EB	1130	1105	-25	0.7	OK	OK
Sevenoaks St WB	466	493	27	1.2	OK	OK
Railway Pde EB	24	12	-12	2.8	OK	OK
Railway Pde WB	65	134	69	6.9	Failed	OK
Total	**6612**	**6528**	**-84**	**1.0**	**OK**	**OK**
East-West Screenline 2						
Albany Hwy EB	1835	1978	143	3.3	OK	OK
Albany Hwy WB	1929	1866	-63	1.4	OK	OK
Carousel Rd EB	527	441	-86	3.9	OK	OK
Carousel Rd WB	222	221	-1	0.1	OK	OK
Lake St EB	623	659	36	1.4	OK	OK
Lake St WB	496	469	-27	1.2	OK	OK
Sevenoaks St EB	845	779	-66	2.3	OK	OK
Sevenoaks St WB	339	310	-29	1.6	OK	OK
Total	**6816**	**6723**	**-93**	**1.1**	**OK**	**OK**
North-South Screenline 1						
Wharf St NB	209	311	102	6.3	Failed	OK
Wharf St NB	408	464	56	2.7	OK	OK
Cecil Ave NB	605	510	-95	4.0	OK	OK
Cecil Ave NB	641	645	4	0.2	OK	OK
Liege St NB	539	621	82	3.4	OK	OK
Liege St NB	990	1015	25	0.8	OK	OK
Station St NB	99	67	-32	3.5	OK	OK
Station St NB	327	305	-22	1.2	OK	OK
Total	**3818**	**3938**	**120**	**1.9**	**OK**	**OK**
North-South Screenline 2						
Wharf St NB	208	150	-58	4.3	OK	OK

Wharf St NB	344	321	-23	1.3	OK	OK
Cecil Ave NB	224	177	-47	3.3	OK	OK
Cecil Ave NB	492	483	-9	0.4	OK	OK
Guthrie St NB	559	548	-11	0.5	OK	OK
Guthrie St NB	480	501	21	0.9	OK	OK
Station St NB	99	67	-32	3.5	OK	OK
Station St NB	327	305	-22	1.2	OK	OK
Total	**2733**	**2552**	**-181**	**3.5**	**OK**	**OK**
Carousel Shopping Centre						
In	2393	2383	-10	0.2	OK	OK
Out	2472	2365	-107	2.2	OK	OK
Total	**4865**	**4748**	**-117**	**1.7**	**OK**	**OK**

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Outer Cordon Volumes In						
Albany Hwy N	1785	1945	160	3.7	OK	OK
Sevenoaks St N	1130	1140	10	0.3	OK	OK
Wharf St N	478	436	-42	2.0	OK	OK
Guthrie St	480	501	21	0.9	OK	OK
William St	946	956	10	0.3	OK	OK
Albany Hwy S	487	507	20	0.9	OK	OK
Kenwick Link	772	776	4	0.1	OK	OK
Nicholson Rd	1471	1445	-26	0.7	OK	OK
Liege St	366	361	-5	0.3	OK	OK
Wharf St S	163	160	-3	0.2	OK	OK
Manning Rd	669	529	-140	5.7	Failed	OK
Total	**8747**	**8756**	**9**	**0.1**	**OK**	**OK**
Outer Cordon Volumes Out						
Albany Hwy N	1376	1325	-51	1.4	OK	OK
Sevenoaks St N	499	515	16	0.7	OK	OK
Wharf St N	309	278	-31	1.8	OK	OK
Guthrie St	559	548	-11	0.5	OK	OK
William St	734	717	-17	0.6	OK	OK
Albany Hwy S	755	769	14	0.5	OK	OK
Kenwick Link	1111	1135	24	0.7	OK	OK
Nicholson Rd	2103	2106	3	0.1	OK	OK
Liege St	81	82	1	0.1	OK	OK
Wharf St S	230	189	-41	2.8	OK	OK
Manning Rd	933	872	-61	2.0	OK	OK
Total	**8690**	**8536**	**-154**	**1.7**	**OK**	**OK**
Total in and Out	**17437**	**17292**	**-145**	**1.1**	**OK**	**OK**

Saturday peak hour

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Turn Counts						
Albany Highway/ Manning Road						
Manning Rd left	49	48	-1	0.1	OK	OK
Manning Rd ahead	24	24	0	0.1	OK	OK
Manning Rd right	953	968	15	0.5	OK	OK
Albany Hwy W left	28	29	1	0.2	OK	OK
Albany Hwy W ahead	1364	1443	79	2.1	OK	OK
Albany Hwy E left	879	843	-36	1.2	OK	OK
Albany Hwy E ahead	1430	1361	-69	1.8	OK	OK
Albany Hwy E right	109	72	-37	3.9	OK	OK
Albany Highway/ Wharf Street						
Albany Hwy W left	101	67	-34	3.7	OK	OK
Albany Hwy W ahead	2272	2201	-71	1.5	OK	OK
Albany Hwy W right	119	115	-4	0.4	OK	OK
Wharf St N left	136	110	-26	2.3	OK	OK
Wharf St N ahead	50	44	-6	0.9	OK	OK
Wharf St N right	193	154	-39	3.0	OK	OK
Albany Hwy E left	14	8	-6	1.8	OK	OK
Albany Hwy E ahead	2131	2042	-89	1.9	OK	OK
Albany Hwy E right	121	101	-20	1.9	OK	OK
Wharf St S left	201	210	9	0.6	OK	OK
Wharf St S ahead	34	23	-11	2.1	OK	OK
Wharf St S right	51	34	-17	2.6	OK	OK
Albany Highway/ Cecil Avenue						
Albany Hwy N left	449	515	66	3.0	OK	OK
Albany Hwy N ahead	1705	1795	90	2.2	OK	OK
Cecil Ave left	172	132	-40	3.2	OK	OK
Cecil Ave right	506	582	76	3.3	OK	OK
Albany Hwy S ahead	1551	1603	52	1.3	OK	OK
Albany Hwy S right	245	166	-79	5.5	Failed	OK
Albany Highway/ Liege Street						
Albany Hwy W left	54	86	32	3.8	OK	OK
Albany Hwy W ahead	1578	1663	85	2.1	OK	OK
Albany Hwy W right	56	70	14	1.8	OK	OK
Liege St N Left	693	724	31	1.2	OK	OK
Liege St N ahead	33	35	2	0.3	OK	OK
Liege St N right	204	259	55	3.6	OK	OK
Albany Hwy E left	52	44	-8	1.2	OK	OK
Albany Hwy E ahead	2173	1990	-183	4.0	OK	OK
Albany Hwy E right	518	583	65	2.8	OK	OK
Liege St S left	36	34	-2	0.3	OK	OK
Liege St S ahead	83	80	-3	0.3	OK	OK

Liege St S right	287	280	-7	0.4	OK	OK
Albany Highway/ Nicholson Road						
Albany Hwy W ahead	1389	1422	33	0.9	OK	OK
Albany Hwy W right	1162	1203	41	1.2	OK	OK
Albany Hwy E left	83	89	6	0.6	OK	OK
Albany Hwy E ahead	1264	1249	-15	0.4	OK	OK
Nicholson Rd left	1328	1328	0	0.0	OK	OK
Nicholson Rd right	385	370	-15	0.8	OK	OK
Albany Highway/ William Street						
Albany Hwy W left	482	501	19	0.9	OK	OK
Albany Hwy W ahead	505	507	2	0.1	OK	OK
Albany Hwy W right	581	618	37	1.5	OK	OK
William St left	84	85	1	0.1	OK	OK
William St ahead	263	264	1	0.1	OK	OK
William St right	567	536	-31	1.3	OK	OK
Albany Hwy E left	16	16	0	0.0	OK	OK
Albany Hwy E ahead	441	414	-27	1.3	OK	OK
Albany Hwy E right	166	171	5	0.4	OK	OK
Kenwick Link left	624	601	-23	0.9	OK	OK
Kenwick Link ahead	280	281	1	0.1	OK	OK
Kenwick Link right	32	33	1	0.2	OK	OK
Sevenoaks Street/ Wharf Street						
Sevenoaks St W left	73	72	-1	0.1	OK	OK
Sevenoaks St W ahead	379	386	7	0.4	OK	OK
Sevenoaks St W right	51	54	3	0.4	OK	OK
Wharf St N left	122	194	72	5.7	Failed	OK
Wharf St N ahead	201	117	-84	6.7	Failed	OK
Wharf St N right	115	108	-7	0.7	OK	OK
Sevenoaks St E left	71	54	-17	2.2	OK	OK
Sevenoaks St E ahead	384	399	15	0.8	OK	OK
Sevenoaks St E right	108	78	-30	3.1	OK	OK
Wharf St S left	67	36	-31	4.3	OK	OK
Wharf St S ahead	152	85	-67	6.2	Failed	OK
Wharf St S right	30	44	14	2.3	OK	OK
Sevenoaks/ Cecil Avenue						
Sevenoaks W ahead	293	296	3	0.2	OK	OK
Sevenoaks W right	241	322	81	4.8	OK	OK
Sevenoaks E left	81	77	-4	0.5	OK	OK
Sevenoaks E ahead	330	335	5	0.3	OK	OK
Cecil Ave left	217	193	-24	1.7	OK	OK
Cecil Ave right	55	30	-25	3.8	OK	OK
Sevenoaks/ Grose Avenue						
Sevenoaks W ahead	352	329	-23	1.2	OK	OK
Sevenoaks E left	40	39	-1	0.2	OK	OK

Sevenoaks E ahead	363	333	-30	1.6	OK	OK
Grose Ave left	65	73	8	1.0	OK	OK
Link Counts						
Lake EB	455	577	122	5.4	Failed	OK
Lake WB	465	508	43	1.9	OK	OK
Guthrie NB	416	501	85	4.0	OK	OK
Guthrie SB	407	404	-3	0.1	OK	OK
Jameson St EB	148	163	15	1.2	OK	OK
Jameson St WB	167	191	24	1.8	OK	OK
Cecil Ave S NB	385	502	117	5.6	Failed	OK
Cecil Ave S SB	441	584	143	6.3	Failed	OK
Cecil Ave N NB	366	400	34	1.7	OK	OK
Cecil Ave N SB	444	477	33	1.5	OK	OK
Carousel Rd EB	274	228	-46	2.9	OK	OK
Carousel Rd WB	252	234	-18	1.2	OK	OK
Wharf St NB	228	165	-63	4.5	OK	OK
Wharf St SB	580	458	-122	5.4	Failed	OK
Station St (Albany) NB	204	196	-8	0.6	OK	OK
Station St (Albany) SB	328	302	-26	1.5	OK	OK
Station St (Sevenoaks) NB	204	266	62	4.0	OK	OK
Station St (Sevenoaks) SB	328	326	-2	0.1	OK	OK
Carousel 1 In	491	444	-47	2.2	OK	OK
Carousel 1 Out	81	69	-12	1.4	OK	OK
Carousel 2 In	307	313	6	0.3	OK	OK
Carousel 3 In	84	91	7	0.7	OK	OK
Carousel 3 Out	157	131	-26	2.2	OK	OK
Carousel 4 In	403	437	34	1.7	OK	OK
Carousel 4 Out	125	97	-28	2.7	OK	OK
Carousel 5 In	72	90	18	2.0	OK	OK
Carousel 5 Out	349	310	-39	2.1	OK	OK
Carousel 6 In	292	292	0	0.0	OK	OK
Carousel 6 Out	465	433	-32	1.5	OK	OK
Carousel 7 In	272	261	-11	0.7	OK	OK
Carousel 7 Out	200	179	-21	1.5	OK	OK
Carousel 8 In	364	366	2	0.1	OK	OK
Carousel 8 Out	372	334	-38	2.0	OK	OK
Carousel 9 In	296	272	-24	1.4	OK	OK
Carousel 9 Out	588	563	-25	1.0	OK	OK
Carousel 10 In	168	142	-26	2.1	OK	OK
Carousel 10 Out	130	112	-18	1.6	OK	OK
Carousel 11 In	142	126	-16	1.4	OK	OK
Carousel 11 Out	354	338	-16	0.9	OK	OK
Carousel 12 In	205	188	-17	1.2	OK	OK
Carousel 12 Out	340	318	-22	1.2	OK	OK

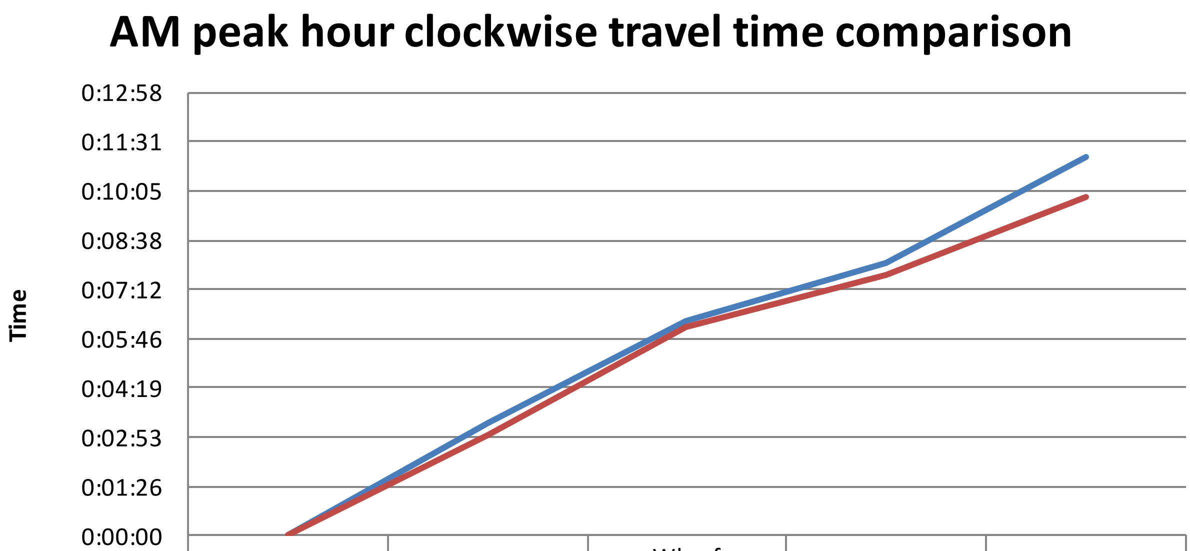
Railway West EB	12	0	-12	4.9	OK	OK
Railway West WB	64	101	37	4.1	OK	OK
Railway East EB	104	97	-7	0.7	OK	OK
Railway East WB	180	183	3	0.2	OK	OK
Renou EB	356	306	-50	2.7	OK	OK
Renou WB	170	207	37	2.7	OK	OK
Pattie EB	226	195	-31	2.1	OK	OK
Pattie WB	143	138	-5	0.4	OK	OK

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Screenlines						
East-West Screenline 1						
Albany Hwy EB	2459	2345	-114	2.3	OK	OK
Albany Hwy WB	2266	2151	-115	2.4	OK	OK
Pattie St EB	226	195	-31	2.1	OK	OK
Pattie St WB	143	138	-5	0.4	OK	OK
Sevenoaks St EB	531	624	93	3.9	OK	OK
Sevenoaks St WB	563	531	-32	1.4	OK	OK
Railway Pde EB	12	0	-12	4.9	OK	OK
Railway Pde WB	64	101	37	4.1	OK	OK
Total	**6264**	**6085**	**-179**	**2.3**	**OK**	**OK**
East-West Screenline 2						
Albany Hwy EB	1688	1819	131	3.1	OK	OK
Albany Hwy WB	2413	2283	-130	2.7	OK	OK
Carousel Rd EB	274	228	-46	2.9	OK	OK
Carousel Rd WB	252	234	-18	1.2	OK	OK
Lake St EB	455	577	122	5.4	Failed	OK
Lake St WB	465	508	43	1.9	OK	OK
Sevenoaks St EB	352	329	-23	1.2	OK	OK
Sevenoaks St WB	403	372	-31	1.6	OK	OK
Total	**6302**	**6350**	**48**	**0.6**	**OK**	**OK**
North-South Screenline 1						
Wharf St NB	256	191	-65	4.3	OK	OK
Wharf St NB	379	308	-71	3.8	OK	OK
Cecil Ave NB	694	681	-13	0.5	OK	OK
Cecil Ave NB	678	714	36	1.4	OK	OK
Liege St NB	655	749	94	3.5	OK	OK
Liege St NB	930	1018	88	2.8	OK	OK
Station St NB	204	196	-8	0.6	OK	OK
Station St NB	328	302	-26	1.5	OK	OK
Total	**4124**	**4159**	**35**	**0.5**	**OK**	**OK**
North-South Screenline 2						
Wharf St NB	249	165	-84	5.8	Failed	OK

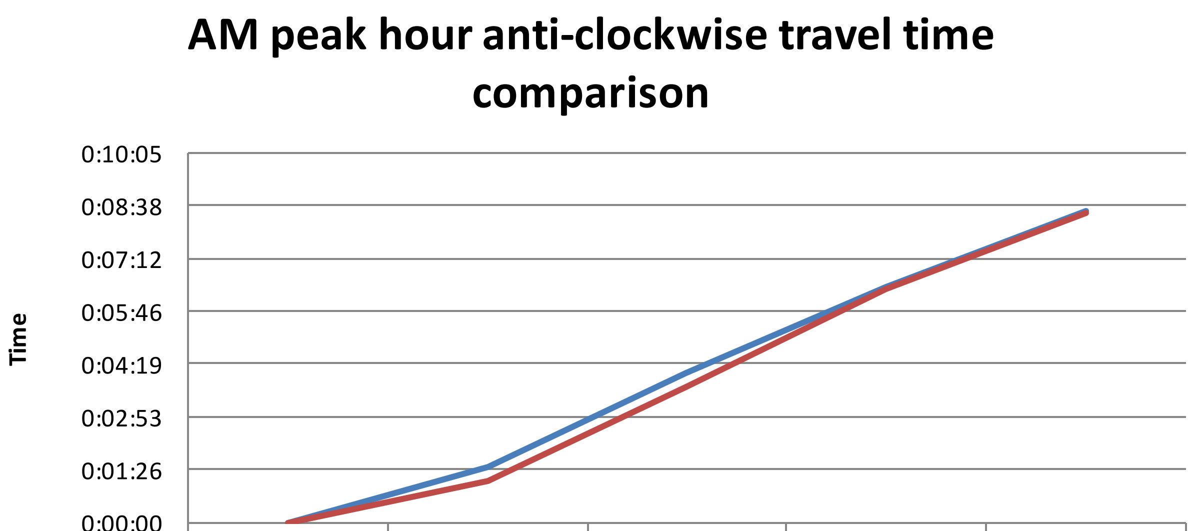
Wharf St SB	323	225	-98	5.9	Failed	OK
Cecil Ave NB	272	223	-49	3.1	OK	OK
Cecil Ave SB	322	399	77	4.1	OK	OK
Guthrie St NB	416	501	85	4.0	OK	OK
Guthrie St SB	407	404	-3	0.1	OK	OK
Station St NB	204	196	-8	0.6	OK	OK
Station St SB	328	302	-26	1.5	OK	OK
Total	**2521**	**2415**	**-106**	**2.1**	**OK**	**OK**
Carousel Shopping Centre						
In	3096	3022	-74	1.3	OK	OK
Out	3161	2884	-277	5.0	Failed	OK
Total	**6257**	**5906**	**-351**	**4.5**	**OK**	**OK**

Movement	Observed	Modelled	Diff	GEH	GEH 5.0	GEH 7.0
Outer Cordon Volumes In						
Albany Hwy N	1392	1472	80	2.1	OK	OK
Sevenoaks St N	503	512	9	0.4	OK	OK
Wharf St N	438	419	-19	0.9	OK	OK
Guthrie St	407	404	-3	0.1	OK	OK
William St	914	885	-29	1.0	OK	OK
Albany Hwy S	623	601	-22	0.9	OK	OK
Kenwick Link	936	915	-21	0.7	OK	OK
Nicholson Rd	1713	1698	-15	0.4	OK	OK
Liege St	406	394	-12	0.6	OK	OK
Wharf St S	286	267	-19	1.1	OK	OK
Manning Rd	1026	1040	14	0.4	OK	OK
Total	**8644**	**8607**	**-37**	**0.4**	**OK**	**OK**
Outer Cordon Volumes Out						
Albany Hwy N	1479	1409	-70	1.8	OK	OK
Sevenoaks St N	566	543	-23	1.0	OK	OK
Wharf St N	333	235	-98	5.8	Failed	OK
Guthrie St	416	501	85	4.0	OK	OK
William St	928	953	25	0.8	OK	OK
Albany Hwy S	621	625	4	0.2	OK	OK
Kenwick Link	860	898	38	1.3	OK	OK
Nicholson Rd	1245	1292	47	1.3	OK	OK
Liege St	141	149	8	0.7	OK	OK
Wharf St S	183	167	-16	1.2	OK	OK
Manning Rd	879	843	-36	1.2	OK	OK
Total	**7651**	**7615**	**-36**	**0.4**	**OK**	**OK**
Total in and Out	**16295**	**16222**	**-73**	**0.6**	**OK**	**OK**

Appendix C. Travel time comparisons

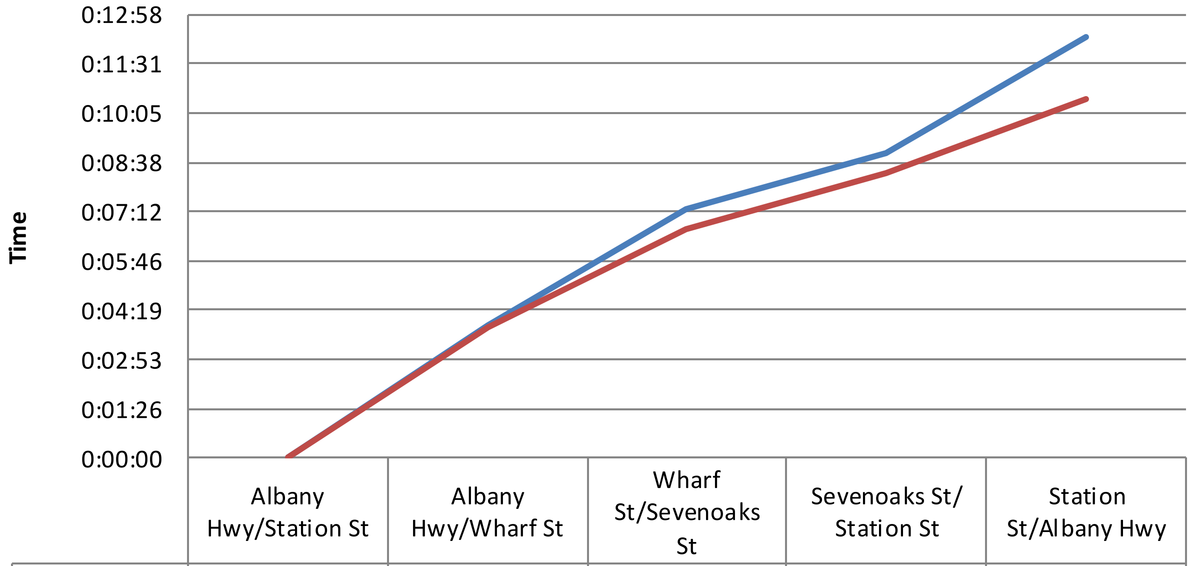


	Albany Hwy/Station St	Albany Hwy/Wharf St	Wharf St/Sevenoaks St	Sevenoaks St/ Station St	Station St/Albany Hwy
Observed	0:00:00	0:03:17	0:06:15	0:07:59	0:11:04
Modelled	0:00:00	0:02:57	0:06:05	0:07:37	0:09:55



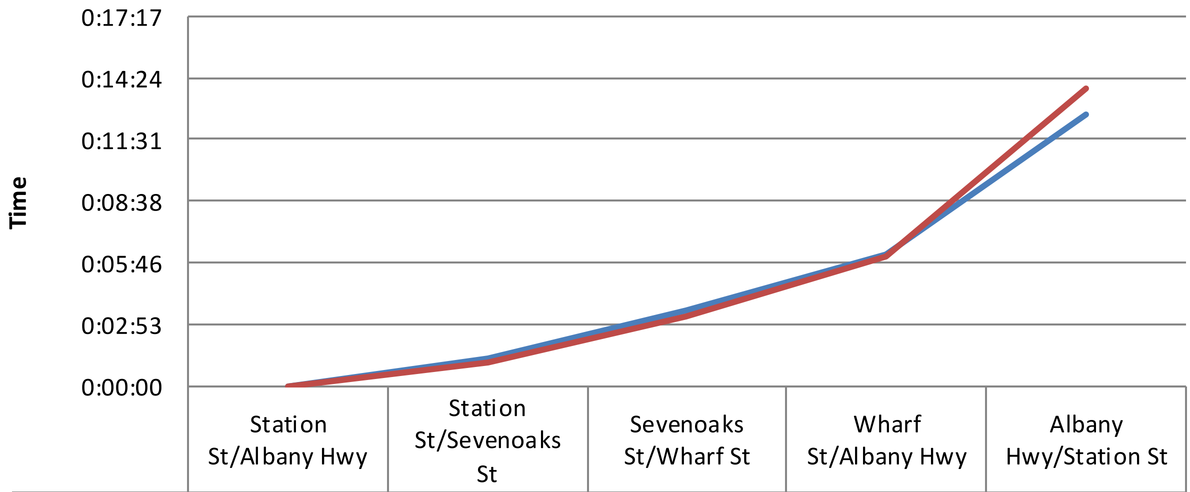
	Station St/Albany Hwy	Station St/Sevenoaks St	Sevenoaks St/Wharf St	Wharf St/Albany Hwy	Albany Hwy/Station St
Observed	0:00:00	0:01:30	0:04:03	0:06:23	0:08:29
Modelled	0:00:00	0:01:08	0:03:42	0:06:21	0:08:27

PM peak hour clockwise travel time comparison



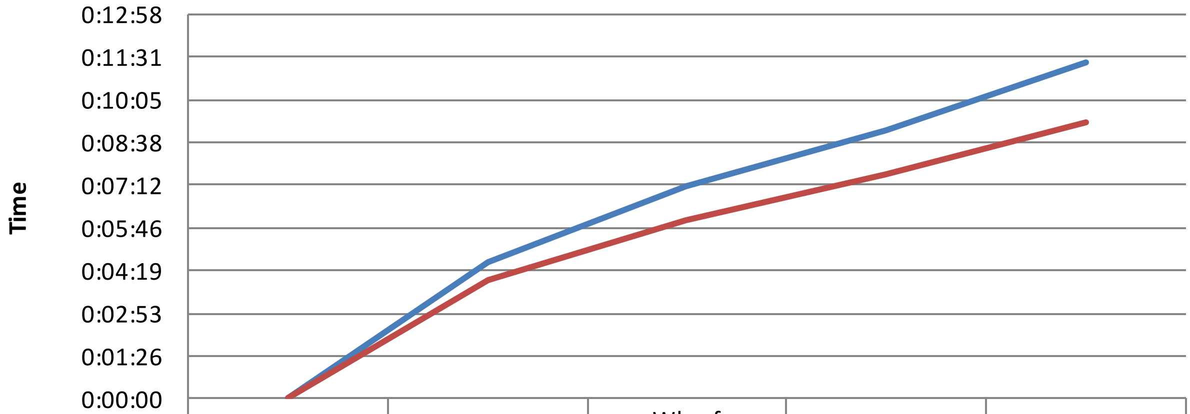
	Albany Hwy/Station St	Albany Hwy/Wharf St	Wharf St/Sevenoaks St	Sevenoaks St/ Station St	Station St/Albany Hwy
Observed	0:00:00	0:03:53	0:07:17	0:08:53	0:12:16
Modelled	0:00:00	0:03:50	0:06:42	0:08:19	0:10:28

PM peak hour anti-clockwise travel time comparison



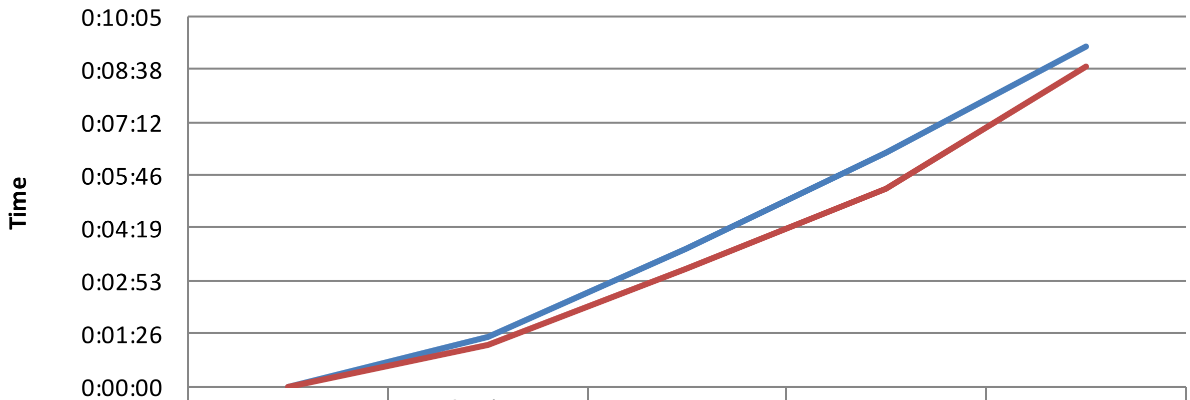
	Station St/Albany Hwy	Station St/Sevenoaks St	Sevenoaks St/Wharf St	Wharf St/Albany Hwy	Albany Hwy/Station St
Observed	0:00:00	0:01:16	0:03:33	0:06:07	0:12:39
Modelled	0:00:00	0:01:06	0:03:17	0:06:01	0:13:52

Saturday peak hour clockwise travel time comparison



	Albany Hwy/Station St	Albany Hwy/Wharf St	Wharf St/Sevenoaks St	Sevenoaks St/ Station St	Station St/Albany Hwy
Observed	0:00:00	0:04:37	0:07:12	0:09:02	0:11:20
Modelled	0:00:00	0:03:59	0:06:01	0:07:33	0:09:17

Saturday peak hour anti-clockwise travel time comparison



	Station St/Albany Hwy	Station St/Sevenoaks St	Sevenoaks St/Wharf St	Wharf St/Albany Hwy	Albany Hwy/Station St
Observed	0:00:00	0:01:20	0:03:44	0:06:23	0:09:16
Modelled	0:00:00	0:01:07	0:03:13	0:05:23	0:08:44

Appendix D. Model audit

The following table provides a summary of each of the key audit recommendations, the recommendations severity and sections of this report that has addressed the recommendations.

Audit comment	Severity	Section of report comment is addressed
Provide a description of the matrix development process proposed for the future year scenario test models, including how this will interface with the base model matrices.	Medium	Section 3.5
The effect of the matrix estimation steps need to be documented.	Major	Sections 3.3.1 and 4.4.3
Some additional information about the comparisons of distribution with the credit card information should be provided (if available).	Medium	Section 3.4
Microsimulation model cordon flows should be provided.	Medium	Section 4.6 and Appendix B
Documentation showing the number of heavy vehicles and their proportion at selected places in the model network area would permit the reader to confirm this situation.	Minor	Not provided
Additional documentation describing how the counts were processed and prepared for application in the modelling is required.	Medium	Sections 2.2 and 3.1
Further information should be provided on the rationale for the selection of roads to be excluded from the model particularly in relation to the loop road around the Westfield Carousel.	Medium	Section 4.1
To assist with the definition of weighted average green times, Appendix B provides an estimate of what each should be based on the IDM data provided and these should be reflected in the modelled green times.	Major	Section 4.2.8
Fixed cycle time models require a reasonably accurate representation of the common cycle times between adjacent intersections to ensure progression is maintained. For this reason some verification of common cycle times and the offsets used in the model should be made.	Major	Section 4.2.8 and Appendix A
Some confirmation from the modeller on the adequacy of the heavy vehicle length distribution adopted for this part of the network (perhaps in comparison to classified counts) and likely impact on modelled queue lengths and reporting of general model operation.	Medium	Section 4.4.2
The modeller should confirm that the train timetable is appropriate for use in the base modelling exercise or amend to reflect latest timetable.	Major	Section 4.2.4
It is recommended that the consultant update the calibration report to reflect these latest results and revise calibration and validation results accordingly.	Major	Sections 4.5 and 4.6, Appendices B and C

Appendix D. 2026 Modelling Note

File Note

JACOBS

Date	14 November 2014
Project No	PB50671
Subject	**Canning City Centre Movement Parking and Access Strategy – 2026 Mesoscopic Modelling Assumptions and Preliminary Findings**

This note documents the assumptions associated with the mesoscopic traffic modelling of a 2026 scenario for the Canning City Centre and the surrounding road network.

Strategic Modelling as Input to the Mesoscopic Modelling – Assumptions, Inputs and Limitations

ROM24 has been used to provide growth factors for the following reasons:

- ROM24 was used as input into the City of Canning Integrated Transport Strategy (ITS), and therefore to be consistent with that piece of work, it makes sense to use those plots
- The ROM24 projects changes in mode share based upon changes in public transport network and service. Public transport network and service is a key component of the City Centre Movement Parking and Access Strategy, and it is a key desire of the plan to reduce car driving and increase public transport. The overarching model methodology of ROM24 allows in some part to account for changes in attraction from car driver to public transport (For the projected ROM24 mode shares for the city centre please refer to Canning City Centre Modelling Strategy Rev C, March 2014); and
- ROM24 provides a medium level of zonal coarseness and a reasonable level of fit between observed and modelled volumes on arterial and sub-arterial roads in the area.

Land use data is a key input to deriving travel demand at the strategic level. The base land uses within ROM24 are based upon land use projections produced by the Metropolitan Land Use Forecasting System (MLUFS). This system projects expected land uses by certain time periods based upon historical trends and land availability. As such, it does not in general take into account aspirational changes to land uses. The City of Canning have a developed a structure plan which has land use aspirations that are consistent with its statutory status as an activity centre. As the purpose of this modelling exercise is to establish the required network under the formation of the City Centre as part of this aspiration, then it is logical to replace the MLUFS land use values with those identified as part of the City Centre Structure Plan for the singular purpose of testing. It should be recognised by using these assumptions, the project values that are likely to be higher than in reality, as there most likely is optimism bias that is inherent within the aspirational component; as such they should not be used in the act of forecasting (ie. the prediction) of traffic, only in modelling a situation. Attached to this note are the modified land uses.

Whilst the ROM24 plots may represent the identified best possible approach to projecting growth, there are a significant number of limitations (that are common across most transport models) that should be borne in mind, including:

- The ROM24 is calibrated based upon data for a number of things:
  - Person travel generation (as sampled in PARTS 2003-2006 survey)
  - Person travel trip length distribution by category of travel (as sampled in PARTS 2003-2006 survey)
  - Revealed mode choice (for samples available in PARTS 2003 - 2006)

- Traffic volumes and travel times on arterial roads for these base years.

  As such it is not specifically designed to provide projections on local roads. It is also heavily calibrated to a single amalgamated time point (2006). Validation of the model has only been undertaken for 2011 traffic and patronage volumes on major arterial and sub arterial routes.

- The ROM24 zones are of a medium level coarseness, and whilst they can be divided down, this essentially changes the level of calibration that was established in some of the above processes – to this end the ROM24 information is being used for growth only;
- ROM24 is not elastic – that is that as general vehicle congestion occurs those public transport routes that are not caught in the same congestion do not become more attractive. International guidance suggests (For example: Variable Demand Modelling, Department of Transport (UK), January 2014) that increased road congestion is expected to lead to decreases in mode choice to car, reduction in the length of trips, and the overall number of trips made. The Canning City Centre is a congested network. Conversely, improvements in the road network may induce a higher mode shift to car driver, increases to travel length and the number of trips made. Findings from post evaluation of arterial road schemes (Eg. POPE 2013 Meta Report, Highways Agency UK, 2013) that elastic models have improved forecasting accuracy compared to fix demand models.
- Behavioural coefficients in decision models are consistent from the base year to future years; this means that the scope for changes in attitudes that occur through changing ethic/aesthetic values (that may occur through an education program like TravelSmart) are not included.
- ROM24 uses road capacities that have been measured in recent times; however due to improvements in vehicles ability to break and accelerate, road capacity has tended to improve over time, and hence greater capacities may be achievable in the future.

The above should always be considered in when examining the values that are used from ROM24 as assumptions into other modelling.

Mesoscopic Demand – Traffic Growth in Westfield Carousel and Bunnings

Traffic growth for Westfield Carousel and Bunnings has been based upon the submitted information associated with each Developer Application (DA). In particular:

	Thursday PM Peak Hour	Saturday Peak Hour
Westfield additional trips	+1132vph	+1630vph
Bunnings additional trips	+374vph	+625vph

The external distribution of been generally maintained as per the base calibrated 2014 scenario, with some slight change in future pattern due to the furnessing approach (also known as frataring) that alters the pattern with respect to changes in growth on boundary locations. The furnessing method is an industry standard method that is often applied by Main Roads engineers to derive future traffic volumes for SIDRA analysis.

As part of the refinement of the scenarios by Jacobs to reach assessment criteria (discussed later in this technical note), consideration will also be given to reductions in these rates based upon changes in parking locations and parking demand management.

Mesoscopic Demands – Zonal Traffic Growth Assumptions (Excluding Westfield Carousel and Bunnings)

Zonal growth has been derived from ROM24 plots and the changes in proposed land use within the City Centre from the ratio of volume at 2031 over that at 2011, then adjusted down to reflect 2026. Ideally growth factors should have been calculated from equivalent subarea ROM24 matrices, however these were not available.

For the growth associated with the Canning City Centre (Not associated with the proposed developments with defined trips), it is noted that the estimate of the average growth across all the areas has been based upon the total land uses. The use of an area wide average across a range of zones has been used to reflect the likely distribution of car parking to promote an avoidance concentrating parking and hence potentially traffic issues to particular locations. It is expected that this would reflect a move towards a greater amount of public parking. This is based on "ultimate" land uses identified in the structure plan and hence may be considered likely to be an overestimate, due to the perhaps ambitious nature of this plan.

Zone / External Network Point	Mesoscopic Model Zone Number/s	% Increase
City Centre (Excluding Westfield and Bunnings)	10,15,55,56,57,58,59,60, 61, 52, 63, 64	22%
Albany Highway East	22	28%
Nicholson Road	23	21%
Welshpool	24	23%
Albany Highway West	26	24%
Shepparton Road	27	20%
Leach Highway East	30	21%
Manning Road West	31	21%
Hayman Road (Curtin University)	33	56%
Kenwick Link	34	26%
Leach Highway West	35	25%
Kewdale Road	38	27%
Roe Highway North	39	70%
Roe Highway South	40, 42	53%
Orrong Road	44	45%

These growth numbers are incorporated within the model by furnessing / frataring the existing matrix to represent these increased totals.

Mesoscopic Network Assumptions

As part of the 2026 scenario, the following improvements on top of the existing network have been included:

(1) Cecil Avenue Upgrade;

(2) Gerrard Street Extension;

(3) William Street Dual Lanes;

(4) Cockram Street Signals;

(5) Extension of Liege Street to Bent Street;

(6) Extension of Liege Street to Guthrie Street;

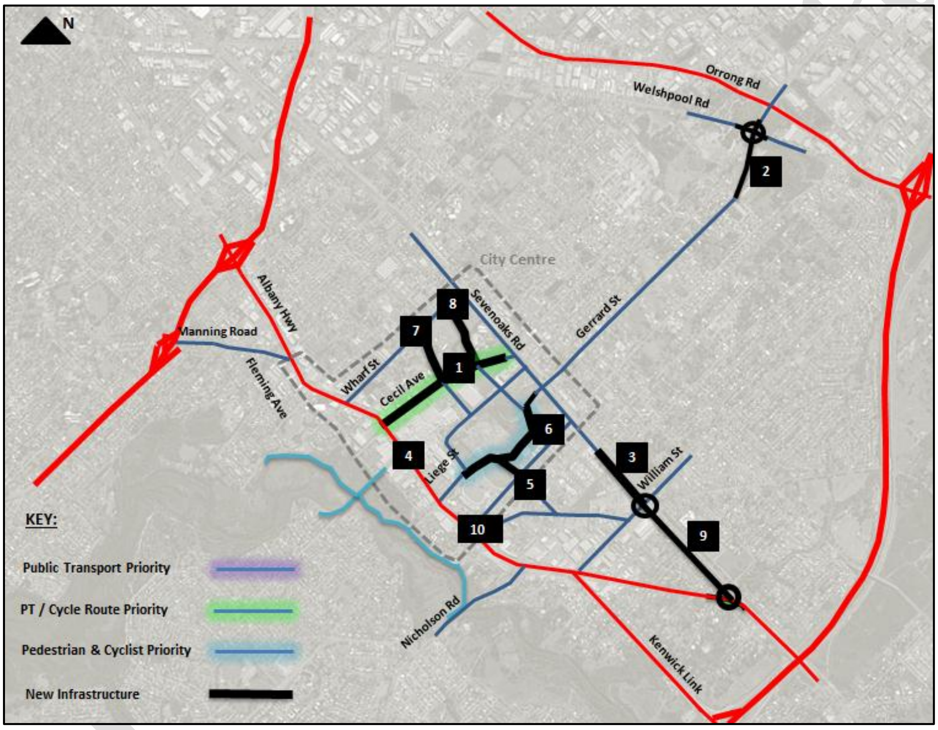
(7) Extension of Carousel Road to Wharf Street;

(8) Extension of Lake Street to Wharf Street;

(9) Sevenoaks Connection between William Street and Albany Highway; and

(10) Signals at Station Street.

The general locations are shown in the figure below.



Mesoscopic Assessment Criteria

Degree of Saturation (DoS) on the primary road network around the City Centre has been used as the basis of the assessment. Whilst the average delays may have been a focus; the point made here is that intersections in this area are already at poor levels of service. The assessment criteria used here to achieve a refinement of a scenario is to achieve a DoS a saturation point of 0.9, this represents a threshold of accessibility; oversaturation will result in standing queues that grow over the period and exponentially cause the capacity of other intersections to reduce through blocking back, and ultimate causes non-functionality of the network. This means that people can no longer reach a destination. This is contrasted against measuring an issue via delay, which means (assuming that intersections are not saturated) that people can reach their destination, but it takes a long time. Oversaturation of the network would potentially result in people not being able to reach their destination at all. It should be noted that at the level of detail modelled, only a coarse estimate of DoS can be made, and that the final outcome should be tested at a microsimulation model level.

Mesoscopic Model Limitations

A number of limitations should be borne in mind with respect to the mesoscopic model:

- The mesoscopic model has been established to provide information about likely routing patterns at a sub-regional level. A separate microsimulation model has also been established and is a more appropriate tool for assessing operational information such as delays and queue-lengths in detail;
- The level of coarseness of the model changes from a fine, almost access point grain around the Westfield Carousel area to a much coarser grain on the other side of the railway;
- Intersections are not modelled in explicit detail – delay is mainly calculated as a function of the number of lanes and the intersection type, whilst banned movements are included. Again, emphasis is placed on establishing the likely routing patterns and hence the level of traffic on approach to an intersection.

Additional Assumptions, Discussion and Preliminary Findings

Clearly the critical movement remains the approach volumes to Liege Street along Albany Highway. Microsimulation modelling suggests that the critical peak occurs on the Saturday Peak Hour, coinciding with the Peak shopping period of the Westfield Carousel. It should be noted that whilst Westfield traffic makes up a significant proportion of traffic along Albany Highway in the critical area, it in itself is only around 30% of the traffic on this road. A Select Link Analysis shows that the traffic projected to use this road is predominantly sub-regional in nature, seemingly connecting residential areas to the South and South East to commercial and retail opportunities along Albany Highway itself.

Figure 1 Select Link Analysis (2026 Saturday Peak Hour) – Albany Highway between Liege Street and Station Street

Apart from removing an amount of Westfield Carousel traffic from the system via some form of grade separation, the alternate options are:

(1) Improve parallel roads and general connectivity;
(2) Reallocate car parking in the City Centre to try and get alternate routes to be used;
(3) Reduce traffic travelling to the City Centre, either through parking pricing or restraint; and
(4) Improve public transport along key desire lines.

With respect to each, through a range of tests, the following was identified:

- In addition to the parallel roads already included within the base assumptions, a connection from Nicholson Road (either as a left only into Woodloes Street, or as a full connection), may attract a reasonable amount of traffic to connect Westfield Carousel Traffic to the new Cockram Street intersection, even whilst as a not direct route. Whilst this may be viewed as creating more permeability in the network and match up with the draft strategic intent of the Movement Parking and Access Strategy, the concerns here would revolve around drawing traffic that the local community may see as 'rat-running'. Additionally it is not clear what land implications exist around this option.
- Reallocation of parking from the south east corner to accessing of Cecil Avenue. It should be noted that the parking that was reallocated retained its origin/destination characteristic, and as such the bulk of this traffic also came from the South East form roads like Nicholson Road. This is felt to be relatively realistic, because the distribution of traffic to shopping centre (whilst perhaps changing a bit in the future) is likely to maintain the same patterns, at least within ten years. Because of this, the effect of this was still to draw traffic along Albany Highway, but instead of turning right at Liege Street, traffic continued along Albany Highway; as such it was felt that there was only small benefit.
- It is not clear how much retail (and associated employment traffic) can be reduced through the implementation of parking pricing, or through the reduction of bays. However, matrices were setup such that traffic could be reduced. Whilst this reduction was adjusted on the Westfield Carousel site, other City Centre land uses may equally (and / or interchangeably) be applied future parking reductions in such a way as to limit car generation in the area.
- It is noted that in the Draft City of Canning Integrated Transport Strategy, identification of additional bus routes (beyond those identified in the In Motion Public Transport Masterplan) from the southern residential areas to areas along Albany Highway were seen as an important connection. In particular, the option of a bus bridge at Greenfields Road linking areas in the south was seen as representing a significant opportunity. The Select Link Analysis seems to confirm that there is demand for such as service that may be able to produce some reductions for those movements.

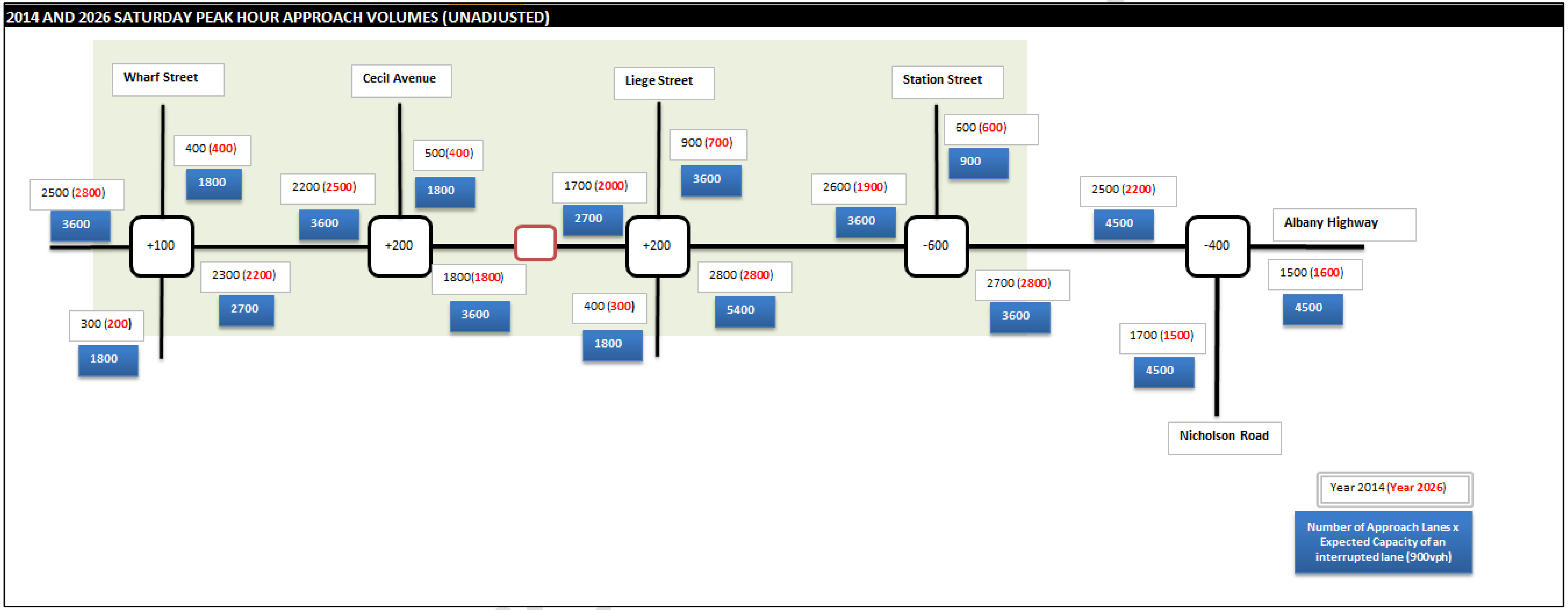
Following from this, additional assumptions have been made to arrive at a future 2026 outcome that is seen as likely to being acceptable from a traffic situation, whilst potentially still within a palatable range with respect to community outcomes:

- Relocation of 10% of Westfield Carousel parking from the South Eastern Corner to Cecil Avenue;
- 30% reduction of car travel to Westfield Carousel through parking management (parking pricing and / or restraint)
- 30% reduction of car travel to areas along Albany Highway (Excluding Westfield Carousel) via the implementation of improved bus services along Albany Highway, particularly on a Saturday.

From these assumptions, a summary of the volumes (2011 and 2026 with the above assumptions and others documented earlier in this note) and the change between years under these assumptions, and a sketch-estimate of capacity on each approach are summarised on the following pages. It is suggested that whilst the scenarios highlighted would most likely have slower travel times and greater delays / queues, they represent a network which is not expected to be more saturated than the current 2011 level. Furthermore, if this was achieved, several of the Movement, Parking and Access Strategy strategic intentions would be better met than some of the alternate road infrastructure scenarios that have been suggested.

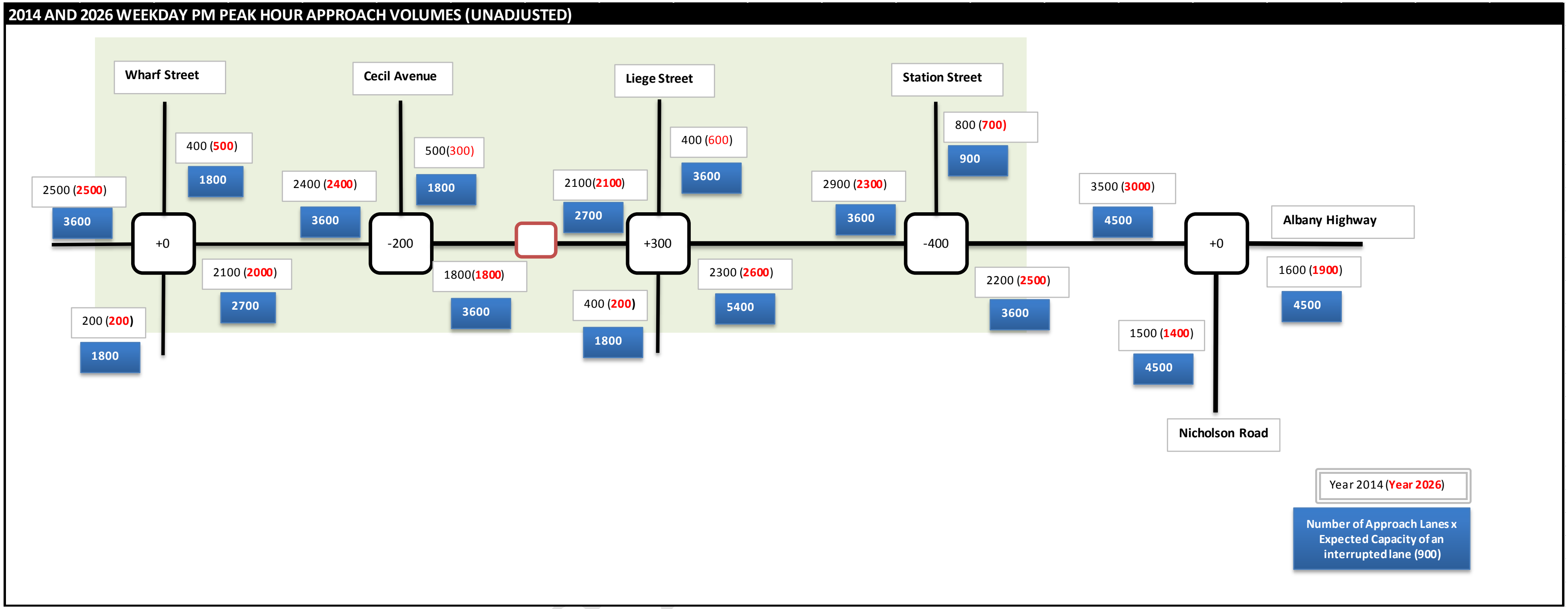
It is recognised that further testing needs to be undertaken at a microsimulation level to assess change in saturation of the network, as well as further testing around the ability to achieve some of the assumptions.

JACOBS



2014 AND 2026 SATURDAY PEAK HOUR APPROACH VOLUMES (UNADJUSTED)
Wharf Street
Cecil Avenue
Liege Street
Station Street
Albany Highway
Nicholson Road
2500 (2800)
3600
400 (400)
1800
+100
2300 (2200)
2700
300 (200)
1800
2200 (2500)
3600
500(400)
1800
+200
1800(1800)
3600
1700 (2000)
2700
900 (700)
3600
+200
400 (300)
1800
2800 (2800)
5400
2600 (1900)
3600
600 (600)
900
-600
2700 (2800)
3600
2500 (2200)
4500
-400
1500 (1600)
4500
1700 (1500)
4500
Year 2014 (Year 2026)
Number of Approach Lanes x Expected Capacity of an interrupted lane (900vph)

JACOBS


2014 AND 2026 WEEKDAY PM PEAK HOUR APPROACH VOLUMES (UNADJUSTED)
Wharf Street
Cecil Avenue
Liege Street
Station Street
Albany Highway
Nicholson Road
2500 (2500)
3600
400 (500)
1800
200 (200)
1800
+0
2100 (2000)
2700
2400 (2400)
3600
500(300)
1800
-200
1800(1800)
3600
2100(2100)
2700
400 (200)
1800
+300
400 (600)
3600
2300 (2600)
5400
2900 (2300)
3600
800 (700)
900
-400
2200 (2500)
3600
3500 (3000)
4500
+0
1600 (1900)
4500
1500 (1400)
4500
Year 2014 (Year 2026)
Number of Approach Lanes x Expected Capacity of an interrupted lane (900)

JACOBS

ROM24 Zone	Population	Occupied Private Dwellings	Employment Opportunities					Primary and Secondary School enrolments - FTE	Tertiary enrolments - FTE	TAFE enrolments - part-time and night classes - FTE	Hospital beds
			Manufacturing	Retail	Construction	Community Services	Other Services				
615	122	52	1,566	697	647	103	250	-	-	-	-
618	56	24	1,611	540	939	7	779	-	-	-	-
619	0	-	1,217	389	650	4	520	-	-	-	-
620	5	2	1,521	388	932	265	967	-	-	-	-
621	26	11	1,581	682	949	215	680	-	-	-	-
622	0	-	1,301	281	1,175	16	639	-	-	-	-
623	0	-	2,342	120	417	21	843	-	-	-	-
783	5503	1,859	45	885	295	306	272	968	-	-	-
784	4939	1,669	99	43	325	234	211	1,032	-	-	-
785	0	-	4,627	859	1,773	581	1,223	-	-	-	-
786	0	-	2,322	1,101	739	18	1,202	-	-	-	-
787	0	-	2,958	665	535	143	1,137	-	-	-	-
788	2503	897	32	42	135	78	47	52	-	-	-
789	4040	1,448	65	935	128	425	332	2,178	-	-	-
790	5012	1,796	25	92	151	259	164	727	-	-	-
791	3280	1,176	19	19	89	133	73	648	-	-	9
792	94	34	646	589	538	52	548	-	-	-	-
793	3313	1,188	21	145	82	118	99	443	-	-	-
794	2543	1,009	20	94	79	110	121	297	-	-	-
795	4907	1,765	41	75	148	285	153	458	-	-	28

JACOBS

796	3973	1,499	25	401	151	376	293	798	-	-	-
797	2714	973	21	29	82	73	50	-	-	-	-
798	6835	2,680	95	1,005	171	270	203	2,046	-	746	-
799	2576	1,010	21	66	108	46	336	246	-	-	-
800	3365	1,426	38	64	108	213	28	184	-	-	-
801	3790	1,486	26	81	135	193	34	304	-	-	-
802	2362	1,005	33	567	118	391	196	-	-	-	-
803	5308	2,212	68	162	128	300	224	-	-	-	-
804	8660	3,608	8	364	154	530	43	586	-	-	-
805	5079	2,099	141	575	60	423	198	-	-	-	14
806	3948	1,631	6	22	85	441	22	268	-	-	14
807	7039	3,087	291	663	227	1,887	179	-	-	-	260
808	4455	1,896	28	77	171	360	32	1,345	-	-	-
809	4963	2,112	51	160	351	137	48	-	-	-	-
810	7904	3,100	130	436	67	798	939	418	-	-	-
811	4748	1,862	178	4,949	93	2,036	4,014	1,107	-	90	-
812	2600	1,020	55	732	8	1,087	962	-	-	-	-
813	4253	1,668	34	65	135	143	37	-	-	-	-
814	3647	1,430	746	664	158	111	175	-	-	814	-
815	2068	811	7	46	24	53	5	469	-	-	-
816	727	285	2	2	16	8	69	-	-	-	22
817	5230	2,051	19	150	289	206	116	499	-	-	-
818	1614	633	3	8	39	19	32	-	-	-	-

File Note

Prepared by:

Richard Isted
Senior Transport Modeller
(08) 9469 4048
richard.isted@jacobs.com

Appendix E. Summary of Modelling Findings

To establish an objective framework for assessing traffic impacts associated with new developments in the City Centre, and the mitigating effects of infrastructure upgrades, a number of steps were undertaken:

1. Traffic data for 2014 was collected, including traffic and pedestrian counts, travel times and on-site observations;
2. The Main Roads Regional Operations Model (ROM) was used to examine spatial travel trends and traffic generation in 2011 and at 2031;
3. The information from this model was used to develop a detailed traffic model of the City Centre and surrounding areas. The parameters of this model were calibrated to the observations of existing traffic; and
4. This model was then used to analyse the impacts associated with expected increases in traffic associated with City Centre developments.

The traffic modelling was undertaken using a three-tiered approach. This approach utilised travel demand data from the ROM model and involved the development of a mesoscopic model of the wider network area and a microsimulation model of the Structure Plan area. The models were developed for a weekday AM and PM peak hour and a Saturday afternoon peak hour. An overview of the modelling approach is illustrated in **Figure 7.1**.

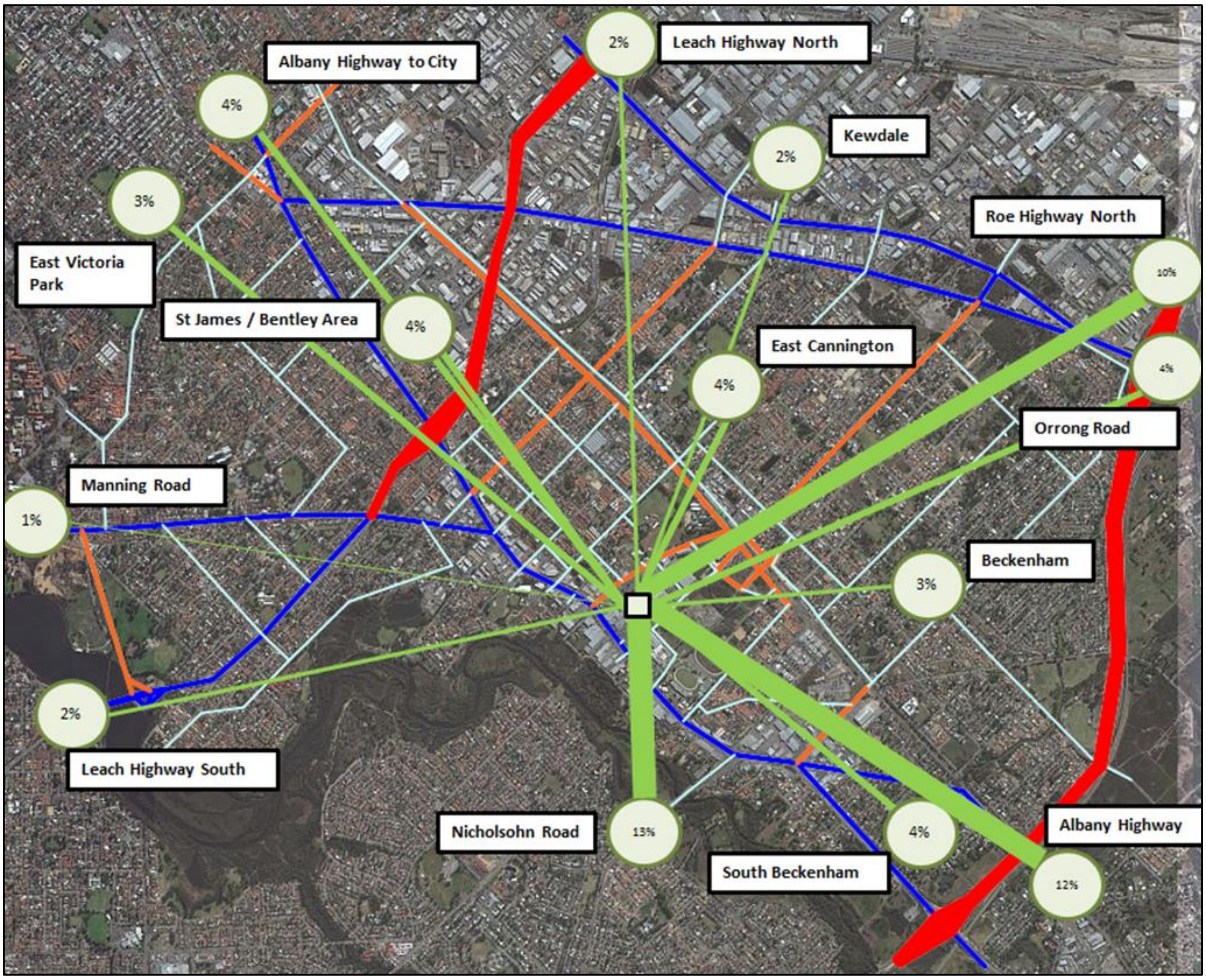
Figure 7.1: Stages of the modelling assessment

A separate report provides details of the modelling methodology, data collection and assumptions for agreement with the City of Canning and key stakeholders (Local Model Calibration Report November 2014) and calibration and validation outcomes. This report is provided in **Appendix C**.

Analysis of data extracted from the 2011 ROM model was used to assess the current distribution of traffic to and from the Canning City Centre. The distribution provided from ROM is illustrated in **Figure 7.2**.

The ROM data suggests that the main origins for vehicles travelling to the City Centre are from the south and east via Nicholson Road, Albany Highway and Roe Highway. Comparatively fewer journeys are shown to originate from the north and west.

Figure 7.2: Existing Traffic Distribution to/from the Canning City Centre



The ROM data was compared by Cardno against credit card data for Westfield Carousel and was found to be generally consistent.

Existing conditions on the road network within and surrounding the City Centre were established by peak hour observations, analysis of existing traffic data and traffic modelling for the base year. This analysis indicated the following key features of the existing operation of the road network:

- Albany Highway currently experiences high levels of delay during the weekday and Saturday peak hours. In the weekday PM peak hour, traffic queues back from the Liege Street intersection to beyond the intersection with Manning Road. In the weekday AM and Saturday peak hours, northbound traffic regularly queues back from the Liege Street intersection to Nicholson Road.
- Existing congestion along Albany Highway appears to stem from the operation of the Albany Highway/ Liege Street intersection. The capacity for the right turn into Liege Street from Albany Highway causes particular issues in the weekday PM and Saturday peak hours. The additional green time required for this movement restricts the heavy southbound movement in the PM peak and the capacity for the right turn is not sufficient in the Saturday peak.
- The signals at the Albany Highway/ Liege Street intersection operate with different phasing arrangements on different days of the week. On Thursdays, Fridays and Saturday, an additional phase is operated to allocate more green time to the right turn from Albany Highway to Liege Street. This leads to additional delay along Albany Highway on these days. On other days of the week more green time is allocated to the Albany Highway phases, leading to increased delay on Liege Street.

- The cycle times for traffic lights along Albany Highway during the peak hours are excessively high (150 to 160 seconds), which creates long waiting times for pedestrians. The cycle times remain high during the off peak periods.
- Moderate queuing and delay is experienced along Station Street on approach to Albany Highway. The right turn onto Albany Highway from Station Street is particularly difficult during the peak hours due to the high volumes of opposing traffic.
- High levels of delay are experienced along Wharf Street at the intersection with Sevenoaks Street. This delay is associated with the operation of the rail crossing, which is called at regular short intervals throughout the peak hours.
- The remainder of the streets within the City Centre (Cecil Avenue, Carousel Road, Grose Avenue) operate reasonably well.

Short Term Traffic Modelling

The detailed traffic modelling was undertaken at the meso and micro levels (as illustrated in **Figure 3.2)** for short term (2016) and long term (2026) assessment years, with initial input from the ROM model.

A number of near term scenarios were modelled to assess the traffic impact of the Westfield and Bunnings developments impact and identify short term infrastructure measures. These are considered near future scenarios as they only consider “live” development applications, and do not consider other developments or growth in traffic. The assumptions associated with the traffic growth were provided by the respective developers.

2016 Mesoscopic Modelling

The mesoscopic modelling was undertaken for the following reasons:

- To facilitate a wide area assessment of network changes that may impact on the amount of traffic travelling through the Structure Plan area.
- To provide a strategic level assessment of road network operation within the Structure Plan area, including forecast changes in travel patterns within the City Centre as a result of future development and network changes.
- To bridge the gap between ROM and the microsimulation modelling – the mesoscopic model will provide refined demand information for input into the microsimulation model of the Structure Plan area.

The modelling was undertaken using an iterative process. As initial results were obtained, scenarios were modified to try and better mitigate the impacts highlighted in each modelling run. The final set of modelling scenarios that were assessed are described in **Table 7.2**. The infrastructure upgrades applied in the modelling scenarios are shown in **Figure 7.3**.

Figure 7.3 : Infrastructure upgrades

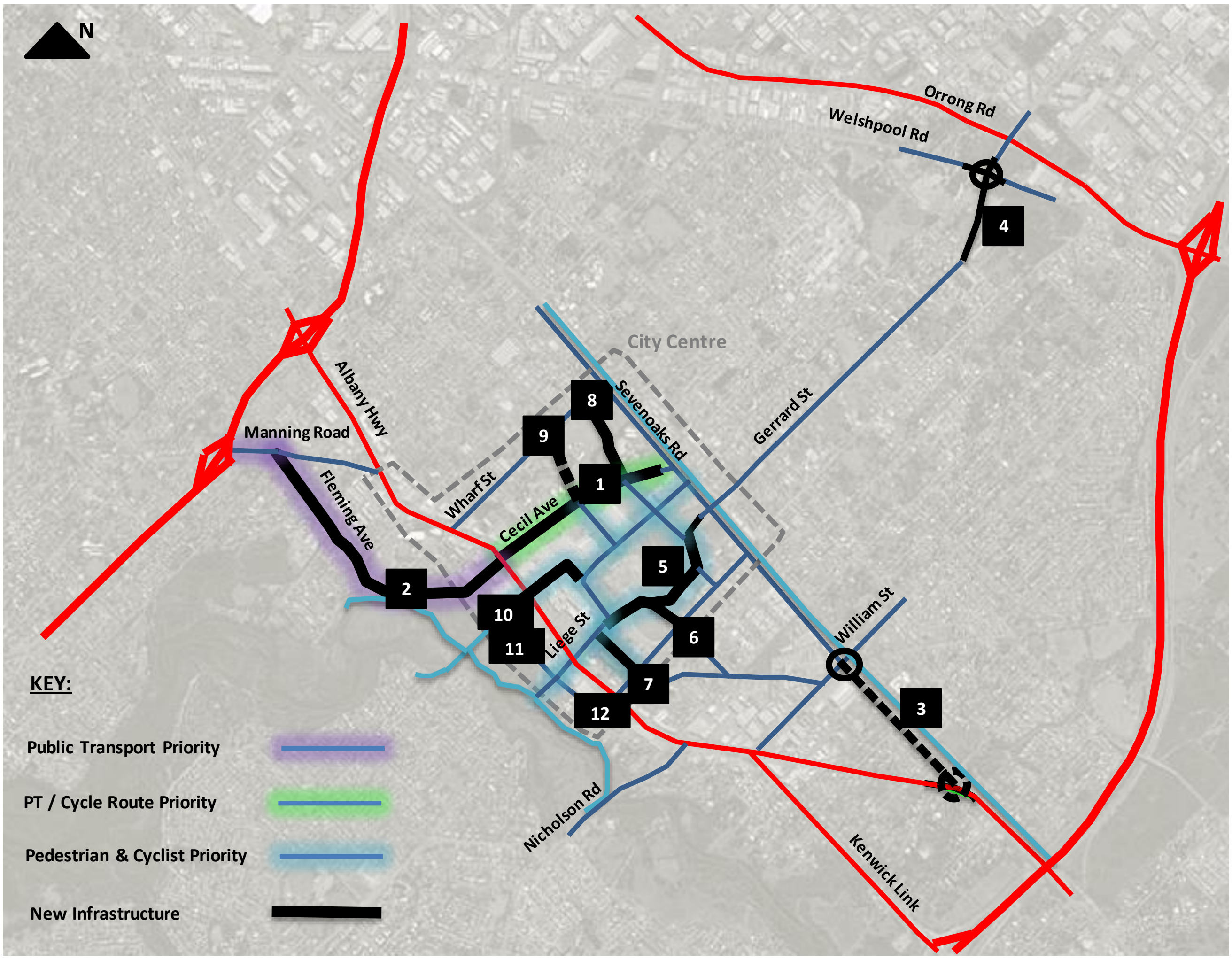


Table 7.2 : Near term mesoscopic modelling scenarios

Scenario	Infrastructure upgrade											
	1	2	3	4	5	6	7	8	9	10	11	12
Scenario 1												
Scenario 2	✓	✓	✓		✓							
Scenario 3	✓	✓	✓	✓	✓	✓		✓	✓			
Scenario 4	✓	✓	✓	✓	✓	✓		✓	✓	✓		
Scenario 5	✓	✓	✓	✓	✓	✓		✓	✓		✓	
Scenario 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓

The key findings from the short term mesoscopic modelling are as follows:

- The Sevenoaks Street and Gerard Street extensions (upgrades 3 and 4) may be required in the short term to mitigate impact associated with increased travel demand to the retail centre.
- The connection from Guthrie Street to Liege Street (upgrade 5) may be important to accommodate future traffic growth, particularly for movements to/ from the north-east.
- A connection between Cecil Avenue and Wharf Street (upgrades 8 and 9) would provide additional east west capacity. When the two links were modelled in the same scenario, the modelling suggested that the link along Carousel Road would be the most beneficial.

- A connection from or over Albany Highway (upgrade 10) may be required to accommodate the forecast higher volumes of traffic travelling to/ from the expanded Westfields shopping centre.

2014 Microsimulation Modelling

Microsimulation modelling was done for a scenario whereby the Westfield Carousel Development Application (DA) was completed by 2014, and hence the traffic from this development was added on top of the existing situation (referred to as the Base) with only the road network improvements suggested within the DA; this scenario was referred to as 2014A. **Figure 7.4** and **Figure 7.5** highlight the average changes in travel times along a number of key routes (for definitions of the routes please refer to the Modelling Strategy Report in **Appendix B**). In reviewing the results of the models, the following issues were raised and are summarised in **Table 7.3**. This modelling was audited by the Transport Modellers Alliance.

Table 7.3: Summary of issues identified in 2014A microsimulation modelling

Time Period	Issues highlighted
PM Peak Hour (5pm – 6pm)	• Delay along Cecil Ave southbound. • Delay along Grose Ave southbound. • Delay along Carousel Rd. • Queuing and delay northbound along Albany Hwy on approach to Liege St – right turn into Liege St and delay associated with on-ramp access.
Saturday Peak Hour (11:30am – 12:30am)	• Queuing and delay southbound along Albany Hwy – large increase in travel times that may be associated with signal operation at Liege St/ Cockram St and increase in southbound traffic flow. • Queuing and delay northbound along Albany Hwy on approach to Liege St – right turn into Liege St and queuing back from on-ramp access.

It is recognised that a number of additional microsimulation modelling scenarios have been undertaken by Cardno on behalf of Scentre using a version of this model, with additional tests. Whilst at the time of this report, these models had not been audited, it is understood that the key findings are:

- Additional signals at Station Street with part of the Southern Link Connection improve travel times from the 2014A scenario to a level within 15% of the 2014 base values;
- A grade separated right hand turn structure over Liege Street from Albany Highway can improve the 2014 scenario to levels better that the 2014 base values.
- The movement of additional parking from Liege Street (as per the DA) to Cecil Avenue would potentially create an additional bottleneck on Albany Highway.

Figure 7.4: Travel times – before and after Westfield Carousel on Key Routes (PM Peak Hour)

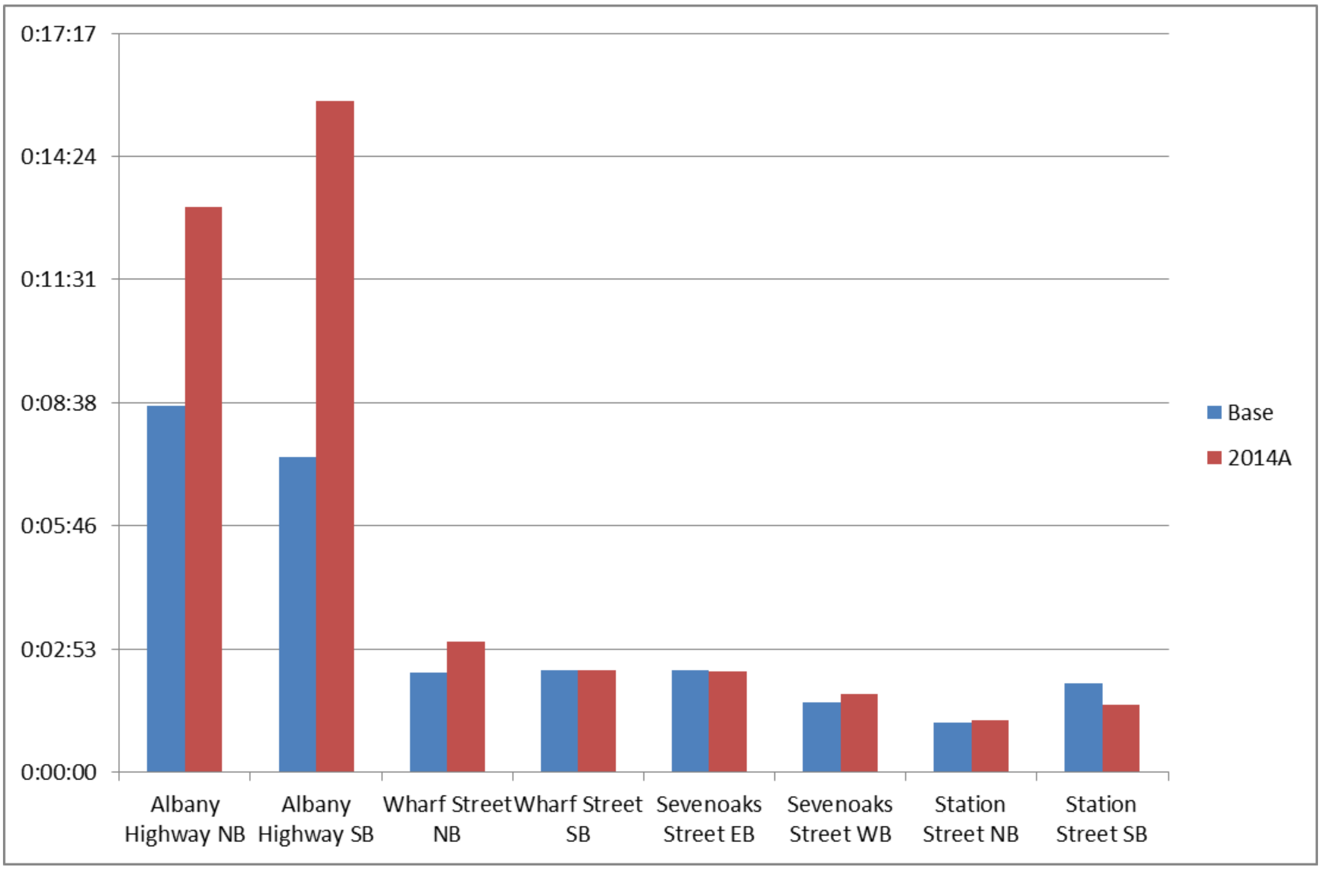
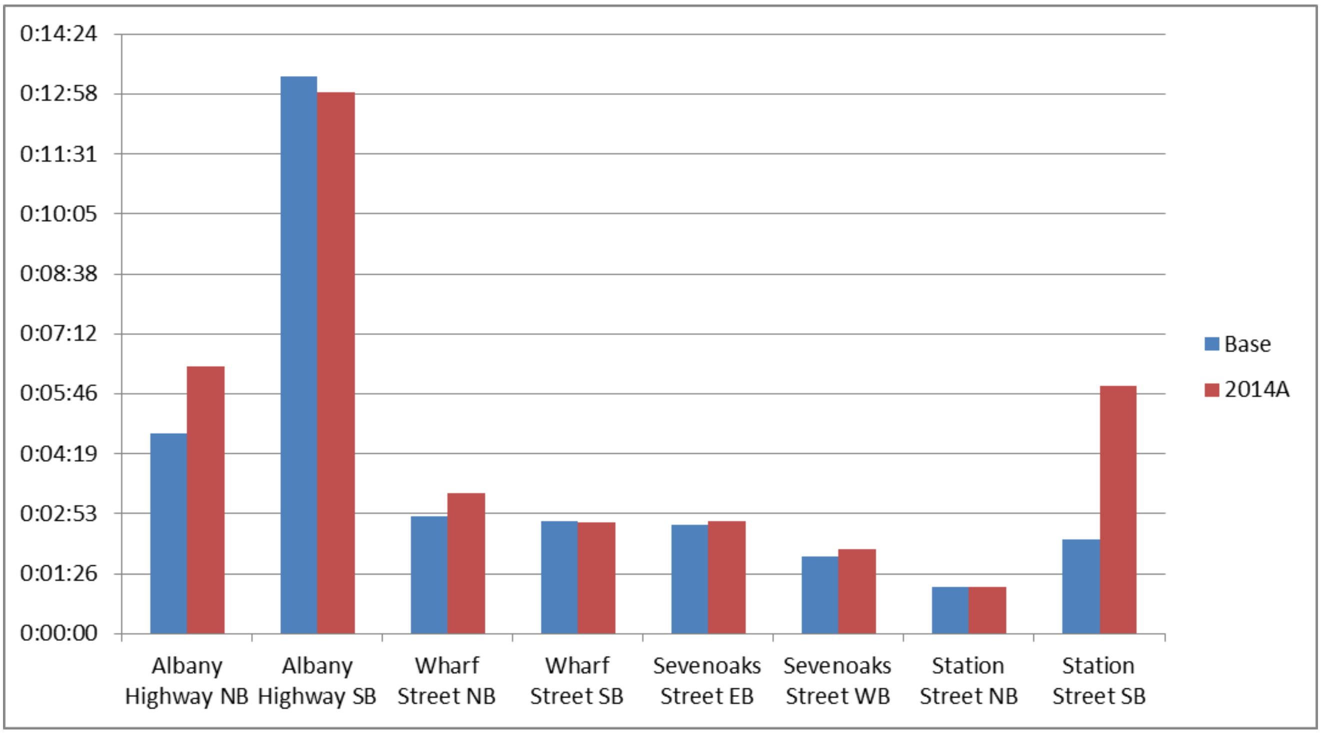


Figure 7.5: Travel Times – before and after Westfield Carousel on Key Routes (Saturday Peak Hour)



Longer Term Traffic Modelling

Longer term traffic modelling has also been undertaken for the Canning City Centre. It should be noted that long term traffic modelling historically has suffered from the following issues:

- Longer term future traffic modelling is typically based on land use inputs that are put together as part of land use plans. These plans are often ambitious with respect to both the quantity and mix of land uses. With respect to the Canning City Centre, the existing land uses are predominantly retail, with a large amount of bulky retail. For example, the City Centre Structure Plan argues for significant increases in the residential and office commercial component within the centre area, and reductions in bulky good retail. Whilst this is desirable from a transport perspective, the ability to achieve the same levels as planned for may not be necessarily achievable from a market perspective. From a market perspective, increasing land uses in association with the status quo (in this case bulky retail) is attractive to developers. However, from a transport and accessibility perspective, allowing the status quo to continue is unlikely to generate the best or even a good outcome.
- Long term future traffic modelling typically makes assumptions about the implementation of certain infrastructure opportunities; in reality these infrastructure opportunities are not always delivered in the intended timeframe, or even at all. For example, at the macroscopic level, there are a number of upgrades to highway infrastructure for the area that have been implemented in the ROM. These features may or may not get delivered within that timeframe, and hence the growth on say a road like Albany Highway may be effected by this.
- In the long term, things such as driver technology and driver behaviour are likely to change dramatically compared to the existing situations. This means that a number of things that are typically accepted as being the same will be different for example:
  - Improved braking and reactions are likely to increase the capacity that may be achieved from a single traffic lane;
  - People's willingness to drive, or take other forms of transport may change over time due to changing societal values;

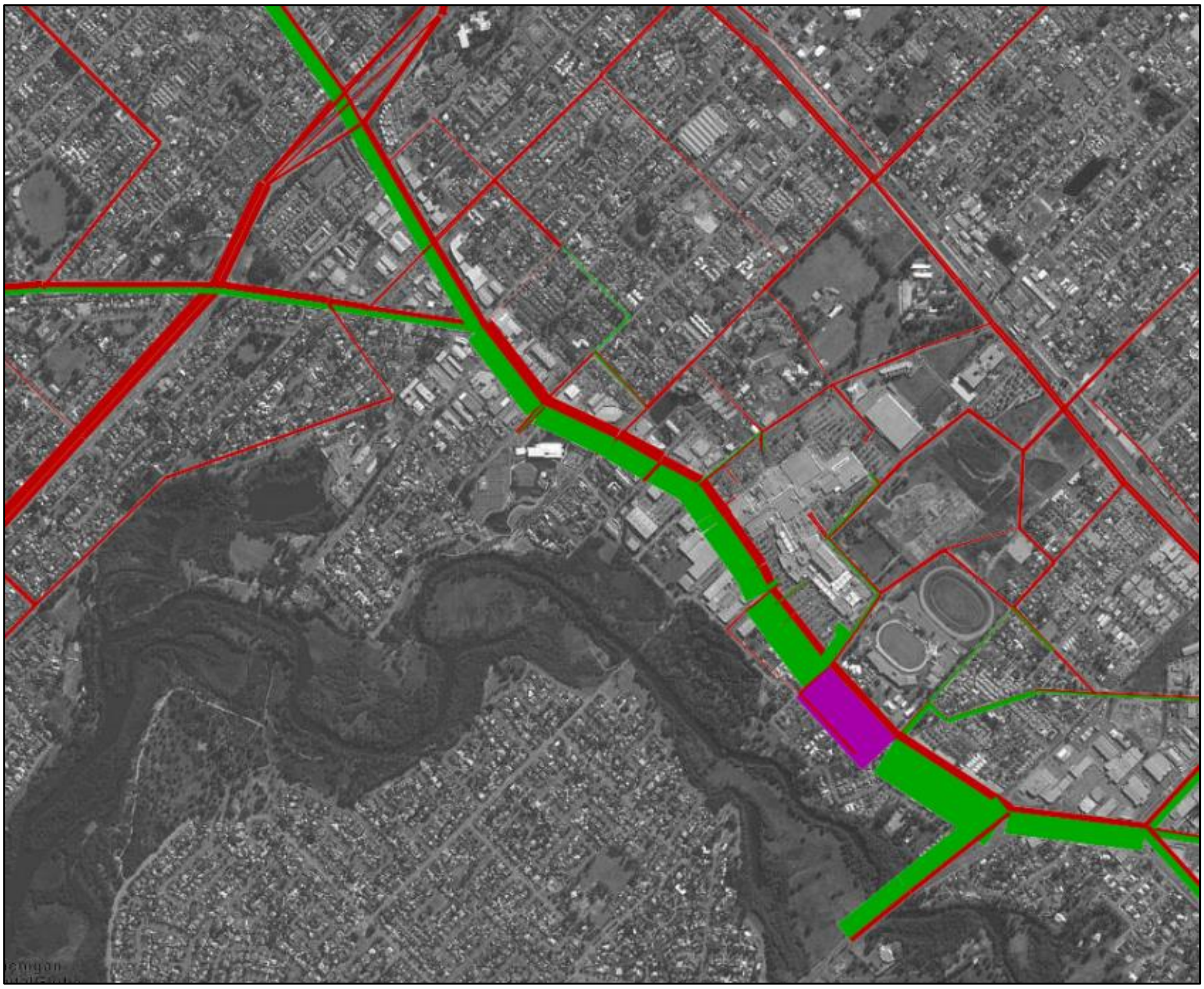
2026 Mesoscopic Traffic Modelling

A mesoscopic traffic modelling exercise of a 2026 scenario for the Canning City Centre and the surrounding road network was undertaken. The key assumptions, limitations and full analysis report are documented in **Appendix D**.

The exercise found that the critical movement would clearly remain the approach to Liege Street along Albany Highway in 2026. Microsimulation modelling suggests that the critical peak occurs on the Saturday Peak Hour, coinciding with the peak shopping period of Westfield Carousel. It should be noted that whilst Westfield traffic makes up a significant proportion of traffic along Albany Highway in the critical area, it in itself is only around 30% of the traffic on this road.

A Select Link Analysis (SLA) shown in **Figure 7.6** shows that the traffic projected to use this road is predominantly sub-regional in nature, seemingly connecting residential areas to the south and south-east to commercial and retail opportunities along Albany Highway itself.

Figure 7.6: Select Link Analysis (2026 Saturday Peak Hour) – Albany Highway between Liege Street and Station Street



Apart from removing an amount of Westfield Carousel traffic from the system via some form of grade separation, the alternate options are:

(1) Improve parallel roads and general connectivity;
(2) Reallocate car parking in the City Centre to try and get alternate routes to be used;
(3) Reduce traffic travelling to the City Centre, either through parking pricing or restraint; and
(4) Improve public transport along key desire lines.

With respect to each, through a range of tests, the following was identified:

- In addition to the parallel roads already included within the base assumptions, a connection from Nicholson Road (either as a left only into Woodloes Street, or as a full connection), may attract a reasonable amount of traffic to connect Westfield Carousel traffic to the new Cockram Street intersection, even though this is not a direct route. Whilst this may be viewed as creating more permeability in the network and match up with the draft strategic intent of the Movement Parking and Access Strategy, the concern here would revolve around drawing traffic that the local community may see as 'rat-running'. Additionally it is not clear what land implications exist around this option.
- Reallocation of parking from the south east corner to accessing of Cecil Avenue. It should be noted that the parking that was reallocated retained its origin/destination characteristic, and as such the bulk of this traffic also came from the south-east from roads like Nicholson Road. This is felt to be relatively realistic, because the distribution of traffic to the shopping centre (whilst perhaps changing a bit in the future) is likely to maintain the same patterns, at least within ten years. Because of this, the effect of this was still to draw

traffic along Albany Highway, but instead of turning right at Liege Street, traffic continued along Albany Highway; as such it was felt that there was only small benefit.

- It is not clear how much retail (and associated employment traffic) can be reduced through the implementation of parking pricing, or through the reduction of bays. However, matrices were setup such that traffic could be reduced. Whilst this reduction was adjusted on the Westfield Carousel site, other City Centre land uses may equally (and / or interchangeably) be applied to future parking reductions in such a way as to limit car generation in the area.
- It is noted that in the Draft City of Canning Integrated Transport Strategy, identification of additional bus routes (beyond those identified in the In Motion Public Transport Masterplan) from the southern residential areas to areas along Albany Highway were seen as an important connection. In particular, the option of a bus bridge at Greenfields Road linking areas in the south was seen as representing a significant opportunity. The Select Link Analysis appears to confirm that there is demand for such a service that may be able to produce some reductions for those movements.

Following from this, additional assumptions have been made to arrive at a future 2026 outcome that is seen as likely to being acceptable from a traffic situation, whilst potentially still within a palatable range with respect to community outcomes:

- Relocation of 10% of Westfield Carousel parking from the South Eastern Corner to Cecil Avenue;
- 30% reduction of car travel to Westfield Carousel through parking management (parking pricing and / or restraint);
- 30% reduction of car travel to areas along Albany Highway (excluding Westfield Carousel) via the implementation of improved bus services along Albany Highway, particularly on a Saturday.

Modelling Summary and Directions

As discussed above, a number of scenarios have been run at different levels of resolution to provide some direction on the gaps and directions that the strategy should address. The key points that the three level of modelling raises are:

- The Albany Highway / Liege Street intersection appears to be the key bottleneck along Albany Highway both now and into the future. This is unsurprising as current data and modelled trends suggest that this is the access for a significant demand from south along Nicholson Road that tries to access / egress the shopping centre. This demand is expected to increase with the increase in the shopping centre and with it the potential throughput through this intersection. This highlights the need to reduce car traffic, and provide a more permeable road network that provides more options.
- The modelling suggests that a significant amount of the demand on Albany Highway within the vicinity of the site appears to be relatively local traffic, rather than regional movements, and that because of existing commercial land use patterns being fairly linear along this corridor, there exists opportunities to manage demand through improved public transport services.
- The trafficable demand that the Westfield Carousel expansion would create without significant parking demand management is expected to be significant and would have a significant impact on the efficiency of the network (particularly on Albany Highway). There appears to be a number of infrastructure improvements that can be done that can manage the accessibility such that traffic can continue to move (these include the Sevenoaks Street extension, the Southern Link Road, Gerrard Street extension), but this would result in degradation of the travel times along Albany Highway, which may be unacceptable to some agencies. To accommodate the full City Centre Structure Plan vision, management of car travel (through aspects such as car parking), improved public transport infrastructure and improved mix of uses is more critical.

It is felt that these points identified from the modelling are the critical issues that the strategy needs to monitor and manage, and that actions around these points have been developed in an iterative process from principles through to strategy development.

It should be noted that the intent of the modelling should not be to “predict and provide”. This approach that has been (and continues to be) adopted for many situations, it is the default behaviour of transport planners / traffic engineers to look for road infrastructure solutions before any other approaches. It is also noted that within current modelling framework used in Western Australia (including the one used in this project) it is easier and faster to test within a modelling context the impact of placing more road capacity infrastructure than it is to rigorously test and quantify the impact of investment in public transport or demand management measures.

Appendix F. Infrastructure Risk Assessment

Canning City Centre Movement Parking and Access Strategy – Infrastructure Plan Risk Assessment (DRAFT)

Risk Matrix

Risk Matrix						
		Determine the Consequence (C)				
	Community	5 - Minor Local Access Impact	4 - Neighbourhood Connector Level Impact	3 - Minor Subregional Impact	2 - Major Subregional road Impact	1 - Regional Road Impact
Determine the Likelihood (L)	A - Almost certain	Medium	High	Very High	Very High	Very High
	B - Probable	Medium	Medium	High	Very High	Very High
	C - Possible	Low	Medium	Medium	High	Very High
	D - Unlikely	Low	Low	Medium	Medium	High
	E - Very unlikely	Low	Low	Low	Medium	Medium

Assessment of Risks Associated with Infrastructure Items

Infrastructure Item	Issue	Initial Rating			Proposed Solution / Control Measure	Revised Rating			Stakeholders involved with the City of Canning
		(L)	(C)	Risk		(L)	(C)	Risk	
1. Cecil Avenue main street redesign for light rail/buses, pedestrians, cyclists, cars and delivery vehicles	Land is not easily obtained	D	3	Medium	Negotiate land reserve for implementation in future	E	3	Low	Landowners
	Funding is not currently available to develop link	C	3	Medium	Establish an implementation plan and/or Business case for Link	D	3	Low	Landowners

	Approval cannot be obtained from other stakeholders	C	3	Medium	Work with authorities to collaboratively agree forms.	D	3	Low	MRWA, DoT, PTA
2. Public transport priority route for light rail / buses	Approval cannot be obtained from other stakeholders	B	3	High	Establish a specific plan for the delivery of the link in consultation with PTA and Main Roads	C	3	Medium	PTA, MRWA
	Funding is not currently available to develop link	B	3	High	Establish a business case jointly with the PTA to develop link	C	3	Medium	PTA, MRWA
3. Extension of Sevenoaks St to Albany Highway and Signalisation of Albany Highway / Sevenoaks St and William Street / Sevenoaks	There are difficulties with getting the City of Gosnells to undertake the necessary works.	C	1	Very High	Work with the City of Gosnells to develop link	D	1	High	City of Gosnells
4. Connection of Gerrard Street to Welshpool Road	State and Federal Environmental approval (Bush Forever) may be difficult to be obtained for the development of the connection.	C	2	High	Design around Bush Forever land	D	2	Medium	
	Funding is not currently available to develop link	C	2	High	Look to establish a developer contribution scheme for the link	D	2	Medium	Land developers, PTA
5a. Connection of Liege Street to Guthrie Street	Approval to use land is difficult to be obtained	C	1	Very High	Work with landowner	D	1	High	Landowners
	State and Federal	C	1	Very High	Design around	D	1	High	

(Southern Link Road) (From Liege Street to Grey Street)	Environmental approval (Bush Forever) may be difficult to be obtained for the development of the connection.				Bush Forever land				
5b. Connection of Liege Street to Guthrie Street (Southern Link Road) (from Grey St onwards)	Approval to use land is difficult to be obtained	C	1	Very High	Work with Western power to obtain approval	D	1	High	City of Canning
	State and Federal Environmental approval (Bush Forever) may be difficult to be obtained for the development of the connection.	C	1	Very High	Design around Bush Forever land	D	1	High	
6. Connection from Southern Link Road to Station Street via Grey Street (Connection from Leige Street to Station St via Grey St)	Approval to use land is difficult to be obtained	C	1	Very High	Work with landowners to get approval for connection	D	1	High	Landowners
	Federal and State approval to use land is difficult to be obtained for direct connection through to Guthrie Street through environmentally sensitive area	C	1	Very High	Explore with relevant authorities the constraints and potential mitigation measures	D	1	High	
8. Connection of Lake Street between Cecil Avenue and Wharf Street	Funding cannot be obtained to implement link	D	4	Low	N/A	D	4	Low	
	Approval to use land is difficult to be obtained from Department of Housing	C	4	Medium	Negotiate with Department of Housing for use of land	D	4	Low	

9. Connection of Carousel Road between Cecil Avenue and Wharf Street	Funding cannot be obtained to implement link	D	4	Low	Look to establish a developer contribution scheme for connection	D	3	Low	
	Access to land is dependent on time frame	D	4	Low	N/A	D	4	Low	
11. Signalised Intersection between Greenfield Street and Cockram Street	Approval to use land is difficult to be obtained for signals between Greenfield Street and Cockram Street.	C	1	Very High	Look to implement bridge connection over Albany Highway from Greenfields Street	C	5	Low	MRWA, Landowners
12. Signalisation of Station Street	Funding cannot be obtained to implement link	C	3	Medium	Look to acquire developer contributions for intersection	D	3	Low	Land Developers
	Approval to use land is difficult to be obtained for implementation of intersection	B	3	Medium	City of Canning and proponents to work closely with Main Roads to look at all options	C	3	Medium	MRWA, Landowners

Appendix G. Recommended Parking Requirements

Canning City Centre Car Parking Rates

Parking rate is per Net Leasable Area (NLA) unless otherwise specified

Use Classes	Parking Rate*	Public or Shared Target
Aged and Dependent Person's Dwellings	As per R-Codes.	0%
Ancillary Accommodation	As per R-Codes.	0%
Auction Mart	N/A	N/A
Bed and Breakfast	N/A	N/A
Caravan Park	N/A	N/A
Caretaker's Dwelling	^	^
Car Park	N/A	N/A
Cattery	N/A	N/A
Child Day Care Centre	1 space per employee and 1 per 20 children	100%
Club Premises	1 space per $4m^2$ of eating, drinking or lounge area.	100%
Community Building	1 space per $50m^2$.	100%
Community Purpose	1 space per $50m^2$.	100%
Contractor's Yard	N/A	N/A
Convenience Store	4.2 spaces per $100m^2$.	100%
Cottage Industry	1 space per employee in addition to residential requirement.	0%
Display Home Centre	^	100%
Educational Establishment	0.6 spaces per employee plus parking for students to be negotiated with the local government.	80%
Extractive Industry	N/A	N/A
Factory Tenement Building	N/A	N/A
Family Day Care Centre	A paved pick-up area to the satisfaction of the local government in addition to residential requirements.	100%
Fuel Depot	N/A	N/A
Funeral Parlour	N/A	N/A
General Industry	N/A	N/A
Grouped Dwelling	1 space per unit	0%
Hazardous Industry	N/A	N/A
Health Centre	1 space per $20m^2$	100%
Home Business	1 space per employee in addition to the residential requirement. Visitor parking to be negotiated with the local government.	0%
Home Occupation	As per definition in Part 6.	0%
Home Office	As per definition in Part 6	0%
Home Store	Extra parking in addition to the residential requirement to be negotiated with the local government.	0%
Hotel	1 space per 4 rooms.	0%
Kennels	N/A	N/A
Light Industry	N/A	N/A
Lunch Bar	N/A	N/A
Market	4.2 spaces per $100m^2$	100%

Use Classes	Parking Rate*	Public or Shared Target
Mechanical Repair Station	N/A	N/A
Medical Consulting Rooms	1 space per 20m^2 of commercial floorspace in addition to the residential requirement.	50%
Mixed Development	Parking in accordance with the requirements for each individual land use.	N/A
Motel	N/A	N/A
Multiple Dwelling	1 space per dwelling	0%
Night Club	1 space per 4m^2 of eating, drinking or lounge area.	100%
Noxious Industry	N/A	N/A
Occasional Uses	N/A	N/A
Office	1.5 spaces per 100m^2.	50%
Open Air Display	1 space per 100m^2 open display area.	50%
Plant Nursery	N/A	N/A
Public Amusement	1 space per 8 persons the building is designed to accommodate.	100%
Public Exhibition	1 space per 50m^2	100%
Public Utility	^	^
Public Worship	1 space per 50m^2	100%
Reception Lodge	1 space per 4m^2 seating area, or 1 space per 50m^2 net lettable area, whichever is the lesser	100%
Recreational Vehicle Construction	N/A	N/A
Residential Building	0.5 spaces per bedroom (or bedspace).	0%
Restaurant/Café	1 spaces per 50m^2 nett leasable area, unless part of a Shopping Centre in excess of 1500m^2 NLA in which occupants share a common parking area, in which case the standards for 'Shop' shall apply as if any floorspace used for the designated use were lettable.	100%
Restricted Premises	4.2 spaces per 100m^2	100%
Retail Establishment	1 space per 50m^2	50%
Retirement Village	1 space per unit	0%
Rural Industry	N/A	N/A
Rural Pursuit	N/A	N/A
Salvage Yard	N/A	N/A
Service Industry	N/A	N/A
Service Station	1 space per working bay plus 1 space per employee.	100%
Shop	4.2 spaces per 100m^2	100%
Showroom	1 space per 50m^2	50%
Single Bedroom Dwelling	1 space per dwelling	0%
Single House	As per R- Codes.	0%
Small Bar	1 space per 4m^2 of eating, drinking or lounge area	100%
Special Facilities	1 space per 4m^2 of eating, drinking or lounge area	100%
Spray Painting (Non-Automative)	N/A	N/A
Stable	N/A	N/A
Stall	^	^
Stock Holding and Salesyards	N/A	N/A

Use Classes	Parking Rate*	Public or Shared Target
Storage Yard	N/A	N/A
Take-Away Food Outlet	1 space per $50m^2$ nett leasable area	100%
Tavern	1 space per $50m^2$ nett leasable area	100%
Telecommunications Infrastructure	N/A	N/A
Trade Display	N/A	N/A
Transport Depot	N/A	N/A
Vehicle Sales Premises	N/A	N/A
Vehicle Workshop	N/A	N/A
Vehicle Wrecking	N/A	N/A
Veterinary Clinic	1 space per $20m^2$ in addition to the residential requirement.	50%
Veterinary Hospital	1 space per $20m^2$	50%
Warehouse	1 space per $100m^2$ GFA	50%

* Developers may negotiate lower parking rates to provide less or no parking on- site and contribute cash-in-lieu towards facilities and services for common-use parking, public transport and alternative modes, at the discretion of the local government. Where developments do provide lower parking rates, provision of bays for car share schemes is strongly encouraged.

^ Parking to be negotiated with the local government.

Canning City Centre Recommended Minimum Bicycle Parking Rates and Showers/Lockers requirement

Land Uses	Bicycle Parking Rate to be Provided
Community	0.6 per 100sqm
Recreation	0.6 per 100sqm
Health	0.6 per 100sqm
Light Industry	0.2 per 100sqm
Office	0.6 per 100sqm
Retail (Carousel)	0.5 per 100sqm
Retail (Outside Carousel)	0.5 per 100sqm
Storage & Bulky Goods	0.2 per 100sqm
Education	0.8 per student
Hotel	0.6 per 100sqm
Residential	1 per unit
Residential (Visitor)	0.1 per unit

Additionally for any location, there should be a provision of 1 female and 1 male shower for every additional 8 bicycle parking bays to a maximum of six male and six female showers per building.

Canning City Centre Recommended Minimum Motorcycle Parking Rates

Land Uses	Motorcycle Parking Rate to be Provided
Community	0.2 per 100sqm
Recreation	0.2 per 100sqm
Health	0.2 per 100sqm
Light Industry	0.1 per 100sqm
Office	0.2 per 100sqm
Retail (Carousel)	0.2 per 100sqm
Retail (Outside Carousel)	0.2 per 100sqm
Storage & Bulky Goods	0.1 per 100sqm
Education	0.2 per employee
Hotel	0.2 per 100sqm
Residential	0.1 per unit

Appendix H. Review of Background Information

Table 7.4 Analysis of Background Information (Issues Wheel)

Domain	Timeframe	Issues / Opportunities	Previous Documentation (If relevant)
Technological	Existing	Canning City Centre is serviced by a number of buses that run in mixed traffic with no priority. Traffic lights along Albany Highway in this area have particularly long cycle times (in excess of 120 seconds).	
	Long Term	Light Rail is identified as travelling between Perth City and Canning City Centre via Curtin University after 2031. This is to be provided by the state government as a priority system, and hence there would be little delay from general traffic.	Public Transport Master Plan 2031 (In Motion)
Environmental	Existing	There are existing environmental protected areas that effect future proposed roads such as the Southern Link Road (Connection of Guthrie Street to Liege Street) and Gerard Street extension to Welshpool Road.	
	Long Term	Within the City Centre Structure Plan, a number of key goals are identified. These are: • Significantly increase the potential mode share of public transport, walking and cycling by: - Encouraging infill development in the City Centre to a population of approximately 25,000 people - Increase cycling coverage tenfold to 100,000 people by providing good access through the improvement if connectivity to the south west of the river and northwest of the railway line. - Support cycling in the City Centre with proper facilities, infrastructure and priority. • In order to increase the public transport mode share, the level of coverage will need to be improved significantly along with the appeal of the mode. • Manage vehicle movements through a parking strategy that would reduce vehicle movements along certain roads to create a City Centre as a people space.	Canning City Centre Structure Plan
Economic	Existing	Westfield Carousel Shopping Centre, built in 1972, has approximately 80,000sqm of floor space. It is Perth Metropolitan Area's largest shopping complex with an estimate of over 10 million visitations annually.	Canning City Centre Structure Plan

<table>
<tr><th>Domain</th><th>Timeframe</th><th>Issues / Opportunities</th><th>Previous Documentation (If relevant)</th></tr>
<tr><td rowspan="2"></td><td>Short Term</td><td><u>Short Term City Centre Developments</u>
There are a number of proposed retail developments and/or expansions including:
• Westfield Carousel wish to expand by 40% in the near future.
• Greyhounds WA and Bunnings wish to (re)-develop in the near future.
These developments may have aspects that are not compatible with the overall future aspiration for the City Centre.</td><td>Discussions with Scentre
DA Submissions to Council by CAHRS and Bunnings Pty Ltd.</td></tr>
<tr><td>Long Term</td><td><u>Long Term Development Aspirations</u>

Desired increase of 10,472 workers in 140,000sqm of new commercial and retail space.

In order to be successful the creation of a central focal point and main street environment for the City Centre requires:
• A double-sided shopping street (understood as Cecil Avenue).
• Direct access to car parking that is convenient to both main street and Carousel customers.
• An anchor tenant or cluster of similar tenants capable of generating sufficient foot traffic to support specialty shops in the street.
• Direct and immediate access to the significant volumes of long term traffic generated into and out of Carousel.

It is recognized that these long term aspirations, whilst consistent with political documentation such as Directions 2031, may either not be achievable from an economic perspective (ie. there is not enough interest from the market in developing in accordance with the vision) or may be hindered by other constraints.</td><td>Canning City Centre Structure Plan</td></tr>
</table>

Domain	Timeframe	Issues / Opportunities	Previous Documentation (If relevant)
Political	Existing	**<u>The Use of Cash-in-lieu of Parking</u>** The City Centre Structure Plan, and the Draft Activity Centres Parking Policy both outline the use of cash-in-lieu as parking management tool. In other councils where cash in lieu has been developed, many developers, some Councillors and JDAP members consider the way cash-in-lieu is being applied to be too onerous. Specifically: • They consider the quantum of cash-in-lieu is too high. This is because the minimum level of parking at which cash-in-lieu kicks in is too high and the overall level of parking required to be provided is too high. • They see no guarantee that the cash-in-lieu collected will be expended on public parking in the area within a reasonable time. These perceptions are responsible for many officer recommendations for cash-in-lieu being waived either by the Council or by JDAP. The major conclusions from a review of these is that: • A one size fits all range of car parking rates for different uses (e.g. retail, office) across the whole municipality is unlikely to provide equitable outcomes and achieve the balance sought by councils. It would result in over supply in some areas and potentially, under supply in others • Providing different car parking rates for 30 or 40 different land uses in centres, particularly mixed use centres, is overly complex. Despite this, for statutory reasons, the City of Canning required this level of complexity in the car parking provision rates (as listed in **Appendix GG**). • The rate of car parking for land uses such as retail and commercial varies considerably, leading to the conclusion that a single rate, even if it can be varied based on circumstances like proximity to public transport, does not provide an accurate estimate of parking needs in different locations. • The minimum level of car parking required in the town planning scheme is generally (but not always) too high; • The amount of cash-in-lieu of parking is often too high (and considered unreasonable) because it is based on minimum levels of parking that are themselves too high. • Minimum levels of bicycle parking in centres should be mandated	Review of Parking Literature (City of Perth and City of Stirling, City of Swan, City of Bunbury, City of Wanneroo)

Domain	Timeframe	Issues / Opportunities	Previous Documentation (If relevant)
	Short Term	The City of Canning may merge or be split into other councils.	
	Longer Term	Canning City Centre is identified as a strategic major centre in Directions 2031.	Directions 2031 (WAPC)
Legal	Existing	Canning City Centre currently provides ample parking for visitors of the City Centre. However providing enough parking encourages visitors to use private cars. As there is a focus on decreasing travel by private car in this strategy, it is important to provide enough parking for those who have no other option while also implementing deterrents to decrease the desirability of driving when there is another option and therefore ease congestion. The key elements are: • Approximately 8,000 car parking bays available in and around the City Centre. • Cannington Train station has 250 car parking spaces, 30 secure bicycle spaces and 7 bus stops (serviced by 19 bus routes). • No existing car parking pricing. The decline in demand for car parking associated with (in many cases) a conservative approach on car parking requirements for development has resulted in an oversupply of parking in many centres. Some of this is due to the introduction of Sunday and evening trading, that has reduced demand for parking at the peak time (currently Saturday between 10am and 1pm).	Review of Parking Literature (City of Perth and City of Stirling, City of Swan, City of Bunbury, City of Wanneroo)
	Short Term	Desire to implement managed parking within the Westfield Carousel site, including paid parking for long stay parkers.	

Domain	Timeframe	Issues / Opportunities	Previous Documentation (If relevant)
	Longer Term	There is a desire to implement paid public parking within the City Centre. It could be expected that there will be a reduced demand for car parking in line with lower levels of driving. There are also an increasing number of people (especially young people) who buy goods online. Many people also research purchasing options online, and this is reducing window shopping in shopping centres. However, there is still a strong social desire to meet people and this often occurs in centres. The introduction of Sunday and evening trading has provided more opportunities for shopping outside of the traditional Saturday lunchtime and Thursday evening peak shopping times. Whilst Saturday (10am to 1pm) remains the peak shopping time, a lower overall percentage of weekly shopping at major centre takes place at this time and this is reducing the demand for parking in Perth, particularly in larger centres. In some eastern states capitals, Sunday lunchtime has become the peak shopping time. Although charging for parking does not occur at most retail and commercial centres in Perth, it is becoming increasingly common in the eastern states. Charging for public parking occurs in a number of centres in Perth including Fremantle, Subiaco, Victoria Park and it has recently been introduced in the Herdsman Business Area in Stirling. In congested centres charging for parking will increasingly be used as part of a package of measures designed to reduce car travel and this will result in lower required levels of parking. Another factor that impacts on the demand for parking is price. In large centres such as central Perth there is a substantial charge for parking, which has in part increased following the introduction of the Perth Parking Policy (PPP). The PPP was introduced in 1999 to manage down the demand for car driving into the city and to help encourage people to travel to the city by other modes. Over the last 15 years, the percentage of people driving to the city has reduced from 50% to under 35%. Whilst employment in the city has grown by 40%, the total number of people driving into the city has declined and travel by public transport has more than doubled.	Canning City Centre Structure Plan Review of Parking Literature (City of Perth and City of Stirling)

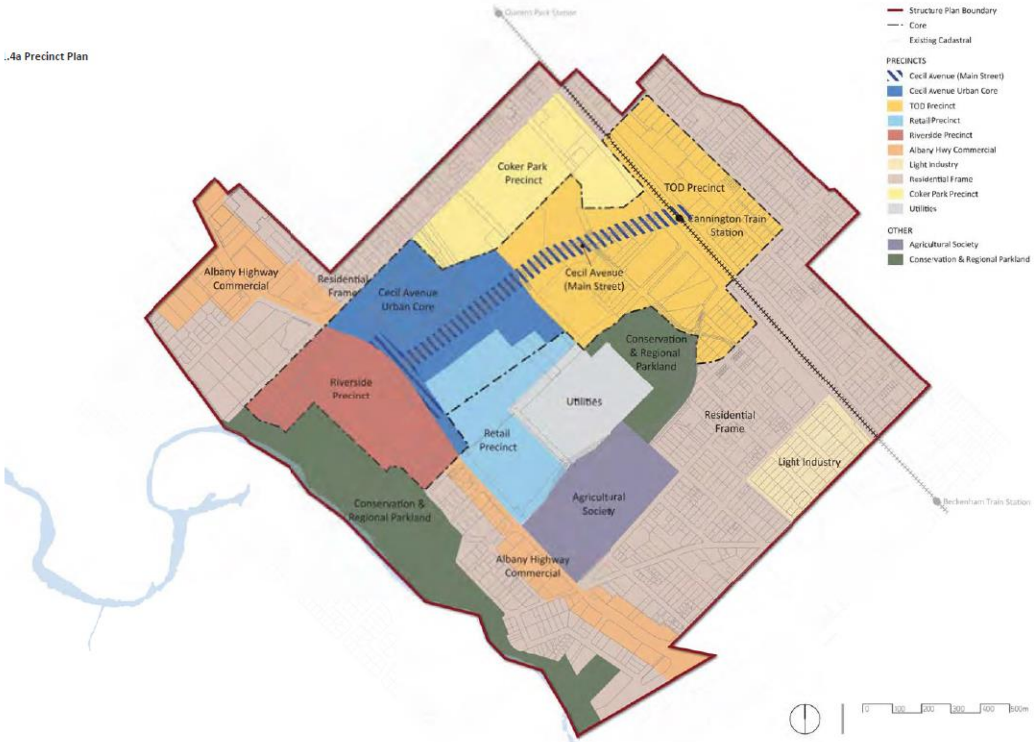
<table>
<tr><th>Domain</th><th>Timeframe</th><th>Issues / Opportunities</th><th>Previous Documentation (If relevant)</th></tr>
<tr><td>Social</td><td>Existing</td><td>Most activities within the Canning City Centre revolve around the Westfield Carousel Shopping Centre and bulky goods retail premises along Albany Highway. Large format retail, bulky goods and car yards are mostly set back from the street and surrounded by car parks – this has a negative impact on the connectivity of uses and pedestrian amenity and achieves little street activation. This currently creates a car-dominated environment and with little high quality urban development making a centre with no place identity and limited diversity and intensity. Land use becomes more diverse away from Albany Highway and on the outer areas of the City Centre. The developments, however, remain isolated at a low building scale and land use intensity. Cannington Leisureplex and a four storey development along Sevenoaks Street are the only significant landmarks in the City Centre.

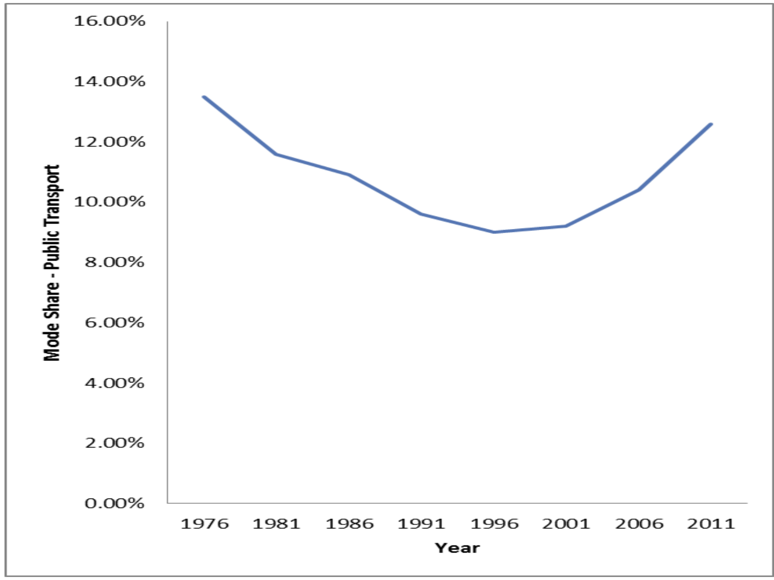
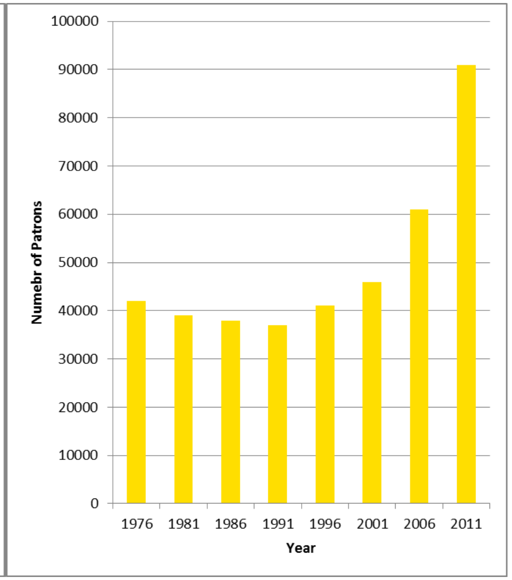
Existing journey to work travel behaviour is shown in the following tables:

<table>
<tr><th></th><th>2011 Population</th><th>2001 Bicycle Mode Share</th><th>2011 Bicycle Mode</th><th>Growth in Mode Share</th></tr>
<tr><td>Inner Councils</td><td>149,966</td><td>2.5%</td><td>3.8%</td><td>50%</td></tr>
<tr><td>Middle Councils</td><td>466,899</td><td>1.1%</td><td>1.4%</td><td>25%</td></tr>
<tr><td>City of Canning</td><td>85,514</td><td>1.3%</td><td>1.8%</td><td>36%</td></tr>
<tr><td>Outer Councils</td><td>285,788</td><td>0.6%</td><td>0.6%</td><td>0%</td></tr>
<tr><td>Edge Councils</td><td>392,737</td><td>0.65%</td><td>0.5%</td><td>(23%)</td></tr>
<tr><td>Perth and Peel Metro Area</td><td>1.83m</td><td>1.1%</td><td>1.3%</td><td>18%</td></tr>
</table>
</td><td>Canning City Centre Structure Plan

Australian Bureau of Statistics</td></tr>
</table>

JACOBS

Domain	Timeframe	Issues / Opportunities	Previous Documentation (If relevant)
	Longer Term	 Currently, there are 1,530 dwellings with an approximate population of 4,600 (which amounts to 4.6 dwl/gross ha). Housing occupies 15% of the total land uses with the vast majority of houses being detached single storey houses. Some low rise mixed use development exists along Cecil Avenue. The density target of 45 dwellings per hectare from current 4.6 dwellings per hectare, whilst the employment quality target is to change from 12% to 16%. Under-utilised and vacant land accounts for about 23% of the City Centre area. 15ha of vacant land (mostly government owned) is estimated to be within 800m of Cannington station. Land designated for transport (car parks, paths, rights of way, railway easements) within the City Centre exceeds the site area (ie. a significant percentage). Land use diversity is low with more than 60% of lots exceeding 1000 sqm.	Canning City Centre Structure Plan
	ity Maps Report 2016		

Domain	Timeframe	Issues / Opportunities	Previous Documentation (If relevant)
	Long Term	The following graphs show the longer term behavioural trends in public transport usage for journey to work with a substantial upturn starting in the late 1990's after years of decline. The mode share of journey to work by public transport has grown by about 40% in the decade to 2011. However, when population growth is factored in, public transport patronage almost doubled over that period.  	ABS Statistics, Bureau of Transport and Regional Economics.

Appendix I. Transport Contribution Methodology

Introduction

As part of the Canning City Centre Movement, Access and Parking Strategy, a number of infrastructure items have been identified as necessary to address the increase in traffic associated with new development within the City Centre. The need for these infrastructure items to provide for the future City Centre is described in this document.

To assist in the fair and equitable distribution of costs associated with the burden of these additional infrastructure needs, the following developer contribution methodology is recommended for use with respect to the City Centre.

As identified in State Planning Policy 3.6 (SPP3.6) – *Development Contributions for Infrastructure,* for this approach to be accepted, it would need to be incorporated into the local planning scheme for the City Centre.

Recommended Methodology

There are a number of methodologies that have been applied around the world; these include:

Method	Description
Trip Demand – Traffic Ratio Methodology	Calculates the developer contribution based on the overall level of traffic growth, both from developments and general background growth, in relation to the existing base traffic levels.
Distance from Infrastructure	Establishes a level of contribution based on the distance between the proposed development and the proposed infrastructure scheme.
Trip Demand – Traffic Growth Methodology	Calculates developer contributions based on the percentage of the development traffic relative to the projected overall growth in the total number of trips on the network, but does not consider the base traffic in the calculation.
Trip Assessment	Calculates the developer contributions based on the level of impact the development has on a road network.
Developer Pays All	In this method, all future development is dependent on the introduction of new infrastructure to accommodate demand associated with those developments.

Jacobs recommends that the City of Canning utilise the Trip Demand - Traffic Growth methodology for the following reasons:

- It is considered the most fair - this method calculates the developer contributions based on the percentage of the development traffic relative to the overall growth in the total number of trips on the network;
- It is relatively simple - It does not consider the base traffic in the calculation. The base traffic does not contribute under this methodology as it has effectively paid for the network it utilises and as it does not need the future infrastructure;
- It is not exposed to variances of assumptions regarding assignment and distribution in the traffic model; and
- This method provides a clear and sound basis with linkages to the local government’s strategic and financial planning processes.

The steps involved in calculating this number are:

1) The developer, as part of their transport assessment, assesses the likely traffic growth (during the PM Peak Hour) due to the proposed development. If this site had active uses in 2014, then this number would be the traffic associated with the new development minus the 2014 traffic generation. If this difference is less than 0, it is assumed to be 0 for the calculation.

2) The percentage contribution is calculated in the following manner:

$$\%\ \text{Contribution} = \frac{\text{Development Traffic}}{\text{City Centre Traffic Growth}}$$

- Where the City Centre Traffic Growth has been calculated from the City Centre Modelling exercise as being 4,950vph.

3) The percentage contribution is then multiplied by the estimated total cost of the infrastructure improvements required in the City Centre. This has been assessed as $20,000,000.00 in 2014.

Timing of Payment

As identified in SPP3.6, developer contributions would become due and payable as outlined in 5.3.3.

The City recognises that any contributions that are received would need to be applied within a reasonable period.