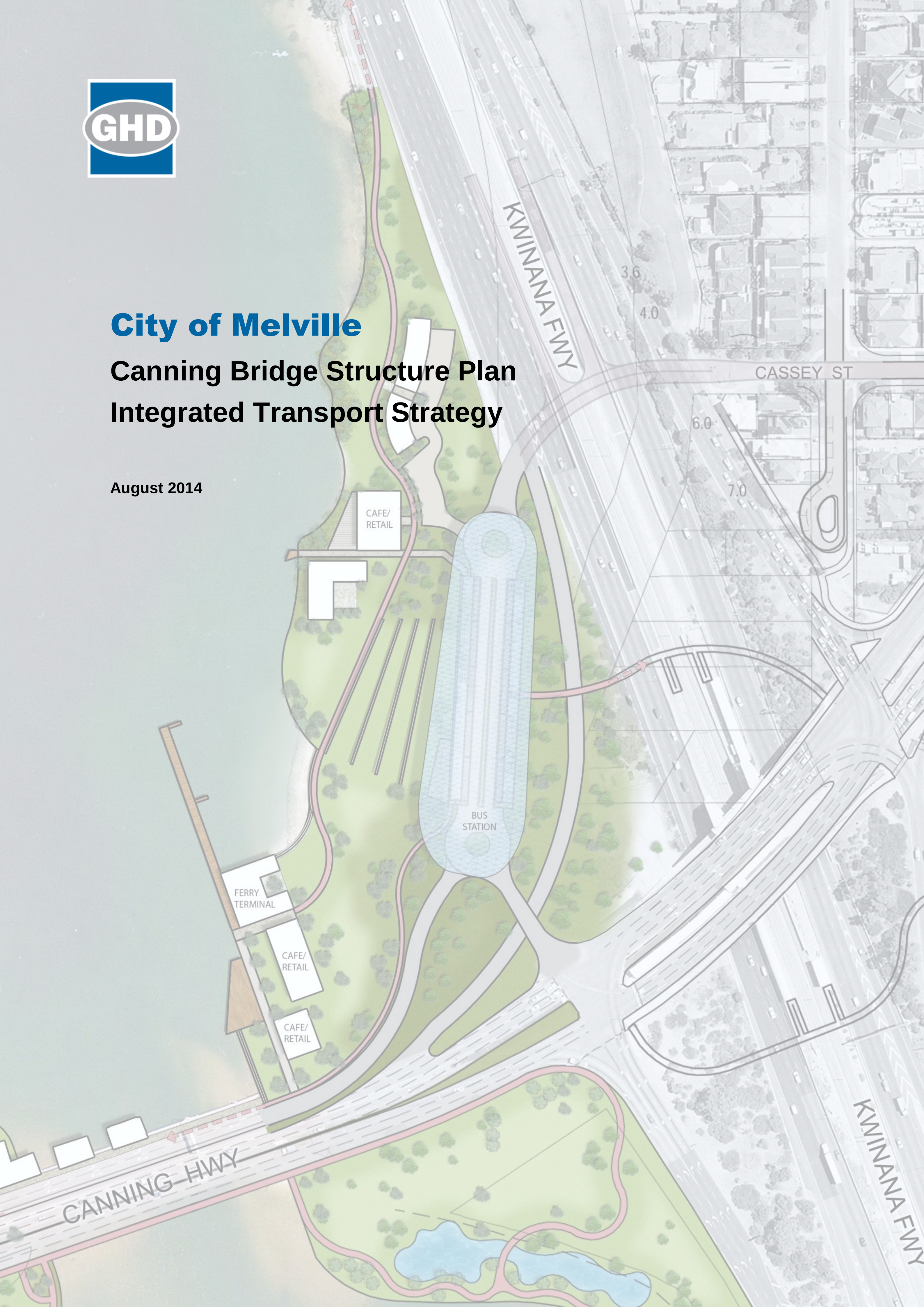
City of Melville

Canning Bridge Structure Plan
Integrated Transport Strategy

August 2014



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1. Introduction

1.1 Overview

The Canning Bridge Structure Plan Integrated Transport Strategy supports and complements the Canning Bridge Structure Plan (CBSP). The broad area covered by the CBSP is shown in Figure 1. This strategy analyses anticipated transport demand as a result of the implementation of the CBSP, compared to "business as usual" (BAU) growth within the study area, as the basis of movement strategies to enable growth in the CBSP area.

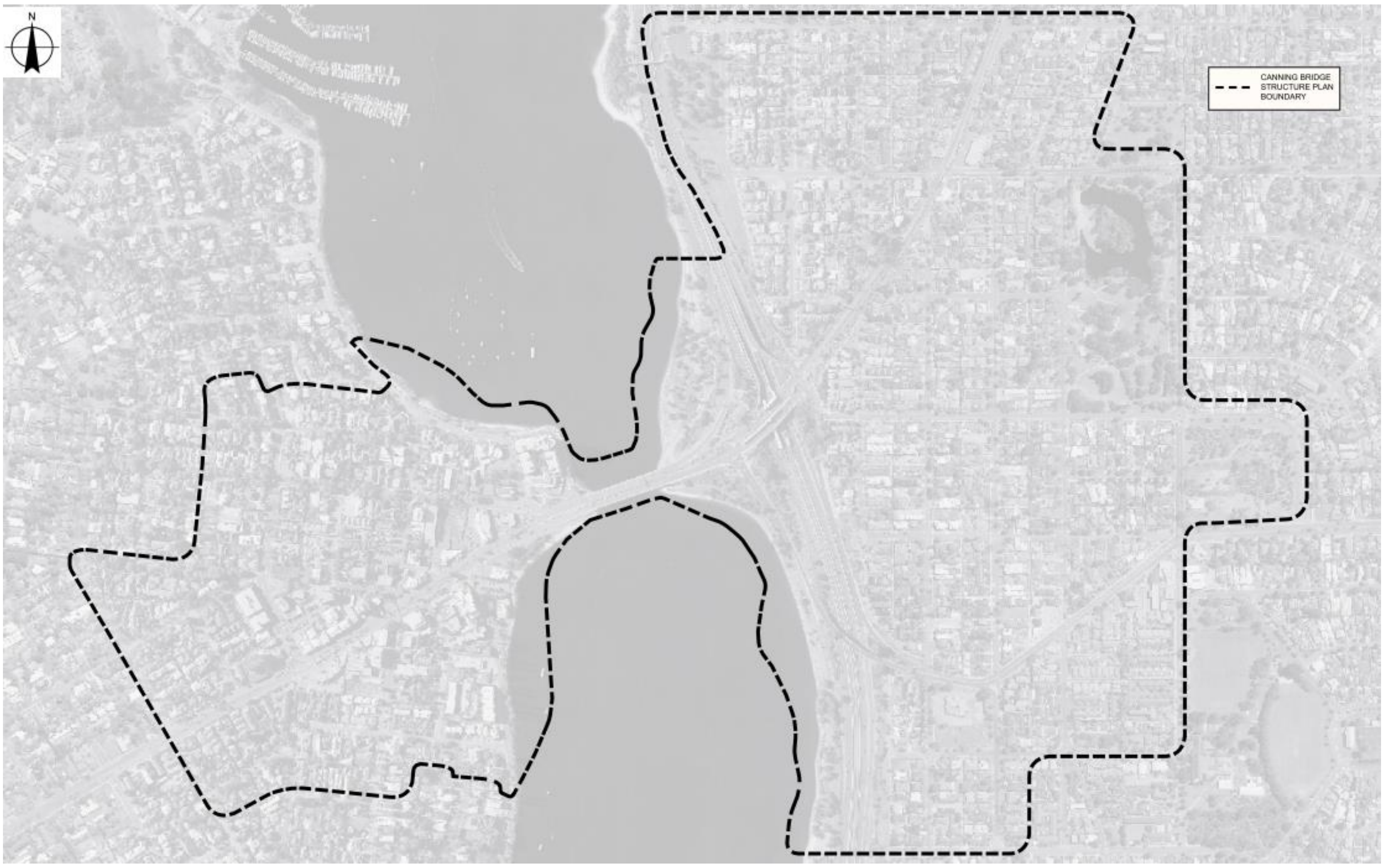

Figure 1 Canning Bridge Structure Plan Area

1.3 Study requirements and content of strategy

An integrated transport strategy draws in analysis and evidence from multiple sources. The transport and planned land uses should be considered in both the local and regional contexts.

The following are discussed:

- The strategic context of the CBSP area
- Regional responses for transport in the area
- Existing transport provision (see Appendix A – Baseline Report)
- Objectives, issues and challenges
- Future transport demand
- Local transport strategy

2. Regional Integrated Movement

2.1 Regional context

2.1.1 Growth of the Perth Metropolitan Region

The Perth Metropolitan Region has been growing consistently over the last 30 years, and currently has a population of 1.6 million people. Growth forecasts for the region anticipate that population will increase to 2.2 million in 2026, and 3.5 million in 2050.

The Perth Metropolitan Region is therefore planning for an additional 600,000 people in the next 12 years, and 1.9 million in the next 35 years. Planning for these extra residents, along with the housing, infrastructure, services and jobs they will require presents a significant challenge to Government.

The regional transport implications of this growth are substantial, potentially generating up to 2 and a half million additional daily car trips to 2031, and over eight million car trips to 2050, on regional roads if significant interventions and changes in urban form and behaviour are not achieved.

Efficient movement and transport in 2031 and 2050 is dependent on appropriate growth scenarios. Regional transport networks – both road and passenger rail - cannot accommodate continued business as usual growth which focusses on outer suburban development with employment focussed within the Perth central business district, requiring over a million people travelling into the City for work each day.

In response to anticipated growth, the State Government has released Directions 2031 and Beyond: Metropolitan Planning Beyond the Horizon (Directions 2031), which seeks to address population growth scenarios and land use patterns for the medium to long term increase of more than half a million people in Perth and Peel by 2031, as well as being prepared to provide for a city of 3.5 million people after 2050. Directions 2031 presents a preferred growth scenario that achieves a balance between greenfield and infill development.

The development of transit oriented developments and activity centres across the Perth Metropolitan Region is essential to enable efficient transport in the future. Benefits to transport and efficient movement include:

– Density in close proximity to public transport assets creating higher demand for public transport that makes investment in improved services cost effective for government;
– Mixed use, including residential and employment development, in an area of amenity provides for employment self-sufficiency, and potential for employment self-containment, reducing the need for people to travel on road or public transport for work;
– Provision of employment in nodes around the Perth Metropolitan Region intersects the number of trips to the Perth Central Business District (CBD), relieving pressure on regional infrastructure in the inner suburbs;
– Provision of density closer to the City with good access to public transport reduces the number of people living in the suburbs with limited public transport, and therefore reduces the number of vehicles on the regional network from the suburbs to the CBD.

2.1.2 Canning Bridge Structure Plan Location

The CBSP area is located approximately 6.3km south of Perth CBD and is strategically located to benefit from the existing good road and rail connections (see Figure 2). Intensification of development in this area will not be without challenges, but there is an opportunity to create an area that takes advantage of the local circumstances to build a local economy with high levels of self-sufficiency.

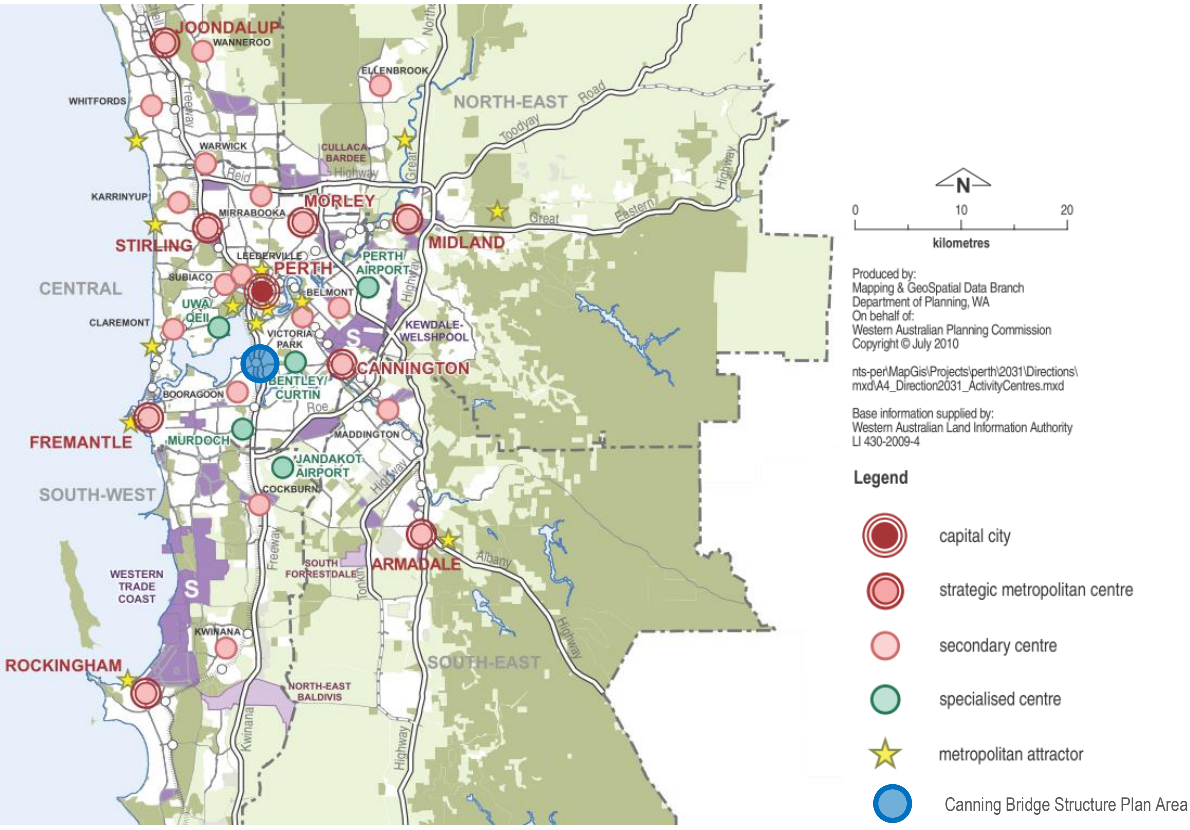

Figure 2 Regional location of the Canning Bridge Structure Plan

The CBSP location in relation to significant regional transport facilities brings several opportunities and challenges. Transport infrastructure within the study area currently serves two separate functions:

1. Regional road transport – connecting Fremantle and Perth's southern suburbs to the Perth CBD via Canning Highway and the Kwinana Freeway;
2. Strategic public transport interchange – with the Canning Bridge Railway Station and multiple bus services crossing the river.

Figure 3 shows indicative regional demands within the CBSP area, based on the Main Roads Regional Operations Model (ROM) and information provided by the Public Transport Authority.

The location of the CBSP area in relation to the existing rail station, bus services, as well as possible light rail and ferry services, creates potential for development of a transit oriented development (TOD). Planning for a TOD will enable the CBSP area to move away from reliance on the regional road network for transport purposes, and instead reduce regional traffic movements by intersecting and displacing vehicle demand generated from urban expansion in the outer suburbs and employment concentration in the Perth CBD, and by increasing access to public transport and other active movements.

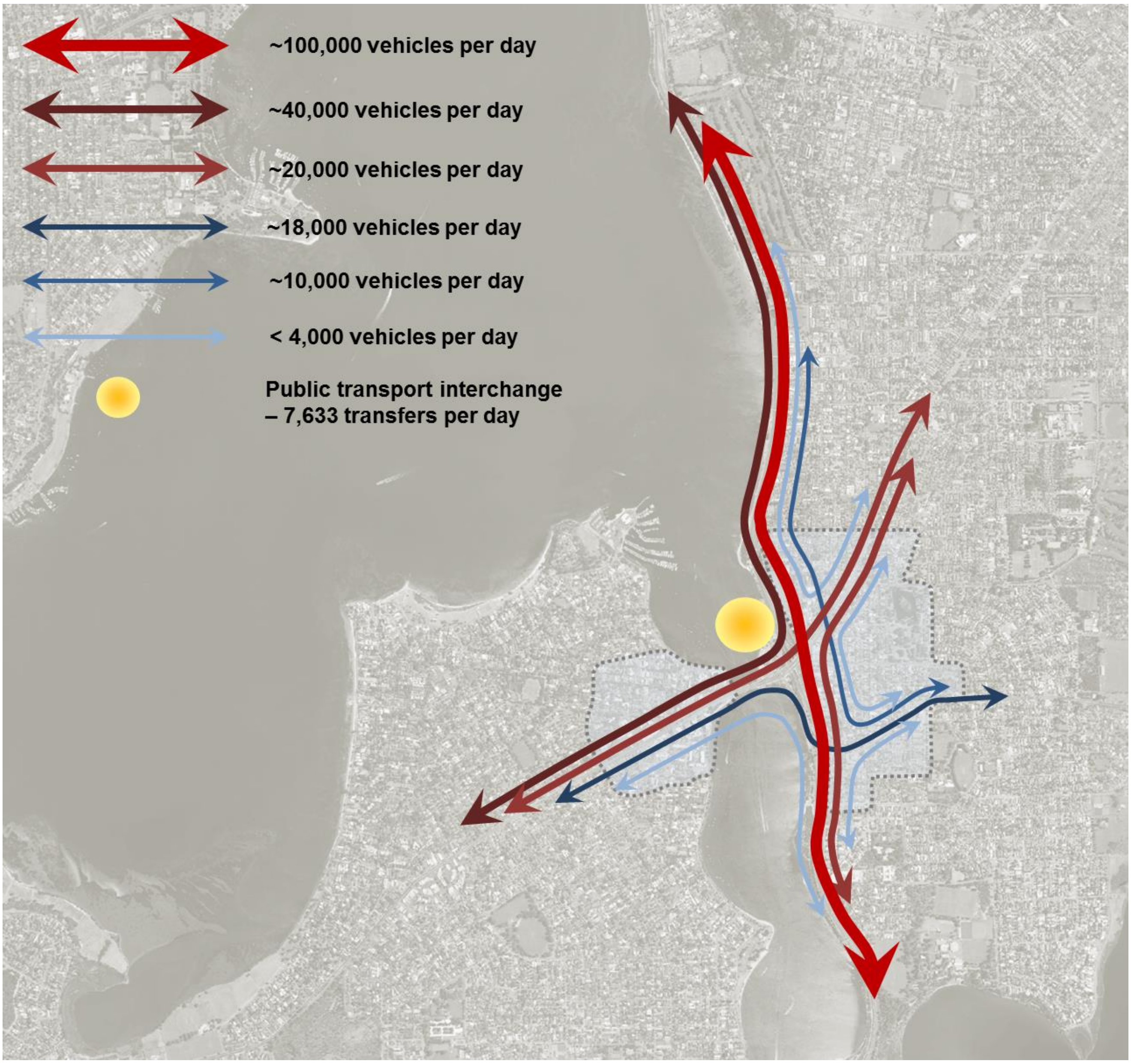

Figure 3 Broad current regional transport flows within the Canning Bridge Structure Plan area

2.2 Regional movement demands

Growth forecasts for the Perth Metropolitan Region will place significantly higher demand on regional transport networks, including regional infrastructure within the CBSP area. These increases are a result of broader metropolitan growth, as well as growth associated with current zoning in the CBSP area, which already allows for significant infill development. This regional growth is anticipated irrespective of implementation of the CBSP. Indicative 2031 traffic flows, based on the Main Roads ROM are shown in Figure 4.

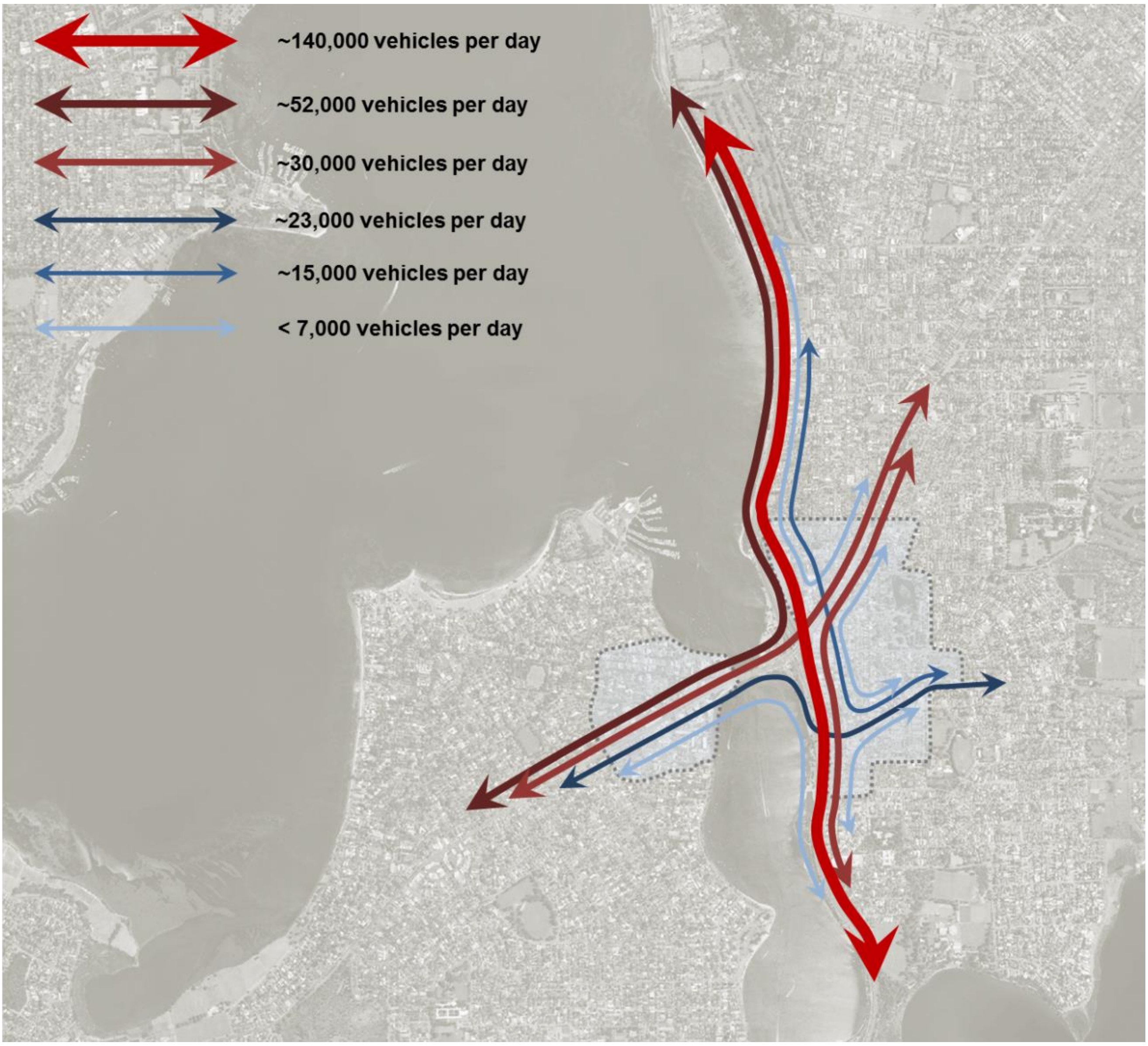

Figure 4 Indicative 2031 regional transport flows within the Canning Bridge Structure Plan area

Regional traffic modelling indicates that the area may experience an increase in regional flows in the order of 36 percent to 2031, irrespective of the implementation of the CBSP, as the current zoning of the area facilitates similar levels of growth to 2031. This assumes there are no major interventions to increase capacity in the regional network. With the implementation of the CBSP and achievement of mode share targets provided in the local transport strategy (i.e. the use of various modes of transport other than only private vehicle transport), growth within the CBSP area will broadly represent only 12 percent of total 2031 indicative regional volumes.

Delivery of the CBSP provides for potential private vehicle trip savings on the regional road network, enabling investment in various interventions to change the way in which people will move through and within the area, compared to currently permissible growth. Section 3.3 of this report presents trip generation (i.e. the estimated number of trips generated by the existing and proposed land uses) and mode share targets for the CBSP area in 2031 and 2050. Achieving these mode share targets within the CBSP area can reduce demand on the future regional road network, as shown in Table 1.

Table 1 Potential daily trips *not taken* in 2051 with the delivery of the CBSP, based on mode share targets for the area

Mode of regional road reduction	Potential, indicative number of trips *not taken*
Increased office space in the CBSP area, intersecting the number of trips between the area and the Perth CBD	19,000
Future population in the CBSP area using public transport rather than the regional road network	45,000
Future population in the CBSP area using active transport (walking or cycling) rather than private vehicles	18,000

2.3 Regional responses

To respond to increased regional demand to 2031 and 2050, the State Government's transport portfolio, including the Department of Transport (DoT), Main Roads (MRWA), and the Public Transport Authority (PTA), is undertaking a range of strategic planning and projects. The implementation of these projects is expected to ease and manage congestion in regional road networks as Perth's population rises. The key focus of the transport portfolio in managing growth is to enable greater access and uptake of public transport. The successful implementation of these projects will assist in managing current regional congestion through the CBSP area.

2.3.1 Public Transport for Perth in 2031 (Draft for Consultation)

Released in draft form in July 2011 by the DoT, Public Transport for Perth 2031 presents a long-term vision for public transport in Perth, with the aim of providing a public transport network that will ultimately support a population of 3.5 million people. This document also identifies required upgrades and new infrastructure to meet the medium-term needs of Perth, providing a detailed list that takes the network through to 2031.

As part of the public transport network expansion, the plan identified the need for an additional 156 railcars and an additional 1000 buses by 2031. In addition, around 29 light railcars would be needed to service the planned 2031 light rail network.

The required capital investments suggested by the plan are divided into two stages: Stage 1 (before 2020) and Stage 2 (before 2031). A number of projects and investment priorities are proposed as part of the plan.

NB: It should be noted that an amended version of this document is due to be released shortly. In addition, several key initiatives of the plan may not be funded in the timeframes indicated in this plan.

Stage 1: Before 2020

The plan calls for light rail to be introduced along three major corridors emanating from the CBD, connecting Curtin University, the University of Western Australia (UWA) and the Mirrabooka Town Centre (via Edith Cowan University's Mt. Lawley campus). The State Government has since announced the MAX Light Rail project, which will include the majority of the planned 2020 light rail network (see Section 2.3.3).

Locally, the plan recognises that the Canning Bridge Station Interchange is at capacity and requires upgrading. As part of this project, priority bus lanes would also be introduced along Canning Highway between Reynolds Road and Henley Street. These upgrades would be needed in the next 5 to 10 years.

Short term improvements to bus services in the Curtin University area include installing bus priority measures along Canning Highway, Henley Street and Jackson Avenue, providing a well-established and highly visible link to Canning Bridge railway station from the university. This will serve as a precursor to the introduction of light rail along this corridor, which will form part of the ultimate light rail network, however no timeframe has been given with regards to its construction.

Stage 2 (before 2031)

Between 2020 and 2031, the plan calls for a rail link to be built between Bayswater and Perth Airport, a project which was later announced by the State Government. Currently, it is unclear when this rail line will be built; however this will provide an alternative transport option to the airport once in operation, potentially reducing some of the regional traffic travelling along Canning Highway and Manning Road.

Also proposed within this timeframe is the establishment of an east-west bus rapid transit corridor between Cannington and Fremantle. This would essentially be an extension of bus priority measures already in place at Fremantle, Murdoch University and along South Street. Although the exact route is yet to be determined, this will provide a fast, legible cross-town link between three railway lines and could potentially take some pressure off of the CBSP area from a regional traffic perspective.

Locally, the plan also calls for bus priority to be provided along Canning Highway between Booragoon and the Causeway. This would presumably be an extension to the bus priority measures introduced in Stage 1. Bus priority has also been raised as a possibility along the Cannington to Curtin University route via Manning Road. It is noted that the provision of bus priority is subject to external factors such as employment and population growth rates, and that these may necessitate the provision of additional measures by 2031.

Ultimate Projects

In the long term, extensions to existing as well as additional public transport services and infrastructure are proposed. These include the extension of the light rail network to the Canning Bridge Station Interchange, a light rail or ferry service between the Canning Bridge Station Interchange and UWA, the provision of a passenger railway line linking Thornlie with Cockburn Central, and additional bus rapid transit infrastructure along Canning Highway and other key east-west routes. As these form part of the ultimate public transport network, no timeframe has been given in the plan for the construction or implementation of these, other than after 2031.

Figure 5 Public Transport for Perth in 2031 (draft) - Ultimate Network

2.3.2 Western Australian Bicycle Network Plan 2014-2031

Developed by the DoT, the Western Australian Bicycle Network Plan 2012-2021 (WABNP) contains a review of the current bicycle network in Perth and selected regional town centres. Based on stakeholder and community feedback, it also sets out objectives for improving and expanding the existing bicycle network through 2021.

The primary intent of the WABNP is to increase the number of cycle trips made for ‘transport purposes’ (such as travelling to school, university, work or the shops). To accomplish this, a number of initiatives and projects are proposed, some of which will require coordination between state and local governments, as well as a number of agencies within the transport portfolio. The WABNP also outlines the need for additional funding arrangements in order to deliver the key recommendations contained in the plan.

Of particular note is the high priority Principal Shared Path (PSP) plan, which outlines a number of proposed improvements to the existing PSP network in Perth. These projects include:

- Widening of the Kwinana Freeway PSP from Narrows Bridge to Mount Henry Bridge at selected locations (work between Narrows Bridge and Thelma Street is scheduled to commence in February 2014 and take approximately three months to complete).
- Construction of the missing Kwinana Freeway PSP sections between Cranford Avenue and South Street.
- Extension of the eastern PSP along Mitchell Freeway from Glendalough Station to Hertha Road, along with the completion of a missing section between Erindale Road and Reid Highway.
- A new PSP from Riversdale Road, Burswood through to Welshpool Road, Welshpool via the Armadale railway line, connecting with existing PSPs at each end.
- A new PSP between Bassendean railway station and Midland, connecting with the existing PSP at Bassendean.
- Completion of two missing PSP sections along the Fremantle railway line between Shenton Park Station and Loch Street.
- An extension of the Fremantle railway line PSP south of Grant Street to Fremantle (full completion of this project is not expected within the WABN’s 10 year timeframe).

In addition to providing and upgrading major cycling infrastructure, other proposed action points from the WABNP include:

- Integrating PSPs and other cycling routes with bus and train stations.
- Building PSPs alongside new and upgraded freeways and major highways.
- Ensuring the inclusion of end-of-trip facilities in new developments where appropriate.
- Incorporate bicycle routes into planning strategies and structure plans.
- Considering cyclists in the design of local council facilities such as roads and parks.
- Promoting and encouraging cycling, including the provision of maps and other relevant information, to the public.

Figure 6 WABNP 2014-2031 Priority Principal Shared Path Projects

2.3.3 Regional transport projects

The State Government has recently announced a number of projects that will increase the capacity of the regional transport network in the shorter term.

MAX Light Rail

Announced in September 2012 by the State Government, the Metro Area Express (MAX) is a 22 km planned light rail network that will connect Mirrabooka, Queen Elizabeth II (QEII) Medical Centre, and Victoria Park Transfer Station with the Perth CBD. The delivery timeline sees procurement for MAX starting from mid-2018, followed by construction commencing in 2019 and completion by late 2022.

Beyond the initial network, possible future extensions may include locations such as Curtin University, the new Perth Stadium in Burswood, UWA and Glendalough and Stirling railway stations.

Forrestfield-Airport Link

The Forrestfield-Airport Link is a planned 8.5 km railway line that will connect Perth Airport and the eastern suburb of Forrestfield with the Midland railway line. Currently, the proposed route starts at Bayswater station, then follows Tonkin Highway before deviating east into the current domestic CBSP area (Terminals 3 and 4). The line then runs underneath the airport runway and continues on to Forrestfield, passing the current international terminal (T1 and T2) along the way. Construction is set to commence in 2016 and be complete by 2020.

2.3.4 Recent projects

Main Roads are working to help alleviate regional congestion in and around Perth through a number of projects. Some of these that are either currently being delivered or have recently been completed include:

- Gateway WA: This $1 billion project will deliver major upgrades to the road network around Perth Airport, including a new free flow system interchange at Leach Highway and Tonkin Highway. Construction works commenced in 2013, with completion expected by 2017.
- Widening of Kwinana Freeway: The section between Leach Highway and Roe Highway was widened to three lanes in each direction in 2012-2013. The southbound carriageway between Roe Highway and Armadale Road is also to be widened to three lanes with construction expected to start from mid-2014.
- Increased capacity in the Graham Farmer Freeway tunnel: In preparation for the permanent closure of Riverside Drive between Barrack and William Streets, a third trafficable lane was provided in the tunnel in 2013.
- Widening of Mitchell Freeway: An additional traffic lane was installed on the section between the Graham Farmer Freeway and Hutton Street in the second half of 2013.
- Traffic Signal Optimisation: Since October 2013, Main Roads has been working to reduce the level of congestion along Canning Highway in Applecross by adjusting the signal timings at key intersections. This ongoing trial is slated for review in early 2014.

3. Local Integrated Movement

3.1 Objectives and Challenges

3.1.1 Objectives of the strategy

The purpose of this ITS is to facilitate the fast and efficient movement of people to, from and within the CBSP area.

In doing so, the physical location of the area in relation to Perth's road network needs to be acknowledged. Kwinana Freeway (approx. 140,000 vpd north of Canning Highway1) and Canning Highway (approx. 68,500 vpd crossing Canning River Bridge[1]) pass through the CBSP area and are both major arterial roads linking Perth's southern and south-western suburbs with the CBD, Fremantle, Midland and other regional centres. The CBSP area currently serves a large proportion of through traffic and, barring any major road network changes elsewhere in Perth, will continue to do so for the foreseeable future. Such changes would require the cooperation of both state and local government agencies.

Therefore, the focus of this transport strategy will be on local initiatives to enable movement in the context of regional congestion. The ultimate aim is for all local trips (i.e. those which both start and finish in the area) to be made via modes of transport other than the private car. A strong emphasis will also be placed on encouraging people who work, live and shop within the CBSP area to travel by using public transport, walking and/or cycling. Managing the demand on the transport network through encouraging the use of local services and employment also forms part of this strategy. The specific actions that are suggested to be taken in order to achieve these are elaborated upon in section 4.

The objectives of the ITS sit within the following headings:

- Economic prosperity
- Environment, liveability and urban form
- Accessibility and mobility
- Health and wellbeing

3.1.2 Economic prosperity

In relation to promoting economic prosperity within the CBSP area, the ITS aims to:

- Maximise business efficiency and reduce costs resulting from delay caused by traffic congestion
- Facilitate access to businesses and retailers so that staff and customers can travel to and from the area more easily by foot, bicycle and by public transport
- Increase pedestrian footfall in the area

This transport strategy seeks to increase opportunities for businesses within the area to engage in the selling and provision of goods and services to both the local and wider community. Facilitating movement around the CBSP area is important in order to encourage new and existing customers to not only visit the area, but stay there as well.

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[1] vpd = vehicles per day. Figures quoted are the Monday-Friday average daily traffic volumes in 2007/08. Source: Main Roads WA Metropolitan Traffic Digest.

Freight and service vehicle access should also be facilitated in an efficient and safe manner, as they support the operation of local businesses. Freight and service vehicle movements should be considered in both the local and long distance contexts.

In addition to providing safe and efficient access, the economic benefits of using modes of travel other than the private car, as well as the increasing costs of road congestion are important and should be considered. In November 2011, the Australian Bicycle Council and Cycling Promotion Fund published a snapshot of the Australian Cycling Economy. Increasing the number of people cycling will help mitigate the costs of inactivity, congestion, pollution and emissions. Figure 7 provides an overview of the identified positive economic impacts.

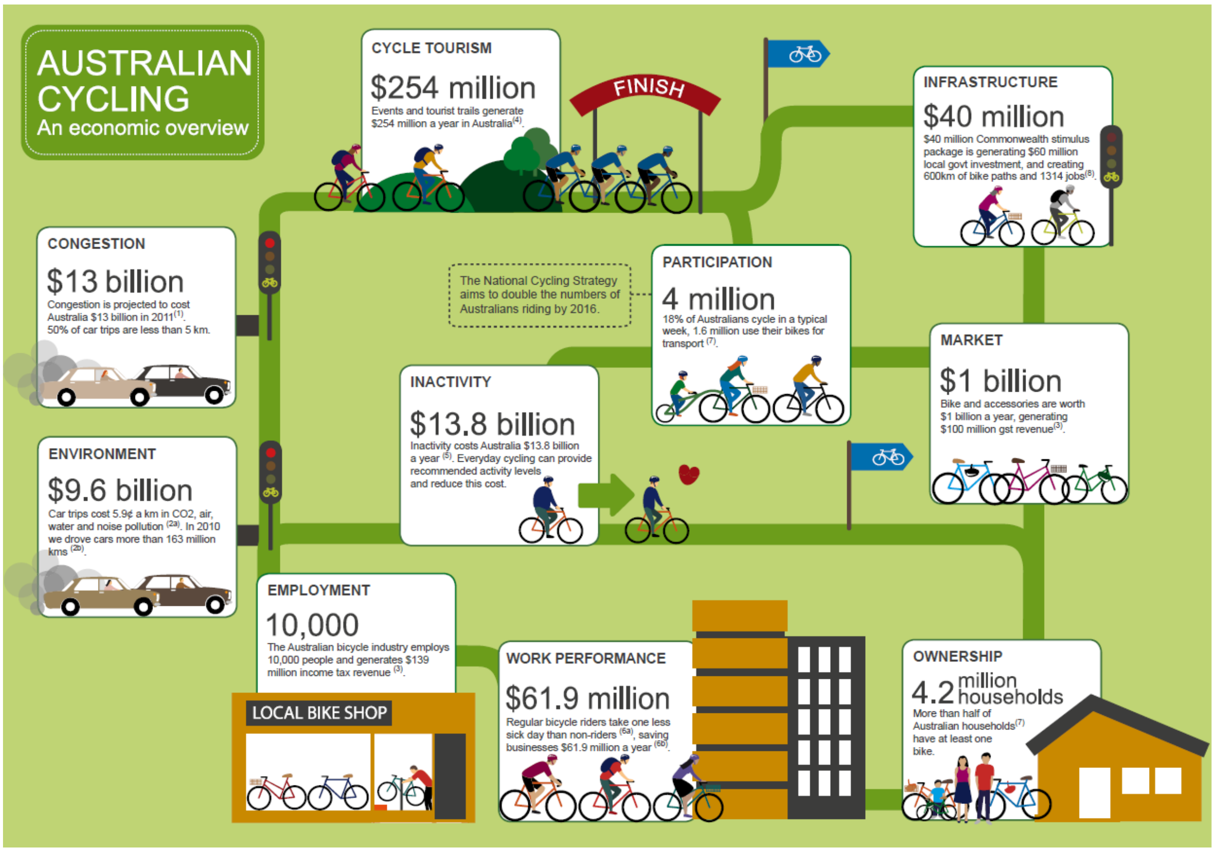


Figure 7 Australian Cycling: An economic overview[2]

3.1.3 Environment, liveability, and urban form

The specific aims of the Transport Strategy with regards to the environment, liveability and urban form are to:

- Reduce emissions resulting from motorised forms of transport
- Provide suitable shade and shelter
- Locate major trip generators close to public transport infrastructure

Greenhouse gases such as those generated by private vehicles are a contributor to global warming; these and other emissions reduce air quality and are detrimental to the environment. The provision of suitable amenities alongside cycling and walking facilities (such as end-of-trip facilities and rest areas) helps encourage their use.

[2] Source: Australian Bicycle Council, Cycling Promotion Fund

Co-locating major trip generators (such as shopping malls, places of education and employment) with major bus routes and/or train stations encourages visitors to consider public transport as a viable alternative to driving.

3.1.4 Accessibility and mobility

With regards to accessibility and mobility around the CBSP area, the ITS aims to:

- Plan future transport strategies around a mode hierarchy that promotes more sustainable forms of transport
- Facilitate access for emergency service vehicles
- Make walking safe, convenient, comfortable, and delightful
- Ensure pedestrian facilities encourage walking to, from and within the CBSP area
- Overcome barriers to movement
- Improve the legibility of transport networks in the CBSP area
- Make cycling safe, convenient, and comfortable for people of all ages and abilities

Enabling residents, customers, employees, and visitors to travel around the area without having to resort to using a car is a key part of this transport strategy. The objectives listed above are expanded upon in more detail below.

Plan future transport strategies around a mode hierarchy that promotes more sustainable forms of transport

The mode hierarchy in the CBSP area places more sustainable forms of transport at the top, with single occupancy car trips at the bottom. This hierarchy should inform all strategy and policy decisions for transport in the CBSP area.

1. Walking
2. Cycling
3. Public transport
4. Taxi, commercial transit, car sharing and clubs
5. Single occupancy car trips

Facilitate access for emergency service vehicles

Emergency service vehicles must be able to reach their destinations in a timely fashion. At the same time efforts to minimise response times should not be at the expense of local area enhancements to street scape and public realm.

Make walking safe, convenient, comfortable, and delightful

People may be averse towards walking all or some of the way to their destination for a number of reasons, including distance, personal safety and lack of available infrastructure. Walking paths within the CBSP area need to accommodate all of these concerns, and should be well designed and maintained in order to provide users with a sense of confidence and security.

Ensure pedestrian facilities encourage walking to, from and within the CBSP area

The CBSP area’s path network needs to facilitate convenient, legible and easy access to its key destinations, such as the train station, commercial, recreational and residential areas. There should also be clear connections to regional walking and cycling routes, such as the Kwinana Freeway PSP, the Perth Bicycle Network, and local shared paths.

Overcome barriers to movement

Barriers to movement can be physical (such as a busy highway preventing pedestrians from easily crossing to the other side), social (such as crime or exposure to intimidation or harassment) or perceived (such as a dark alley, passage through which is not conducive to personal safety). Such impediments are a disincentive to walking or cycling, and should be removed or otherwise properly managed in order to maximise pedestrian mobility.

Improve the legibility of transport networks

Navigating around the CBSP area by car is as easy as reading a road map, and finding out where the train goes is simply a matter of following the railway tracks. However, what may not be as obvious is how one might get around using buses, bikes or just on foot. Promoting the locations and routes of bike paths, walking trails and high-frequency bus services can go a long way towards demonstrating that these non-car transport networks are just as reliable as the road network in terms of facilitating travel to a wide range of destinations.

Make cycling safe, convenient, and comfortable for people of all ages and abilities

Unlike driving on the roads, no licence is needed to ride a bike, which means that anybody who is physically able to cycle can start riding today. Care, however, must be taken to ensure that all cycling facilities provided cater for all ages and levels of ability, from young to old, novices to seasoned professionals.

3.1.5 Health and wellbeing

This transport strategy aims to improve the health and wellbeing of people visiting, living and working in by:

– Encouraging a 'walking culture'

– Facilitating healthy lifestyles

Changing the status quo of driving as being the default (and sometimes only) choice to get somewhere requires a behavioural shift. This can be facilitated through the encouragement of a 'walking culture', whereby people consider walking to their destination first before resorting to other modes of travel. Ideally, the car should only be used as a last resort if one's intended destination is too far away to walk or cycle to, is inaccessible by public transport, or if the purpose of a trip would make walking impractical (such as transporting heavy goods). People who walk more often also find that they are willing to walk for longer distances, thereby increasing the range of trips that can be made without having to drive.

The health benefits of walking over using private vehicles also need to be promoted. In particular, walking doubles as a form of exercise in addition to facilitating travel, meaning that time (and even money) can be saved by not having to go to the gym. People also need to be made aware of the hidden costs of single-occupant car trips in terms of personal health, financial and environmental impacts.

3.2 Current issues and opportunities

A baseline data review for movement within CBSP area is provided within Appendix A. This review outlines the existing transport provision within the CBSP area, along with key problems and opportunities for the future.

The following tables summarise the key issues related to movement in and around The CBSP area. The multitude of problems and opportunities within the CBSP area fall within five key strategic issues:

1. Regional vehicle demand is too high
2. The current transport network does not adequately facilitate multi-modal transport
3. Elements of the current road network do not facilitate safe and efficient vehicle movements;

4. Existing public transport services are unattractive/inadequate and do not actively encourage their use; and

5. Increasing parking demand.

Table 2 Traffic Issues and Opportunities – Issue 1

Strategic Issue 1: Regional vehicle demand is too high			
Implications	**Opportunities/ Options**	**Benefits**	**Disadvantages**
Road network is already congested, resulting in very long queues at intersections and freeway ramps	Widen/build more roads	Increases road capacity	Limited space available to widen roads Expensive Encourages people to drive in and through the CBSP area Defers congestion into the future, does not eliminate it completely
	Encourage mode shift away from private vehicles by promoting alternative transport modes	Walking, cycling and public transport are all more efficient at moving people than private vehicles Increases people capacity of road network	Investment in additional infrastructure/services required to both accommodate and encourage uptake in non-car travel modes Car based culture
	Create work from home and local employment opportunities	Reduces/eliminates the need for travel Frees up existing road network capacity	Not everyone can work from home
Kintail Road being used as rat run	Close intersecton of Canning Beach Road and Canning Hwy	Reduces traffic along Kintail Road Increases use on other underutilised intersections including Reynolds Road, Ardross Street.	Reduces vehicle accessibility for local residents Increases traffic on other section of Canning Highway Increases traffic on other intersections (Sleat Rd, Reynolds Rd, Ardross Street
Canning Highway/Henley Street and Canning Highway/Sleat Road intersections have a relatively high number of reported crashes due to congestion and queuing	Upgrade intersection capacity	Improves traffic flow	Geometric site constraints may limit available upgrade options

Table 3 Traffic Issues and Opportunities – Issue 2

Strategic Issue 2: Current transport network does not adequately facilitate multi-modal transport			
Implications	**Opportunities/ Options**	**Benefits**	**Disadvantages**
Canning Bridge StationI relatively difficult to access via all transit modes; does not facilitate additional public transport mode options	Build new station interchange	Maximises local legibility and visibility of public transport network Separates public transport vehicles from general traffic, improving their reliability Improves amenity for passengers using the Canning Bridge Station Interchange Increases bus capacity at the Canning Bridge Station Interchange Prepares the interchange for future introduction of light rail, ferry Provides operational flexibility for PTA	Expensive Design of station interchange potentially constrained by land owned by the Swan River Trust
	Long term opportunity to utilise Cassey Street as a link from Canning Highway to new interchange	Removes bus traffic from Canning Highway/freeway interchange Improves journey times, transfers for bus passengers	Expensive Height differences would necessitate the acquisition of properties Amenity impacts for existing properties on Cassey Street
Reliability, competitiveness of bus services severely affected by road congestion	Build new bus lanes along Canning Highway	Bus services no longer affected by road congestion Significantly improves bus journey times Bus services are more attractive, visible	Possible land acquisition required Active enforcement required to prevent unauthorised use
	Repurpose existing lanes as bus lanes along Canning Highway	Bus services no longer affected by road congestion Significantly improves bus journey times Bus services are more attractive, visible Road widening not required	Severely restricts vehicle movement Active enforcement required to prevent unauthorised use
	Implement bus priority at key intersections along Canning Highway	Improves bus journey times May be sufficient westbound Low cost to implement	Increases delay for other road users
Pedestrians, cyclists dissuaded from using Canning Highway due to lack of facilities, high traffic volumes	Provide cycle lanes on Canning Hwy	Improved journey times, safety for cyclists	Potential conflict points remain between cyclists and other road users
	Provide suitable crossing facilities across Canning Highway	Increases pedestrian permeability and safety Encourages movement on foot Complements public transport services and improves their attractiveness	Traffic volumes may necessitate grade separation of pedestrian movements, which can be expensive

Strategic Issue 2: Current transport network does not adequately facilitate multi-modal transport			
Implications	**Opportunities/ Options**	**Benefits**	**Disadvantages**
	Improve access to bus stops (whether by moving existing stops or adding in new ones)	Makes buses more accessible, attractive as walking distance is lower Encourages mode shift from cars to buses	May result in unnecessarily long bus routes and travel times
Safety is compromised around the CBSP area due to lack of kiss 'n' ride facility	Implement formal kiss 'n' ride facility at station	Relieves local streets of traffic associated with informal kiss 'n' ride Reinforces Canning Bridge Station Interchange as a public transit hub	May encourage additional car trips to and from the interchange

Table 4 Traffic Issues and Opportunities – Issue 3

Strategic Issue 3: Elements of the current road network do not facilitate safe and efficient vehicle movement			
Implications	**Opportunities/ Options**	**Benefits**	**Disadvantages**
Canning River Bridge is the only river crossing in the area and therefore represents a bottleneck in the local road network	Provide alternative road bridge nearby Canning River Bridge	Relieves congestion on Canning River Bridge Increases efficiency of traffic movement	Expensive Land acquisition required May encourage further car usage
Southern span of Canning River Bridge requires replacement by 2037	Build third span, potentially reserved for public transport vehicles, walking, cycling	Gives public transport vehicles their own right of way, maximising service capacity Increases visibility of public transport services Maximises safety for pedestrians and cyclists	Expensive Heritage listing of Canning River Bridge may limit scope of improvement works
Southbound freeway traffic entering from Manning Road must do so via the Canning Highway freeway intersections	Build Freeway south on-ramp at Manning Road	Relieves Canning Highway intersections of some traffic Reduces travel time for vehicles making this movement	Land acquisition required
New developments along Canning Beach Road and Kintail Road on opposite sides of the road "form" mini intersections without control.	Close Canning Beach Road/Canning Highway intersection	Relieves local road network of traffic, improving safety Potentially improves traffic flow along Canning Highway	Limits accessibility to these developments from Canning Highway Increases traffic along Sleat Road

Table 5 Traffic Issues and Opportunities – Issue 4

Strategic Issue 4: Existing public transport services are unattractive/inadequate and do not actively encourage their use			
Implications	**Opportunities/ Options**	**Benefits**	**Disadvantages**
Insufficient capacity on trains during peak hour	Provide more train services	Makes public transport more attractive in terms of frequency, reliability and comfort	Cost involved with extra services Additional train sets required?
Inadequate feeder bus services in areas away from Canning Highway do not encourage people to travel using public transport (particularly around Manning Road and within Mt Pleasant)	Increase frequency of existing services	Improves their attractiveness and accessibility May entice more people to use the bus	Requires extra service kilometres
	Provide new services/routes	Improves public transport attractiveness and accessibility May entice more people to use the bus	Requires extra service kilometres

Table 6 Traffic Issues and Opportunities – Issue 5

Strategic Issue 5: Increasing parking demand			
Implications	**Opportunities/ Options**	**Benefits**	**Disadvantages**
Demand for commuter and long term parking results in overflow of parked vehicles in residential areas nearby to the station	Build a Park 'n' ride facility	Provides additional parking bays for commuters May encourage additional public transport (rail) patronage	Expensive Requires additional land Significantly increases vehicle trips to and from the station Undermines the ongoing viability of bus feeder services
	Control long term and commuter parking by implementing time limited parking	Eliminates all-day park 'n' ride commuter parking	Requires active enforcement to ensure compliance
Parking demand will increase if scale of development increases	Provide additional parking (e.g. multi storey parking lots)	Relieves local roads of parking problems	Limited space available to provide additional parking Expensive (particularly if parking structures are built) Inefficient use of land Doesn't encourage walking, cycling or use of public transport
	Limit the amount of parking provided (e.g. maximum parking ratios, hard caps on the number of bays provided, etc.)	Demonstrates that travel to and from the CBSP area should be via modes of travel other than private car	May result in worsening of existing parking issues
	Consider using cash-in-lieu funds to promote trip reducing measures (including end-of-trip facilities, cycle parking and public transport investments)	Can assist in reducing the need for car travel (and subsequently parking bays)	May divert funds from directly addressing existing parking issues

3.3 Future Transport Demand

3.3.1 Overview

The estimated number of trips generated by the proposed development in the CBSP has been carefully considered to understand the future transport demand in the CBSP area. These trip generation calculations have been undertaken based on the current zoning/land use in the area (in the BAU case), and proposed development described by the CBSP. Discussion is also provided on potential mode share targets (i.e. how many trips are targeted to occur in each mode of transport) for the study area.

Trip comparisons are shown in graphs in the following sections.

3.3.2 Mode Share Targets

As a useful basis for the mode share targets, it is important to understand the current status quo. Based on 2011 mode share proportions for the study area taken from the recent Australian Bureau of Statistics (ABS) census data the following existing mode shares (Table 7) are indicated for all trips generated (both peak and non-peak):

Table 7 Current mode splits

Mode	Current split
Car driver/car passenger	65.44%
Train, light rail, BRT, bus, ferry	13.19%
Walking and cycling	4.51% (comprised of 2.45% and 2.06% respectively)
Other including telework (work from home)/shop (internet retail) taxi, motorbike etc	16.85% (including 14.12% telework/shop, 0.29% taxi, 0.29% motorbike)

Source: ABS

Mode share targets are not set in Directions 2031 or the Public Transport Plan for Perth; rather these documents focus on identifying and encouraging current trends for an increase in forms of transport other than car driver/car passenger movements. The Public Transport Plan for Perth and Directions 2031 both promote a number of aspiration mode share possibilities based on current trends of mode shift, as shown in the Table 8.

Table 8 Trends for Overall mode splits to 2031 (Directions 2031)

Mode	% split 2031
Car driver/car passenger	50%
Train, light rail, BRT, bus, ferry	12.5%
Walking, cycling	19%
Other including telework (work from home)/ shop (internet retail) taxi, motorbike etc	(18.5%)

(%) Not stated.

These rates are similar to earlier targets set in the Metropolitan Transport Strategy for the whole of the Perth Metropolitan area as shown in Table 9:

Table 9 Metropolitan Transport Strategy Targets for mode splits to 2029

Mode	% split 2031
Car driver/car passenger	57.5%
Train, light rail, BRT, bus, ferry	12.5%
Walking, cycling	24%
Telework (work from home)/ shop (internet retail) etc	4%
Taxi/motorbike	2%

The targets proposed in current day strategies such as the Public Transport Plan for Perth and Directions 2031, as well as the older Metropolitan Transport Strategy, are based on overall outcomes for Metropolitan Perth. This suggests that for activity centres, higher mode splits than those promoted is quite reasonable; and in fact may be necessary to achieve the targets.

Already there is evidence that implementing some of the strategies outlined in the Public Transport Plan will lead to increased public transport usage. The recent introduction of the high-frequency 950 bus service from Morley to UWA has resulted in a 24% increase in overall patronage for the bus routes it directly replaced almost four months ago, with a 49% increase in patronage being registered on Sundays (source: PTA website). This shows that people are prepared to use high quality alternative transport services – as long as they are provided.

In addition, the promotion and marketing of route 950 (dubbed the "Superbus") as Perth's most frequent bus service is clearly paying dividends, as people who might not otherwise use public transport are using this service; evidenced by the marked growth in passenger numbers over a short period of time. This demonstrates that improving public transport service legibility can help increase the mode share of public transport.

Mode share targets for Stirling City Centre (Table 10), as a similar activity centre being planned in Perth's inner suburbs, provide a benchmark for future targets in The CBSP area.

Table 10 Mode split targets for Stirling City Centre

Mode	% split in 2031
Car Driver/Car Passenger	50%
Train, light rail, BRT, Bus, Ferry	18%
Walking, cycling	32%
Telework (work from home)/ shop (internet retail) etc	N/A
Taxi/motorbike	N/A

The CBSP area provides greater opportunity to meet these targets than Stirling, due to some different characteristics, including:

– Canning Bridge Station Interchange is within one zone to the City, therefore public transport is a more affordable and attractive choice;

– The CBSP area is an existing office destination, with existing demand for office expansion creating greater immediate and long term opportunity for local employment.

– The CBSP area has existing examples of high density residential development in proximity to public transport

– The CBSP area does not provide park and ride facilities, therefore there is existing motivation for public transport and active transport modes to access the station, consistent with TOD principles, without large parking areas creating additional barriers to the station.

It should be noted that the CBSP area in particular is affected heavily by regional traffic that is passing through the precinct. As a result, it is even more important for trips that are local to the study area to be made via non-car modes of travel, in lieu of a more regional mode shift to public transport, cycling and walking.

3.3.3 Canning Bridge Structure Plan Mode Share Targets

In view of the nature of the planned development, the proximity to the public transport interchange and potential for future services, realistic mode share targets for 2031 and 2050 are suggested for the CBSP area as follows:

Table 11 Target mode splits for the Canning Bridge Structure Plan area

Mode	Current zoning (BAU)	CBSP to 2031	CBSP to 2050
Car Driver/Car Passenger	65.44%	50%	35%
Train, light rail, BRT, Bus, Ferry	13.19%	20%	25%
Walking, cycling	4.51%	7%	12%
Telework (work from home)/ shop (internet retail) etc	16.56%	20%	25%
Taxi/motorbike	0.29%	3%	3%

3.3.4 Comparison of Person Trips and Transport Demand

Transport modelling usually comprises a consideration of number of trips taken multiplied by the typical demand for the mode type being assessed. For example, if each household generated 10 trips per day and there were 100 households, this would equate to 1000 trips taken for a particular area. If 50% of those trips were taken by private cars this would equate to 500 vehicles per day on the roads within that given area. This is a simplistic description, but is a dimple basis upon which to understand the following analysis.

The total number of people trips generated (trips taken) by the current approved land use to 2051 and the CBSP land use respectively are compared in Figure 8.

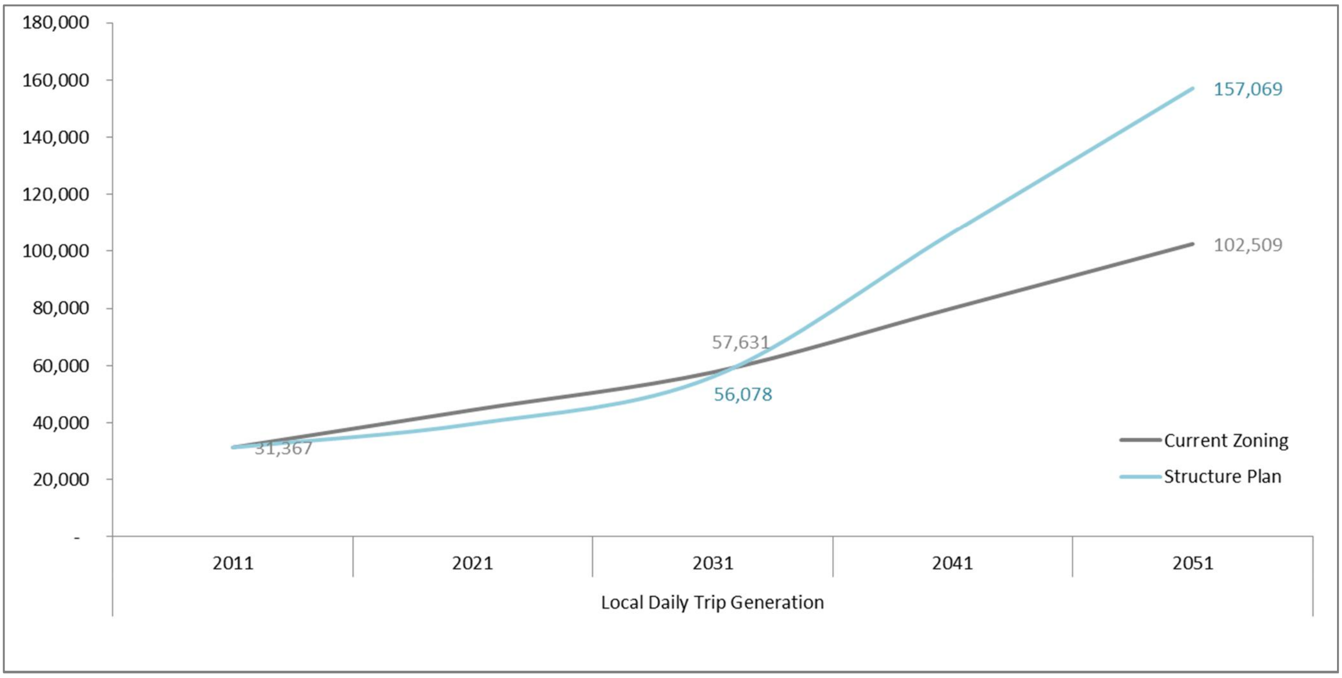


Figure 8 Total trip generation – current zoning potential vs implementation of the Canning Bridge Structure Plan

The graph indicates very similar trip generation to 2031 based on current zoning and that proposed in the CBSP. However, trip generation curves steeply upward beyond 2031 due to greater residential and employment based population, resulting in some 50% more trips being taken.

In order to best understand how the target mode share for the CBSP area would affect traffic generation in terms of private vehicle demand between 2011 and 2051, the total trip generation(Figure 8) is multiplied by the target mode demand for private vehicles (35% - Table 11). The resultant trips generated are compared with current BAU projections (Figure 9).

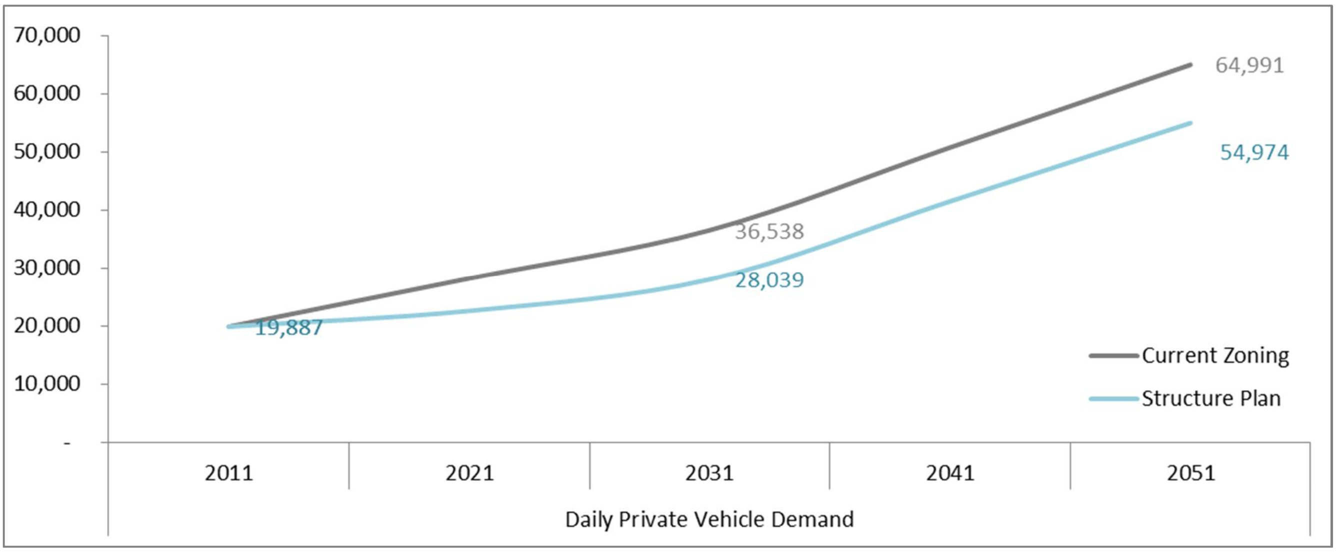


Figure 9 Private vehicle demand – current zoning potential vs implementation of Canning Bridge Structure Plan

The graph indicates a slight reduction in private vehicle trip demand between the CBSP and current zoning (BAU) growth to 2051, if mode share targets in the CBSP area can be achieved through implementation of the CBSP and the ITS.

Figure 10 indicates the mode share for the current zoning (BAU) and the CBSP growth and shows the order of magnitude of increases in public transport, walking/cycling and working from home through implementation of the CBSP and integrated transport strategy.

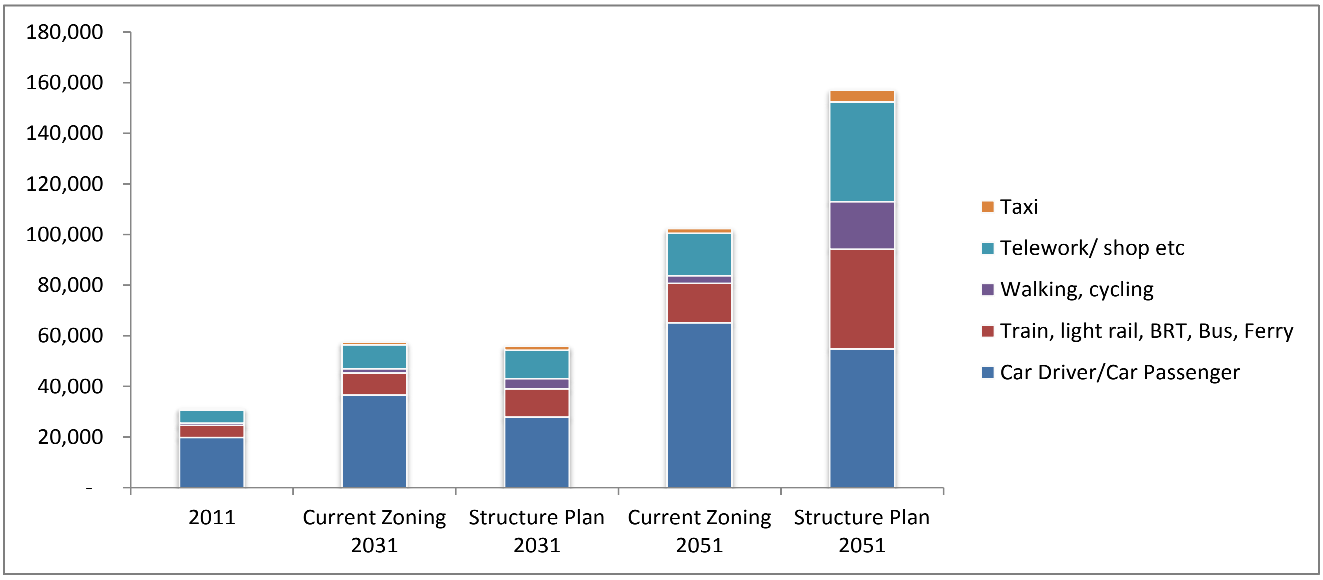


Figure 10 Multi-modal demand – current zoning potential vs implementation of Canning Bridge Structure Plan

Of note is that over 50% more people trips will be generated in 2051 if the CBSP is implemented compared to the current zoning scenario; however the number of car driver/car passenger trips is about the same. The ultimate goal of this transport strategy is for all local trips to be made via non-car modes, leaving only regional and through traffic as the contributors to car trips within the CBSP area. Since this strategy does not propose any direct actions to address regional traffic, it can be expected that the volume of regional car driver/car passenger trips will remain roughly the same regardless of whether the CBSP is implemented. The only difference between the two scenarios is the level of build out; the extra trips generated by the CBSPs increased scale are to be accommodated via non-car transit modes as seen in Figure 10.

This has a number of implications:

– The growth rate of local (and therefore total) road traffic can be managed through proper implementation of the ITS; and

– The total volume of vehicular traffic that can be accommodated within the CBSP area is physically constrained by the available road space. The number of car trips cannot increase if there is no road capacity left to absorb additional traffic;

– Therefore, if the number of people trips continues to grow as envisaged under the CBSP, people will inevitably have to travel using other (non-car) modes of transport. Subsequently, there will be a redistribution in mode share across the network as people try to find alternative methods of travel (such as by using walking, cycling or using public transport) or eliminate the need to travel entirely (such as by visiting another destination closer to their point of origin, teleworking/shopping, etc);

– Hence, to accommodate this increased demand for non-car travel, a corresponding increase in the provision of related services and infrastructure (such as more buses, trains, footpaths, cycling facilities, and so forth) is required.

As the focus of this ITS is on moving people, it is important to note that the efficiency of the road network can actually be increased in terms of moving people via a mode shift from cars to public transport. Currently, some 500 bus services pass through the Melville side of The CBSP area daily. Assuming each bus carries 60 people, this represents a capacity of 30,000 people per day, which is the equivalent of three lanes of traffic. The people capacity of the transport network has the potential to increase even further by introducing additional services and/or increasing existing service frequencies, all without having to widen existing or provide new roads.

The longer term mode share targets for 2051 are therefore likely to be very different to those achieved currently, with significant reductions in the proportion of private vehicle trips made. The ITS will outline the actions needing to be taken in order to address these challenges and meet the proposed mode share targets.

4. Integrated Transport Strategy

4.1 Overview

This transport strategy uses a range of techniques, technologies, and planning interventions to achieve the necessary mode shift and reduction in movement demands to support the CBSP. Figure 11 indicates the relationship between the various interventions and Table 12 provides a summary of these movement interventions, showing how each strategy contributes to demand management, behaviour change, and efficient network operations necessary to enable movement within the CBSP area.

– Demand management involves taking active measures to reduce the number of trips generated each day, or in other words, reducing the need for people to travel.

– Mode shift describes the phenomenon by which people change their main method of travel from one mode to another (e.g. car to walking)

– Peak spreading is the redistribution of trips during the peak period to other times of the day. This improves the utilisation of the road by reducing the maximum level of demand on the road network, thereby resulting in less congestion.

– Improved network operations involve finding and implementing measures designed to make better use of the existing road infrastructure, thereby increasing its overall vehicle capacity.

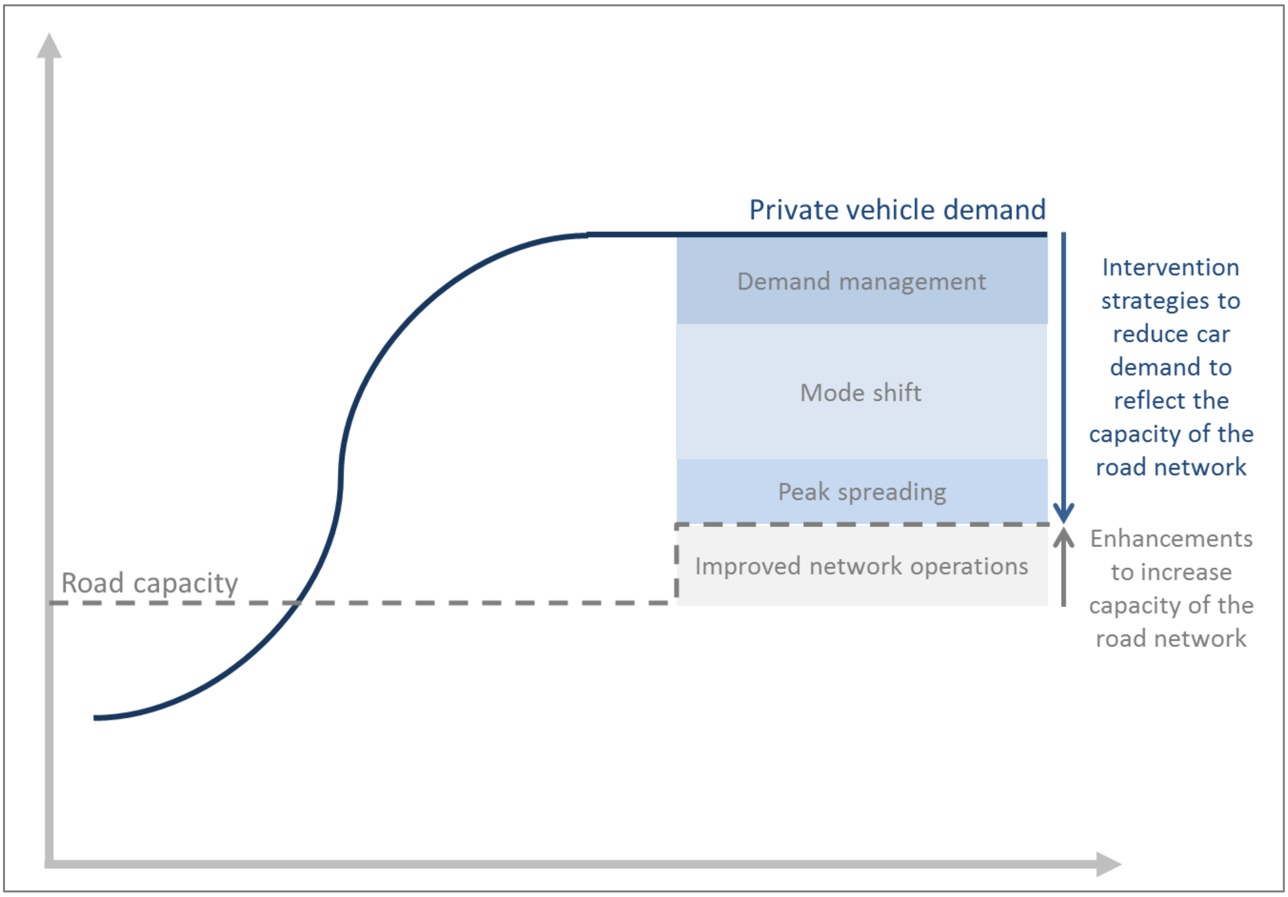


Figure 11 Use of intervention strategies to match demand to capacity

Table 12 Strategic Responses and Intervention Strategies

Strategic Response	Intervention	Benefit	Outcome
Land use plan based on transit oriented design	Local jobs and services	Removes the need to travel long distances People can walk or cycle to and from work locally	Demand management
	Density in proximity to strategic public transport	Increased population is able to effectively make use of public transport for commuting	Mode shift
Technology and behaviour change	Working from home	Removes the need to travel to work	Demand management
	Modified working hours (shift work, staggered hours to avoid traditional 9-to-5)	Changes the time of travel to avoid current peaks	Peak spreading
Greater links to strategic public transport	Public transport hub supporting water systems, train station, bus station	Provides a centralised intermodal transfer point between services	Mode shift
	Rapid transit corridors providing light-rail and/or high-frequency bus services	Improves reliability and legibility of public transport network	Mode shift
Promote cycling opportunities.	Provide on road facilities and path connections	Walk or cycle to and from work locally	Mode shift
Promote walking opportunities.	Provide pedestrian facilities including path connectivity and path connections	Walk to and from work and public transport facilities	Mode shift
Car Share systems	Encourage development of car share systems	Reduces travel demand, vehicle movements	Demand management
Local employment opportunities	Provide for greater employment within the CBSP area	Reduces travel demand Reduces the number of vehicle movements in the CBSP area	Demand management
Adopt principles in the City of Melville Activity Centre Parking Management and Strategy	Address the ongoing supply and management challenges that are consistent with the new approach to parking strategy	Influences the decisions people make when travelling Reduces travel demand, vehicle movements	Demand management, improved network operations

4.2 Land use plan based on transit oriented development

The provision of appropriate land uses associated with strategic public and active transport (cycling and walking) infrastructure is the key strategy to reduce trip generation and achieve the mode shift necessary to relieve road based movement demand within the CBSP area.

The land use plan proposed by the CBSP (Figure 12) identifies high-density residential and employment generating land uses in close proximity to the Canning Bridge Station Interchange, and along Canning Highway which supports high-frequency bus services, potential future light rail services, and rapid public transport in the form of either light rail or dedicated bus services. Consistent with transit oriented development principles, the CBSP provides for the reduction of vehicle-based movements within the CBSP area by providing opportunities to live and work locally, and providing greater opportunities to live in close proximity to strategic and regular public transport services.

The CBSP also provides for greater employment within the CBSP area; this provides potential to reduce the number of regional vehicle movements through the CBSP area by decentralising employment from the Perth Central business district.

The anticipated reduction in trip generation and achievable mode shift achievable by this land use plan is described in Section 3.3.3. These modified movement demands are supported by the following mode specific strategies. The action plans provide a road hierarchy that supports mode shift, and a parking action plan for the CBSP area. These strategies provide detailed action plans to increase efficiency of pedestrian, cycle, and public transport movements within the road hierarchy. Table 13 illustrates possible trips not taken as a result of the implementation of the CBSP and ITS.

Figure 12 Canning Bridge Structure Plan

Table 13 Potential daily trips *not taken* with the delivery of the CBSP, based on mode share targets for the area 2051

Mode of regional road reduction	Number of trips
Increased office space in the CBSP area, intersecting the number of trips between the CBSP area and the Perth CBD	19,053
Future population in the CBSP area using public transport rather than the regional road network	45,443
Future population in the CBSP area using active transport (walking or cycling) rather than private vehicles	18,177

A further advantage is that the CBSP provides a focus for significant office development in the Applecross/ Mount Pleasant area and as a result will encourage peak hour movement in the opposite direction to current behaviour, thereby making more effective use of the network.

4.3 Local movement hierarchy

To support the land use plan for the CBSP area, a local movement hierarchy has been prepared. The hierarchy provides the overall approach to transport planning in the CBSP area, along with recommended spatial corridors to support all movement modes, including active and public transport movements. The local movement hierarchy provides the spatial foundation for all other transport action plans and interventions in this ITS.

The proposed movement hierarchy acknowledges the significant regional traffic congestion that occurs within the CBSP area, and focuses on alternative movement modes to enable connectivity in the context of that regional congestion. The local movement hierarchy facilitates local movements within and outside of the CBSP area in two ways:

- Using strategic public transport and cycling infrastructure to link the CBSP area to its surrounding regional context; and
- Promoting pedestrian and cycle movements and local public transport to link the various areas within the CBSP area to each other and to strategic public transport infrastructure.

This hierarchy of movement is shown in Figure 13.

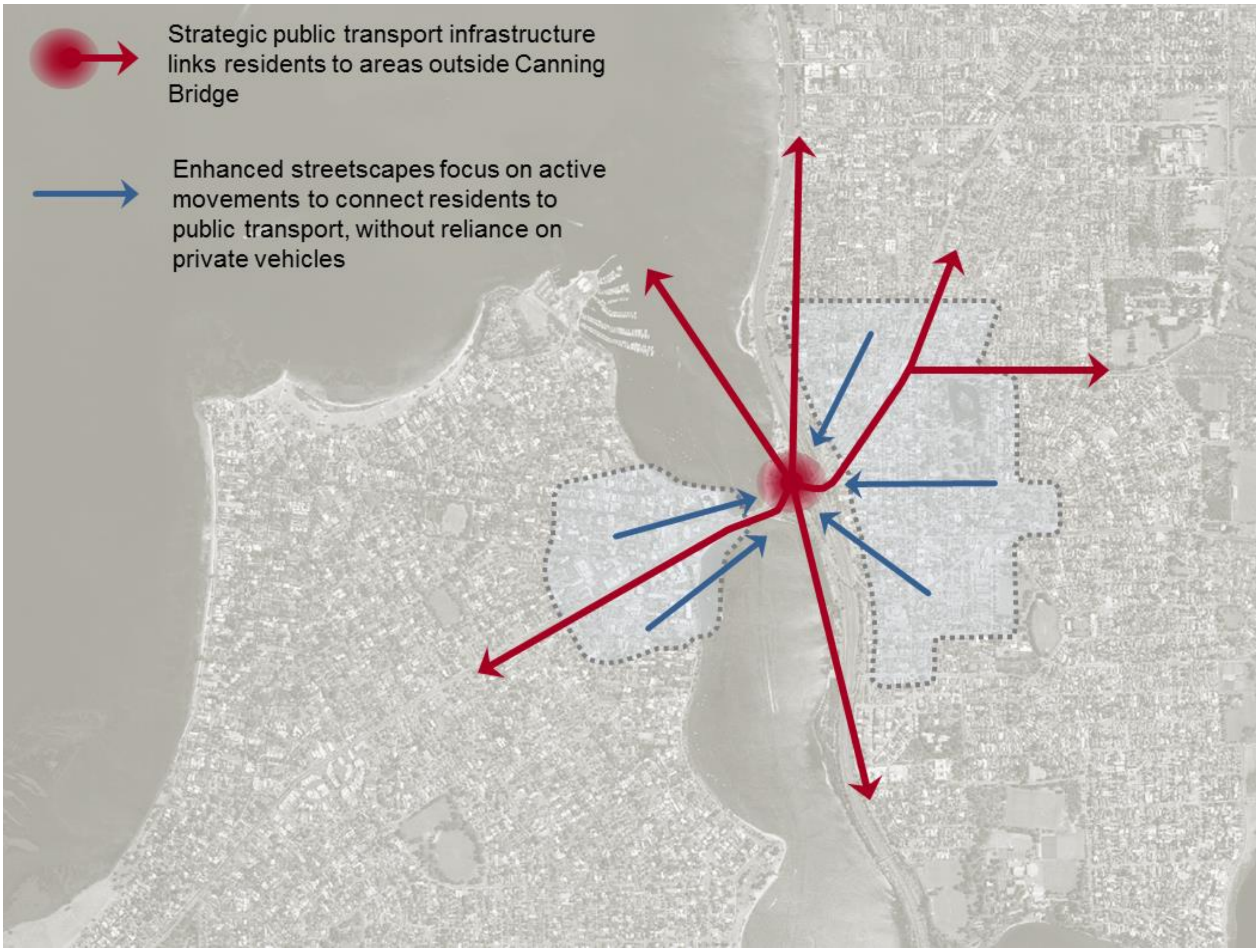


Figure 13 Proposed hierarchy of movement in the Canning Bridge Structure Plan area

The hierarchy of movement described in Figure 13 is further elaborated in the local road hierarchy shown in Figure 14. In summary, the local road hierarchy shows the Canning Bridge Station Interchange, as a strategic public transport hub, and Canning Highway as the focus for movement. These strategic public transport assets are connected into the CBSP area through "public transport boulevards".

"Local connectors" and "local access ways" prioritise pedestrian and cycle movements to enable residents and workers within the CBSP area to access local services and employment and link into public transport. Prioritised local cycle movements connect into strategic PSPs along the river foreshore. The detail of this movement hierarchy is shown through key features and typical midblock cross sections at each of the movement corridor types from Figure 15 to Figure 22.

It is noted, that while the Movement Network Plan identifies Cassey Street as a Public Transport Boulevard, the Department of Transport has analysed a number of routes for a transit connection between the CBSP area and Curtin University. The final route choice has not been made and further work is being undertaken to finalise this link. The Movement Network Plan thus identifies Henley Street as a potential alternative

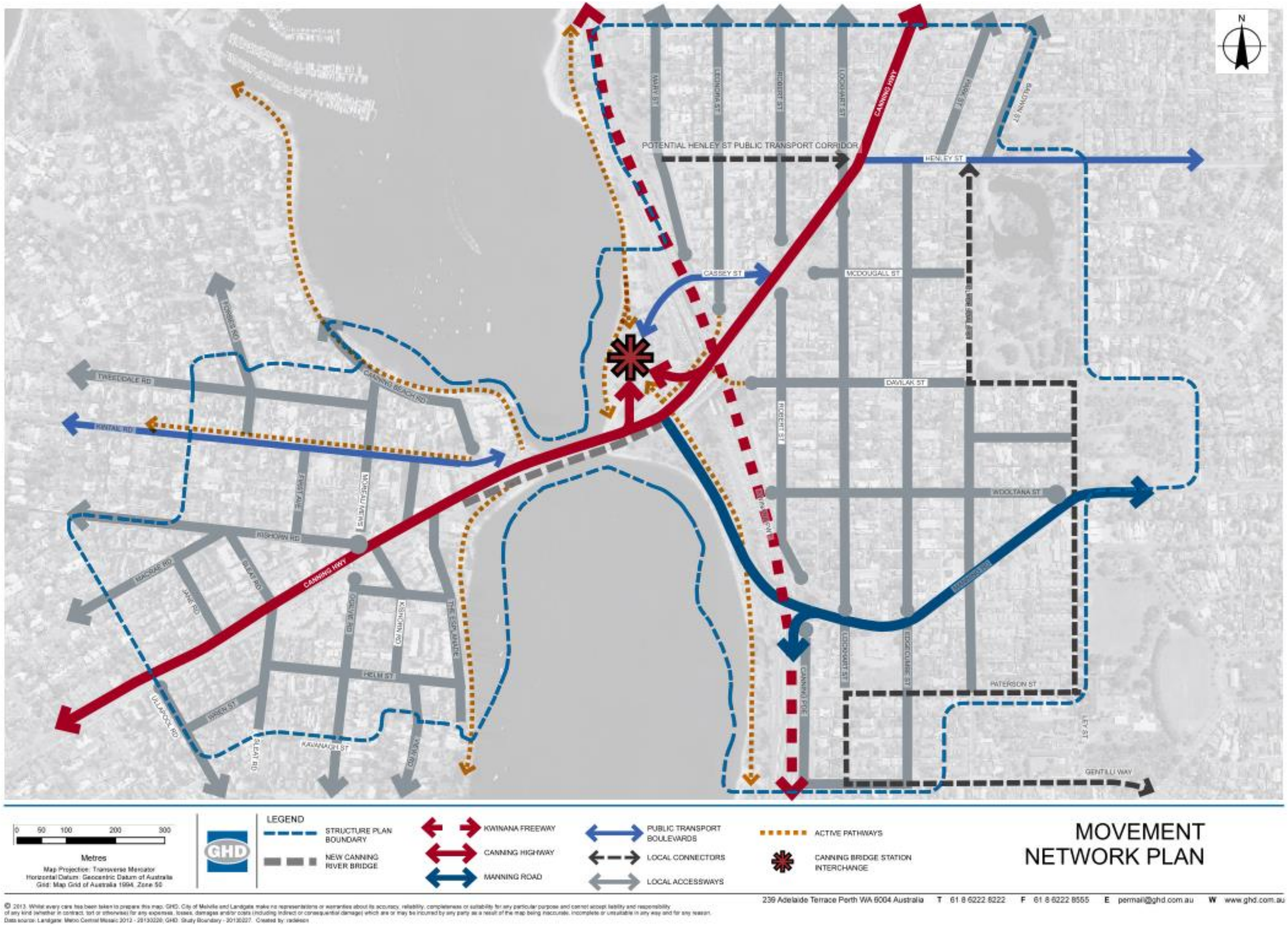


Figure 14 Canning Bridge Structure Plan Movement Network Plan

4.3.1 Canning Bridge Station Interchange – connecting the CBSP area to Perth and beyond

The centre of the CBSP area, the Canning Bridge Station Interchange is a public transport hub consolidating commuter rail, light rail, bus, and ferry opportunities within the CBSP area. The hub will link into mixed use and residential areas via pedestrian and cycle links to enhance access to public transport.

Pedestrian and cycling access needs to be confirmed as part of the detailed road planning and design including access across Canning Highway.

Figure 15 Indicative sketch – Canning Bridge Station Interchange

4.3.2 Canning Highway

Canning Highway becomes a linear focus for regional public transport with the introduction of dedicated lanes for priority public transport (rapid transit) along with enhanced pedestrian and cycle connections. Figure 16 illustrates a typical mid-block cross section of Canning Highway through Applecross and Mount Pleasant. The typical cross section of Canning Highway through the Como area is two lanes plus bus lanes in each direction, although the rapid transit lanes may be kerbside or median, dependent upon future rapid transit requirements.

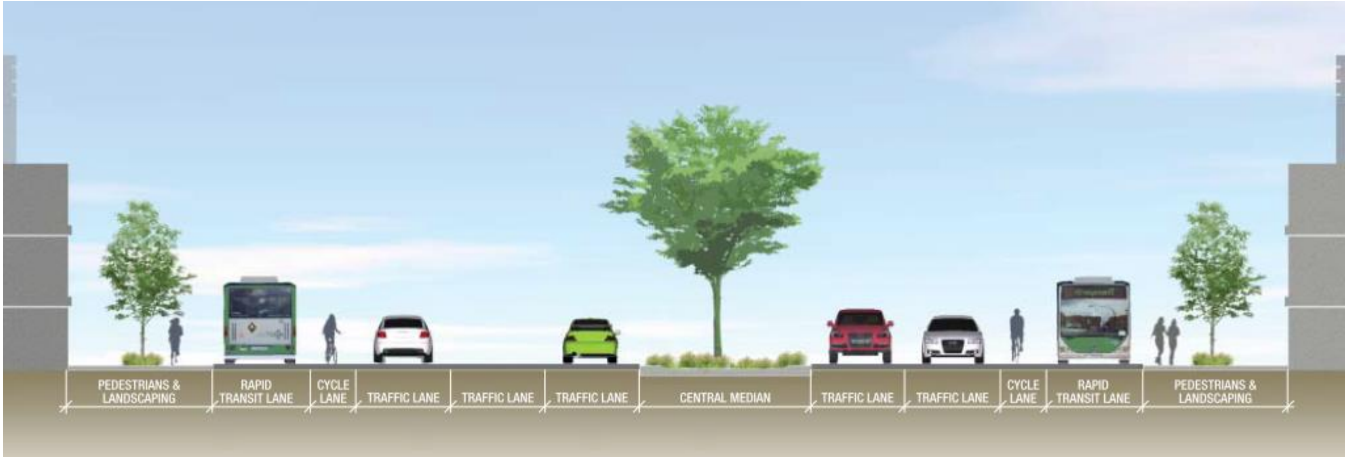


Figure 16 Indicative cross section – Canning Highway

4.3.3 Canning River Bridge

The Canning River Bridge facilitates improved pedestrian links across the Swan River, and supports regional public transport, vehicle, and cycle movements. A new traffic bridge will eventually carry regional traffic, whilst one of the old heritage bridges will be retained as a place exclusively for public transport, cyclists, and people. The large space for pedestrians will create opportunities for markets, stalls, and shelter from weather to better link Applecross and Mount Pleasant to the station. Figure 17 shows an indicative cross section.

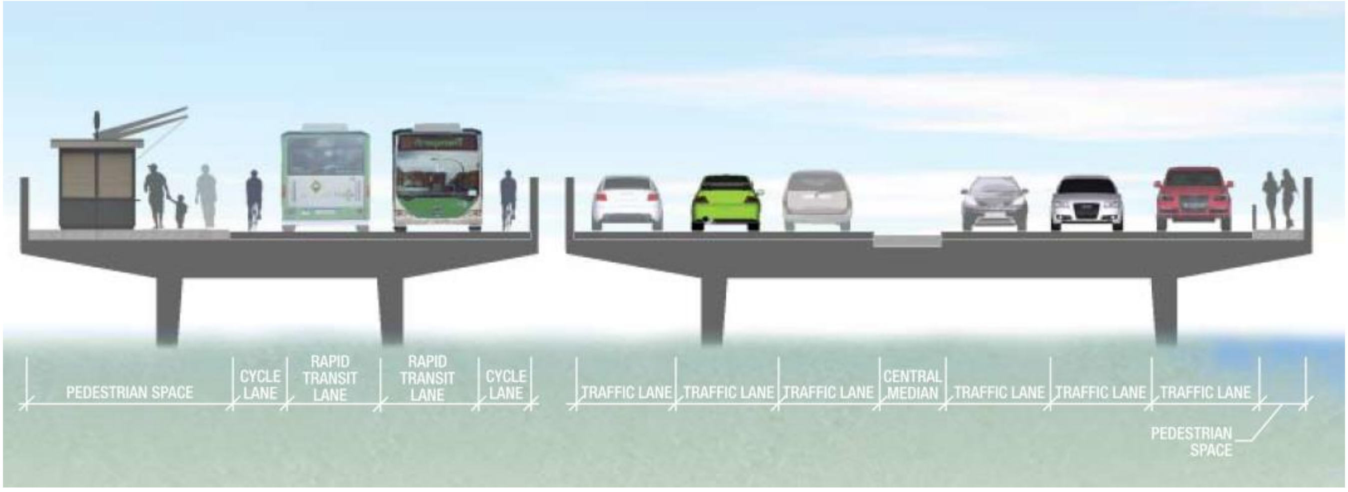


Figure 17 Indicative cross section – Canning River Bridge

4.3.4 Manning Road

Figure 18 shows a typical, mid-block section for Manning Road. Future road upgrades will provide enhanced pedestrian and cycle connections, with dedicated pathways between the development area and the PSP network. Dedicated cycle lanes will continue through to Curtin University to the east if and when the road is upgraded.

Figure 18 Indicative cross section – Manning Road

4.3.5 Public Transport Boulevard

The public transport boulevards proposed throughout the CBSP area are primary connecting roads to and from the Canning Bridge Station Interchange. Figure 19 shows a typical, mid-block section for roads that will place priority on public transport, with opportunity for rapid transit services in the future, noting that the rapid transit lanes may be kerbside or median, dependent upon future rapid transit requirements.

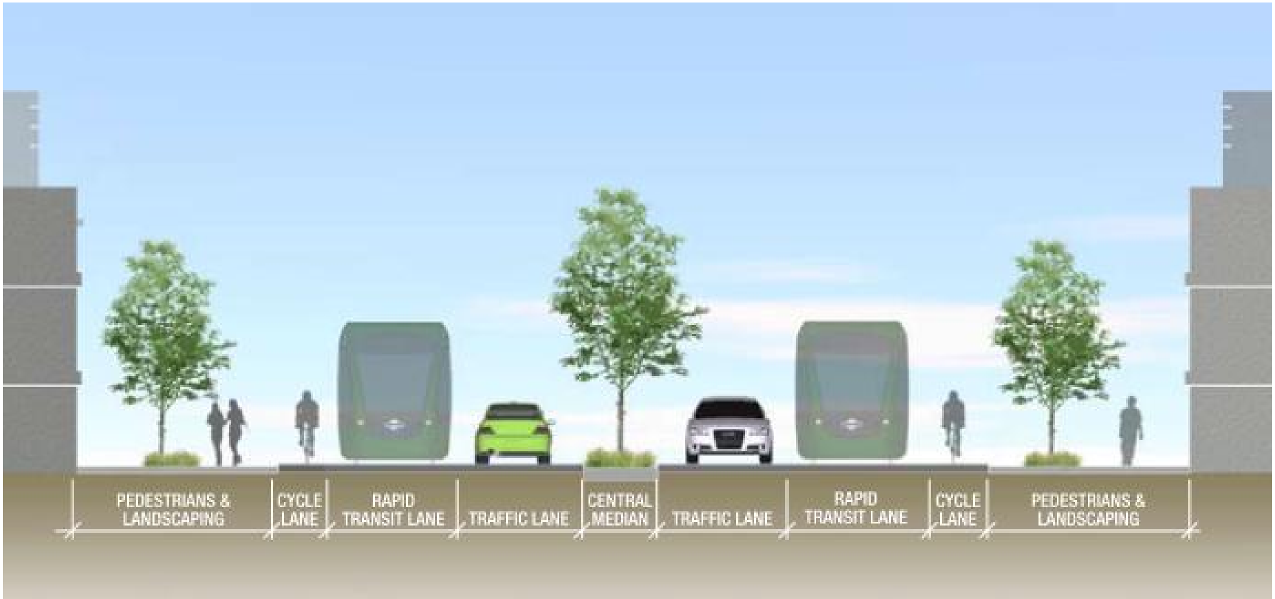


Figure 19 Indicative cross section – Public Transport Boulevards

4.3.6 Local Connectors

Local connectors have been proposed to link local development areas to public transport boulevards, and facilitate pedestrian and cycle movements in the context of vehicle congestion. Figure 20 shows a typical, mid-block section for roads that provide public transport and private vehicle access into the residential and commercial areas. These roads will provide dedicated cycle and pedestrian areas to encourage active transport into and out of the area.

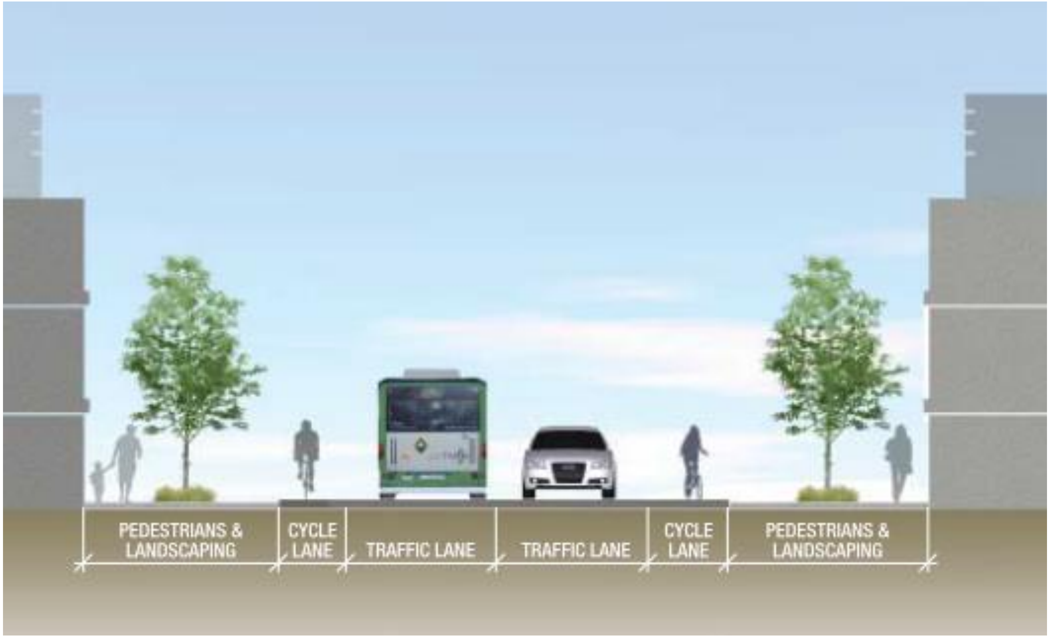


Figure 20 Indicative cross section – Local Connectors

4.3.7 Local Accessways

Shared spaces allow for public transport and local vehicle access whilst encouraging pedestrian and cyclist safety and comfort. Internal detailed road design will encourage public transport, cyclists and pedestrians rather than private vehicle movements. The design of local access ways will be different in retail areas and residential streets, with activity and vibrancy on the street encouraged to support urban design strategies.

Figure 21 shows a typical, mid-block section for internal roads. Internal detailed road design will encourage cyclists and pedestrians rather than private vehicle movements on local access ways.

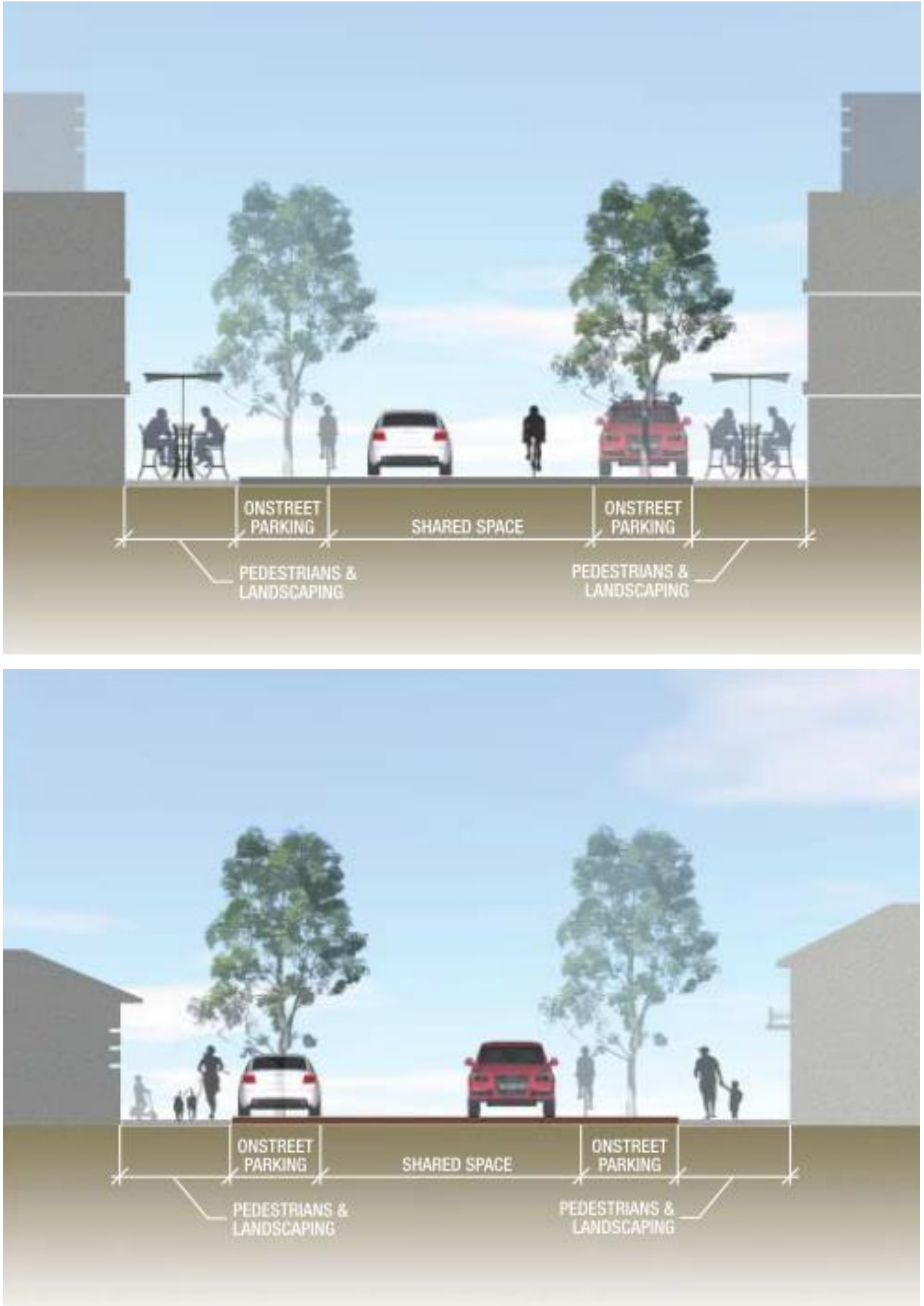


Figure 21 Indicative cross sections – Local Access Ways

4.3.8 Active Pathways

Figure 22 shows a sectional strategy to enhance active movements along the Swan and Canning Rivers. Active pathways provide exclusive links for pedestrians and cyclists. Regional cycle movements, particularly linking into the Perth Bicycle Network and commuter pathways, are separated from pedestrian paths to provide greater safety.

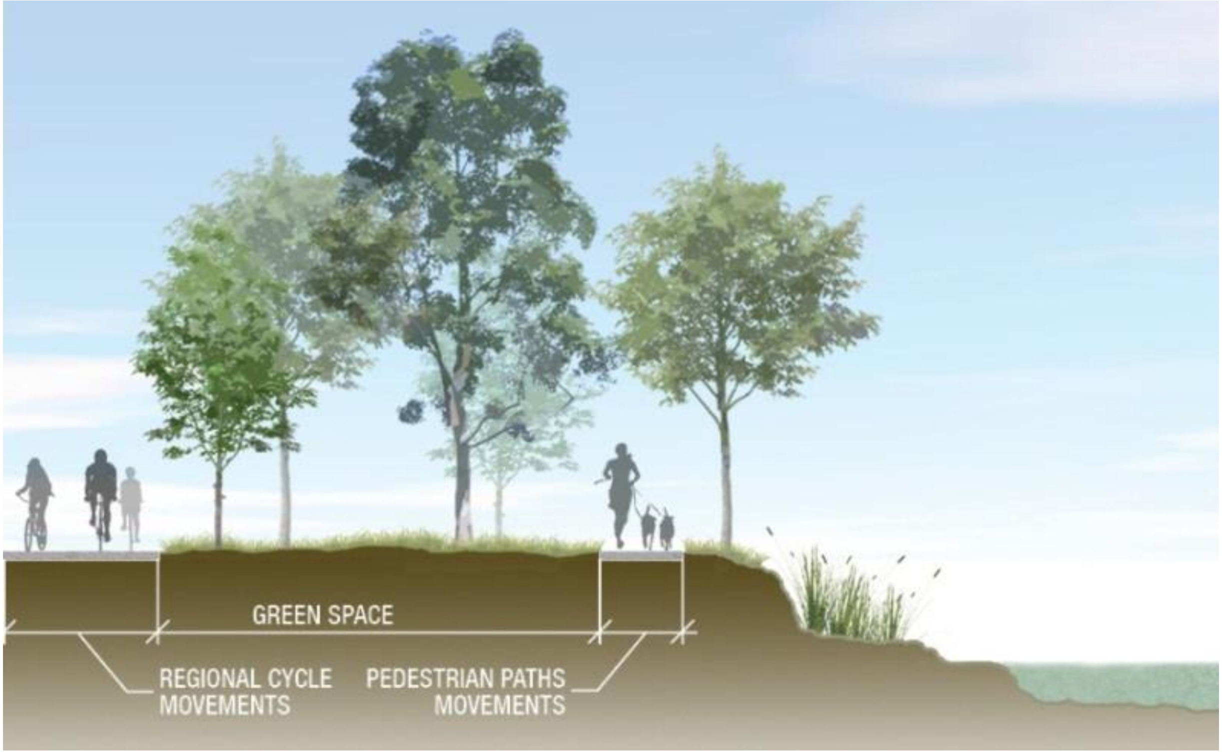


Figure 22 Indicative cross section – Active Pathways

4.4 Local road upgrades

The intersection of Kintail Road and Canning Beach Road with Canning Highway is a key issue in the growth of the CBSP area. Current conflict at the intersection of Kintail Road with Canning Beach Road occurs between traffic exiting from Kintail Road to Canning Highway, and traffic turning right from Canning Highway into Canning Beach Road.

In the longer term, the movement network proposes the redevelopment of Kintail Road as a public transport boulevard, connecting bus and (potentially) light rail across the northern existing bridge to the Canning Bridge Station Interchange. The closure of Canning Beach Road will facilitate bus movements on and off the bridge and manage potential conflict with private vehicles as movement demand increases. The comparative impact of the closure of Canning Beach Road, along with other options for the intersection, is provided in Appendix C.

In the short term, current traffic counts show that the predominant movement through the intersection is to and from Kintail Road and Canning Highway. There are comparatively few movements making the right turn from Canning Highway to Canning Beach Road, which cause the current conflict.

A number of alternatives have been developed during the course of this study; Figure 23 illustrates a potential short term intersection improvement to remove this conflict, by removing the right turn access to Canning Beach Road from Canning Highway. Alternative access to Canning Beach Road would be available via Sleat Road or other routes via Kintail Road; with left hand movements from Canning Beach Road to Canning Highway retained.

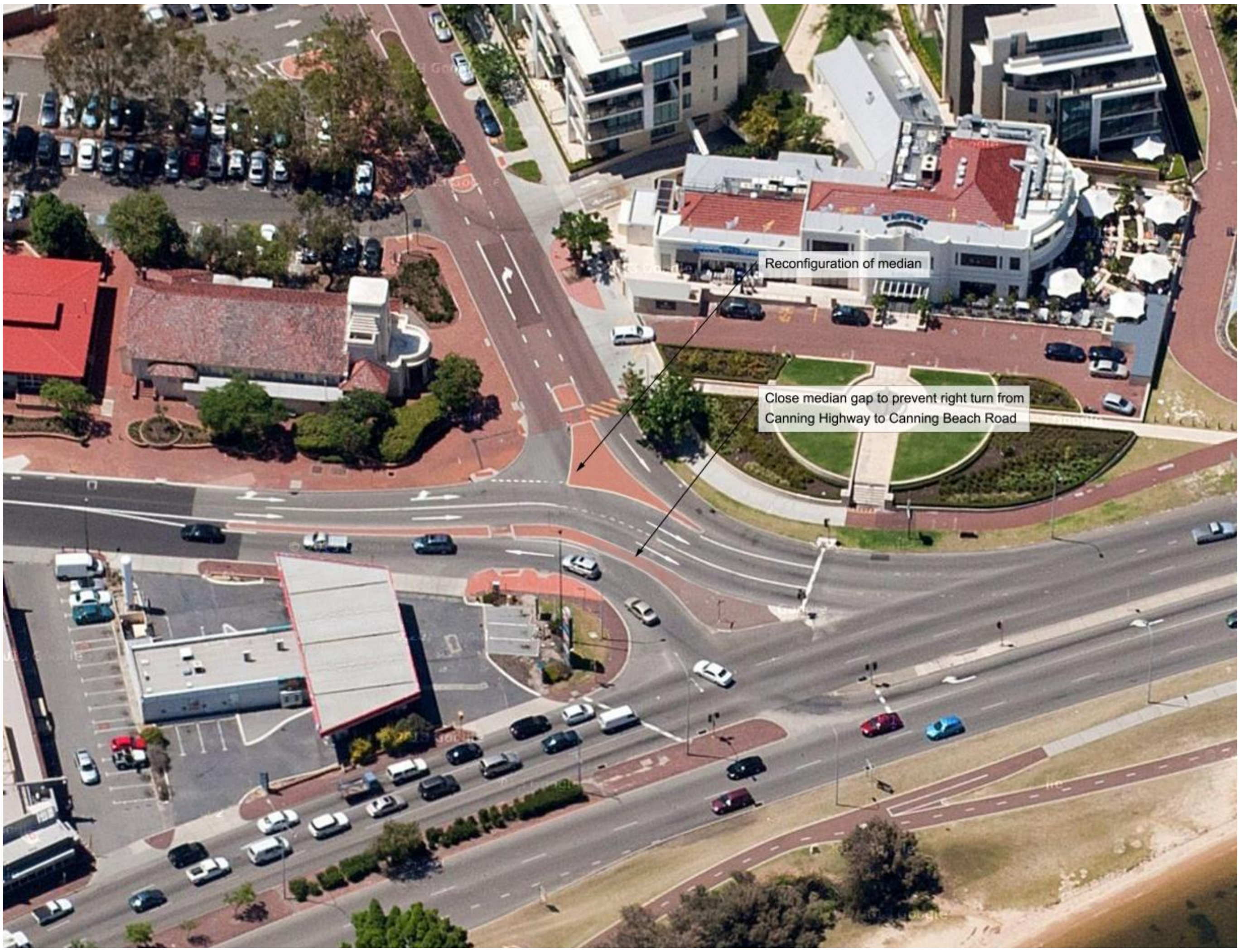


Figure 23 Proposed Canning Beach Road/Kintail Road Intersection Treatment

Source: Department of Planning

The restriction of the right hand turn to Canning Beach Road will impact on some properties in the immediate vicinity; current traffic counts suggest that 50 to 55 movements per day will be required to utilise alternative access.

5. Public Transport Action Plan

Public Transport Action Plan – providing greater links to strategic public transport

With the increased number of trips that will be generated from the CBSP area, a mode shift from private cars to public transport will be critical to ensure the continued accessibility, liveability and productivity of the CBSP area. An aspirational target of 10% of all trips in the CBSP area being made using public transport by 2031 is proposed in order to achieve this. This section describes how various improvements to public transport services can assist in moving towards this mode share target.

It should be noted that any specific recommendations relating to public transport services are subject to review, approval and implementation by the Public Transport Authority (PTA).

5.1 Public Transport Strategy Statements

To encourage this mode shift, public transport has to be convenient and attractive to use. The following strategy statements should guide any future transit planning within the CBSP area:

PUB 1 Cater for all trip purposes

PUB 2 Provide high quality public transport services that are accessible to everyone

PUB 3 Provide real time service information

PUB 4 Improve the visibility and legibility of the public transport network

PUB 5 Facilitate easy transfers between public transport services

PUB 6 Integrate public transport services and infrastructure with other modes of travel

PUB 7 Provide attractive and accessible transit stop facilities

PUB 8 Prioritise public transport over private car usage

5.2 Public Transport Considerations

5.2.1 Canning Bridge Station Interchange

The current location of the Canning Bridge railway station presents a number of constraints, most notably the inability to expand the facility in order to accommodate additional bus services. Being surrounded by Canning Highway also reduces the accessibility of the station to local residents and pedestrians.

Constructing an integrated transport hub to the north-west of the current interchange will provide much-needed additional bus layover bays and passenger stands, allowing the station to support additional bus routes and more frequent services. It will also be designed to allow for the future introduction of light rail services along Canning Highway, as well as potential future ferry services along the Canning and Swan rivers.

5.2.2 Public Transport Accessibility

One way in which the convenience and attractiveness of public transport may be quantified is its accessibility, which can be defined in this context as “the ability for people to [use public transport to] get to key services at reasonable cost, in reasonable time and with reasonable ease”[3]. This concept is very important as people will not (and cannot be expected to) use public transport if it is too far away from their location, and/or if it does not facilitate travel to their desired destinations (such as places of education and employment, shopping centres, recreational and health facilities) . Subsequently, providing highly accessible public transport services increases

[3] UK Social Exclusion Unit, cited in Poole 2003 (http://abstracts.aetransport.org/paper/index/id/1691/confid/9)

its utility to prospective users, heightens the probability that public transport will be used in favour of private vehicles and will assist greatly in achieving the aforementioned mode shift target.

Public Transport Accessibility Level (PTAL) is a method for determining public transport accessibility at a given location. It is a high-level tool that also provides a quick and simple method of determining the effective coverage level of public transport in a given area. PTAL was developed in 1992 by the London Borough of Hammersmith and Fulham for use in London, where public transport is not only highly accessible from many locations, but is also effective in facilitating travel to a wide range of destinations within a reasonable amount of time.

The PTAL method offers several advantages in terms of assessing public transport accessibility as it takes into account the following:

– Walking distance to services (accessibility increases with decreasing distance)
– Frequency of services (accessibility increases with frequency)
– Mode reliability (i.e. punctuality) and preference (e.g. most people prefer trains over buses)
– Versatility (i.e. able to assess the accessibility at any given location)

As PTAL is a measure of access to public transport, the final destination of the services is not directly considered. Transfers (or the ability to transfer) between services are also not a determinant of the level of accessibility in a particular location.

An initial baseline analysis of existing public transport services within the CBSP area was undertaken using the PTAL method, thus guiding the determination of improvement needs to the transit service to aid mode shift and identifying areas that lack adequate public transport coverage. This baseline analysis of the AM peak period was conducted using data obtained from Transperth timetables on the 17th of December, 2012. Results from this analysis are illustrated in Figure 24, whilst a percentage breakdown of the total land areas covered by each PTAL category is listed in Table 14.

The results indicate that public transport accessibility is highest adjacent to the Canning Bridge Station Interchange and it decreases as one moves further away from the station, reflecting the notion that increasing walking distance from a transit stop reduces its attractiveness. There is moderate to good public transport accessibility around the major corridors of the Canning Bridge Station Interchange, Canning Highway and Henley Street, which can be attributed to the higher frequency of bus services along these roads. Of specific note are the low scores for the area around Manning Road, Canning Beach Road north of Kintail Road and The Esplanade south of Helm Street, which are either not served directly by public transport or have very low service frequencies.

Previous assessments, as outlined in the "Transport Assessment: Baseline Data Review" report indicated a relatively high walkable access to bus stops within the CBSP area, with only small pockets of residential areas in the CBSP area not within walking distance (400m) of a bus stop. In contrast, the Canning Bridge railway station had a very small walkable catchment (within 800m walking distance), which is due to its relative location and the impact of barriers impeding pedestrian access such as the Canning Highway, Canning River, Kwinana Freeway and Mandurah Railway Line.

In total, over 75% of the CBSP area returns a PTAL category of 3 (poor) or lower, despite the vast majority of the area being within walking distance of a bus stop or train station. This suggests that public transport is not currently an attractive transit option for most people living in the CBSP area. Considering these results, it can be concluded that higher service frequencies will increase public transport accessibility, as observed around Canning Highway, Canning Bridge railway station and Henley Street.

Table 14 Area covered by each Public Transport Accessibility Level category

PTAL/Description	Map Colour	Area (ha)	% of total area
No category		6.269	4.0
1 (very poor)		40.840	25.7
2 (very poor)		26.424	16.7
3 (poor)		48.461	30.5
4 (moderate)		26.062	16.4
5 (good)		10.219	6.4
6 (very good)		0.395	0.2
7 (excellent)		0	0
8 (excellent)		0	0
Total		**158.670**	**100.0**

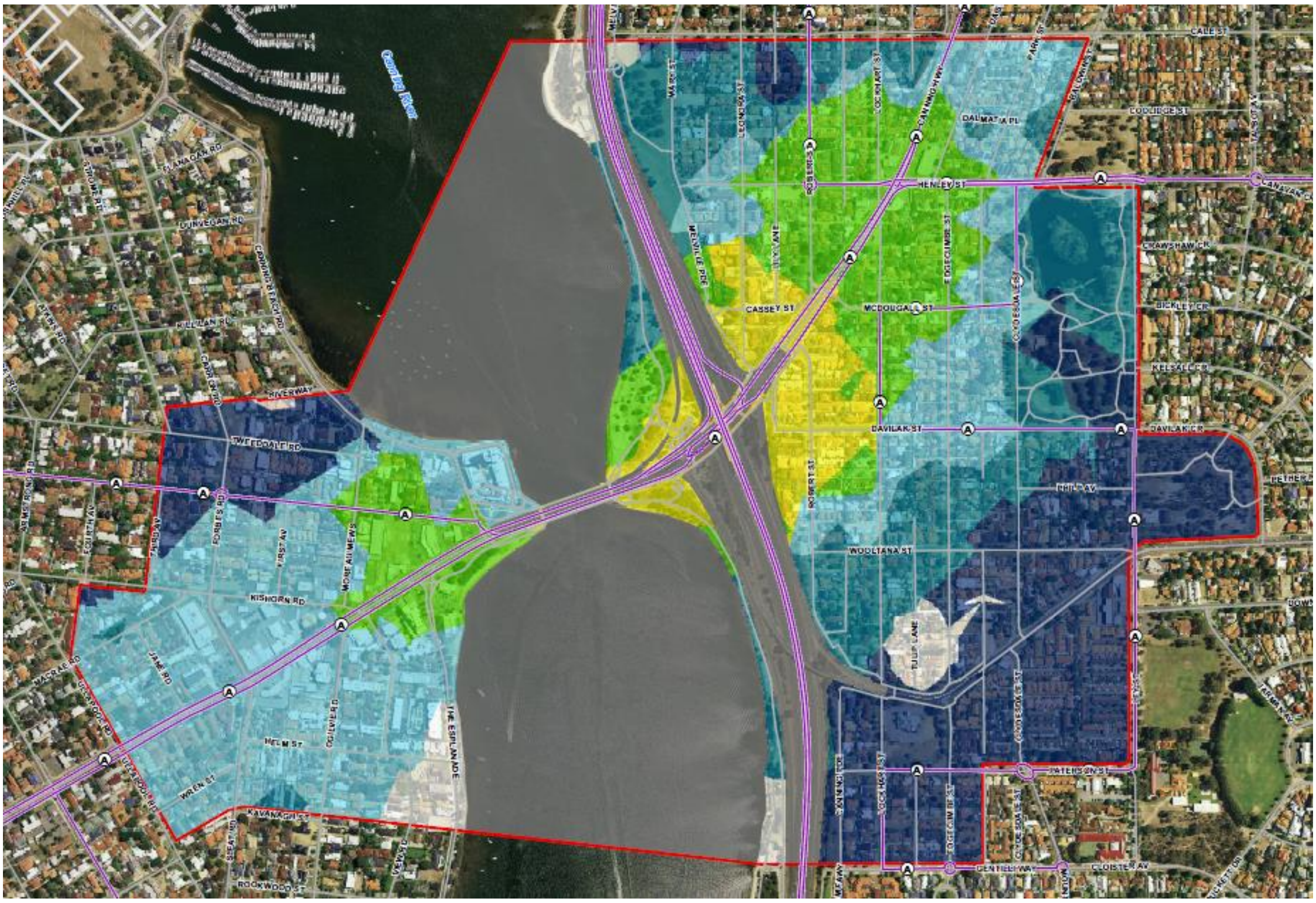


Figure 24 Public Transport Accessibility Level within the CBSP area – Weekday AM Peak

Furthermore, introducing new and/or rerouting services will be required to ensure all areas of the CBSP area are within walking distance of a transit stop (particularly around Manning Road and The Esplanade). This would help encourage people who live in these areas to use public transport as the reduced walk increases the convenience of accessing the service.

It should be noted that the results of the PTAL analysis presented above are based on the AM peak period, when service frequencies are typically at their highest. During the interpeak, at night and on weekends, the PTAL will decrease as service frequencies are reduced. Therefore, another consideration that needs to be taken into account is the operating hours of the services.

5.2.3 Service Operating Hours

A major advantage of private car usage is the freedom to travel at any time of the day or night. Users of public transport are however limited to the operating hours of the services, which can vary from route to route. Outside of these hours, people would have to drive to their destination when they might have otherwise used public transport. Therefore, restricted operating hours for public transport represent missed opportunities to encourage people to use buses and trains instead of private vehicles.

However, not everyone has the opportunity to simply drive to their destination. Some people may not hold or be able to obtain a drivers' licence (for various reasons such as age, medical condition, disability etc.) and thus are either heavily or fully dependent on public transport to get to where they want to go. Furthermore, people who do hold a drivers' licence may not have ready access to a vehicle, either because they don't own one or have to share one with somebody else. For many, public transport represents the only viable option in terms of travelling beyond a reasonable walking distance to their desired destinations.

Restricting the time period during which public transport services operate reduces the number of activity options that are accessible to people who are unable to drive. Conversely, extending the operating hours of bus and train services not only increases the range of destinations accessible to people who cannot drive, but provides additional opportunities for people who can drive to replace car trips with travel on buses and trains. Combined with high service frequencies, these measures will subsequently go a long way towards achieving a mode shift from private cars to public transport.

Currently, the CBSP area is relatively well served by buses and trains in terms of operating hours, with the earliest services passing through the Canning Bridge station at 5:20 am and the latest services passing through at 12:20 am on weekdays. On weekends, services through the Canning Bridge station are available as early as 6:10 am on Saturdays (7:20 am on Sundays) and as late as 2:20 am on Saturday night (12:10 am on Sunday night). Destinations accessible via these early and late services include those along Canning Highway (including Fremantle and Victoria Park), Booragoon and the Mandurah line (including Perth). These should be maintained as a minimum; however there are opportunities to increase the operating hours of existing services east of Canning Bridge station (such as the 100 and 101, which finish at 8 pm on weekends).

The operating hours of each existing service is summarised in Table 34, which can be found in Appendix B.

5.2.4 Suggested Bus Frequencies

How often and when public transport is provided during the day are important attributes that factor into the decision as to whether to use a bus or train instead of driving. As discussed above, the more frequent a service and the longer the operating hours, the higher the probability that public transport will be an attractive option for a specific trip.

At present, most routes (or combination of routes) have peak period frequencies of between 10 and 20 minutes, while the rail services run at 10 minute frequencies.

In determining the preferred frequency for bus services, it is important to consider their integration with the train timetable to allow for seamless transfers between each mode. Currently, the frequency of rail services at the Canning Bridge station is ten minutes. Thus in planning the bus timetable, service frequencies of multiples of ten are recommended. If the frequency of rail services changes to five minutes, frequencies of bus services should also be in multiples of five.

Clock-face timetabling is also important to encourage the use of public transport, as this reduces the need for passengers to carry a timetable or otherwise know the departure times of their service in advance of using it.

Based on the above considerations, the following service categories are proposed as defined below. The corresponding service frequencies suggested for each service category in order to encourage mode shift from cars to public transport is listed in Table 15.

Regional routes

Regional bus routes are those which provide connectivity between adjacent and regional centres, such as the CBD, Garden City, Fremantle and Victoria Park, whilst also providing frequent access to Canning Bridge railway station. Some examples of current bus routes passing through the CBSP area that would fit into this category include the following:

– 106: Esplanade Busport to Fremantle Station (via Canning Highway)

– 111: Esplanade Busport to Fremantle Station (via Canning Highway & Kwinana Freeway)

– 150: East Perth to Booragoon Bus Station (via Reynolds Road)

– 160: East Perth to Fremantle Station (via Reynolds Road & Marmion Avenue)

– 881: Esplanade Busport to Munster (via Booragoon Bus Station)

– 940: Esplanade Busport to Hamilton Hill (via Booragoon Bus Station)

Local Feeder Routes

Local feeder routes aim to provide the CBSP area with good public transport accessibility to and from Canning Bridge railway station, and are envisaged as the primary mode of transport for people who live or work outside of walking distance from the railway station. The PTA have successfully implemented a bus feeder network along the Joondalup and Mandurah lines that provides fast and efficient train connections for passengers living near stations. However at present no feeder services have been implemented at the Canning Bridge station, with passengers being served only along established bus corridors such as Henley Street and Canning Highway.

Special Routes

Special routes serve specific destinations such as Curtin University Bus Station or school routes (e.g. routes 100/101). No structural changes are proposed for these services as part of this Integrated Transport Strategy.

Table 15 Suggested bus service categories and frequencies

Service Category	Frequency		Hours-of-Service
	Peak	Other	
Regional Routes	5-10 min	10-15 min	6:00 am – 12:00 am
Local Feeder Routes	10 min	10 min	6:00 am – 9:00 pm
Special Routes	5-10 min	5-10 min	6:00 am – 12:00 am

These frequencies would result in higher vehicle kilometres and thus higher operational costs for transit services. However, this additional investment is critical to accommodate the increased population and resultant person trips within the limits of the road network capacity; to achieve the vision of transit being the preferred choice of travel in Perth's strategic centres and through growth corridors; and to achieve the aspirational mode shift as discussed in section 3.3.3.

5.3 Proposed Initiatives

In light of the above discussion, the following are some general action points that will help facilitate a mode shift from private cars to public transport:

– **Create an integrated public transport hub at the Canning Bridge station:** This multimodal facility will serve as a transport focal point within the CBSP area. Passenger mobility within the area is enhanced as the hub will provide access to a wide range of destinations (within and beyond the area), intermodal transfers (bus-train connections and bicycle lockers) and transit options (including links to walking and cycling paths). The previous section discussed how this hub would integrate with the local movement network.

– **Increase service frequency:** In addition to increasing the attractiveness of public transport and therefore the likelihood that it will be used (see "Public Transport Accessibility" above), other benefits include improved reliability (the impact of late services on passenger waiting times is lessened) and better timetable legibility (services are so frequent that passengers will not need to know exactly when the next service is arriving). Ultimately, passengers should be able to make use of the public transport system to go anywhere at any time.

– **Improve pedestrian access and personal safety:** Ensuring safe and easy passage (including more crossing points) for pedestrians getting around the CBSP area is important, particularly in terms of facilitating access to the Canning Bridge Station Interchange and the existing high-frequency bus services on Canning Highway and Henley Street. Implementing strategies to increase footfall will also help to promote access to and encourage the use of public transport services, as well as improve passive surveillance of the area (see the Pedestrian Action Plan, Section 6, for more information). Ensuring that public transport users feel safe both on and when waiting for services is crucial, particularly if non-car travel is to be encouraged at night or outside of peak hours.

– **Extend operating hours of public transport services:** This would provide more transit options on weeknights and weekends, increasing its utility to off-peak commuters, shift workers and irregular travellers.

– **Upgrade existing and introduce new routes:** Any changes should aim to serve parts of the CBSP area not currently within walking distance of a transit stop (particularly around Manning Road and The Esplanade), thus providing residents in these areas with additional transit options.

– **Provide passengers with access to real-time bus tracking:** This will assist passengers in finding out whether their service is delayed and allows them to adjust their travel plans accordingly. Currently, the PTA is running a trial out of the Karrinyup bus depot that allows this information to be viewed via the official Transperth mobile 'app'. However, other methods of accessing this information should be considered for the benefit of those who do not have access to a smartphone and/or mobile internet access.

– **Implement bus priority:** Consider traffic control measures to facilitate competitive travel times via public transport and implement where appropriate (e.g. bus lanes, queue jumps, bus-only turning movements). These also highlight to car drivers the existence of bus routes along roads which have bus priority measures, improving the visibility of the public transport network.

- **Investigate alternative modes of public transport:** Determine the feasibility of introducing light rail and ferry services.
- **Maximise public transport affordability:** With fuel costs continuing to rise, low bus and train fares provide a financial incentive for people to use public transport.
- **Limit the provision of park-and-ride:** By providing few or no parking bays, passengers are encouraged to use the feeder bus services to get to Canning Bridge Station Interchange, as opposed to driving there. This will help increase the mode share of public transport whilst decreasing the mode share of private cars.
- **Install a formal kiss-and-ride area:** Delineating a clear zone where vehicles can drop off and pick up passengers will help promote the Canning Bridge Station Interchange as a central hub for public transport connections to and from the CBSP area. This will also help take pressure off residential streets near the station, which are currently being utilised as informal kiss-and-ride points.

The public transport strategy statements to which the above action points align with are summarised in Table 16.

Table 16 Alignment of initiatives with Public Transport Strategy Statements

Strategy/initiative	Alignment with public transport strategy statements
Create an integrated public transport hub at the Canning Bridge station	PUB 4, PUB 5, PUB 6, PUB 7
Increase service frequency	PUB 2
Improve pedestrian access and personal safety	PUB 6, PUB 7
Extend operating hours of public transport services	PUB 1, PUB 2
Upgrade existing and introduce new routes	PUB 2, PUB 4, PUB 7
Provide passengers with access to real-time bus tracking	PUB 3, PUB 4
Implement bus priority	PUB 4, PUB 8
Investigate alternative modes of public transport	PUB 2, PUB 6
Maximise public transport affordability	PUB 2
Limit the provision of park-and-ride	PUB 8
Install a formal kiss-and-ride area	PUB 6

6. Pedestrian action plan

Pedestrian action plan - making active movement easier

This ITS aims to develop a transport system that promotes accessibility, liveability and good health outcomes. To achieve this, every effort needs to be made to encourage persons to consider walking and cycling as a real alternative to the car for some or all of their daily trips. Thus, travel within the CBSP area should focus on the ease of travel by bicycle or on foot. Any trips that are shorter than three kilometres should be candidates for either cycling or walking.

To address the increased number of trips that will be generated from the CBSP area, a mode shift to active transport will be critical to ensure the continued liveability and productivity of the CBSP area. An aspirational target of 10 percent of all trips in the area being cycling or pedestrian trips by 2031 is proposed to achieve this.

This part of the strategy focuses on the steps that need to be taken in order to encourage people to walk to, from and within the CBSP area.

6.1 Pedestrian Strategy Statements

The pedestrian strategy statements are within the broad areas of "protection", "comfort", and/ or "delight". The strategy statements are listed below (and illustrated in Figure 25).

PED 1 Create a safe pedestrian environment

PED 2 Provide footpaths of appropriate widths and standard

PED 3 Improve the permeability of the pedestrian network and provide facilities to remove barriers to pedestrian movement

PED 4 Provide footpaths that are accessible to all users

PED 5 Make the area easy to navigate on foot

PED 6 Provide quality public spaces

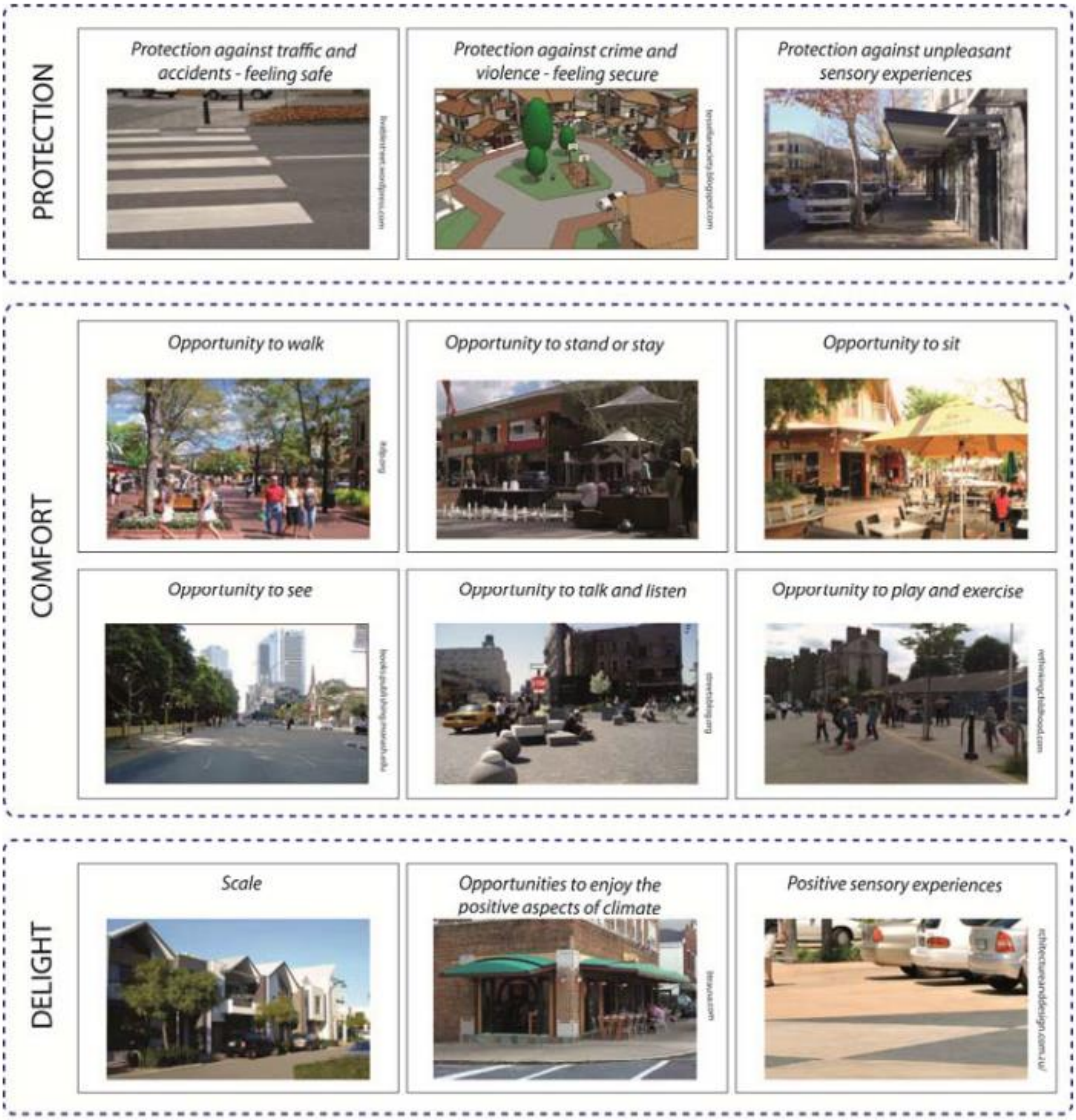


Figure 25 Pedestrian Strategy Considerations

6.2 Pedestrian Considerations

6.2.1 Planning and Designing for Pedestrians: Guidelines

In November 2011, the DoT released *Planning and Designing for Pedestrians: Guidelines*, a document which aims to provide a single point of reference with regard to the planning, design and construction of pedestrian facilities in Western Australia. These guidelines specifically state that the term ‘pedestrian’ covers any form of non-vehicular movement (including the use of wheelchairs, guide dogs and other mobility aids).

The development of these guidelines was coordinated by the DoT and received input from multiple organisations and government agencies, including the Department of Planning, MRWA, PTA, the Western Australian Local Government Association (WALGA), the Royal Automobile Club of Western Australia (RAC), the Disability Services Commission and the Institute of Public Works Engineering Australia. They also make reference to the Australian Standards as well as relevant design documents and publications produced by Austroads, MRWA, PTA and others.

This section summarises the major design elements advocated within these guidelines and how they should be applied to The CBSP area.

Planning for Pedestrians

The provision of well-planned pedestrian facilities (or lack thereof) can have a significant impact on the ‘walkability’ of a pedestrian route, which is a measure of “how friendly the environment is and the ease in which pedestrians can travel through [the] space”. Several factors influence the walkability of a route, including connectivity, legibility, safety and level of service.

The planning of pedestrian networks should be informed by five key principles:

- Connected – do walking networks provide good access to key destinations?
- Comfortable – does the path width, surface, landscaping and adjacent scale of development provide an attractive walking environment?
- Convenient – can streets be crossed easily, safely and without delay by all pedestrians?
- Convivial – are routes interesting, clean and free from threat?
- Conspicuous – are walking routes set out in a coherent network, clearly signposted and are they published in local maps?

Based on these, pedestrian networks should be planned to:

- Minimise walking distances between land uses
- Provide a clear route to entrances of large developments (rather than surrounding car park areas)
- Avoid conflicts with vehicular movements where possible
- Provide appropriate pedestrian crossing facilities on busy roads
- Provide paths on most streets (with the exception of lightly trafficked local streets), preferably on both sides

Pedestrian safety for every user (including those with disabilities) is an important element of pedestrian network planning and design. This includes protection from hazards and risks associated with vehicular traffic, as well as the propensity for crime to occur. Passive surveillance and good lighting should be provided in order to provide a safe and attractive walking environment.

Public transport users also benefit from well-planned pedestrian networks. Increased walkability not only gets more people within walking distance to bus stops and train stations, it also makes those services more attractive. The guidelines recommend that walking distances to bus stops are limited to 400 metres (a five minute walk) and 800 metres (a ten minute walk) for train stations. It is crucial to the uptake of public transport that the surrounding pedestrian network actually encourages people to walk.

Technical Design Elements

The guidelines provide several design principles relating to the technical aspects of pedestrian facilities and routes. Some of the main points are listed below:

- Pedestrian facilities that are designed for people with a range of disabilities will generally assist all pedestrians.
- Pedestrian routes should not be obstructed or encroached upon by street furniture, overhanging vegetation, signage or other objects.
- The minimum width of a footpath or pedestrian route should be based on the demand and mix of users using the path
- Surfaces must be slip resistant, flat and even, with tactile guidance surface indicators (TGSI) provided where appropriate
- Adequate and uninterrupted sight lines are to be provided at all crossing points
- Increased levels of lighting should be provided at focal points and hazardous locations
- Signage should assist pedestrians in navigating their way to key destinations, as well as warning motorists that they are approaching a pedestrian crossing

6.3 Proposed Initiatives

Facilitation of pedestrian movements is a fundamental strategy for the CBSP area. A number of structural, land use, and other strategies to encourage walking as a mode of choice for residents are provided below.

Provide shared spaces

The CBSP Movement Network Plan proposes significant number of shared spaces on local access ways to prioritise pedestrian and cycle movements.

A shared zone (or shared space) describes an area that is used by both pedestrians and vehicular traffic, in which vehicles are legally required to give way to pedestrians at all times. Shared zones are located in areas where pedestrian movements are to take precedence over vehicular traffic.

The built form of the road must encourage motorists to drive at a low speed, actively reminding them that they are entering a street environment where driving conditions are quite different to a typical road or highway. As a traffic calming measure, shared zones are most effective when there are high volumes of pedestrians using it. This combined with its relatively high installation expense means that shared zones are typically installed only where high footfall is either expected or to be encouraged.

To ensure the safety of people passing through the zone, there are several criteria which govern the placement and design of shared zones. Some of these are listed here:

- Traffic volumes should be less than 300 vehicles per day after the zone has been installed
- A speed limit of 10 km/h applies to all vehicles passing through a shared zone
- The design of the shared zone shall be such that vehicle operating speeds generally do not exceed 10 km/h
- Raised kerbs are to be removed, showing that pedestrians have right of way
- Surface textures that are different to the surrounding road network are to be provided in the shared zone (along with other visual cues), signifying the different street environment

- Entrance and exit widths shall be narrowed so that there is a physical entry and exit to the zone (additional traffic calming measures may be provided where pedestrian volumes are low)
- Roads should have significant physical interruption to vehicular traffic through the use of bollards, landscaping, plants and parallel parking
- There should be minimal turning, reversing and intersecting vehicle movements within the zone
- Any parking spaces and loading zones provided should be located next to the trafficable path and clearly marked and signed
- Service and emergency vehicles should be able to use the roads within the zone

Care needs to be taken to ensure that the design of a shared zone does not compromise the safety of the visually impaired, as sometimes there is no obvious distinction between the roadway and the pedestrian walkway. As guide dogs are trained to stop at kerbs, the absence of these in a shared zone may pose a danger to its owner. Additional tactile cues may need to be provided to supplement such a treatment.

Austroads Guide to Traffic Management, Part 7: Activity Centres provides information and examples of shared zones in busy commercial, tourist and heritage areas where there is a desire to create a more pedestrianized area, whilst Part 8: Local Area Traffic Management, Section 7.5.7 provides information on the application of shared zones on local streets. AS 1742.4-2008, Section 3.2.6 illustrates the signs that are to be used in order to define the extent of a shared zone (reproduced in Figure 26).

It is noted that it may not be possible to fully design (signage, paving etc.) shared zones on all local access ways; in some cases through routes will necessitate greater speeds that 10 km/h, however, the aspiration goal to achieve a virtually car-free network of roads through the CBSP area remains. Over time it is expected that this may become more palatable, as other initiatives from this ITS become and reality.

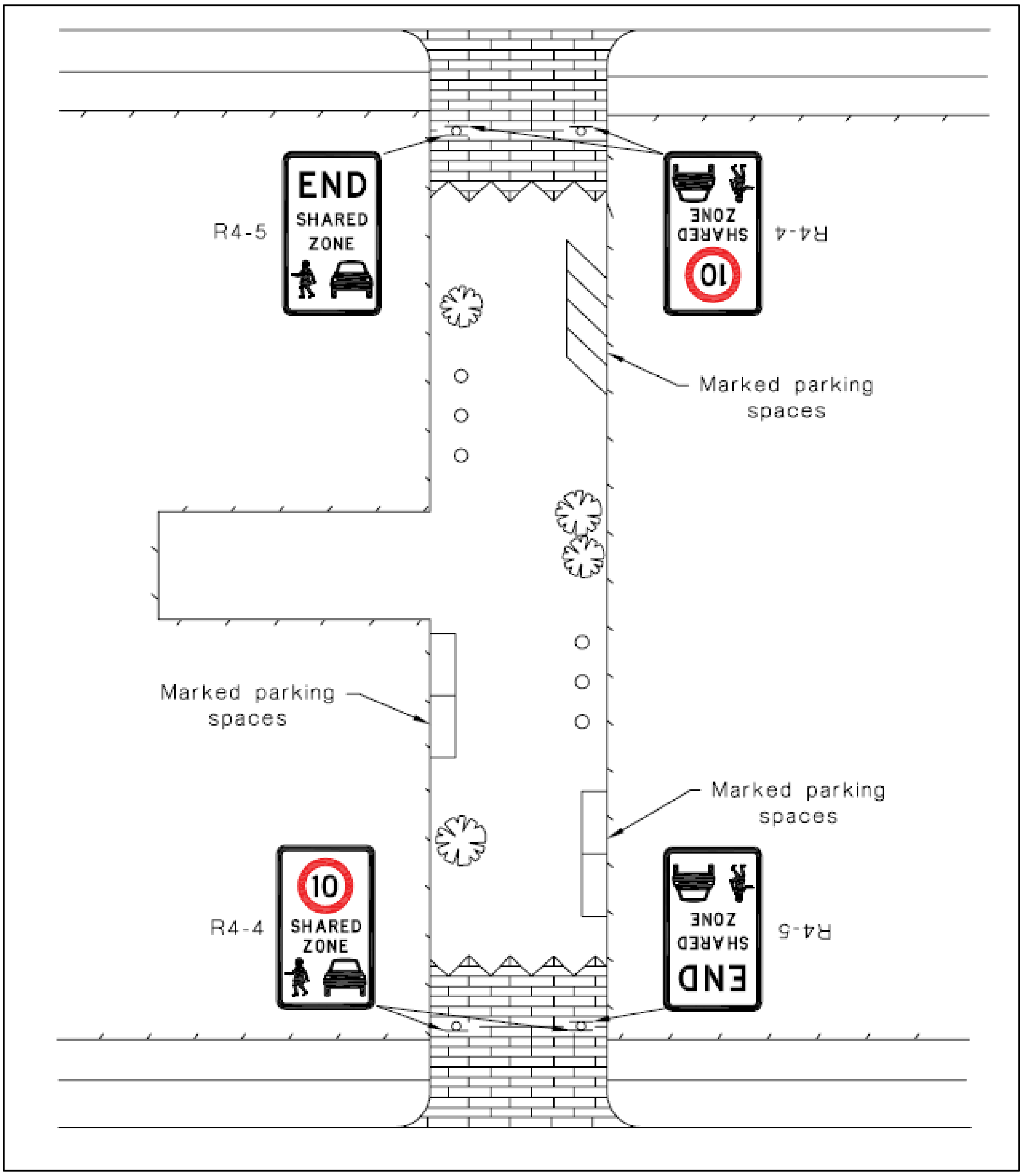


Figure 26 Typical Shared Zone Treatment[4]

[4] Source: AS 1742.4 – 2008, Figure 3.2

Figure 27 Typical carriageway surface section of the Exhibition Road Scheme, London, UK

Reduce road speeds in the Canning Bridge Structure Plan area

The earlier baseline traffic assessment confirmed a number of locations where there is currently a high crash record. Critical intersections include Canning Highway / Reynolds Road, followed closely by the Canning Highway / Canning Beach Road intersection.

Congestion and queuing were considered to be contributing factors at most intersections, with inadequate street lighting also impacting on the traffic safety. A high number of rear end collisions occur on Canning Highway at the signalised intersections.

Proposed modifications at the Canning Beach Road intersection will reduce conflicting movements and improve safety.

The local road network is planned as a low speed environment and will enhance the overall safety for all road users.

The CBSP endorses the WA Road Safety Strategy, Towards Zero and aims to improve road safety by:

– Safe Road Use – Improving road user behaviour.

– Safe Roads and Roadsides – Improving road infrastructure.

– Safe Speeds – Ensuring speed limits and travel speeds are appropriate for the safety of the road infrastructure.

Activate frontages

The CBSP provides for the development of a mixed use environment, with activated street frontages to encourage walking and improve the pedestrian environment.

Urban design guidelines prepared for the CBSP should focus on activating areas that do not currently have natural surveillance, current actual or perceived crime hotspots, and areas identified as key pedestrian routes.

Protect and provide pedestrian facilities on desire lines

Figure 28 provides a recommended Pedestrian Network Plan, showing key desire lines and areas requiring enhanced access and crossings.

Pedestrian crossing types will need to be considered in road upgrades, utilising dedicated pedestrian phases, parallel walk phases, or staggered crossings as appropriate. At grade crossings should be provided as a preference to overpass or underpasses, which (due to grade or safety concerns) are often not widely used by pedestrians.

Manage pedestrian/cycle conflict

Conflict between pedestrians and cyclists should be managed throughout the CBSP area through streetscape and path upgrades in line with the movement network plan. This includes:

– Separated pedestrian and cycle movements along regional cycle pathways (particularly along the river)

– On street cycle paths to reduce pedestrian conflict through internal streets

Figure 32 identifies key locations where local access ways may result in conflict between pedestrians and cyclists. Detailed design for these structures and locations should carefully manage conflict through sound planning for the transition between on and off-road facilities and intuitive and consistent signage.

Provide footpaths of appropriate widths and standard

In general, the width of a footpath should be based on the level of demand and mix of users using the route. More specifically, Planning and Designing for Pedestrians: Guidelines provides minimum and recommended footpath widths based on information contained in Austroads' Guide to Road Design Part 6A: Pedestrian and Cyclist Paths and the Western Australian Planning Commission's Liveable Neighbourhoods:

– 1.2 m is the absolute minimum width, allowing passage for a single wheelchair. This should only be used in constrained environments for a short distance.

– 1.8 m is the desired minimum path width (1.5 m absolute minimum), allowing passage for two wheelchairs to comfortably pass each other. Near schools and shops, a 2.0 m should be provided.

– 1.54 m is the clearance width that should be maintained between a bus shelter and the kerb (as specified by the PTAs Public Transport Bus Stop Layout Guidelines). If insufficient space is available, the absolute minimum through-route width is 1.2 m.

– 2.4 m is the desirable minimum through-route width for commercial or shopping environments (demand may necessitate a wider footpath)

Where the footpath is either temporarily or permanently restricted by obstacles (such as alfresco dining areas, signage or street furniture), its total width should be wide enough to accommodate at least the minimum pedestrian through-route widths stated above.

Other design elements that require consideration include (but are not limited to) the placement of street furniture, vertical clearances, surface finishes and ramp gradients.

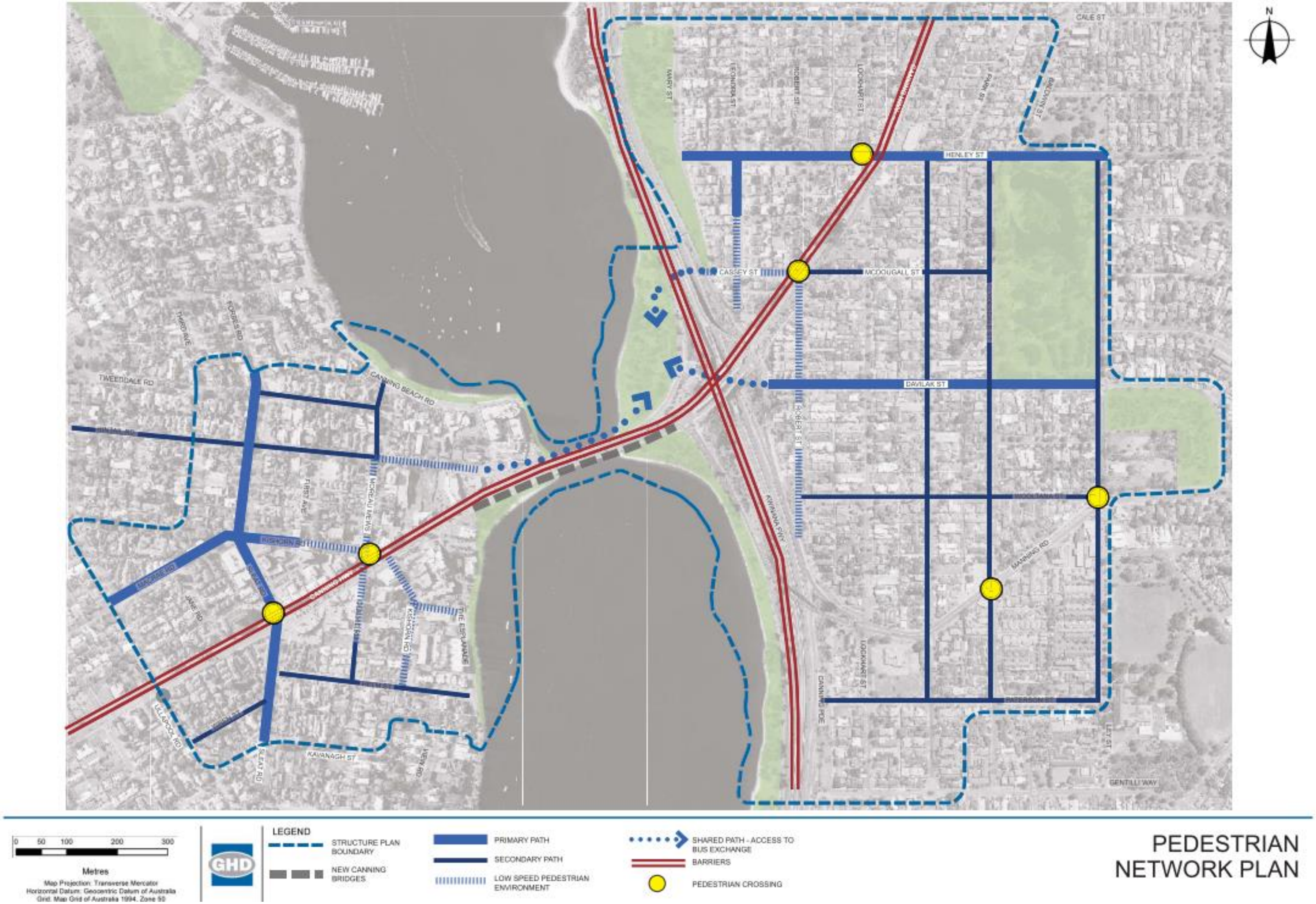


Figure 28 Pedestrian Network Plan

Improve the permeability of the pedestrian network and provide facilities to remove barriers to pedestrian movement

Pedestrian permeability refers to the degree of freedom in which people can move around a particular area on foot. Improving the level of pedestrian permeability within the CBSP area inherently reduces the walking distance required to reach a destination, and therefore makes walking more conducive as a mode of travel. This has flow-on effects to public transport, where its accessibility is partially determined by the walking distance to transit stops (see the Public Transport Strategy for more detail).

One of the ways in which pedestrian permeability can be increased is by providing new and promoting existing pathways and connections. In particular, streets that end in cul-de-sacs should afford passage to pedestrians, a situation that is evident east of the Canning Bridge Station Interchange. Pedestrian pathways are only useful if they facilitate access towards destinations or in directions people want to go, and hence they should overlap with desire lines and crossings. Finally, all pedestrian routes should have a reasonable level of natural surveillance in order to deter opportunistic crime.

Barriers to pedestrian movement inhibit pedestrian movement around the CBSP area, making walking less attractive. These can be physical (such as a busy highway that is difficult to cross), social (such as crime or exposure to intimidation or harassment) or perceived (such as a dark alley, which may be a threat to personal safety).

To encourage walking within the CBSP area, barriers should be identified and either removed or properly managed. Examples of these include providing safe pedestrian crossings (either at-grade or grade separated) across high-volume roads such as Canning Highway and Manning Road, ensuring that all pedestrian routes have sufficient lighting and visibility to dissuade ambush attacks, and maintaining an adequate security or police presence around known or likely crime hotspots. Pathways should be as wide as practicable and pedestrian routes through chokepoints such as laneways should be avoided or mitigated where possible.

Provide footpaths that are accessible to all users (mobility and visually impaired)

All new and existing footpaths within the CBSP area should be useable and accessible to anyone, including people with disabilities and impairments. They should be DDA compliant and designed according to AS 1428: Design for access and mobility.

Provide quality public spaces

The vision for the public open space within the CBSP area is to build upon the existing public space network to create a linked series of high quality spaces which facilitate a vibrant community experience. The creation of convenient and safe links via high quality public realm streetscapes are intended to decrease vehicle dependency within the CBSP area as a whole and create pedestrian priority zones within community and commercial hubs.

Connections to isolated areas of public open space along the river on the South Perth side are to be integrated into increased commercial and retail development to create destinations rather than commuter corridors. This increased access will allow for greater utilisation of one the biggest attractors in the CBSP area, the river.

Make the area easy to navigate on foot

In addition to quality footpaths, adequate wayfinding signage should be provided in order to assist pedestrians with navigating around the CBSP area on foot. Information that is to be provided on such signs should include the direction, distance and walking time to key destinations (such as shopping facilities, tourist attractions, transit stops and recreational facilities), as well as a map depicting their relative location.

An example of appropriate pedestrian wayfinding signage is illustrated in Figure 29.

Figure 29 Wayfinding signage near Mends Street, South Perth

Lighting

The CBSP endorses the following principles:

- Lighting can increase the perception of safety and deter crime.
- Lighting in the public realm should be sensitive to not producing glare or spill whilst still providing continuous cover.
- The use of multiple lights will provide consistent cover and avoid black spots and reduce the contrast between shadow and light.
- All access and egress routes should be clearly lit, fittings should be high mounted, vandal resistant and deflect light downwards.

– Pedestrian-oriented lighting along pathways, bikeways and public open space is a key element in the creation of useable walkable networks.

Key elements for the selection of lighting within the public realm are;

– Durable fixtures resistant to the environmental conditions of the site and the proximity to the river

– Use of closer spacing's to allow the use of low wattage luminaires as opposed to less frequent spacing's and higher wattage, to reduce glare and consistent lighting levels.

– Lighting in key community hubs are to be used to add interest, character and appeal to the streetscape.

Mid-trip facilities

Mid trip facilities endorsed by the CBSP include:

– Route signage

– Water fountains

– Seating

– Handrails at road crossings

– Pram Ramps

– Artwork

– Designated Crossing areas.

Shade and shelter

It is important to provide adequate shade and shelter at appropriate locations for the comfort and convenience of users to include planting, trees and structures.

6.3.1 Summary showing alignment of initiatives with Pedestrian Strategy Statements

The Pedestrian Strategy Statements to which the above action points align with are summarised in Table 17.

Table 17 Alignment of initiatives with Pedestrian Strategy Statements

Strategy/ initiative	Alignment with Pedestrian Strategy Statements
Provide car free zones and shared spaces	PED 1, PED 3, PED 6
Reduce road speeds in the CBSP area	PED 1
Activate frontages	PED 1, PED 6
Protect and provide pedestrian facilities on desire lines	PED 1, PED 2, PED 3, PED 4, PED 5, PED 6
Manage pedestrian/ cycle conflict	PED 1
Provide footpaths of appropriate widths and standard	PED 2
Improve the permeability of the pedestrian network and provide facilities to remove barriers to pedestrian movement	PED 3
Provide footpaths that are accessible to all users (mobility and visually impaired)	PED 4

Make the area easy to navigate on foot	PED 5
Provide quality public spaces	PED 1, PED 3, PED 6
Lighting	PED 1
Mid-trip facilities	PED 6
Shade and shelter	PED 1, PED 3, PED 4, PED 5, PED 6

7. Cycle Action Plan

In addition to public transport and walking, encouraging people to cycle forms an important part of the transport strategy. Whilst the range of destinations available within walking distance is somewhat limited, in contrast nearly all of the CBSP area is accessible within a three kilometre (approximately 15 minutes) bicycle ride. This makes cycling a highly feasible mode of transport within the CBSP area.

The benefits of cycling are not just limited to increased travel range. Figure 30 illustrates the significant impact that encouraging people to switch from cars to bicycles can have on urban spaces by showing the relative space required for 60 cars, 60 people and 60 cyclists. This scale diagram is an accurate representation of the relative space occupied by the various transport methods. Therefore, a mode shift from cars to bicycles will result in better utilisation of space, as more cyclists can move through a given point than drivers in vehicles.

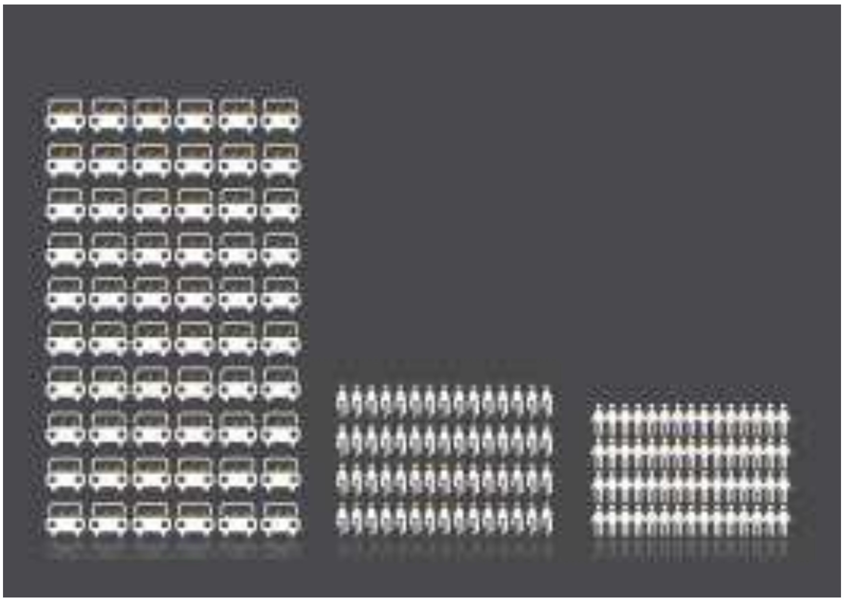


Figure 30 Comparison of space utilisation of 60 cars, cyclists and people[5]

7.1 Cycle Strategy Statements

The cycle strategy statements are listed below:

CYC 1	Provide a legible cycle network of roads and paths that serves longer-distance commuter and recreational trips
CYC 2	Provide a network of routes that is usable by cyclists of all abilities
CYC 3	Improve the safety of cycling
CYC 4	Promote development that includes quality end of trip facilities for cyclists
CYC 5	Designated local networks and routes designed to provide low-stress routes, to feed the regional network and to provide for shorter local trips to shopping centres, recreational activities, and public transport hubs
CYC 6	Full construction of route sections between origins and destinations consistent with the route purpose

[5] Source: Australian Bicycle Council National Cycling Strategy

CYC 7 Convenient access into and through residential, commercial and industrial subdivisions, and major developments

CYC 8 Access and facilities to travel with a bicycle on public transport (at all times, including peak hours)

CYC 9 Secure long and short-term bicycle parking facilities at major destinations

CYC 10 Safe routes to schools

CYC 11 Well-defined bicycle facilities on arterial roads where significant cyclist demand exists including specifically for commuter trips

CYC 12 Calming in local streets

CYC 13 Paths which are interesting, that include rest areas at appropriate intervals on regional routes, and are designed to appropriate geometric standards

CYC 14 Implementing regulatory, warning and guidance signage on paths.

7.2 Cycling Considerations

7.2.1 Regional initiatives

The Perth Bicycle Network Plan (Transport WA, 1996)

The requirements for a cycle network have been encapsulated, in an Australian context, in the concept of the 4-Cs in the Perth Bicycle Network Plan. These emphasised the development of a network of cycle facilities which:

– is Convenient, accessible and safe

– is Comprehensive, providing access to most destinations for most cyclists

– establishes Connectivity

– has regional Coverage

The aim of this Cycling Action Plan is to achieve meeting these four areas.

National Cycling Strategy (NCS) 2011-16

The vision for the Strategy was to double the number of people cycling in Australia by 2016 from 2011. It was developed as a coordinating framework identifying responsibilities of all levels of government, community and industry stakeholders to encourage more people to get on their bicycles and start riding for a better life. It identified that increasing the number of people who ride a bike for transport and recreation has a host of benefits to individuals and society. This framework guidance, based on six strategies should form the basis for the strategy and initiatives of this Cycle Action Plan. The six strategies were as follows:

1. Cycling promotion - Promote cycling as a viable and safe mode of transport, and an enjoyable recreational activity.
2. Infrastructure and facilities - Create a comprehensive and continuous network of safe and attractive routes to cycle and end-of-trip facilities.
3. Integrated planning - Consider and address cycling needs in all relevant transport and land use planning activities.
4. Safety - Enable people to cycle safely.
5. Monitoring and evaluation - Improve monitoring and evaluation of cycling programs and develop a national decision-making process for investment in cycling.

6. Guidance and best practice - Support the development of nationally consistent guidance for stakeholders to use and share best practice across jurisdictions.

WABNP (WA Bicycle Network Plan)

The WA Bicycle Network Plan 2014 – 2031 maps the way ahead to service WA's expanding cycling needs, particularly those of riders commuting to work. Key recommendations of the Plan which are important to the delivery of this Cycle Action Plan include:

– Expansion of the PSP network

– A connections to schools program

– A connections to rail/major bus stations program

– Review of traffic management on local roads

– Review of local bicycle routes

More information about the WABNP is included in section 2.3.2.

TravelSmart

TravelSmart is a unique tool that works directly with individuals in their households to help them make informed travel choices about how to get to places using their cars less and walking, cycling and using public transport more. TravelSmart is about empowering people to make decisions that have a direct environmental, health and economic benefit and has earned support from the Australian Government.

The programme has been adopted by local communities, including local governments, schools, universities, hospitals and workplaces, assisting in the self-manage process of changing transport. In this way, TravelSmart helps to build the capacity of organisations and institutions to influence the travel behaviour of their staff and customers.

TravelSmart should be adopted as part of the development of transport movements within the CBSP area. The provision and improvement of current cycling infrastructure is an important key consideration to encourage the adoption of TravelSmart throughout the CBSP community.

7.3 Proposed Initiatives

Location of appropriate cycling paths

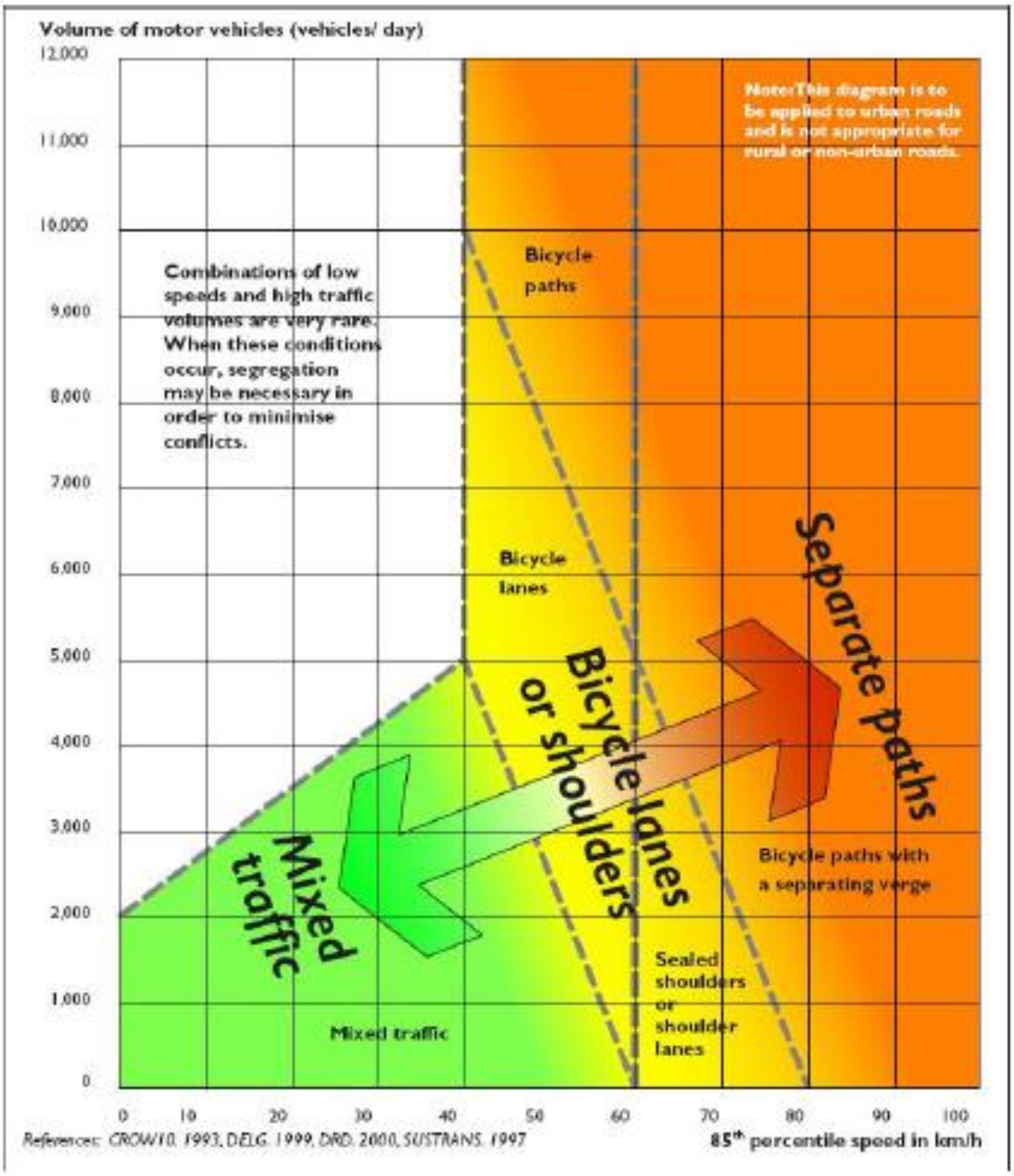
Figure 31 provides an example of guidelines for the selection of an appropriate type of bicycle facility. It relates the degree of separation required for cyclists to the speed and volume of general traffic. It should, however, be noted that jurisdictional policy and implementation strategies may also influence selection of particular facilities.

A key message of Figure 30 is that the separation of cyclists from motor vehicles is not always required on local and collector roads that have traffic volumes less than 5000 vehicles per day and speeds less than 40 km/h. In these circumstances, it is considered appropriate that adult cyclists may share the road with motor vehicles and younger cyclists may use the footpath where this is supported by appropriate road rules.

Figure 32, the Cycle Network Plan for the CBSP, shows the location of appropriate cycle path configurations. The information includes the location of Principle Shared Paths (PSP's), acceptable on–road cycling locations through low traffic volume roads and the location of off road, segregated cycle paths. The configuration of the Cycle Network Plan allows good cycle connectivity in all directions through the CBSP area while ensuring that inter connectivity between cycling and other transport modes is achievable.

In WA, most rules applying to cars also apply to cyclists. A full list of these can be found in the Road Traffic Act 1974, Road Traffic Code 2000 and Road Traffic (Bicycles) Regulations 2000.

All cycle paths created should adhere to the guidelines as provided in Austroads Part 6A: Pedestrian and cyclist paths, as well as Australian Standard AS 1742.9-2000 Part 9.



Source: Figure 4.7 of Austroads (2009b). RTA (2005, Fig 3.2).

Figure 31 Separation of cyclists and motor vehicles by speed and volume

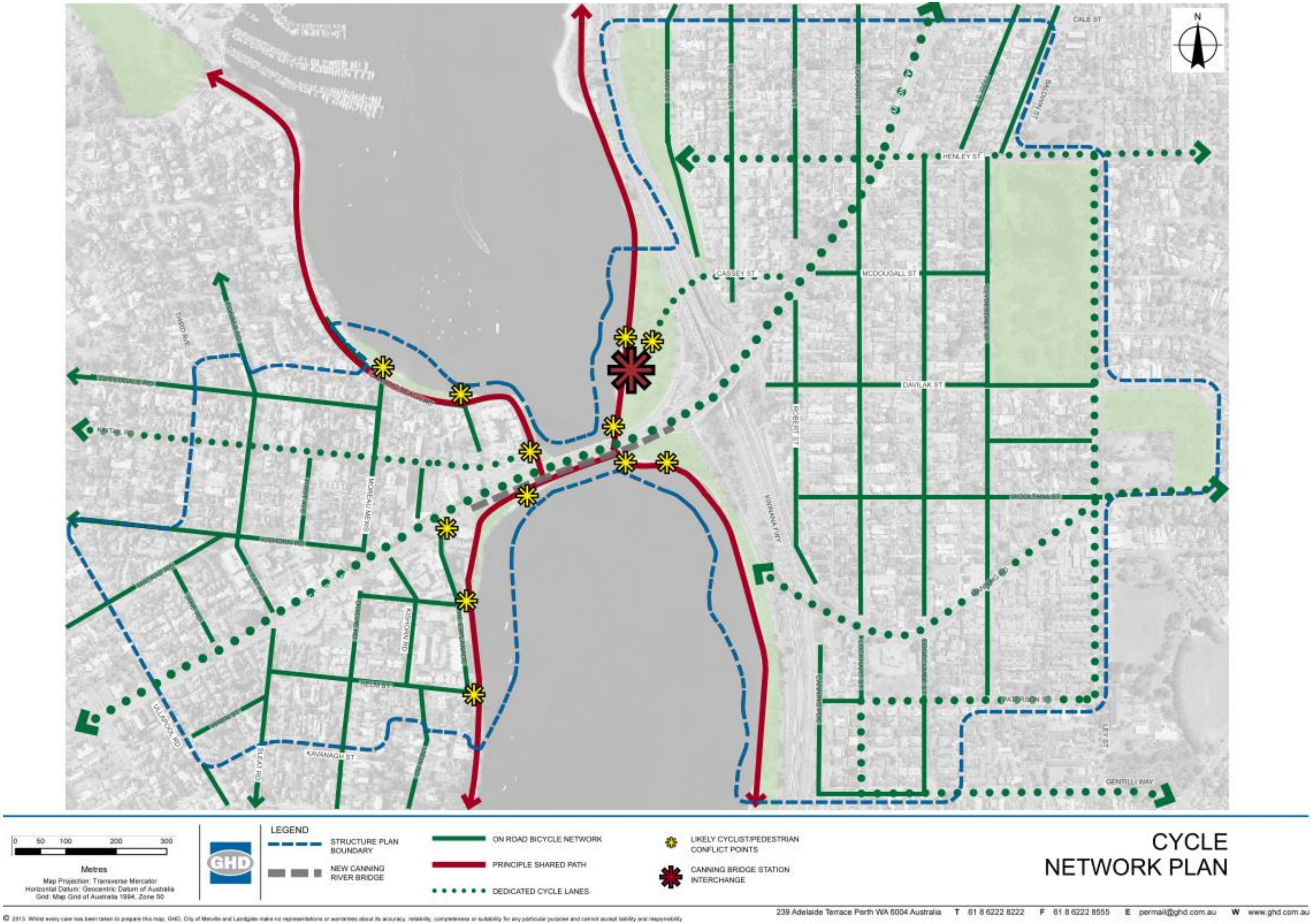


Figure 32 Cycle Network Plan

Minimising pedestrian/cycle conflict

The cycling action plan aims to promote safe conditions both for cyclists and other transport modes that interconnect with cycling facilities.

Conflict issues between cyclists and pedestrians typically fall into one or more of the following categories:

- Inappropriate path use behaviour;
- Poor path design; and
- Poor path maintenance

The main issue between cyclist and pedestrian conflict is at intersections and tight corners where there is poor visibility. It is therefore important that the installation of any new shared path facilities be provided with appropriate signage, lighting and surface conditions, as well as appropriate vertical and horizontal alignments within acceptable Austroads and Australian Standards guidance. Figure 30, the Cycle Network Plan identifies a number of locations where conflict movements between cyclists and pedestrians are most likely to occur. At these locations, it is important that cyclist movement speeds are controlled and considered, and information regarding these potential conflict movements is provided on all approaches (using both sign posts and road surface markings). There should also be minimal street furniture and vegetation to ensure minimal obstruction to visibility on all conflict point approaches.

It is important that cycle path maintenance is regularly undertaken (a review within every five years to review pathway condition as well as vegetation growth is essential). A location on the local government website, to identify and record locations where there are hazards, should be made available for use by the public to both repair, as well as the ability to identify any “hotspots” that may require review and update of design.

A summary of the requirements for the Action Plan are as follows:

- Cycle paths should be safe for all users, including persons with disabilities and visual impairment
- Cycle paths should be accessible from the carriageway at junctions and have minimum ‘give ways’
- Cycle paths should be well designed, attractive, comfortable and have a good riding surface

Where necessary in areas of high volume pedestrian movements, such as at transport stations and commercial CBSP areas, cycling and pedestrian movements should be segregated. Figure 32 identifies the locations where it will be necessary to reduce conflict by creating a separate path for cyclists and for pedestrians.

Providing end of trip facilities in new developments

The provision of end of trip facilities is essential to enable those who commute by bicycle to their place of work to feel refreshed before they commence work and ensure that their bicycle is in a safe and secure location during their time working. The following measures are required to be fulfilled to provide satisfactory end of trip facilities for bicycles:

- Minimum cycle parking numbers –Currently there are no Local Government guidelines regarding this. However for reference, Figure 33 shows the Transport for London minimum bicycle parking standards for new developments. Of note is the minimum requirement for two cycle parking spaces regardless of location or land use.
- Accessibility to/from on street facilities – Clear access should be provided to and from the street, which is not shared with others (if possible). The access should also have no obstacles en route to the cycle path facilities.
- Showers and lockers – this is currently required in the City of Melville for developments that provide 12 or more cycle parking spaces (one locker per space and a minimum of one shower is also required).

– In situ commercial development should also be encouraged to improve their own end of trip facilities for current employees if possible.

To ensure end of trip facilities are designed and created properly, adherence to AS 2890.1-1993 Parking Facilities, Part 3 – bicycle parking facilities should be considered.

Figure 33 Transport for London cycle parking standards for new developments

Location		Cycle Parking Standard * Minimum 2 spaces
Shops	Food retail	Out of town 1/350m²* Town centre/Local shopping centre 1/125m²*
	Non-food retail	Out of town 1/500m²* Town centre/Local shopping centre 1/300m²*
	Garden centre	1/300m²*
Financial and professional services	Offices, business and professional	1/125m²*
Food and drink	Pubs, wine bars	1/100m²*
	Fast food takeaway	1/50m²*
	Restaurants, cafes	1/20 staff for staff + 1/20 seats for visitors
Business	Business offices	1/250m²*
	Light industry	1/250m²*
	R&D	1/250m²*
General industrial		1/500m²*
Storage and distribution	Warehouses	1/500m²*
Hotels	Hotels	1/10 staff
	Sui generis hostels	1/4 beds
Residential institutions	Hospitals	1/5 staff + 1/10 staff for visitors
	Student accomodation	1/2 students
	Children's homes, nursing homes, elderly people's homes	1/3 staff
Dwelling house	Flats	1/unit
	Dwelling houses	1/1 or 2 bed dwelling, 2/3+ bed dwelling
	Sheltered accomodation	1/450m²
Non-residential institutions	Primary schools	1/10 staff or students
	Secondary schools	1/10 staff or students
	Universities, colleges	1/8 staff or students
	Libraries	1/10 staff + 1/10 staff for visitors
	Doctor, dentist, health centres, clinics	1/50 staff + 1/5 staff for visitors
Assembly and leisure	Theatres, cinema	1/20 staff for staff + 1/50 seats for visitors
	Leisure, sports centres, swimming pools	1/10 staff + 1/20 peak period visitors
Train stations	A Central London termini	1/600 entrants
	B Zone 1 interchanges	1/1000 entrants
	C Strategic interchanges	1/600 entrants
	D District interchanges	1/200 entrants
	E Local interchanges	Upon own merit
	F Zone 1 non-interchanges	1/200 entrants
	G Tube termini/last 3 stations	1/150 entrants
	H Other	Upon own merit
Bus stations		1/50 peak period passengers

Cycle Hub

Where physical conditions prevent a continuous bicycle trip, public transportation can provide a link to previously inaccessible destinations, thereby affording cyclists the opportunity to make longer trips. Improving bicycle access would also attract new transit riders and assists in expanding a transit stop's catchment area. Distances to transit stops that may be too far to walk currently may be within range of a short bicycle trip.

Providing secure parking for bicycles at transit stops and stations in the study area is a less expensive and more space-efficient alternative to providing parking for privately owned vehicles. There are also issues regarding acquiring sufficient land to build a car park within 400 m of Canning Bridge Station Interchange. The Cycle Network Plan shown in Figure 32 identifies the most appropriate location for a cycle hub that provides direct, short distances to alternative modes of transport.

The following identifies the most important features for a cycle hub within the CBSP:

- Direct accessibility to all other modes of transport within the study area such as for:
  - Canning Bridge railway station;
  - Bus services stopping at Canning Bridge railway station; and
  - Dedicated pedestrian footpaths.
- The acceptable maximum walking distance is 400 m. The proposed cycle hub is located within this distance to connect to the largest transit stations in the study area. Shaded linkages from vegetation and structures would provide a comfortable connection.
- Secured storage for bicycles and locker facilities for cyclists.
- Provision of visual security both at the hub and along the transit connections.
- Pursue the opportunity to create a bike loan/hire system, particularly to and from the Canning Bridge Station Interchange, the rest of the CBSP area and nearby locations such as Curtin University.

Integrate on-street cycle parking into urban form

Bicycle parking facilities are installations which allow for the secure parking of bicycles. They include bicycle lockers, lock-up cages or compounds for long-term parking, and bicycle parking rails (either floor- or pavement-mounted rails or wall-mounted rails) for short-term parking, as described in Australian Standard AS2890.3 and the Austroads Guide to Traffic Engineering Practice Part 14 – Bicycles. Examples are shown in Figure 34.

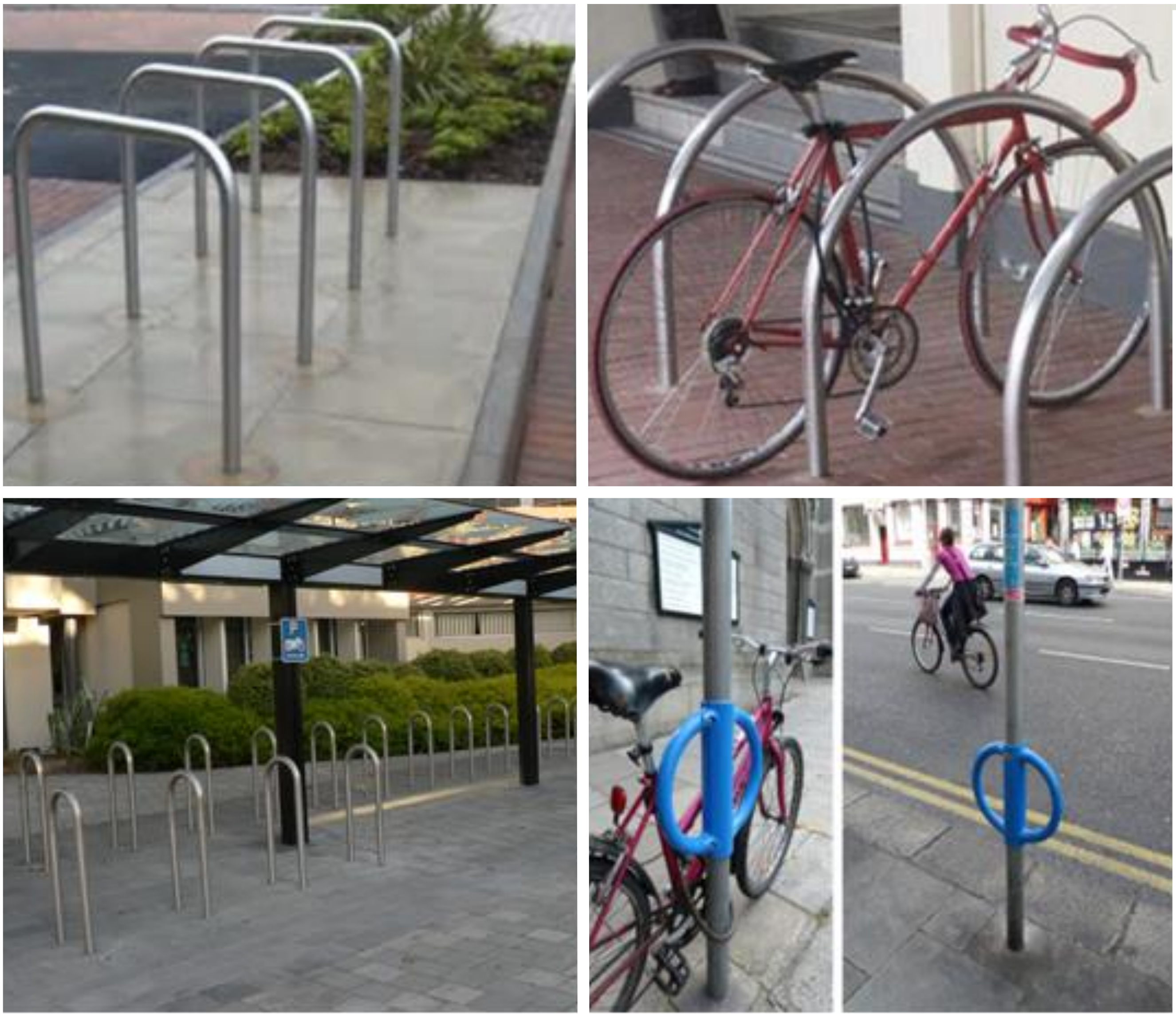


Figure 34 Examples of on-street bicycle parking

Principal Shared Path (PSP)

The Principle Shared Path (PSP) facility, a separated path for cyclists and pedestrians that runs on the eastern side of Canning River, to provide direct connectivity from the study area north to Perth City and beyond and south as far as Mandurah as shown in the Cycle Network Plan in Figure 32.

An example of a separated cycle path facility, located in the City of Subiaco, with signage and alongside road and footpath facilities is shown below

Figure 35 Example of a Shared Path Treatment

7.3.1 Summary showing alignment of initiatives with Cycle Strategy Statements

The Cycle Strategy Statements to which the above action points align with are summarised in Table 18.

Table 18 Alignment of initiatives with Cycling Strategy Statements

Strategy/ initiative	Alignment with Cycling Strategy Statement
Maintain a network of safe, attractive bicycle routes	CYC 1, CYC 2, CYC 3, CYC 5, CYC 6, CYC 7, CYC 10, CYC 13, CYC 14
Promotion of cycling in the CBSP area.	CYC 2, CYC 3, CYC 7, CYC 8, CYC 10
Connection of cycle network with separated cycle path along higher speed, higher volume roads	CYC 1, CYC 2, CYC 3, CYC 6, CYC 11, CYC 14
Bicycle crossing facilities at intersections to assist connection of cycling network	CYC 2, CYC 3, CYC 5, CYC 7, CYC 14
Connected network of on road cycle paths on lower speed, lower volume roads	CYC 3, CYC 5, CYC 12, CYC 14
Dedicated bridge crossings for cyclists and pedestrians	CYC 1, CYC 2, CYC 3, CYC 6, CYC 13, CYC 14
Provide adequate end-of-trip facilities in both new and existing buildings	CYC 4, CYC 9

8. Parking Action Plan

8.1 Parking Considerations

Parking is a component of the overall transport system and can influence the decisions people make when travelling. Parking needs to be considered in the context of the overall transport system and therefore a strategy cannot be developed in isolation of the broader transportation objectives.

The vision for the CBSP area is based on the promotion of more sustainable modes of transport and therefore there needs to be a shift from current trends in dealing with car parking supply and demand. The City of Melville has developed an Activity Centre Parking Management and Strategy (ACPMS - draft) to detail their new approach.

This strategy incorporates the five sustainable parking principles outlined in the ACPMS, including:

1. Focus on people access not vehicle access;
2. Provide efficient and effective alternatives to car access;
3. Parking policy and strategy must support sustainable transport;
4. The appropriate amount of parking for a centre will be well below the unconstrained demand for parking; and
5. The provision of parking requires a demand management, not a demand satisfaction approach.

The objectives of this strategy are consistent with those detailed in the ACPMS and include:

- Ensure sufficient parking supply to support prosperous and vibrant commercial activity centres;
- Provide enforcement resources to ensure safety, adequate turnover of parking spaces to support business activity in the areas to protect residential amenity;
- Ensure parking spaces availability is managed according to varying needs of businesses, customers and commuters;
- Promote “shared” or publically available parking in preference to single user parking;
- Apply CPTED (crime prevention through environmental design) principles in the design of off-street parking facilities;
- Determine an appropriate amount per space for cash in lieu and allow flexibility in how the resulting funds are best spent;
- Accommodate parking for all vehicles including motorcycles and bicycles;
- Support accessibility to activity centres by recognising all travel modes including walking, cycling, and public transport; and
- Review the strategy for future needs.

This strategy includes initiatives that contribute towards achieving these objectives.

Parking issues in the CBSP Area can be classified in terms of supply or management. Supply issues deal with the number of available spaces and the expectation that more should be provided, management issues relate to available facilities not being used effectively.

Car parking is an issue that is raised as a concern by residents, stakeholders, and council representatives. There is a perception that the streets surrounding the Canning Bridge Station Interchange are littered with cars that are using the residential area as informal park and ride.

The City of Melville's ACPMS also identifies that some of the parking intended for short term parking to serve local retailers is also being utilised for longer stay park and ride and by employees in the centre.

This strategy includes initiatives to address the ongoing supply and management challenges that are consistent with the new approach to parking strategy.

8.2 Proposed Initiatives

8.2.1 New Approach

The traditional approach to car parking was focused on providing a supply that would allow drivers to easily find car parking at their destination, and considered the supply required for each site independently of surrounding land uses. As articulated in the ACPMS, the traditional "predict and provide" approach was based on the premise that parking problems were only related to inadequate supply.

The ACPMS sets out the City of Melville's new approach to parking with the recommendation that:

"future strategies for the City of Melville must therefore incorporate measures not only to curtail the supply of parking, but also to manage parking so as to significantly alter current modes of travel."

Therefore, this strategy moves away from the "predict and provide" approach to consider initiatives that focus on management and an "appropriate" supply of car parking.

Parking Control and Management Plan

Parking Strategy No 1: A CBSP area Parking Management Plan should be developed for the CBSP area

Priority: Short Term

This strategy sets out the higher level principles for addressing the supply and management of parking in the CBSP area. A Parking Management Plan will address the specific parking issues in the area, in the short, medium, and longer term in more detail. The Parking Management Plan should address the transitional arrangements, or provide guidance on how developers should consider these.

Parking Strategy No 2: A Parking Control and Management Plan should be provided by developers as part of the development application process for all developments that include more than five car parking spaces.

Priority: Short Term

The Parking Control and Management Plan submitted by a developer should set out how parking in the proposed development will be controlled and managed after establishment. This places responsibility on the developer to implement plans to manage their parking demand and can assist with complying with planning conditions.

Parking Strategy No 3: Develop a Parking Control and Management Plan Guidance document to advise developers of their requirements and ensure consistency of approach across the CBSP area

Priority: Short Term

The Council will require a consistent approach to the review of Parking Control and Management Plans to ensure that development applications are considered on their own merit. The development of a guidance document for developers will assist both parties in understanding what is expected and reasonable.

It is anticipated that the content of a Parking Control and Management Plan would include: definition of the aims and objectives, discussion of the existing and future developments/ site usage, an action plan detailing initiatives, responsibility for implementation and championing, timeframe for initiatives, and detail on the monitoring and enforcement process.

Parking Ratios and Standards

Parking Strategy No 4: Provide an appropriate amount of car parking at each development that considers the opportunity to provide shared and reciprocal parking, and is consistent with the wider transport strategy objectives

Priority: Short Term

Over or under provision of car parking can result in either wasted development opportunities or over-spill of car parking into surrounding areas. Neither is particularly desirable and therefore there is a need for new development to provide an amount of car parking that is appropriate to the type of development and the facilities available to travel by alternative modes of transport.

Parking Strategy No 5: Define the maximum parking requirements for new developments in the CBSP area using the target mode share for car driving

Priority: Short term

The City of Melville's ACPMS includes discussion and recommendations for changes to the minimum car parking ratios/ standards. Maximum parking standards should also be developed and agreed as part of the Parking Management Plan. These should be consistent with the target mode share for car driving and achievable within the context of the wider transport strategy for the area.

Parking Strategy No 6: Adopt maximum car parking ratios/ standards for residential development

Priority: Short Term

The following car parking ratios are recommended for residential development in The CBSP area.

- Single Bedroom Dwelling or Studio : 0.75 space per dwelling
- Two Bedroom Dwelling: 1 space per dwelling
- Equal to or greater than three bedroom dwelling: 1.25 spaces per dwelling
- No visitor parking will be provided for residential dwellings. Visitor parking should be provided through sharing of parking with other land uses e.g. offices.

Parking Strategy 7: Permit "car-free" development, providing appropriate management mechanisms are in place via a Parking Control and Management Plan

Priority: Short Term

Maximum or minimum car parking standards allow local authorities to more easily determine the policy compliance of a new development. However, some flexibility should be considered to allow developers to promote car free development. Developments that are intending to provide parking below the current minimum standard should submit a Parking Control and Management Plan.

Parking Strategy No 8: 25% of car parking bays provided as part of a development in CBSP should be designed as "small vehicle bays", in accordance with the GreenStar guidelines.

Priority: Short Term

The GreenStar guidelines/ scoring awards credits to developments that provide "small vehicle bays" that has dimensions of 2.3m x 5.0m. Adopting a requirement for 25% of bays to meet this requirement will assist in rationalising the space required for car parking.

Cash In Lieu

Parking Strategy No 9: Consider the merits of Cash in Lieu for CBSP cognisant of actual developer provision and use of revenue for measures including public parking and promotion of other trip reducing measures, cycle parking, end of trip facilities and public transport incentives.

Priority: Short Term

Cash in lieu has various attributes and broadly allows developers to pay the cash in lieu instead of constructing car parking bays, if providing all of the required bays is not possible or is too expensive.

The revenue from cash in lieu is used to build public car parking bays for shared use. The benefit of the shared use facility is this allows customers to park once and visit multiple sites if necessary.

A further benefit of cash in lieu is businesses are able to meet their parking requirements without on street parking and allows continuous storefronts without gaps created by parking and access. A safer and more walkable environment is likely to result.

Concerns identified in the ACPMS include impact on the viability of a development, high cash in lieu costs, there is no guarantee that the cash in lieu revenue will be used (or when) to provide the required public parking and actual provision may be fewer than the development shortfall.

The ACPMS indicates that the City of Melville has not imposed cash in lieu for several years however it is recommended that the City consider the merits of cash in lieu for the CBSP area cognisant of actual developer provision and use of revenue for measures including public parking and promotion of other trip reducing measures, cycle parking, end of trip facilities and public transport incentives.

Deck Parking

Parking Strategy No 10: Provide multistorey decked car parks for communal parking in the CBSP area.

Priority: Medium Term

There is an opportunity to provide a decked car park in several locations. Opportunities should be considered as/ when they arise and the private sector should be encouraged to explore decked car parking opportunities.

Parking Strategy No 11: Screen multistorey decked car parks with buildings to integrate design within the urban form

Priority: Short Term

The visual impact of car parking structures should be minimised. An effective method for doing this is the screening using the built form. Therefore, decked car parking should be integrated into the built form, either by providing car parking beneath or above the ground floor, or within the building envelope. This will allow the active frontage of the development to be maintained.

Parking Strategy No 12: Ensure that decked car parks are designed with consideration to CPTED principles

Priority: Medium Term

Car parks should be designed so that safety and security is maximised.

Improved User Information

Parking Strategy No 13: The current website information on car parking within the CBSP area is improved to include detailed information about public parking facilities, their hours of operation, time restrictions, fees and alternatives.

Consider the use of 'Apps' and opportunities to provide real time information on the location of available parking bays.

<u>Priority: Short Term</u>

The (Draft) ACPMS identified a lack of useful information for drivers including car parking availability within the City. The planned CBSP area may include a Council controlled decked car park and it will be important to convey availability and access information to drivers.

Available information should include hours of operation, time restrictions, fees and alternatives.

The ACPMS also identified Apps that provide detailed real time information regarding car parking availability. Reliable information will reduce driver frustration and delay when visiting the area.

Way Finding

Parking Strategy No 14: Develop a way finding and parking signage system including real time parking availability signs for the CBSP area, consistent with the broader area to assist drivers to know where car parking facilities are located.

<u>Priority: Medium Term</u>

In order to assist drivers visiting the area find key destinations it is important to provide adequate way finding measures which include signs, directories and other design features. Visitors to the area will not necessarily know where facilities are located and good information will assist drivers to plan their route. There will also be benefits by reducing circulating traffic and congestion.

The way finding measures should be consistent with the measures for the broader area.

Real time signs could also be considered to advise drivers of car parking availability with the public car park.

Management Strategies

Residents parking, Parking Control and Management Plans, parking supply, and user information and way-finding are discussed in more detail within other sections of this parking strategy. This discussion covers the wider management strategies that can be adopted to manage the use of the supply of car parking.

Parking Strategy No 15: Encourage and permit developments to adopt a strategy of sharing car parking spaces

<u>Priority: Short Term</u>

This will require:

- Establishment of procedures for implementing shared parking;
- Education of planning officers and developers;
- A process for determining who can share parking with whom;
- Good pedestrian access, security and appropriate signage for shared parking;
- Regular parking studies of accumulation and users to inform future shared parking schemes and identify any potential issues;

– Have supporting transportation strategy initiatives to ensure that overspill parking does not eventuate; and

– Agreement of enforcement arrangements and jurisdiction between private land owners and the Council.

Parking Strategy No 16: Implement a controlled parking zone (CPZ) in the CBSP area

Priority: Short Term

A CPZ would allow the Council to implement timed, paid, or a combination of both parking controls to manage the usage of on and off street public car parking in the CBSP area. This will require a combination of timed and paid parking strategies.

Parking Strategy No 17: Implement paid and timed parking in the CBSP area to encourage public transport use, higher turnover of parking bays and discourage long term parking.

Priority: Medium to Long Term

The introduction of paid and timed parking is intended to:

– Encourage a higher turnover of parking spaces;

– Create a pricing structure where a higher charge is levied for the most convenient parking spaces;

– Set parking fees at a level that encourages public transport usage;

– Encourage businesses to price parking and then offer discounts/ refunds/ free parking to their bona fide clients; and

– Implement a parking pricing structure that is flexible depending on the time of day and day of week.

The current paid parking in the CBSP area is located at the library (Mon – Sat 8am - 6pm), Raffles Basement Car park (Mon – Sun 8am-6pm) and Moreau Mews(Mon – Sat 8am - 6pm) . Approximately 220 bays are available, fees are charged at $1.20/hr and $2/hr (Raffles).

The ACPMS indicates a high usage at weekends.

Parking and travel demand is heavily influenced by pay parking and can also influence car parking duration and mode choice. The ACPMS suggest that Pay Parking generally results in reductions in car use and traffic congestion and is one of the essential transport measures necessary to ensure the long term viability of commercial centres,

Key objectives from the ACPMS include setting fees high enough to encourage a shift in travel mode or times and high enough to generate a maximum 85% occupancy.

The setting of appropriate fees needs to be referenced to public transport fares and the ACPMS suggests that all day parking fees should be higher than a two zone return train fare. This is relevant to the CBSP area due to the close proximity to the Canning Bridge Station Interchange. The area is also well served by buses and use of Public Transport for travelling to and from the area needs to be encouraged by the Parking Strategy and mechanisms available.

The pricing structure should encourage short term use to promote a high turnover of spaces and discourage long term parking.

Parking Strategy No 18: Ring-fence revenue obtained from paid parking schemes for reinvestment in transportation initiatives that promote alternative modes of transport.

Priority: Short Term

Revenue obtained from paid parking schemes to be reinvested into transportation schemes that provide alternatives to the car for travel to and from the CBSP area.

Resident Parking

Parking Strategy No 19: Implement a residential parking scheme that allows residents access to parking adjacent to their property at all times of the day.

Priority: Short Term

This can assist with allowing residents to find a parking space adjacent to their property. Resident parking schemes can take the form of time restrictions combined with resident parking permits, or parking meters with exemptions for residents. Residents could be required to purchase annual permits. The City of Melville's ACPMSsuggests an annual charge of $50 to cover administration and enforcement costs.

Disability Permit Holders

Parking Strategy No 20: Provide disability bays in accordance with the Australian Disability Parking Scheme.

Priority: Short Term

Bays should be provided in accordance with the Australian Disability Parking Scheme. Where possible bays should located off street and conveniently located.

Public Transport - Buses and Taxis

Bus stops facilities are consider as part of the Public Transport Strategy and includes recommendations for bus stops, shelters and services. These are not further considered here.

Kiss and Ride

Kiss and Ride is being developed as part of the Multi Modal Transport Interchange and it is critical that this function is accommodated inside the facility to avoid this taking place on Canning Highway.

The Department of Transport needs to ensure that adequate facilities are provided at the interchange.

Drop Off/pick up

Parking Strategy No 21: Provide on street drop off/pick locations on the east side of the Canning River (in South Perth) to serve the Interchange.

Priority: Short Term

Short term, drop off and pick up (5-15 minutes) could be provided at some key locations within the CBSP area, particularly on the east side of the Canning River to supplement the Kiss and Ride facilities within the Interchange and reduce the need for this traffic to access the Bridge.

Park and Ride

Parking Strategy 22: Discourage informal park and ride associated with the Interchange by appropriate Parking Management measures including timed parking and CPZ.

Priority: Short Term

It is understood from discussion with stakeholders that Park and Ride facilities will not be provided as part of the Interchange. It is clear therefore that there is significant risk of long term parking by commuters in the surrounding streets. Recent surveys indicate some commuter parking in the surrounding streets, i.e. Robert Street,

The Parking Strategy needs to mitigate the risk of commuters parking in the surrounding residential streets to include timed parking and paid parking.

Loading Facilities - Service vehicles

The provision of adequate loading facilities is essential to the successful operation of a commercial centre. All new development should accommodate service facilities within the development, appropriate enforcement is necessary to ensure these areas are not used for private parking resulting in undesirable servicing activities on the street.

Parking Strategy No 23: Loading zones to be clearly signed to allow free parking after 5pm.

Priority: Short Term

Short to Medium Stay

Parking Strategy No 24: Ensure adequate short to medium stay parking is available to accommodate the commercial areas and this is enforced to maintain adequate turn over.

Priority: Short Term

The ACPMS discusses the need to provide short stay parking up to two hours and 2-4 hours for business and retail needs. Enforcement is needed to ensure compliance.

Car sharing systems

Parking Strategy No 25: Investigate the feasibility and potential location of reserved bays for the future introduction of car sharing schemes.

Priority: Medium to Long Term

Car sharing systems can help reduce the need for private car ownership by providing members with short-term access to vehicles parked in specially-reserved bays (see section 9 for more information). Feasibility studies should be conducted into the number and potential location of such bays that might be provided in future should such a scheme be implemented.

Cyclists

Parking Strategy No 26: Ensure that adequate parking provisions and end of trip facilities for cyclists be incorporated into all new development to encourage and promote travel by cycling.

Priority: Short Term

The ACPMS considers that a high priority should be given to parking for cyclists and planning requirements should ensure that adequate parking provisions and end of trip facilities for cyclists be incorporated into all new development to encourage and promote travel by cycling.

Motorcycle and Scooter Parking

Parking Strategy No 27: Ensure motor cycle parking is provided at appropriate locations within the CBSP area.

Priority: Short Term

Dedicated motorcycle spaces should be provided to accommodate users and reduce car trips.

Education

Parking Strategy No 28: As part of the broader Parking Strategy for the area undertake an ongoing campaign of community communication about the unsustainability of current parking expectations.

Priority: Short Term

The ACPMS emphasises the need to educate the motoring public regarding the negative effects and unsustainability of providing increased parking to cater for a growing demand. The ACPMS promotes an upgraded and ongoing campaign of communication on the unsustainability of current community parking expectations. Issues to be addressed are identified as:

- Drivers cannot expect unlimited parking close to their destination;
- Unlimited supply has environmental, social and economic drawbacks;
- Principle of user pays;
- Supply is not unlimited;
- Need for sustainability planning;
- Benefits of improved compliance;
- Benefits of Parking Control and Management Plans; and
- Options for reinvestment of income from parking services into improving infrastructure.

Enforcement

Parking Strategy No 29: Ensure adequate resources are allocated to parking enforcement within the CBSP area.

Priority Short Term

The value of parking restrictions and parking management is dependent upon users complying with the regulations. The impacts are diminished if compliance is poor; therefore it is necessary to have a visible enforcement system to effectively control the scheme.

Recent technology advances allow in-ground detectors to measure the time a vehicle is parked and allow infringements to be issued. This is one measure that could be further examined for the CBSP area.

The ACPMS emphasises that more efficient enforcement practices are urgent as they will have an effect on parking demand.

Survey of Car parking Profile

Parking Strategy No 30: Regularly monitor the parking profile to assess its operation and effectiveness and highlight issues. This information will allow targeted remedial measures; provide a good base study for subsequent changes and also application to other areas. An annual survey is considered appropriate.

Priority: Short Term

The car parking requirements and demands of any area change over time influenced by a number of factors including type of development, public transport availability, accessibility, fee structure, mode split, financial climate , fuel prices, work from home opportunities etc. It is considered necessary therefore to regularly monitor the parking profile to assess its operation and effectiveness and highlight issues. This information will allow targeted remedial measures; provide a good base study for subsequent changes and also application to other areas.

9. Improved Technology and Changing Practices

The following is a list of practices, developments and technologies that can assist in managing and promoting efficient movement through the CBSP area. Whilst there is not a lot of direct control available over these, they all have the potential to reduce the demand placed on the transport network, and may play a bigger role as congestion increases.

Improved network operations

Main Roads are currently investigating ways in which the efficiency of the existing road network can be improved (such as the current Traffic Signal Optimisation program along Canning Highway). This is a cost-effective way to manage congestion, and may help reduce the need for expensive capital works (such as additional lanes and roads).

Promoting local employment and services

The need for residents to travel outside the CBSP area for long distances can be mitigated by encouraging the use of local services (such as shops and recreational facilities), as well as through local employment.

Working/shopping from home

Current and future advances in technology may enable an increasing proportion of the workforce to work from home, thereby reducing the demand on transport networks. In addition, e-commerce may eliminate the need for people to travel to the shops, with goods ordered online being delivered right to one's front door.

Peak spreading

If some people leave for work a little bit earlier or later, the same total travel demand during peak hour can be effectively redistributed over a longer time period. This can potentially reduce the peak demand below the maximum capacity of the road network, improving its ability to accommodate expected traffic volumes.

Car sharing systems

A car sharing system or scheme gives members access to a fleet of allocated vehicles that are parked in strategic locations. These are especially useful for people who only need to drive occasionally, as they can realise the benefits of driving without having to incur the initial and recurring expenses of car ownership. Existing car owners also benefit in that they have access to vehicles that suit one-off or infrequent needs (such as a van for transporting bulky goods, or a people mover for driving large groups around), or if they simply wish to drive something different to their usual ride (such as a sports or luxury car).

Although there are currently no car share schemes in Perth, there are several commercial operators that have successfully implemented them in Sydney, Melbourne, Adelaide and Brisbane. Whilst the decision to implement a car sharing scheme within the CBSP area would be up to these operators, they would need to negotiate with local authorities regarding the placement of parking spaces or 'pods' reserved for these shared vehicles.

The implementation of a car sharing scheme has the potential to eliminate the need for car ownership within the CBSP area. Under this transport strategy, all inter- area trips and most trips into and out of the area would be made by walking, using public transport or cycling. A car sharing scheme would greatly complement the strategy as users can simply hire a vehicle for the few occasional trips that do require one, such as transporting heavy goods or visiting remote locations that are not served by public transport.

Effect of increasing road congestion, parking difficulties and fuel prices on mode choice

Much of the benefits of driving (such as journey times and mobility) are at their peak only when there are few or no other road users. When a large volume of motorists either wish to travel to the same destination or even drive along the same road, these benefits are quickly diminished, and the drawbacks associated with driving become much more evident. People may be forced to weigh up the benefits of driving with the drawbacks they experience during their trip.

As the number of vehicles on Perth's regional road network continues to rise, so too will the level of congestion and the associated cost and inconvenience that will be experienced by motorists. This may come in the form of increased journey times, wasted fuel as a result of idling in traffic, stress, and in some extreme cases, incidences of aggressive and unsafe driving. On their own, these drawbacks may outweigh the benefits of driving to such a degree that they actually encourage the behavioural change advocated in this transport strategy, such as through using public transport, cycling or walking to get to their destination, or by reducing the need to travel. In other words, the presence of congestion may actually increase the rate at which the aforementioned strategies will work.

A similar phenomenon can be observed in relation to parking, where the benefits of driving can be outweighed by the need to find and/or pay for parking. This is most evident at destinations which attract a high number of trips, such as the Perth CBD, entertainment venues and shopping centres. Therefore, some may consider public transport, walking or cycling to be preferable to driving as a result of the time, money and hassle saved.

Finally, motorists are exposed to rising fuel prices, which over time can significantly increase the cost of driving. As discussed above, congestion also results in unnecessary fuel consumption, further increasing the cost of driving. Given that cycling and walking are practically free, and the cost of public transport only changes annually, there is a financial incentive to consider these alternative modes of transport.

Effect of demand management, road pricing to reduce congestion

In other cities in Australia and around the world, road pricing and other demand-driven measures to reduce congestion have been implemented, such as toll roads and congestion charging schemes. It is important to note that none of these measures are currently being considered by the State Government; however these would reduce the vehicular demand on the road network and assist in increasing the mode share of non-car travel if they were to be implemented in the future.

10. Implementation Plan

10.1 Overview

Following completion of the Integrated Transport Strategy a number of actions and strategies are recommended. This report should be used by State and Local Governments to consider in their transport planning and capital works programs.

Key transport strategies necessary to ensure transport infrastructure supports the CBSP are to be implemented over an appropriate timeframe. Timeframes will be dependent upon stakeholder inputs and assessment of likely requirements based on a range of factors including demand and patronage forecasts and funding availability. Notwithstanding, it is critical that the Councils continue to engage with the State Government to promote the development of significant infrastructure components such as the new bus station component of the Canning Bridge Station Interchange.

Suggested timeframes include:

- Critical: 0 to 10 years
- Medium term: 11 to 20 years
- Long term: Beyond 20 years

10.1.1 Critical transport infrastructure (short term, 0-10 years)

Road Infrastructure	Public Transport	Active Transport	Parking
Support planning for Public Transport Boulevards *(Department of Transport; Cities of Melville and South Perth)*	Establishment of "kiss and ride" facilities for Canning Station Interchange *(Public Transport Authority)*	Develop path network (Local Connectors) *(Cities of Melville and South Perth)*	Develop a Parking Management Plan for the CBSP area, including requirements and guidance for Parking Control and Management Plans by developers as part of the development application process *(Cities of Melville and South Perth)*

Road Infrastructure	Public Transport	Active Transport	Parking
Review modification to Canning Beach Road/Kintail Road/Canning Highway Intersection *(City of Melville)*	Construction of new bus station within integrated transit hub, including new pedestrian access *(Department of Transport; Public Transport Authority)*	Design and construction of cycle and pedestrian access to new bus station *(Public Transport Authority)*	Implement a residential parking scheme that allows resident's access to parking adjacent to their property at all times of the day. *(Cities of Melville and South Perth)*
Design and construction of Canning Highway road reservation to incorporate: – priority bus lanes in both directions; – dedicated cycle lanes; and – enhanced pedestrian experience *(Main Roads, WA)*	Implementation of an east-west rapid transit system along Canning Highway *(Department of Transport; Public Transport Authority)*	Design and construction of pedestrian crossings to Canning Highway *(Main Roads, WA)*	Ensure motor cycle parking is provided at appropriate locations within the CBSP area. *(Cities of Melville and South Perth)*
Design and construction of public transport boulevards *(Cities of Melville and South Perth)*	PTA to review bus services and facilities and improve as required *(Public Transport Authority)*		Develop a way finding and parking signage system including real time parking availability signs for the CBSP area, consistent with the broader area to assist drivers to know where car parking facilities are located. *(Cities of Melville and South Perth)*
Design and construction of local accessways within relevant development stages *(Cities of Melville and South Perth)*			Implement a controlled parking zone (CPZ) in the CBSP area, particularly timed parking to discourage informal park and ride, and to encourage public transport use, higher turnover of parking bays and discourage long term parking. *(Cities of Melville and South Perth)*
Water sensitive urban design (WSUD) features within road reserves and public open spaces to treat stormwater runoff *(Cities of Melville and South Perth)*			Ensure adequate resources are allocated to parking enforcement within the CBSP area. *(Cities of Melville and South Perth)*

10.1.2 Necessary transport infrastructure (medium term, 10-20 years)

Road Infrastructure	Public Transport	Active Transport	Parking
Design and construction of local accessways within the CBSP Mixed Use area *(Cities of Melville and South Perth)*	PTA to review bus and rail services and facilities and improve as required *(Public Transport Authority)*	Develop path network (all path and road types) *(Cities of Melville and South Perth)*	Develop multistorey decked car parks for communal parking in the CBSP area *(Cities of Melville and South Perth)*
Construction of the southbound Kwinana Freeway on ramp from Manning Road *(Main Roads, WA)*	Continual improvements to public transport infrastructure in accordance with the Public Transport Masterplan *(Public Transport Authority)*	Enhance regional active pathway network as part of foreshore works *(Department of Transport)*	Investigate the feasibility and potential location of reserved bays for the future introduction of car sharing schemes *(Cities of Melville and South Perth)*
Replace Canning River Traffic Bridge *(Main Roads, WA)*	Design and construction of light rail link from Curtin University to the CBSP area (*Department of Transport; Public Transport Authority)*	Redevelop retained northern timber bridge as pedestrian and cycle way *(Main Roads, WA)*	
Progress development of movement network *(Cities of Melville and South Perth)*			
Water sensitive urban design (WSUD) features (such as biofiltration swales) within foreshore reserves to treat road stormwater runoff *(Cities of Melville and South Perth)*			

10.1.3 Supporting transport infrastructure (long term, 16+ years)

Road Infrastructure	Public Transport	Active Transport	Parking
Progress development of movement network *(Cities of Melville and South Perth)*	Construction of Cassey Street Link to Bus Station (uncommitted, subject to design and confirmation) *(Public Transport Authority)*	Progress development of path network (all path and road types) *(Cities of Melville and South Perth)*	Regularly monitor the parking profile to assess its operation and effectiveness and highlight issues. This information will allow targeted remedial measures; provide a good base study for subsequent changes and also application to other areas. An annual survey is considered appropriate. *(Cities of Melville and South Perth)*
Progress Regional Road Initiatives *(Main Roads, WA)*	Potential establishment of ferry services within Canning Bridge Station Interchange *(Public Transport Authority)*	Enhance regional active pathway network as part of foreshore works *(Department of Transport)*	

Appendices

Appendix A – Baseline Report

Canning Bridge Structure Plan

Transport Assessment - Baseline Data Review

Phase 1: Analysis

August 2014

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1. Introduction

1.1 Overview

GHD has been commissioned by the City of Melville for the Project Partners[1] to provide transportation consultancy advice with regards to providing a transport assessment for the proposed changes and planning of the activity centre at Canning Bridge Activity Centre (the study area).

The purpose of this report is to define the existing situation, baseline transport conditions and undertake a gap analysis in the context of the outcomes of discussions with the main stakeholders.

1.2 Study area

The study area and vision for Canning Bridge is shown in Figure 1.

Figure 1: Site Location

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[1] The City of Melville is the contracting party, with the client group inclusive of the City of Melville, The City of South Perth, the Department of Planning/Western Australian Planning Commission, the Department of Transport, the Public Transport Authority and Main Roads WA. The client group will be referred to as the Project Partners.

1.3 Previous studies

The Canning Bridge study area and surrounds has been the subject of many previous studies; the primary stakeholders highlighted and forwarded those that are considered relevant, including:

- Canning Bridge Interchange – Concept Design
- GHD Traffic Study (2009)
- Canning Bridge Station – STEM Modelling (July 2010)
- Canning Bridge Interchange: Passenger Data Collection Consultancy (June 2010)
- Jackson Road Bus Priority Works (December 2009)
- Bentley Technology Precinct Traffic Study (May 2008)

2. Strategic Context

2.1 Existing and emerging transportation policies

2.1.1 National policy

The COAG agreed on 1 January 2012 that all state governments have plans in place that meet the objective to integrate functions and governance and the federal government would link future infrastructure funding decisions to achieving these criteria.

The national context, in terms of objectives and requirements for transportation, most relevant to this Transport Assessment of the Canning Bridge Structure Plan are:

- National Charter for Integrated Land Use and Transport Planning
- Australian Transport Council policy directions
- Infrastructure Australia policy directions (including Our Cities, Our Future)
- National Guidelines for Transport System Management in Australia
- National Road Safety Strategy 2011 to 2020
- Australian Local Government Association policy direction
- Australian National Cycling Strategy 2011 to 2016
- Our Cities, Our Future – A National Urban Policy for a Productive, Sustainable and Liveable Future 2011
- National Disability Strategy (2010 to 2020) and Disability Discrimination Act 1992

2.1.2 State policy and guidance

Table 1 overleaf is a summary of the state policy that needs to be considered in the transport assessment for Canning Bride study area.

Table 1: State Policy and Guidance

State Policy and Guidance		Relevance to Canning Bridge Study Area
State Planning Policy 4.2 Activity Centres for Perth and Peel	Sets out the broad policy requirements for movement and urban form. SPP 4.2 includes information relating to – Parking supply; – The ability to provide contribution to more sustainable modes of transport in lieu of a proportion of car parking bays;, and – The ability for developers to reduce their onsite parking. The planning policy suggests that activity centres are the focal point for bus services. Given that the area benefits from a main line rail service there is a significant opportunity to provide a high quality, sustainable town centre providing the barrier formed by the river and major road connections can be addressed.	An appropriate **parking policy** will need to be defined for Canning Bridge. This should take consideration of the content within the emerging Activity Centre Parking Paper; this is currently in draft. There is **opportunity to reduce the parking requirements** to encourage a mode shift away from single occupancy car trips.

State Policy and Guidance		Relevance to Canning Bridge Study Area
Development Control Policy 1.6 Planning to Support Transit Use and Transit Oriented Developments	Emphasis on the delivery of transit related development outcomes on local government planning processes, through the preparation and consistent application of provisions within town planning schemes, planning policies and design controls.	The policy requires and/or encourages that: – Street pattern be designed to **enhance general walkability** and facilitate pedestrian access to transit facilities. – Streetscapes are designed to promote walking and improve the general level of **amenity for pedestrians**; and – Continuity of footpaths should be ensured, with layouts planned so as to **avoid pedestrians having to cross major roads**. – Existing surface level car parking is replaced with **structure parking**.
Planning and Designing for Pedestrians: Guidelines (Department of Transport, 2012)	Provides a summary of the standards and guidelines from Austroads, Main Roads WA and other state organisations. Local government is responsible for planning, constructing and maintaining much of the pedestrian network. Therefore	The access and parking strategy for Canning Bridge study area should consider the content of this guidance document in terms of path widths, inclusive design, and crossing requirements.

State Policy and Guidance		Relevance to Canning Bridge Study Area
Draft Public Transport for Perth in 2031 (Department of Transport, 2011)	Draft public transport master plan is currently being revised based on the consultation feedback received by the department.	Draft Master Plan shows: – **Bus Rapid Transit** Infrastructure by 2031 **along Canning Hwy**, connecting to Booragoon, Curtin University and Victoria Park via the Canning Bridge railway station.
Draft Western Australian Bicycle Network Plan 2012-2021 (Department of Transport, 2012)	States the tasks of local authorities: – Manage and maintain local cycle facilities; – Complete and maintain local bicycle plans; – Ensure **integration** with the Western Australia bicycle network plan; – Ensure that the design of all roads and other council facilities include **adequate consideration** of cyclists; – Ensure **land is set aside along river foreshores** for completion of the recreational cycle shared path network; and – Incorporate **end of trip facilities**.	The development of strategies for Canning Bridge study area needs to consider these tasks.

3. Baseline Transport Conditions

3.1 Overview

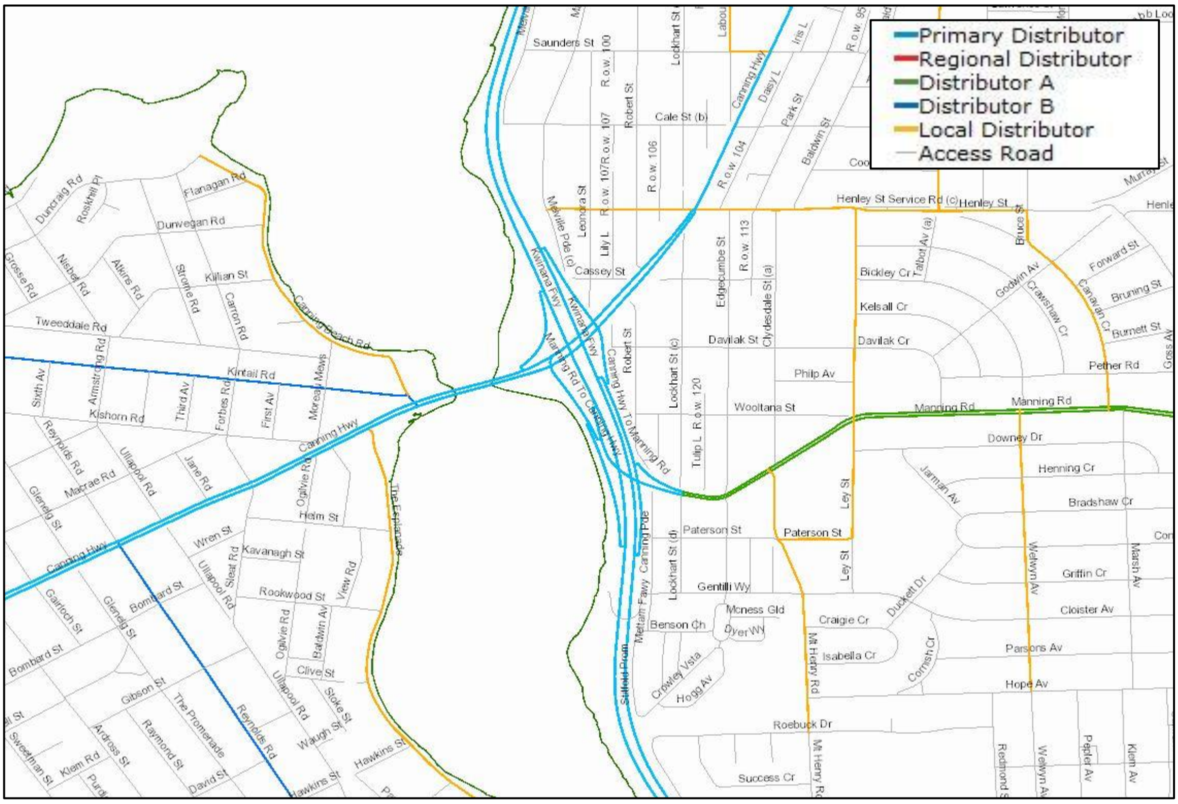
The purpose of this section of the report is to outline the baseline transport.

3.2 Roads

3.2.1 Road Network

Strategically, the Kwinana Freeway and Canning Highway facilitate vehicle travel in north-south and east-west directions respectively; both are identified as Primary Distributors in the Main Roads WA road hierarchy, as shown in Figure 2.

Figure 2: Main Roads WA Road Hierarchy



Manning Road and Kintail Road are designated as distributors A and B respectively; while Henley Street, The Esplanade, Canning Beach Road, Ley Street, Mount Henry Road, and Paterson Street are all designated as being local distributors. All other roads within the study area are designated as being access roads. This demonstrates that there are no formally designated regional distributor roads in the study area

3.2.2 Traffic Volumes

Table A-1 in Appendix A shows the historic traffic data from surveys that have been undertaken between 2005 and 2012. In the majority of cases this shows that there have been consistent traffic volumes on the roads within the current network, thus indicating that traffic has not increased on the majority of roads.

For this study additional traffic counts have been commissioned to inform the development of a PARAMICS model for the Canning Bridge Precinct. The locations of these are:

- Canning Hwy/Sleat Rd - All movements including Pedestrians;
- Canning Hwy/The Esplanade (left-in-left-out movements only);
- Canning Hwy/Kintail Rd - All movements including Pedestrians; and
- Canning Hwy/Henley St - All movements including Pedestrians.

The traffic movements and findings of the PARAMICS model will be reported in the Transport Assessment of the proposed intensification of the Canning Bridge Precinct.

3.2.3 Travel Time Survey

A travel time survey was undertaken along Canning Highway in August 2012 on a “typical weekday” between 7:45-9:15 and 16:45-18:15. This will be used in the modelling of the proposed development.

3.2.4 Crash Statistics

A crash statistics analysis was undertaken for the study area, for the period January 2007 to December 2011. The detailed results for all intersection are shown in Appendix B.

Table 2: Crash Statistics (2007 - 2011)

Location	Rear End	Side Swipe	Right Angle	Right Thru
Canning Hwy & Reynolds Rd	114	5	2	0
Canning Hwy & Sleat Rd	81	9	5	1
Canning Hwy & The Esplanade	6	1	2	0
Canning Hwy & Canning Beach Rd	96	4	1	0
Canning Hwy & Kintail Rd	3	0	34	0
Canning Hwy & Henley Str	45	5	3	6

Table 2 shows the critical intersections, which indicates that most crashes occurred at the intersection of Canning Highway / Reynolds Road, followed closely by the Canning Highway / Canning Beach Road intersection.

Congestion and queuing were considered to be contributing factors at most intersections, with inadequate street lighting also impacting on the traffic safety.

The high incidents of right angle crashes at the intersection of Canning Highway and Kintail Road could be attributed to the layout of the intersection with Canning Beach Road; however this would need to be investigated further to confirm the assumption.

3.2.5 Car Parking

Given the location of Canning Bridge (within zone 1 of the Transperth network) there is potential for users of the rail service to use the streets within 10 minutes' walk of the station as informal park and ride.

In order to understand whether this is occurring and to get an understanding of the relative parking demand in the area, a survey of the number of car parking spaces available, existing restrictions and occupancy through the day was undertaken on Thursday 16th August 2012.

Car parking inventor and restrictions

The survey included reporting of the total parking supply within the study area. Collation of the data shows that there are currently 3,500 spaces that cars are able to utilise. Figure C-1 in Appendix C shows the current parking supply.

There are 56 different parking restriction types in the study and details of these restrictions are shown in Appendix C

Car parking demand

The previous sections demonstrate that there are a significant number of car parking spaces available within the study area. The parking survey highlighted that generally the utilisation of these spaces was low.

The average occupancy of spaces in the whole study through the day is 649 (18%), with the peak of 835 (24%) occurring between 15:00 and 16:00.

Figure 3 shows the car parking occupancy for the study area and Table 3 provides the aggregated data for the streets within the study area with occupancy levels of over 50%.

Details of the occupancy level for all surveyed streets are shown in Appendix C.

Table 3: Parking Occupancy Levels

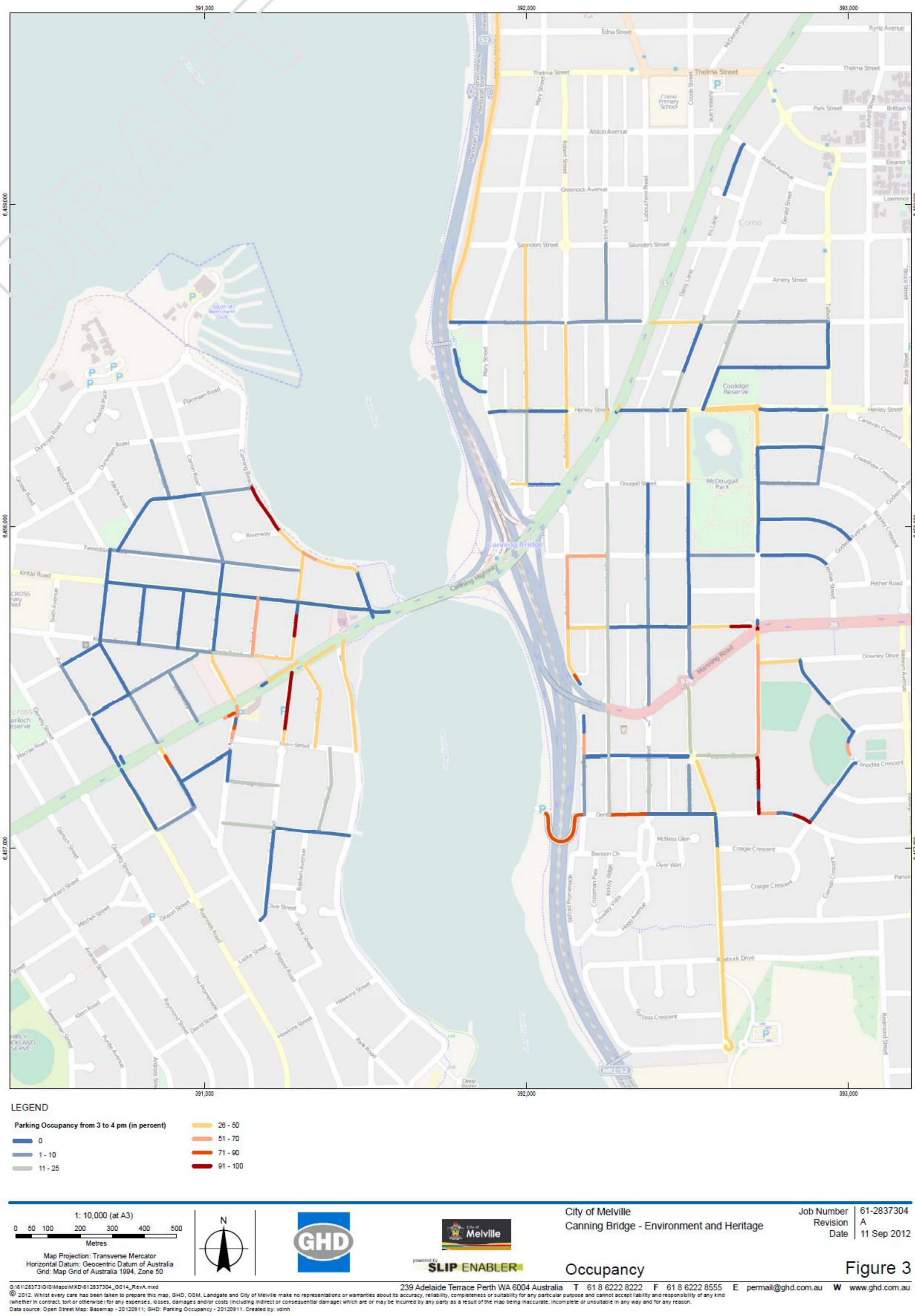
Road	Parking Spaces	Overall Occupancy	Occupancy 15:00 to 16:00
Canning Hwy	60	29.9%	66.7%
Cassey St	44	45.6%	65.9%
Cloister Ave	30	21.3%	76.7%
Cnr Jarman and Duckett	11	21.7%	54.5%
First Ave	12	72.4%	66.7%
McDonalds and Chicken Treat	31	52.9%	51.6%
Moreau Mews	62	52.2%	71.0%
Ogilvie Rd	69	41.9%	58.0%
Sleat Rd	158	42.1%	56.3%

Of note is that the roads just east of the Canning Bridge railway station have relatively higher occupancy rates, which could indicate park-and-ride activity in this area:

Table 4: Parking Occupancies - East of Canning Bridge Railway Station

Road	Parking Spaces	Overall Occupancy	Occupancy 15:00 to 16:00
Cassey St	44	45.6%	65.9%
Melville Pde	27	25.4%	40.7%
Leonora St	73	21.3%	28.8%
Total Vehicles	**144**	**42**	**61**
Percentage Occupancy		**29%**	**42%**

Figure 3: Car Parking Occupancy (15:00 - 16:00)



3.3 Public Transport

3.3.1 Bus Services

The Canning Bridge study area benefits from a good bus and train service. Nine bus services utilise the river crossing at Canning Bridge; these are shown in Figure 4.

The majority bus routes continue through to the Perth CBD[2]. Most travel along the Kwinana Freeway while two routes (Routes 105 and 106) continue eastwards along Canning Hwy. Routes 100 and 101 from Curtin University terminate at the interchange, while Route 148 from Freemantle terminates in Como, adjacent to the rail interchange.

Figure 4: Existing Bus Routes

The PTA has provided some patronage information for the stops in this area; this is shown in Table 5 which indicates that the most utilised stops are at the intersection of Canning Hwy with Kishorn and Ogilvie Roads.

Table 5: Bus Stop Boardings and Alightings

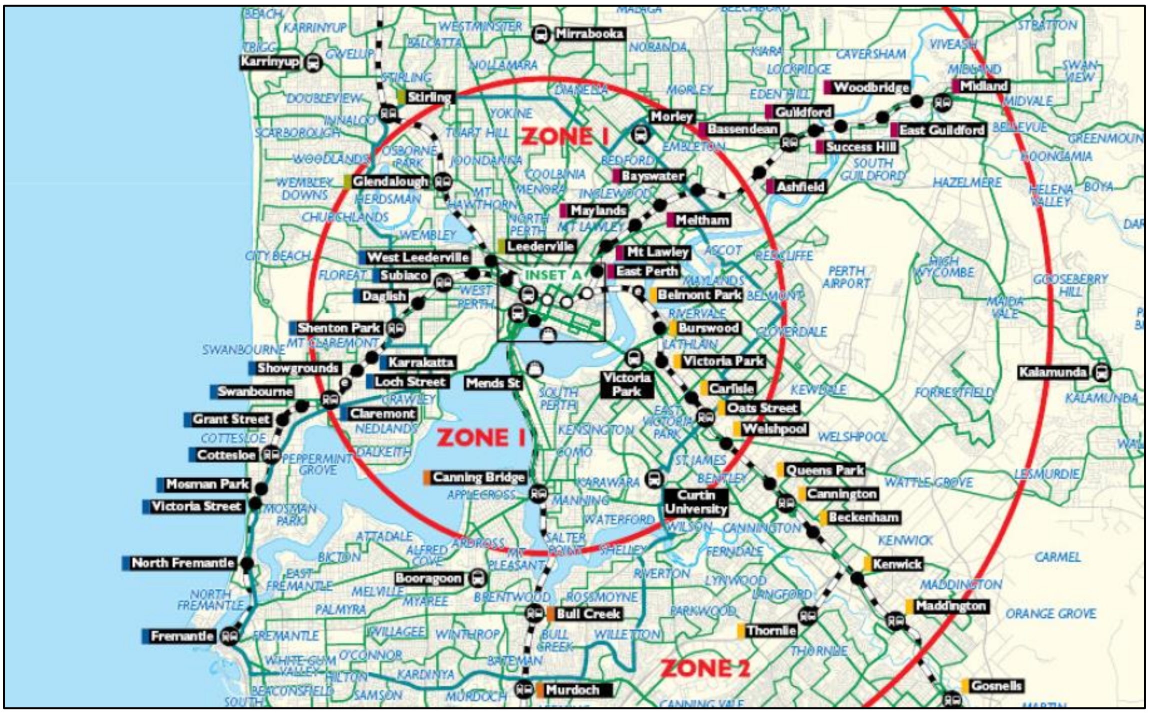
Stop ID	Location	Boarding (weekday)	Alighting (weekday)
10323	Canning Highway/ Kishorn Road	**255**	190
10245	Canning Highway/ Ogilvie Road	79	**247**
10322	Canning Highway/ Sleat Road	32	24
10246	Canning Highway/ Ullapool Road	30	74
10321	Canning Highway/ Ullapool Road	61	19

[2] This is in line with the policy that bus routes operating north of Leach Hwy would continue to the CBD, thus not enforcing the need to transfer at the railway station.

3.3.2 Rail Services

Canning Bridge is located within zone 1 of the Transperth network (shown in Figure 5). The station provides access to services operating on the Mandurah Line with an average travel time of 15 minutes to the Perth CBD. Currently rail services operate at a 10 minute frequency during the peak periods (i.e. every second train stopping) and a 15 minute frequency off peak.

Figure 5: Transperth Rail Network



3.3.3 Bus and Rail Interchange

The PTA has provided survey data of the typical number of train passengers boarding the services (no alighting data) from Canning Bridge during an average weekday.

This information shows that approximately 52,000 people board stations on the Mandurah line and 3,550 of these are at Canning Bridge[3]. The data also shows that 2,260 (i.e. 64% of travellers) bus-to-train transfers occur at Canning Bridge thus indicating the importance of the bus-rail interchange. Due to the proximity of the Canning Bridge study area to the CBD it can be assumed that a high percentage of transfers at the station would be from bus passengers on Routes 101 and 100 from Curtin University and Route 148 from Freemantle as these are the only routes that terminate at or adjacent to the railway station and don't continue to the CBD.

An additional survey that was undertaken on 28 April 2010 showed data that is broadly consistent with the 2011 data provided by the PTA. The benefit of this survey was that alighting data (from the train) was also captured. The mode-to-mode transfer data is shown in Table 6. This shows that approximately 2,800 bus-to-train and train-to-bus transfers occur during the 16-hour weekday survey, indicating a high volume of commuting to work trips[4].

[3] Data from September 2011

[4] The total train boarding data in Table 7 is broadly consistent to the 2011 data, albeit the bus to train transfers are 20% lower in 2011 compared with 2010.

Table 6: Mode-to-mode Transfer at the Canning Bridge Interchange

From/ To	To Bus	To Train	To Other	Total From
From Bus	350	2,782	124	**3,256**
From Train	2,800	0	682	**3,550**
From Other	268	547	80	**895**
Total To	**3,359**	**3,329**	**886**	**7,633**

3.4 Active Transport

3.4.1 Overview

The Department of Transport encourages local authorities to develop TravelSmart maps as part of improving public awareness of alternative modes of travel.

Details of the TravelSmart Plans developed by the City of Melville and City of South Perth are shown in Appendix D.

3.4.2 Cycling

Cycling will become a more important mode of transport as public awareness of health and environmental issues increases, combined with deterioration of road levels of service and the realisation that it unsustainable to simply use a road building and widening “predict and provide” approach to transport planning and strategy.

In the Canning Bridge study area a Principal Shared Path (for commuter cycling) is located along the east of the river connecting Mandurah with the Perth CB; while a recreational cycle path is located to the west. Closer to the city approximately 3,000 cyclists use the Principal Shared Path.

The Department of Transport commissioned cycle counts at locations throughout the Perth Metropolitan Area, including Alfred Cove in Melville and Ardross Street (shown in Figure 6 and Figure 8 respectively). Whilst the Alfred Cove count site is located outside of the Canning Bridge study area the data is useful in understanding how cycle trends have changed.

Additional information regarding the cycle network and counts on the Kwinana Freeway Principal Shared Path is shown in Figure 7.

Figure 6: Cycle Count Locations - Ardross Street

The results are shown in Table 7.

Table 7: Cycle Counts

Location	2012 Counts (06:30 – 09:30	2011 Counts % change	1999 Baseline Counts % Change
Ardross Street	118	-14%	62%
Alfred Cove	600	46%	210%

Given the relatively low numbers cycling the fluctuation along Ardross Street between the 2012 and 2011 data could be simply due to variations in the day-to-day cycling numbers.

Figure 7: Kwinana Freeway – Bicycle Counter Weekly Averages

Figure 8: Cycle Count Location - Alfred Cove

3.4.3 Walking

The pedestrian network in the Canning Bridge study area is impacted by several barriers, including:

- Canning Highway
- Canning River
- Kwinana Freeway and Mandurah Railway Line
- Large blocks of private development that do not have public connections through them

Pedestrian access to public transport

The City of Melville stated during consultation that the accessibility of bus stops needs to be improved.

A pedshed analysis has been undertaken to determine the catchment area from bus stops and the existing Canning Bridge Interchange. These are shown in Figures 9 and 10.

The figures show that accessibility to bus stops far exceeded the rail accessibility. Of note though are the areas that are not within the 400m bus pedshed, especially south of Canning Bridge Highway along the western shore of the River

Figure 9: Pedshed from Existing Bus Stops

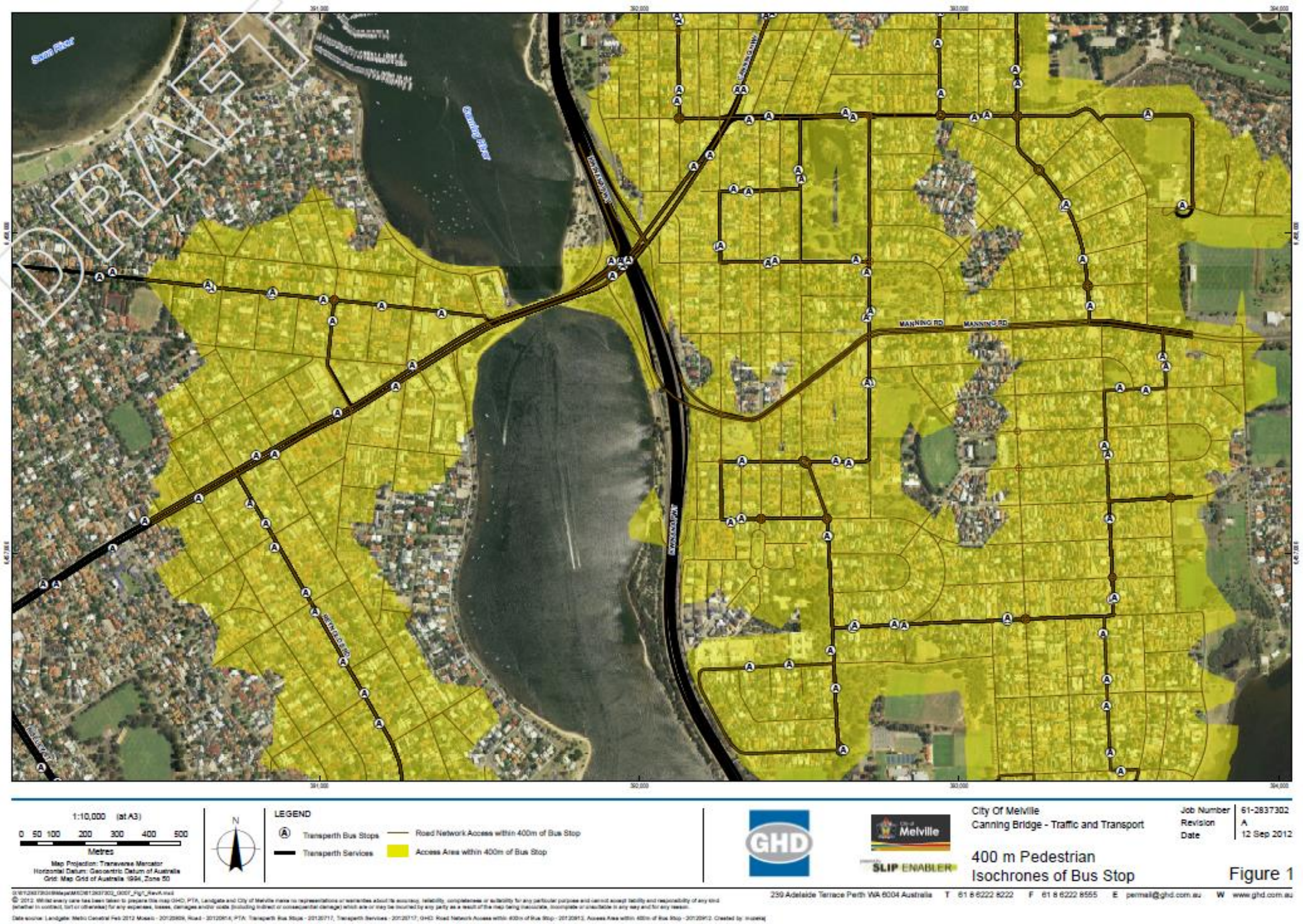
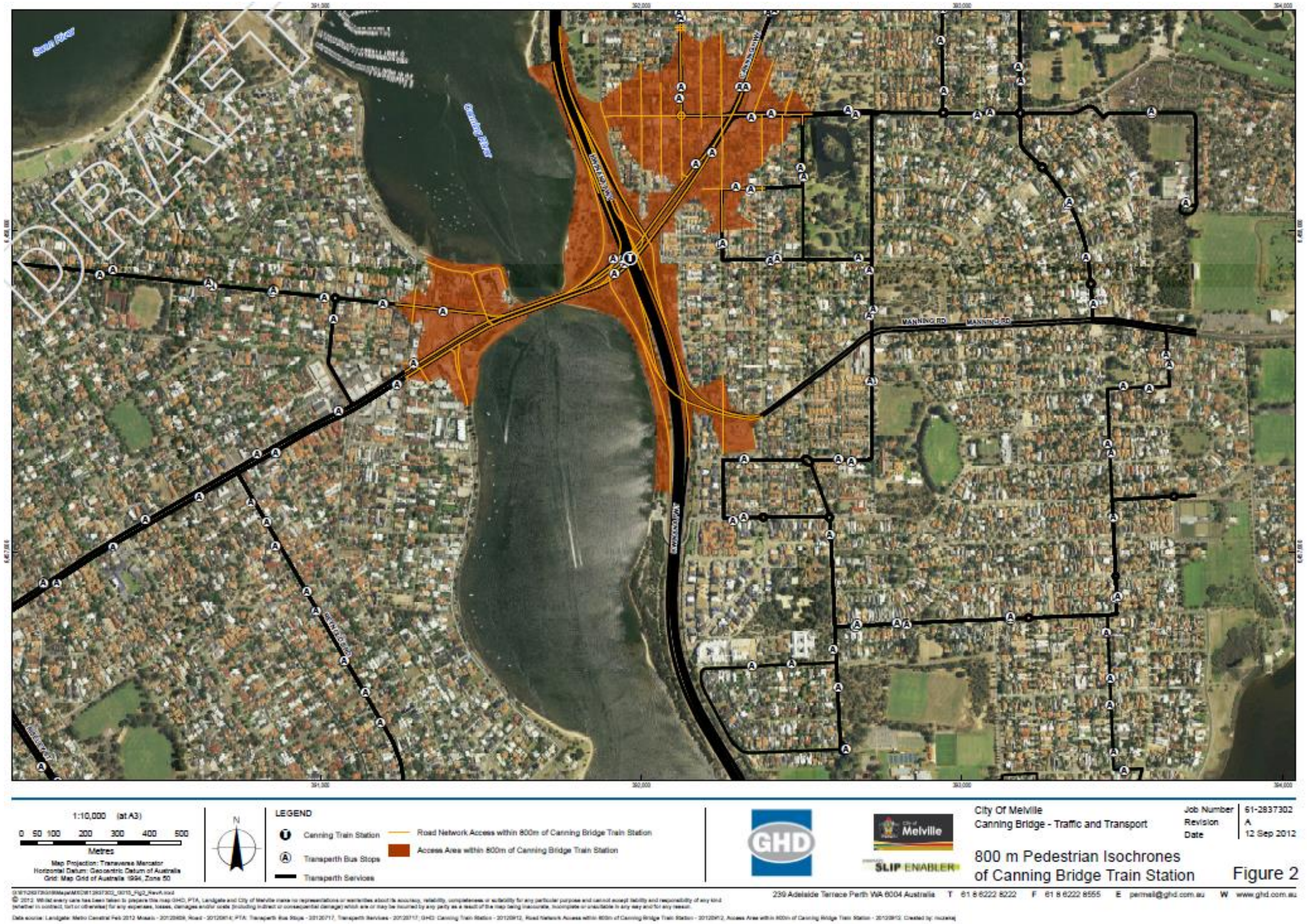


Figure 10: Pedshed from Canning Bridge Interchange



4. Gap Analysis

4.1 Overview

The purpose of the gap analysis is to define the issues that need to be addressed as part of the transport assessment and identify whether there are additional data/ information requirements. It is likely that different stakeholders will have different requirements because of their own specific key performance indicators.

4.2 Stakeholder Consultation

From the Consultation the following issues were identified that need to be addressed during the transport assessment.

A detailed account of the discussions can be found in Appendix E.

Table 8: Summary of Stakeholder Issues

	Private Vehicles	Public Transport	Active Transport
Road Network	Be cognisant of current congestion and resultant rat runs through the study area.	Consider bus lane along Canning Bridge: – lane take vs. lane add	Consider the provision for adequate cycling and pedestrian facilities on identified local routes to promote safety and encourage mode shift.
Parking	Consider cash-in-lieu provision for parking when development does not have the capacity/space. Consider. Investigate possibility for structure parking.		
Public Transport	Consider the use of the redundant northern bridge for public transport.	Consider impact of development in Murdoch and increase of students at Curtin University on the operation of bus and rail services. Consider integration of ferry services with the bus interchange and pedestrian access.	Ensure easy access to bus stops to encourage mode shift.

	Private Vehicles	Public Transport	Active Transport
Bus Interchange	Consider need for/desirability of Kiss-and-Ride and Park-and-Ride at future bus interchange	Consider desirability of terminating future light rail from Curtin University on the Canning Road Interchange.	Access of the bus interchange and railway station needs to be optimal to encourage model shift
Cyclists and Pedestrians		Consider the location of the Principal Shared Path in relation to the planned bus interchange.	Make provision for trip-end facilities for cyclists

4.3 Traffic and Parking Assessment

Understanding the traffic volumes will be an important component of this study because there is concern amongst some of the stakeholders that it will be challenging to accommodate the additional traffic generated by new developments. In addition, consideration will need to be given to how car parking provided as part of development is accessed because this can cause local safety and congestion issues.

The traffic assessment will need to understand the operation of the base road network in both the current and future scenarios. A Paramics model will inform the development of the transport strategy for the study area. Issues that will need to be considered as part of the assessment are:

- How the current and future base networks are operating and whether the additional traffic generated by development in the Canning Bridge study area can be accommodated.
- Whether a bus lane on Canning Highway is accommodated through an additional lane or lane take from an existing road traffic lane.
- Vehicle permeability through the area will need to be considered to identify where new links would offer value to the network.
- Appropriate car parking provision for new development and measures to encourage reduction of parking or support reduced parking where space is limited within a development.
- Minimisation of future car parking overspill into the streets surrounding the station.
- How Canning Bridge will be redeveloped post 2037 and the future road, public transport, walking and cycling requirements.
- The impact of the future changes to the public transport interchange on:
  - Lockhart Street
  - Manning Road
  - Edgecumbe Street
  - Freeway ramps
- What the parking strategy will be for the study area.

Commentary on whether the new traffic generation represents a material increase above the base traffic should be included in the transport assessment.

A balanced assessment needs to consider the impact on traffic flow, bus operation, and pedestrian/ cycle connectivity as well as the amenity in the study area. .

4.4 Public Transport

The investigation and consultation with the stakeholders have highlighted the following to be considered as part of the transport assessment:

- Mode shift could be impacted by capacity constraints:
  - Rail could reach capacity after the opening of development in Murdoch in 2014.
  - Curtin University is expected to double in the next 20 years; this will impact on the operation of bus and rail services.
- The current reliability/ punctuality of bus services is affected by congestion along and at intersections on Canning Highway.
- The transport assessment should consider whether there are optimal locations for bus stops within the study area.
- Current plans for the extension of the LRT to be provided at the current interchange on Canning Bridge needs to be considered.
- Integration of the Ferry services with public transport and active transport needs to be considered.

The SmartRider data would provide understanding of existing bus/ rail patronage within the study area and allow an understanding of where and whether there is spare capacity on the existing and future public transport services. This will allow understanding of what potential there is for mode shift to public transport.

A concept design for the interchange has been prepared. The form of the interchange and access will influence the ease of mode-to-mode transfers.

4.5 Walking and cycling

Walking and cycling are important modes within a transit oriented development. The following issues were identified during the investigations and consultation:

- Access to public transport needs to be improved.
- Pedestrian and cycle permeability in the study area needs to be improved.
- The assessment and structure plan should make provision for end-of-trip facilities.
- Cycling on southern side of Canning Hwy is not compliant, but used by cyclists.
- Pedestrian crossing of Manning Road needs to be addressed.
- Consider the location of the Principal Shared Path in relation to the planned bus interchange

The transport assessment needs to consider whether there are desire lines and barriers that can be improved as part of the proposed development; this will require pedshed analysis of the future bus stops and sensitivity testing of the impact of new paths and/or relocation of bus stops.

4.6 Summary

There are a significant number of challenges that need to be considered when developing the transport strategy for the study area.

The mode share targets that are adopted will differ for different elements of the area. It is suggested that mode share for travel to the study area, from the study area, and at the interchange are considered independently. The rationale is that mode choice is determined by the availability of infrastructure, ease of mode transfer, congestion/ delay, cost/ time (generalised cost), and availability of car parking and end-of-trip facilities at the trip destination.

Appendices

Appendix A Traffic Volumes

Table A-1: Summary of Historic Traffic Counts

Road	2011 Traffic Counts (to calibrate ROM)	SCATS Data (vpd)						Melville Road Traffic Digest (vpd)		South Perth Traffic Digest (vpd)	
		2012	2011	2010	2008	2006	2005	2008/09	2006/07	2008/09	2007/08
Canning Highway (south of Henley Street)	38,203 vpd		36,954							39,050	
Canning Highway (north of Henley Street)			34,086							34,710	
Canning Highway (at Canning Bridge)					67,533					67,700	
Canning Highway (west of the river)	49,809 vpd										
Canning Highway (east of Sleat Road)			49,110					53,320			
Canning Highway (west of Sleat Road)	46,538 vpd										
Canning Highway (east of Reynolds Road)			45,895								
Canning Highway (west of Reynolds Road)					43,624						
Manning Road (from freeway)	15,138 vpd										
Manning Road (towards freeway)	15,175 vpd										
Manning Road (west of Elderfield Road)		30,155		28,705	30,048		25,286				30,000
Manning Road (east of Ley Street)					26,141					26,660	
Kintail Road (west of Canning Beach Road)	5,374 vpd				11,523			11,550			
Kintail Road (east of Armstrong Road)		5,600									
Kintail Road (east of Ardross Street)						5,266					
Canning Beach Road (north of Kintail Road)					5,663			5,660			
Reynolds Road (south of Canning Highway)				5,474							
Reynolds Road (north of Canning Highway)			8,769								
Sleat Road (south of Canning Highway)				5,560					6,250		
Ullapool Road (north of Coogee Road)					2,552			2,570			
The Esplanade (north of Coogee Road)					2,684			2,700			
The Esplanade (south of Canning Highway)					3,231			2,240			

Appendix B Crash Statistics

A crash statistics analysis has been undertaken for the study area; the data covers the period January 2007 to December 2011. The results are shown in Table 3 to 14.

Table B-1: Canning Highway/ Reynolds Road intersection crash statistics

State Frequency Rank No. 83 State Cost Rank No. 214 Intersection No. 4047

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	MELVILLE (C)
Street 2	REYNOLDS RD	**Region**	METROPOLITAN
Street 3		**Cost**	$3,401,377
Intersection Classification	State and Local Roads	**Total Crashes**	121*

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
114*	5	2	0	23*	14	0	1	4	0	32*

The above table indicates a high number of reported crashes 121, 114 (94%) are rear end collisions. 23 (19%) crashes occurred in wet conditions. Congestion and queuing are considered to be contributory factors. Crashes resulting in casualty are higher than the state average.

Table B-2: Canning Highway/ Ullapool Road intersection crash statistics

State Frequency Rank No. 4319 State Cost Rank No. 7708 Intersection No. 14086

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	MELVILLE (C)
Street 2	ULLAPOOL RD	**Region**	METROPOLITAN
Street 3		**Cost**	$83,577
Intersection Classification	State and Local Roads	**Total Crashes**	3

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
3	0	0	0	0	0	0	0	0	0	1

The reported crash history does not indicate a safety issue at this intersection.

Table B-3: Canning Highway/ Sleat Road intersection crash statistics

State Frequency Rank No. 131 State Cost Rank No. 226 Intersection No. 3601

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	MELVILLE (C)
Street 2	SLEAT RD	**Region**	METROPOLITAN
Street 3		**Cost**	$3,329,700

Intersection Classification	State and Local Roads	Total Crashes	103*

Crash Details										
Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
81*	9*	5	1	21*	23*	2*	0	2	3*	15

The above table indicates a high number of reported crashes 103, 81 (79%) are rear end collisions. 21 (20%) crashes occurred in wet conditions and 23 (22%) occurred at night. Congestion and queuing are considered to be contributory factors. Street lighting may also be an issue.

Table B-4: Canning Highway/ Ogilvie Road intersection crash statistics

State Frequency Rank No. 7846 State Cost Rank No. 13854 Intersection No. 116287

Summary of Intersection Crashes			
Street 1	CANNING HWY	Authority Name	MELVILLE (C)
Street 2	OGILVIE RD	Region	METROPOLITAN
Street 3		Cost	$27,859
Intersection Classification	State and Local Roads	Total Crashes	1

Crash Details										
Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
1	0	0	0	0	1	0	0	0	0	0

The reported crash history does not indicate a safety issue at this intersection

Table B-5: Canning Highway/ Kishorn Road intersection crash statistics

State Frequency Rank No. 7846 State Cost Rank No. 4172 Intersection No. 14093

Summary of Intersection Crashes			
Street 1	CANNING HWY	Authority Name	MELVILLE (C)
Street 2	KISHORN RD	Region	METROPOLITAN
Street 3		Cost	$201,798
Intersection Classification	State and Local Roads	Total Crashes	1

Crash Details										
Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
0	0	1	0	0	1	0	0	0	0	0

The reported crash history does not indicate a safety issue at this intersection.

Table B-6: Canning Highway/ Ogilvie Road intersection crash statistics

State Frequency Rank No. 7846 State Cost Rank No. 4172 Intersection No. 14093

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	MELVILLE (C)
Street 2	KISHORN RD	**Region**	METROPOLITAN
Street 3		**Cost**	$201,798
Intersection Classification	State and Local Roads	**Total Crashes**	1

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
0	0	1	0	0	1	0	0	0	0	0

The reported crash history does not indicate a safety issue at this intersection.

Table B-7: Canning Highway/ The Esplanade intersection crash statistics

State Frequency Rank No. 1872 State Cost Rank No. 2719 Intersection No. 14097

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	MELVILLE (C)
Street 2	THE ESPLANADE	**Region**	METROPOLITAN
Street 3		**Cost**	$346,164
Intersection Classification	State and Local Roads	**Total Crashes**	10

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
6	1	2	0	0	1	0	0	1	0	0

The reported crash history does not indicate a significant safety issue at this intersection.

Table B-8: Canning Highway/ Canning Beach Road intersection crash statistics

State Frequency Rank No. 131 State Cost Rank No. 289 Intersection No. 4471

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	MELVILLE (C)
Street 2	CANNING BEACH RD	**Region**	METROPOLITAN
Street 3		**Cost**	$2,919,103
Intersection Classification	State and Local Roads	**Total Crashes**	103*

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
96*	4	1	0	25*	24*	0	1	4	1	20*

The above table indicates a high number of reported crashes 103, 96 (93%) are rear end collisions. 25 (24%) crashes occurred in wet conditions and 24 (23%) occurred at night. Congestion and queuing are considered to be contributory factors. Street lighting may also be an issue. Crashes resulting in casualty are higher than the state average.

Table B-9: Canning Highway/ Robert Street intersection crash statistics

State Frequency Rank No. 7846 State Cost Rank No. 13854 Intersection No. 116285

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	S.PERTH (C)
Street 2	ROBERT ST	**Region**	METROPOLITAN
Street 3		**Cost**	$27,859
Intersection Classification	State and Local Roads	**Total Crashes**	1

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
1	0	0	0	0	0	0	0	0	0	0

The reported crash history does not indicate a significant safety issue at this intersection.

Table B-10: Canning Highway/ Henley Street intersection crash statistics

State Frequency Rank No. 285 State Cost Rank No. 425 Intersection No. 14121

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	S.PERTH (C)
Street 2	HENLEY ST	**Region**	METROPOLITAN
Street 3		**Cost**	$2,327,576
Intersection Classification	State and Local Roads	**Total Crashes**	67

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
45	5	3	6	20*	14	0	1	4	0	11

The above table indicates a high number of reported crashes 67, 45 (67%) are rear end collisions. 20 (30%) crashes occurred in wet conditions and 14 (21%) occurred at night. Congestion and queuing are considered to be contributory factors. Street lighting may also be an issue.

Table B-11: Canning Highway intersection crash statistics

State Frequency Rank No. 1872 State Cost Rank No. 1875 Intersection No. 4470

Summary of Intersection Crashes			
Street 1	CANNING HWY	**Authority Name**	S.PERTH (C)
Street 2	CANNING HWY ON - H015 NTH BOUN	**Region**	METROPOLITAN
Street 3		**Cost**	$546,831
Intersection Classification	State Road Only (including National Highway)	**Total Crashes**	10

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
7	0	1	0	2	1	1*	0	0	0	1

The reported crash history does not indicate a significant safety issue at this intersection.

Table B-12: Canning Highway/ Kintail Road intersection crash statistics

State Frequency Rank No. 609 State Cost Rank No. 527 Intersection No. 47317

Summary of Intersection Crashes			
Street 1	KINTAIL RD	**Authority Name**	MELVILLE (C)
Street 2	CANNING BEACH RD	**Region**	METROPOLITAN
Street 3		**Cost**	$2,005,856
Intersection Classification	Local Road Only	**Total Crashes**	38*

Crash Details

Rear End	Side Swipe	Right Angle	Right Thru	Wet	Night	Ped	Cycle	Truck	Motorcycle	Casualty
3	0	34*	0	3	10*	0	0	2*	0	8*

The above table indicates a high number of reported crashes 38, 34 (89%) are right angle collisions. 10 (26%) crashes occurred at night. Congestion and queuing are considered to be contributory factors. Further investigation would be necessary to determine causes of the right angle collisions.

Canning Highway/Ramp intersections:

The key statistics are:

- 165 reported crashes
- 111 (67%) rear end collisions
- 38 (23%) crashes occurred at night

Congestion and queuing are considered to be contributory factors. Street lighting may also be an issue.

Appendix C Parking Supply and Demand

Figure C-1: Existing Parking Supply

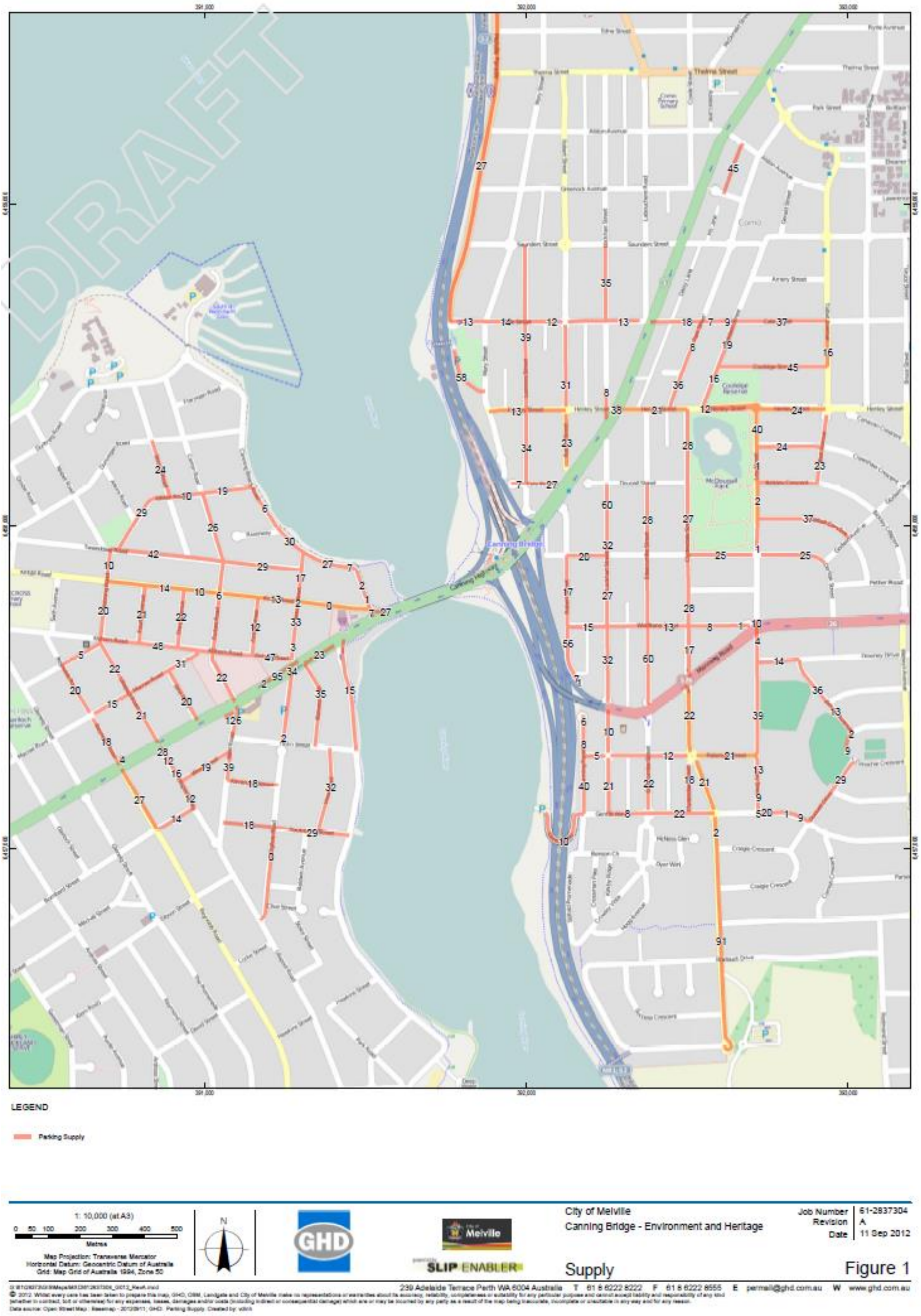


Table C-1: Car parking restrictions

Restriction	Number of Spaces	Restriction	Number of Spaces
½ P and kiss and ride	15	Disabled	27
2P	747	No standing or parking	28
3P	68	Paid and on-street	77
4P	253	P5	4
Private	184	Paid and off-street	78
Service (e.g. filling station, air+water etc)	5	Visitors	6
Clearway	7	Unrestricted	2,036
TOTAL		**3,535**	

Table C-2: Parking Occupancy Levels

Road	Parking Spaces	Overall Occupancy	Occupancy 15:00 to 16:00	Road	Parking Spaces	Overall Occupancy	Occupancy 15:00 to 16:00
Armstrong Rd	**30**	**0.0%**	**0.0%**	**Kavanagh St**	**18**	**9.0%**	**11.1%**
Baldwin St	**35**	**6.4%**	**8.6%**	**Kelsall Cres**	**37**	**6.7%**	**0.0%**
Bickley Cres	**23**	**12.4%**	**8.7%**	**Killian Rd**	**58**	**3.3%**	**3.4%**
Bombard St	**14**	**6.6%**	**7.1%**	**Kintail Rd**	**90**	**0.6%**	**0.0%**
BP Service Station	**4**	**3.8%**	**0.0%**	**Kishorn Rd**	**136**	**17.0%**	**21.3%**
Cale St	**136**	**12.7%**	**12.5%**	**Leonora St**	**73**	**21.3%**	**28.8%**
Canning Beach Rd	**91**	**39.2%**	**47.3%**	**Ley St**	**114**	**22.3%**	**43.9%**
Canning Hwy	**60**	**29.9%**	**66.7%**	**Lockhart St**	**201**	**16.2%**	**14.4%**
Canning Pde	**54**	**17.9%**	**13.0%**	**Mackenzie Rd**	**5**	**7.7%**	**0.0%**
Carron Road	**26**	**2.4%**	**3.8%**	**Macrae Rd**	**46**	**2.3%**	**2.2%**
Cassey St	**44**	**45.6%**	**65.9%**	**McDonalds and Chicken Treat**	**31**	**52.9%**	**51.6%**
Cloister Ave	**30**	**21.3%**	**76.7%**	**Melville Pde**	**27**	**25.4%**	**40.7%**

Road	Parking Spaces	Overall Occupancy	Occupancy 15:00 to 16:00	Road	Parking Spaces	Overall Occupancy	Occupancy 15:00 to 16:00
Clydesdale St	140	9.7%	10.0%	Moreau Mews	62	52.2%	71.0%
cnr Canning and Henley	38	32.4%	28.9%	Mt Henry Rd	21	24.2%	47.6%
Cnr Canning and Kintail	107	30.8%	41.1%	Mt Henry Tavern carpark	93	21.1%	29.0%
Cnr Jarman and Duckett	11	21.7%	54.5%	Ogilvie Rd	69	41.9%	58.0%
Cnr Ley and Downey	61	19.2%	37.7%	Olives Reserve	58	1.2%	0.0%
Cnr Ley and Manning	20	17.7%	25.0%	Park St	44	13.5%	15.9%
Coolidge St	45	0.3%	0.0%	Paterson St	50	4.5%	6.0%
Crawshaw Cres	24	5.8%	0.0%	Reynolds Rd	65	4.4%	3.1%
Davilak Cres	25	0.3%	0.0%	Robert St	135	41.8%	44.4%
Davilak St	45	36.2%	33.3%	Rookwood St	47	7.4%	8.5%
Downey St	14	11.0%	28.6%	Sleat Rd	158	42.1%	56.3%
Duckett Dr	29	0.0%	0.0%	Strome Road	24	3.2%	4.2%
Edgecumbe St	139	4.9%	7.9%	Talbot Ave	39	10.5%	5.1%
First Ave	12	72.4%	66.7%	The Esplanade	38	33.4%	36.8%
Forbes Rd	6	3.8%	0.0%	Third Ave	22	7.7%	0.0%
Fourth Ave	21	2.2%	0.0%	Tweeddale Rd	71	4.7%	2.8%
Gentilli Way	40	30.8%	37.5%	Ullapool Rd	111	15.3%	20.7%
Henley St	96	5.8%	4.2%	View Rd	32	9.9%	12.5%
Jane Rd	20	6.9%	10.0%	Wooltana St	50	16.2%	22.0%
Jarman Ave	51	3.3%	5.9%	Wren St	19	0.8%	0.0%

Appendix D Active Transport

Figure D-1: TravelSmart Map for Apple Cross (City of Melville)

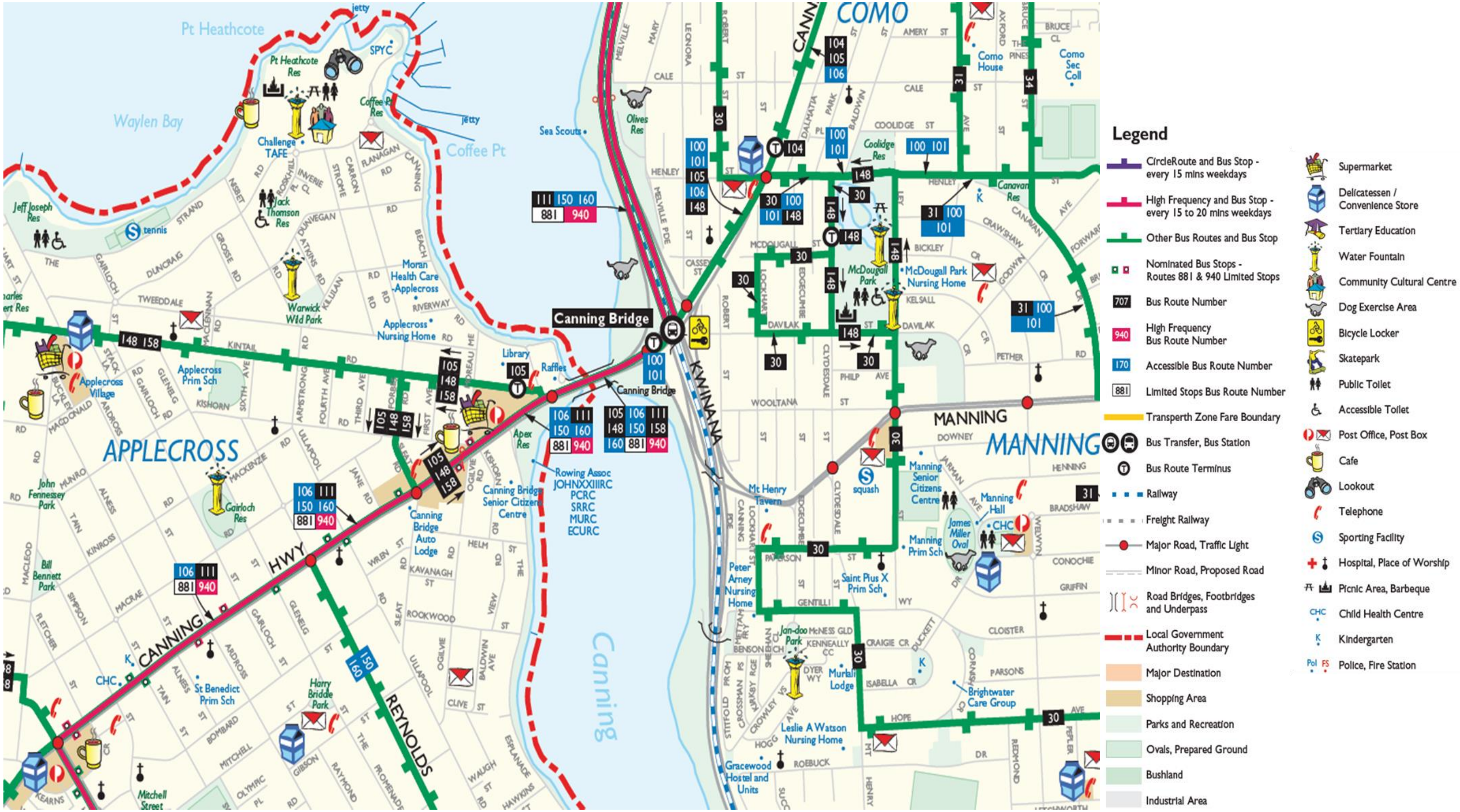
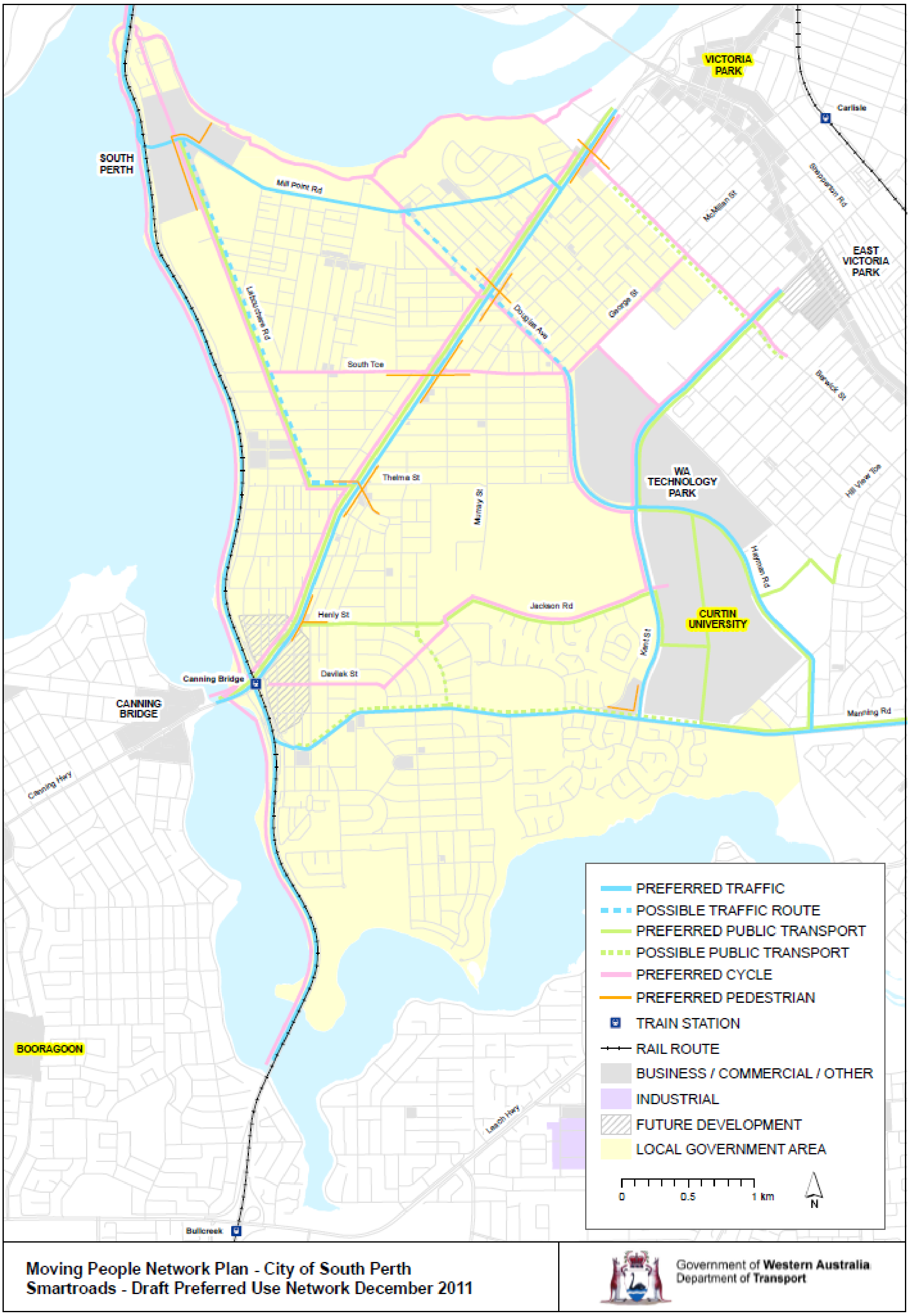


Figure D-1 SmartRoads Plan for South Perth



Appendix E Stakeholder Feedback

Table E-1: Stakeholder Feedback – City of Melville

	Challenge/Opportunity	Comments
Traffic	**Challenge**	• Road network is already congested. Need to accommodate the additional traffic generated by the new developments. • Rat runs are experienced on adjacent routes (see plan) to bypass congestion on Canning Bridge Hwy. New traffic light at Ardross Road led to further rat runs.
	Opportunity	• Identify opportunities for new links in the road network; however ensure that it contributes to the traffic flow. • Improve permeability into the area.
Parking	**Challenge**	• Some parking spill over experienced in areas such as Ogilvie Road, Rookwood Road, Kintail (west of Forbes)
	Opportunity	• Need guidance on how to provide for parking when development does not have the capacity/space. Consider cash-in-lieu. • Investigate possibility for structure parking. • Understand the mode split that can be achieved to inform the parking and travel behaviour.
Safety	**Challenge**	• Concern about intersection of Kintail and Canning Beach Road • Access to new developments (to under croft parking) causes safety concerns. (Kintail Road). Accesses on opposite sides ”form” mini-intersections without control
Active Transport	**Challenge**	• New roundabouts in Kintail Road are an issue for cyclists. Kintail Road is a nominated cycle route
	Opportunity	• Look at mode split and how to achieve a higher active transport use. • Need clear delineation of cycle and pedestrian access to interchange
Public Transport	**Challenge**	• Access to bus stops needs to be improved

Table E-2: Stakeholder Feedback – City of South Perth

	Challenge/Opportunity	Comments
Canning Bridge Precinct Vision	**Challenge**	• Is supported by Council, but concern is raised regarding traffic impact and provision of other services • Need to address short term solution; not only long term.
Traffic: Canning Bridge Hwy	**Challenge**	• Bridge causes bottle neck with resulting queuing in both directions. • Queuing is exacerbated by the congested freeway and cars queuing on the ramps.
	Opportunity	• Future reservation of Canning Bridge Hwy should be 40m, to allow for two traffic lanes and a bus lane in each direction, including a median. • This would necessitate acquisition of land which could be an opportunity to "kick-start" densification
Traffic: Manning Rd	**Challenge**	• Southbound on-ramp is critical to address rat runs: on northbound onramp; right over the bridge; then right onto south on-ramp
Bus Interchange	**Challenge**	• Issues to be addressed in the short term: ○ Accessibility to the station ○ Provision for Kiss-and-Ride ○ Parking in residential roads (approximately 120 cars per day). Current small Park-and-Ride area behind Church in Cassey Street is temporary only and is about to cease. • New interchange: ○ Needs to address pedestrian access ○ Needs to make provision for Kiss-and-Ride facilities. ○ Cassey Street link: issue with height difference (4,5 m) would necessitate the acquisition of properties

Table E-3: Stakeholder Feedback – Public Transport Authority (PTA)

		Comments
Rail Services	**Challenge**	• Peak services: only every 2nd train stops – 10 minute frequency ○ Off Peak services: all trains stop – 15 minute frequency • Capacity is fine; however if Murdoch opens in 2014 capacity would be reached without additional rolling stock • Curtin University is expected to double in the next 20 yrs., which will impact on bus and rail services
	Future planning	• Aim to have all trains stop at Canning Bridge (i.e. 5 minute frequency)
Bus Services	**Challenge**	• Key issue for bus services: reliability along Canning Bridge Hwy. ○ Bus priority is needed from Canning Bridge to Wallace • A study is being undertaken on the rationalisation of bus stops through the study area

	Future planning	• Bus services to the city are currently the preferred mode, i.e. no transfer and seat on the bus.
		  ○ This might change as congestion to the city, and resultant travel times, increases.
		• No specific long term plans re frequency; will respond to demand and dependant on funding
		• All bus route changes are directly connected to the implementation of the bus interchange.
		  ○ Some terminating routes will then be planned (bus interchange makes provision for lay over)

Bus Interchange	**Opportunity**	• Concept designs have been prepared and costed and business case done. However no funding commitment • Interchange is increased from 6 to 12 bays with four lay-over bays.
Ferry		• It is unlikely that a ferry service will be feasible due to transfer penalties and travel time. Modelling will be undertaken to determine patronage

Table E-4: Stakeholder Feedback – Main Roads

	Comments
Traffic: Canning Hwy	• Aim to have no public transport vehicles on the Canning Bridge from the northern terminal of Kwinana Fwy interchange to Kintail Road. • Ultimate bus interchange will make provision for separation of public transport from private vehicles
Traffic: Canning Bridge	• Southern bridge will be decommissioned by 2037 • Northern bridge will be kept for pedestrians, cycling and public transport • New bridge will be built to the south of the current bridges (3 lanes eastbound, 2 lanes west bound) ○ Being south of the current bridge will need to be tied in with the road on either end
Traffic: Manning Rd	• The construction of the interchange will change the road network: ○ Close Lockhart Str at Manning Road ○ Full-movement intersection at Manning Road and Edgecumbe Str • Need to make provision for ramp metering in the long term.
Bus Priority	• The Metropolitan Regional Scheme determined reserves that allow for extra lanes to be constructed for lanes west between Kintail and Risley Street • Bus lanes should be added to current lanes, i.e. no lane take
Bus Interchange	• Do not want to encourage Kiss-and-Ride or Park-and-Ride at the interchange

Table E-5: Stakeholder Feedback – Department of Transport

		Comments

Road Network:
 	
Bus Priority
	Opportunity	• Bus priority should be provided from Canning Bridge to Wireless Hill.
		  ○ Bus-lanes on the eastward are critical, while queue-jumps should be sufficient westward.
		  ○ Internal assessment to determine the preferred option (lane-add or land-take). Results should be available within two weeks

Parking Strategy	Opportunity	• DOT approach is to identify the maximum traffic that can be supported by the network and then set parking caps accordingly. • Prelim design prepared for Henley Street Jackson Road route
Active Transport	Cycle Counts	• There is a permanent count site on the same path at the Narrows Bridge. This has provided daily figures of 2,300 and 2,540 for April and March 2012 respectively (both directions). An increase of 8-10% from 2011. • The count data for the Canning Bridge / Manning Road area for the same path is expected to be comparable but a fraction less, since some cyclists would assimilate into the South Perth area (north of the Canning Bridge).
	Opportunity	• Structure plan needs to make provision for bike parking

Public Transport:
 	
LRT from Curtin University
	Route definition study	• Preferred alignment is along Henley and Jackson Road, then terminating at the current bus interchange on the bridge
		  ○ Alternative is Manning Street
		• There's no space in the planned bus interchange to accommodate the LRT.
		  ○ The platform requirements of bus and trams are incompatible to accommodate bus and LRT at same interchange.

Ferry Services	Opportunity	• Ferry service needs to be considered in Structure Plan • Make provision for good transfer to bus and rail

Table E-6: Stakeholder Feedback – Department of Planning

	Comments
Road Network	• The impact of the development on local roads needs to be investigated • Southward on-ramp from Manning Road is critical ○ Pedestrian crossing opportunities at Manning Road needs to be addressed

Bus Priority	• Bus lanes need to be addressed
	  ○ Rationalisation of Canning Bridge was determined to Glenelg Street, Melville. Did not continue eastwards
	  ○ Canning Bridge Hwy reservation east of ±Robert Street needs to be resolved

Bus Interchange	• Interchange design is constrained by the land owned by the Swan River Trust
	• Pedestrian access has been compromised in current concept designs.
	• Ramps to the city have to be provided
	• Stopping patterns of rail service needs to change
	• Challenges at bus interchange:
	  ○ Pedestrian access
	  ○ Interchange: bus/rail, bus/ferry and rail/ferry
	  ○ LRT
	  ○ Kiss-and-ride and Park-and-Ride provision
	  ○ Phasing

Bus services	• No bus routes run along Manning road to the bus interchange. Route 30, while going north does not enter the bus interchange
	• Bus Travel times:
	  ○ Bus interchange to Bus Port: 11 minutes
	  ○ Bus Port to East: 15 minutes

Ferry Services	• Can be feasible if good transfers are achieved and high speed ferries are used. (Gary Merritt and Mark Burgess)

Table E-7: Stakeholder Feedback – DOT, Main Roads and PTA Cycling Representatives

	Comments
Principal Shared Path (east of river)	• Connects CBD with Mandurah. • Average of 3,000 cyclists daily (closer to the city)
	• Sight distance under the bridge is compromised by a tight corner • Occasional flooding at high tide (Storm surge) • Future development on the foreshore would conflict with fast moving cyclists.
Recreational Path (west of river)	• Conflict with fast moving cyclists on east shore.
Road Network	• Need to provide local cycle routes, e.g. Kintail Road • Cycling on southern side of Canning Hwy is non-compliant • Informal facilities along Manning Road
Bus Interchange	• Need direct access from north-east of the study area • Lack of trip-end-facilities impact use of cycles to the interchange

Appendix B – Trip Generation

Current development movement demand

The current (2013) estimated land use development scale and its associated trip generation is included in Table 19 and Table 21 respectively, whilst the trip rates used in this analysis are included in Table 20.

Table 19 Current development (2013) land use scales

Land Use	Unit	Scale
Residential (1 bedroom)	dwelling	0
Residential (2 bedroom)	dwelling	190
Residential (3+ bedroom)	dwelling	1,708
Office	m^2	24,241
Retail	m^2	6,871
Entertainment	m^2	2,934
Other (e.g. fast food etc)	m^2	2,625

Table 20 People trip rates

Land Use	Unit	People Trip Rates				Daily Trip Rates
		AM		PM		
		IN	OUT	IN	OUT	
Residential (1 bedroom)	per dwelling	0.12	0.48	0.48	0.12	6.00
Residential (2 bedroom)	per dwelling	0.18	0.72	0.72	0.18	9.00
Residential (3+ bedroom)	per dwelling	0.24	0.96	0.96	0.24	12.00
Office	per 100 m^2	4.00	0.00	0.00	4.00	12.50
Retail	per 100 m^2	5.88	5.88	5.88	5.88	58.82
Entertainment	per 100 m^2	0.15	0.15	2.49	2.49	60.00
Other (e.g. fast food etc)	per 100 m^2	0.33	0.33	0.33	0.33	12.54

Table 21 People trip generation (2013)

Land Use	Unit	People Trip Generation				Daily Trip Generation
		AM		PM		
		IN	OUT	IN	OUT	
Residential (1 bedroom)	per dwelling	0	0	0	0	0
Residential (2 bedroom)	per dwelling	34	137	137	34	1710
Residential (3+ bedroom)	per dwelling	410	1640	1640	410	20496
Office	per 100 m^2	970	0	0	970	3030
Retail	per 100 m^2	404	404	404	404	4042
Entertainment	per 100 m^2	4	4	73	73	1760
Other (e.g. fast food etc)	per 100 m^2	9	9	9	9	329
	TOTAL	**1831**	**2194**	**2262**	**1900**	**31367**

Planned development movement demand

Overview

The multi-modal movement demands of the different zoning and CBSP land use scenarios will be influenced by the transport infrastructure that is (or is not) provided. The basis for the multi-modal calculations is the people trip rate to which different mode shares are applied.

The vision for public transport across the wider Perth metropolitan area is articulated in the 2031 Public Transport Masterplan. For the purposes of the calculations in this part of the assessment, it is assumed that supply can meet demand. The intended outcome of this movement demand analysis is to compare the land use scenarios in the context of potential mode share outcomes. The integrated transport strategy should then be determined to provide adequate supply of transport capacity.

The corridor and mode specific movements are discussed in greater detail in the transport strategies for the CBSP area and regional areas.

Current zoning (BAU) fully built out

The existing land use zonings allow for the development scales included in Table 22 to be built in the CBSP area under the existing planning permissions. The total number of people trips forecast to be generated as a result of the current land uses being fully built out are included in Table 23; these were calculated using the trip rates included in Table 20.

Table 22 Current zoning (BAU) land use scales

Land Use	Unit	Scale
Residential (1 bedroom)	dwelling	68
Residential (2 bedroom)	dwelling	1,361
Residential (3+ bedroom)	dwelling	3,530
Office	m^2	120,788
Retail	m^2	26,422
Entertainment	m^2	24,535
Other (e.g. fast food etc)	m^2	16,986

Table 23 People trip generation (BAU 2051)

Land Use	Unit	People Trip Generation				Daily Trip Generation
		AM		PM		
		IN	OUT	IN	OUT	
Residential (1 bedroom)	per dwelling	8	33	33	8	408
Residential (2 bedroom)	per dwelling	245	980	980	245	12249
Residential (3+ bedroom)	per dwelling	847	3389	3389	847	42360
Office	per 100 m^2	4832	0	0	4832	15099
Retail	per 100 m^2	1554	1554	1554	1554	15542
Entertainment	per 100 m^2	37	37	611	611	14721
Other (e.g. fast food etc)	per 100 m^2	56	56	56	56	2130
	TOTAL	**7579**	**6048**	**6623**	**8153**	**102509**

Canning Bridge Structure Plan scenario - 2031

The estimated development scales under the CBSP in 2031 are included in Table 24, with the resulting people trip generation included in Table 25. To take a conservative approach in the estimation of the CBSP trip generation, the same generation rates used for "business as usual" (see Table 20) were applied to the land use scales predicted for 2031.

Table 24 2031 vision development scales

Land Use	Unit	Scale
Residential (1 bedroom)	dwelling	880
Residential (2 bedroom)	dwelling	1760
Residential (3+ bedroom)	dwelling	1760
Office	m^2	35200
Retail	m^2	7700
Entertainment	m^2	7150
Other (e.g. fast food etc)	m^2	4950

Table 25 People trip generation (Canning Bridge Structure Plan 2031)

Land Use	Unit	People Trip Generation				Daily Trip Generation
		AM		PM		
		IN	OUT	IN	OUT	
Residential (1 bedroom)	per dwelling	106	422	422	106	5279
Residential (2 bedroom)	per dwelling	317	1267	1267	317	15839
Residential (3+ bedroom)	per dwelling	422	1690	1690	422	21119
Office	per 100 m^2	1408	0	0	1408	4400
Retail	per 100 m^2	453	453	453	453	4529
Entertainment	per 100 m^2	11	11	178	178	4290
Other (e.g. fast food etc)	per 100 m^2	16	16	16	16	621
	TOTAL	**2733**	**3859**	**4026**	**2900**	**56078**

Canning Bridge Structure Plan scenario - 2051

The estimated development scales under the CBSP in 2051 are included in Table 26, with the resulting people trip generation included in Table 27. To take a conservative approach in the estimation of the CBSP trip generation, the same generation rates used for "business as usual" (see Table 20) were applied to the land use scales predicted for 2031.

Table 26 2051 vision development scales

Land Use	Unit	Scale
Residential (1 bedroom)	dwelling	2538
Residential (2 bedroom)	dwelling	5077
Residential (3+ bedroom)	dwelling	5077
Office	m^2	89600
Retail	m^2	19600
Entertainment	m^2	18200
Other (e.g. fast food etc)	m^2	12600

Table 27 People trip generation (Canning Bridge Structure Plan 2051)

Land Use	Unit	People Trip Generation				Daily Trip Generation
		AM		PM		
		IN	OUT	IN	OUT	
Residential (1 bedroom)	per dwelling	305	1218	1218	305	15228
Residential (2 bedroom)	per dwelling	914	3655	3655	914	45691
Residential (3+ bedroom)	per dwelling	1218	4874	4874	1218	60921
Office	per 100 m^2	3584	0	0	3584	11200
Retail	per 100 m^2	1153	1153	1153	1153	11529
Entertainment	per 100 m^2	27	27	453	453	10920
Other (e.g. fast food etc)	per 100 m^2	42	42	42	42	1580
	TOTAL	**7243**	**10969**	**11395**	**7668**	**157069**

Appendix C – Microsimulation Modelling Scenarios

This appendix outlines the approach and results of four microsimulation traffic modelling test scenarios which have been undertaken to evaluate the likely impact to the existing traffic conditions based on a number of potential road closures and new links. The modelling has been undertaken using base models which were developed to represent the current onsite road network and surveyed traffic volumes.

Evaluation and analysis of future forecast traffic volumes for the study area was not included as part of this microsimulation assessment, rather that has been undertaken separately and in conjunction with Main Roads and the Regional Operations Model (ROM).

Background

As part of the CBSP, a microsimulation traffic model was developed to represent existing onsite conditions on the road network within the study area. This traffic model was developed using Paramics simulation software and was based upon traffic data collected in September 2012. Two separate base models were developed to represent the critical AM and PM peak hour periods. The modelled network consisted of Canning Highway between Reynolds Road and Henley Street and the intersections with the following road links, and is shown in Figure 36:

- Reynolds Road;
- Sleat Road;
- The Esplanade;
- Kintail Road;
- Kwinana Freeway; and
- Henley Street.

The base model development and calibration process is discussed and reported in *Canning Bridge Structure Plan Microsimulation Traffic Model; Base Model Validation Report, October 2012*. (See Appendix D).

Figure 36 Traffic Model Study Area

Test Scenarios Descriptions

Four discrete test scenarios were modelled, each for the AM and PM peak periods. These scenarios consisted of the following:

Test 1 - Closure of Kintail Road and Canning Beach Road

Kintail Road and Canning Beach Road to be closed to general traffic at the intersection with Canning Highway. The traffic volumes currently using these two roads to be redistributed onto Sleat Road to access Canning Highway. Bus vehicles would still be permitted to access and egress Kintail Road onto Canning Highway to facilitate the current bus routes which traverse this path.

Test 2 - Closure of Canning Beach Road only

Kintail Road to remain open to general traffic, however Canning Beach Road to be truncated prior to Canning Highway. Current traffic volumes utilising Canning Beach Road to be redistributed to Kintail Road and Sleat Road (an assumption of a 60% and 40% redistribution split respectively was adopted for the modelling scenario).

Test 3 - Closure of Kintail Road and Canning Beach Road, with a new signalised intersection (west of Kintail Road) permitting left-in-left-out movements only

Kintail Road and Canning Beach Road to be closed to general traffic at the intersection with Canning Highway, and a new signalised intersection to be provided on Canning Highway on the northern side of The Esplanade intersection.

This proposed new link and junction is shown in the model screenshot in Figure 37. Only left turn movements out of (and into) the new link would be permitted. That is, the existing westbound carriageway of Canning Highway and intersection with The Esplanade to remain unchanged. Existing traffic volumes which currently utilise Kintail Road and Canning Beach Road to access/egress Canning Highway to be redistributed to the new link (for left turn movements), and Sleat Road (for right turn movements). Public transport bus vehicles would still be permitted to utilise Kintail Road. The new link has been modelled as consisting of two southbound lanes and one northbound lane between Canning Highway and Kintail Road.

Figure 37 Test 3 – New Left-in-Feft-out Signalised Intersection

Test 4 - Closure of Kintail Road and Canning Beach Road, with a new signalised intersection (west of Kintail Road) permitting left-in-left-out movements and right turn in

Test 4 represents a similar proposal to that of Test 3; however has the added inclusion of permitting right turn movements from Canning Highway into the new link road. Accordingly, existing traffic volumes currently turning right into Kintail Road or Canning Beach Road from Canning Highway have been modelled to utilise the new link road (as opposed to Sleat Road as in Test 3). Right turn movements out of the new link road remain banned. An image of the modelled network for this scenario test is shown in Figure 38.

Figure 38 Test 4 – New Signalised Intersection (Left in and out and right turn in)

Modelling Results

The model network scenarios were coded to represent the four separate tests described in Section 0, for each of the AM and PM peak periods, and the models simulated using five unique seed values for each model. The intersection performance results for key junctions have been extracted for evaluation, namely Sleat Road, Kintail Road and the new signalised intersection. The performance results, as well as qualitative commentary, for each scenario is provided below and compared against the corresponding current performance of these junctions.

Test 1

The performance (Level of Service) of the intersections of Canning Highway with Sleat Road and Kintail Road under both the existing onsite conditions, as well as the Test 1 configuration is displayed in Table 28 for the AM and PM peak hour periods.

It should be noted that the intersection of Canning Highway and Sleat Road is currently exhibiting poor operating performance, with level of service (LOS) F being reported for the AM peak and LOS E during the PM peak. This result is consistent with the conditions observed onsite during site inspections at the time of the traffic survey collection.

The results of the Test 1 scenario indicate a substantial deterioration of intersection performance at Sleat Road with the redistributed traffic volumes from Kintail Road and Canning Beach Road. The intersection is expected to remain at LOS F (which is the maximum) and the average delay is expected to increase approximately 40 seconds and 60 seconds during the AM and PM periods respectively. Observations of the simulation model in operation reveal sustained congestion on all approaches to the intersection, extending to the upstream junctions through the modelled periods which are shown in Figure 39.

The transfer of demand from Kintail Road and Canning Beach Road adds approximately 1400 and 1100 vehicles per hour through the Sleat Road intersection during the AM and PM peak hours respectively. The modelling has shown that the configuration of the intersection at this location provides insufficient capacity to service the increased traffic volumes arising from a closure of Kintail Road and Canning Beach Road.

As would be expected, the performance of the Canning Highway and Kintail Road intersection improves significantly due to the removal of all general traffic from the minor leg of this junction. That is, only bus vehicles have remained permissible at this location to utilise Kintail Road, as such this site was found to perform satisfactorily.

Table 28 Test 1 – Intersection Level of Service Results

	AM BASE	AM TEST 1	PM BASE	PM TEST 1
Canning Hwy/Sleat Rd				
Canning Hwy Eastbound	F	F	C	F
Canning Hwy Westbound	D	F	F	E
Sleat Rd Southbound	E	D	E	D
Sleat Rd Northbound	D	F	E	F
Intersection	***F***	***F***	***E***	***F***
Average Delay (sec)	***77***	***118***	***59***	***121***
Canning Hwy/Kintail Rd/Canning Beach Rd				
Canning Hwy Eastbound	D	A	D	A
Canning Hwy Westbound right turn	C	D	C	D
Canning Beach Rd Southbound	C	n/a	A	n/a
Kintail Rd Southbound	E	A	C	A
Intersection	***C***	***A***	***C***	***A***
Average Delay (sec)	***36***	***4***	***31***	***1***

Figure 39 Test 1 – Congestion at Sleat Road Intersection (AM peak period)

Test 2

The Test 2 configuration consists on maintaining Kintail Road open to general traffic whilst closing Canning Beach Road. This situation would eliminate the current configuration whereby Kintail Road and Canning Beach Road intersect immediately prior to Canning Highway. As part of this model scenario it was assumed that 40% of the existing Canning Beach Road traffic would redistribute to Sleat Road, with Kintail Road absorbing the remainder. The results of the Test 2 modelled scenario are displayed in Table 29.

Table 29 demonstrates that the proposed Test 2 scenario would provide improved operations at the intersection of Canning Highway and Kintail Road, with only a modest impact to the performance of Sleat Road. The enhanced performance of Kintail Road is due to the elimination of the existing requirement for Kintail Road traffic to yield to vehicles entering Canning Beach Road from Canning Highway.

Table 29 Test 2 – Intersection Level of Service Results

	AM BASE	AM TEST 2	PM BASE	PM TEST 2
Canning Hwy/Sleat Rd				
Canning Hwy Eastbound	F	F	C	D
Canning Hwy Westbound	D	E	F	F
Sleat Rd Southbound	E	E	E	D
Sleat Rd Northbound	D	E	E	D
Intersection	***F***	***F***	***E***	***E***
Average Delay (sec)	***77***	***82***	***59***	***58***
Canning Hwy/Kintail Rd/Canning Beach Rd				
Canning Hwy Eastbound	D	C	D	C
Canning Hwy Westbound right turn	C	C	C	C
Canning Beach Rd Southbound	A	n/a	A	n/a
Kintail Rd Southbound	E	D	C	C
Intersection	***C***	***B***	***C***	***B***
Average Delay (sec)	***41***	***27***	***31***	***27***

Test 3

The configuration of scenario Test 3 consists of the provision of a new link between Canning Highway and Kintail Road, and an associated signalised intersection permitting left turn movements only. The modelled results from this scenario, for the AM and PM peak hours, are shown in Table 27 and are compared against the existing onsite conditions. It should be noted that the new intersection has no base for comparison.

Table 30 demonstrates that the Test 3 configuration is expected to result in a substantial deterioration of performance of Sleat Road owing to the increase in traffic loadings resulting from vehicles which currently turn right off Canning Highway into Kintail Road and Canning Beach Road. However, the proposed new intersection is expected to perform satisfactorily at level of service B during both the AM and PM periods. This is also shown in Figure 40, where congestion is apparent within the model on approach to Sleat Road; however the new junction operates satisfactorily.

Figure 40 Test 3 – Canning Highway Congestion (AM peak period)

Table 30 Test 3 – Intersection Level of Service Results

	AM BASE	AM TEST 3	PM BASE	PM TEST 3
Canning Hwy/Sleat Rd				
Canning Hwy Eastbound	F	F	C	F
Canning Hwy Westbound	D	F	F	F
Sleat Rd Southbound	E	D	E	D
Sleat Rd Northbound	D	F	E	F
Intersection	***F***	***F***	***E***	***F***
Average Delay (sec)	***77***	***127***	***59***	***121***
Canning Hwy/Kintail Rd/Canning Beach Rd				
Canning Hwy Eastbound	D	A	D	A
Canning Hwy Westbound right turn	C	D	C	D
Canning Beach Rd Southbound	A	n/a	A	n/a
Kintail Rd Southbound	E	B	C	A
Intersection	***C***	***A***	***C***	***A***
Average Delay (sec)	***41***	***4***	***31***	***5***
Canning Hwy/'New' road				
Canning Hwy Eastbound		B		B
Canning Hwy Westbound right turn		A		A
'New' Rd Southbound		D		C
Intersection	***n/a***	*B*	***n/a***	*B*
Average Delay (sec)	***n/a***	*26*	***n/a***	*18*

Test 4

Visual observations of the Test 4 simulation in operation revealed comparable performance to that of the existing situation along Canning Highway. The statistical outputs presented in Table 31 also support this statement. That is, the intersection of Sleat Road operates in Test 4 comparably to the Base model, and the new intersection operates is a similar respect to that of the existing Kintail Road intersection with regards to level of service.

Table 31 Test 4 – Intersection Level of Service Results

	AM BASE	AM TEST 4	PM BASE	PM TEST 4
Canning Hwy/Sleat Rd				
Canning Hwy Eastbound	F	F	C	C
Canning Hwy Westbound	D	E	F	F
Sleat Rd Southbound	E	D	E	E
Sleat Rd Northbound	D	E	E	E
Intersection	***F***	***F***	***E***	***E***
Average Delay (sec)	***77***	***80***	***59***	***57***
Canning Hwy/Kintail Rd/Canning Beach Rd				
Canning Hwy Eastbound	D	A	D	A
Canning Hwy Westbound right turn	C	D	C	C
Canning Beach Rd Southbound	C	n/a	A	n/a
Kintail Rd Southbound	E	A	C	A
Intersection	***C***	***A***	***C***	***A***
Average Delay (sec)	***36***	***6***	***31***	***8***
Canning Hwy/'New' road				
Canning Hwy Eastbound		C		D
Canning Hwy Westbound right turn		C		C
'New' Rd Southbound		C		B
Intersection	***n/a***	***C***	***n/a***	***C***
Average Delay (sec)	***n/a***	***30***	***n/a***	***34***

Intersection Performance Summary

A summary of the key intersection performance statistics from the modelled scenarios is provided in Table 32 and Table 33 for the AM and PM periods respectively.

Table 32 Intersection Level of Service Summary – AM Peak

	BASE	TEST 1	TEST 2	TEST 3	TEST 4
Canning Highway/Sleat Road					
Intersection LOS	F	F	F	F	F
Average Delay (sec)	77	118	82	127	80
Canning Highway/Kintail Road/Canning Beach Road					
Intersection LOS	C	A	B	A	A
Average Delay (sec)	41	4	27	4	6
Canning Highway/'New' road					
Intersection LOS				B	C
Average Delay (sec)				26	30

Table 33 Intersection Level of Service Summary – PM Peak

	BASE	TEST 1	TEST 2	TEST 3	TEST 4
Canning Highway/Sleat Road					
Intersection LOS	E	F	E	F	E
Average Delay (sec)	59	121	58	121	57
Canning Highway/Kintail Road/Canning Beach Road					
Intersection LOS	C	A	B	A	A
Average Delay (sec)	31	1	27	5	8
Canning Highway/'New' road					
Intersection LOS				B	C
Average Delay (sec)				18	34

Summary

Microsimulation modelling was undertaken for the four proposed scenarios for each of the AM and PM peak periods.

The key findings from the simulation testing include the following:

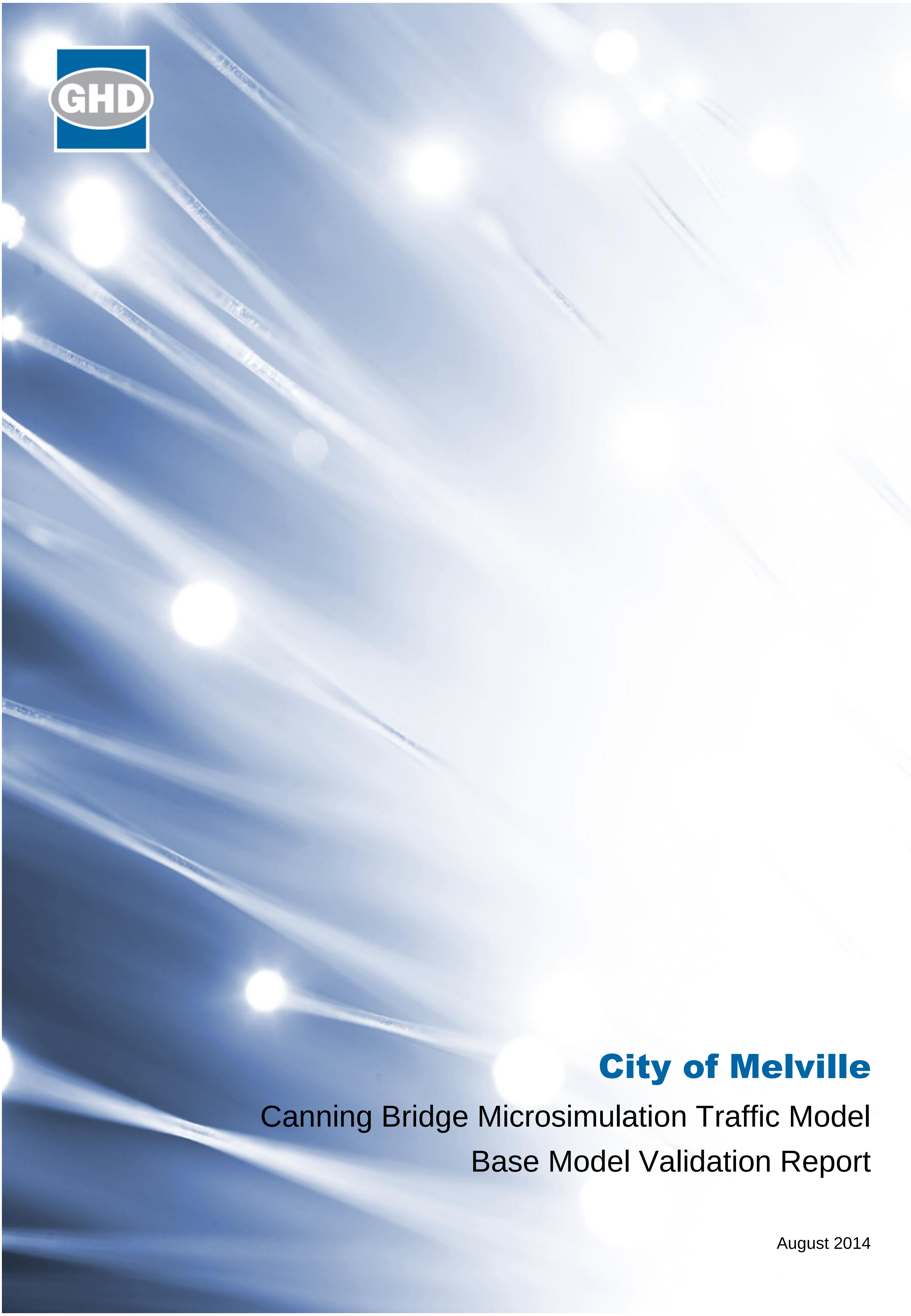
– The current operation of Canning Highway is close to capacity, with the intersection of Sleat Road currently exhibiting level of service (LOS) F and E during both the morning and afternoon peak periods respectively;

– The closure of both Kintail Road and Canning Beach Road to general traffic (Test 1) would force substantially more vehicles to utilise Sleat Road to access Canning Highway, approximately 1400 and 1100 vehicles per hour during the AM and PM periods respectively. These higher traffic volumes would increase delays and congestion considerably at the Sleat Road intersection. This junction in its current form would be unable to service the full extent of the redistributed traffic from Kintail Road and Canning Beach Road;

– The closure of Canning Beach Road, whilst maintaining Kintail Road open to general traffic (Test 2), improves the operation of the Kintail Road intersection by eliminating the current arrangement whereby vehicles exiting Kintail Road onto Canning Highway must yield to right-turners from Canning Highway into Canning Beach Road. The operation of Sleat Road under this Test 2 configuration is expected to remain largely unchanged from current conditions;

– The provision of a new link road connecting Canning Highway and Kintail Road (Test 3 and 4), would essentially act as a substitute to the direct connection of Kintail Road with Canning Highway. As such, if only left turn movements were permitted (Test 3) then the existing right turn movements would be required to utilise Sleat Road. This scenario would cause a significant increase to congestion and delays at the Sleat Road intersection. However, if the right turn movement was also permitted (Test 4) then only a small impact to Sleat Road would be expected, and the proposed new signalised junction would be expected to operate comparably to the current Kintail Road intersection with regards to level of service.

Appendix D Canning Bridge Structure Plan Microsimulation Traffic Model; Base Model Validation Report, October 2012



City of Melville

Canning Bridge Microsimulation Traffic Model
Base Model Validation Report

August 2014

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1. Introduction

City of Melville has engaged GHD to undertake a Canning Bridge Structure Plan. As part of the traffic assessment for this study, GHD is undertaking local area microsimulation traffic modelling to assist in the evaluation of the transport network. This report discusses the development of the initial 'Base' models which provide a representation of the current on-site conditions on the Canning Highway corridor between Reynolds Road and Henley Street, and outlines the calibration and validation methodologies that have been employed.

The purpose of this report is to demonstrate and provide confidence that the Canning Bridge study area Base models are a robust representation of the on-street conditions and as such provide a suitable foundation for the subsequent testing of a future year scenario. The report therefore provides information relating to the following topics:

- Data sources used for the modelling;
- Model network development;
- Trip matrix development;
- Model calibration; and
- Model validation.

Figure 1 outlines the adopted study area for the traffic modelling assessment.

Figure 1 Extents of Model Study Area

2. Data Collection

2.1 Introduction

Microsimulation models typically require large volumes of data in order to accurately represent traffic networks at a microscopic level and to ensure the model is a good representation of current on-site conditions. This section of the report details each dataset that has been collected for the study and used in the model development. It provides information relating to the type of data, the source of the data and the date and time periods that the data was collected for.

2.2 Traffic Volume Data

Traffic volume count data was obtained from a number of sources including the following:

- SCATS loop counts;
- Manual turning movement surveys; and
- Historical tube count data available through Main Roads website.

2.2.1 SCATS Loop Counts

Signalised intersection detector counts were requested from Main Roads for the sites within the Canning Bridge study area. These signalised intersections consisted of the following:

- Canning Highway / Reynolds Road (TCS 128);
- Canning Highway / Sleat Road (TCS 62);
- Canning Highway / Kintail Road (TCS 157);
- Canning Highway / Kwinana Freeway northbound exit ramp (TCS 906);
- Canning Highway / Kwinana Freeway southbound exit/entry ramps (TCS 308);
- Canning Highway / Henley Street (TCS 276); and
- Manning Road / Lay Street (TCS 273).

Detector counts were provided in hourly intervals for each intersection loop for Wednesday 20 June 2012.

These types of traffic counts have a number of limitations which need to be considered when assessing the suitability of such data to use as an input into traffic models. These constraints include:

- Some intersection movements are not captured since some lanes are not covered by an in-pavement detector, e.g. often left turn slip lanes are not detected (such as the left turn from the Kwinana Freeway southbound exit ramp);
- Some lanes have multiple designations e.g. a shared left turn and through movement lane. In these instances it is unclear from the detector count what proportion of vehicles conduct each movement (such as the detectors at the Sleat Road intersection);

- Detectors are not always reliable e.g. detectors can be faulty and hence not record all vehicles accurately; and
- Detector counts do not differentiate between vehicle classifications.

2.2.2 Manual Turning Movement Count Surveys

To supplement the SCATS detector count data (and to overcome some of the shortcomings of that data set) a number of manual turning movement surveys were collected. These were undertaken by Excel Traffic Data at the following sites:

- Canning Highway / Sleat Road;
- Canning Highway / The Esplanade;
- Canning Highway / Kintail Road; and
- Canning Highway / Henley Street.

Surveys were undertaken during for the following time periods (during August 2012):

- AM Peak: 6.30 – 9.00; and
- PM Peak: 16.00 – 18.00.

Traffic count data was provided in the form of turning counts in 15 minute intervals and was disaggregated into car and truck vehicle types.

2.2.3 Historical Data

The Main Roads data website was used to source the summary results of a number of surveys which had previously been undertaken throughout the study area. These surveys were used by GHD to inform the project of indicative volumes on areas of the network not covered by SCATS loops or manual surveys (e.g. Kwinana Freeway). The obtained counts ranged in date from 2008 and 2011.

2.3 Signal Data

In addition to the SCATS detector counts (discussed in Section 2.2.1), traffic signal operation data was sourced from Main Roads for each signalised intersection in the study area to ensure signal operations could be represented accurately. The signalised sites included:

- Canning Highway / Reynolds Road (TCS 128);
- Canning Highway / Sleat Road (TCS 62);
- Canning Highway / Kintail Road (TCS 157);
- Canning Highway / Kwinana Freeway northbound exit ramp (TCS 906);
- Canning Highway / Kwinana Freeway southbound exit/entry ramps (TCS 308); and
- Canning Highway / Henley Street (TCS 276).

The specific signal data which was requested and subsequently provided by Main Roads consisted of the following:

- SCATS TCS graphics;
- IDM (intersection diagnostic monitor) data files (from July 2012); and
- Signal co-ordination/linking information.

2.4 Travel Time Data

Vehicular journey times through the study area were recorded on-site for the key corridor of Canning Highway. This information would provide the key source of model validation data (discussed in detail in Section 5). GHD collected travel time survey data, as well as in-car video footage for the AM and PM peak periods on Wednesday 15 August 2012. GHD staff undertook these travel time surveys which allowed observations of queuing and congestion levels on-site to be considered during the calibration and validation stages of the modelling process.

The key route along Canning Highway was surveyed and subsequently disaggregated into the key mid-block intervals identified in Figure 2 and Table 1.

Figure 2 Surveyed Travel Time Routes

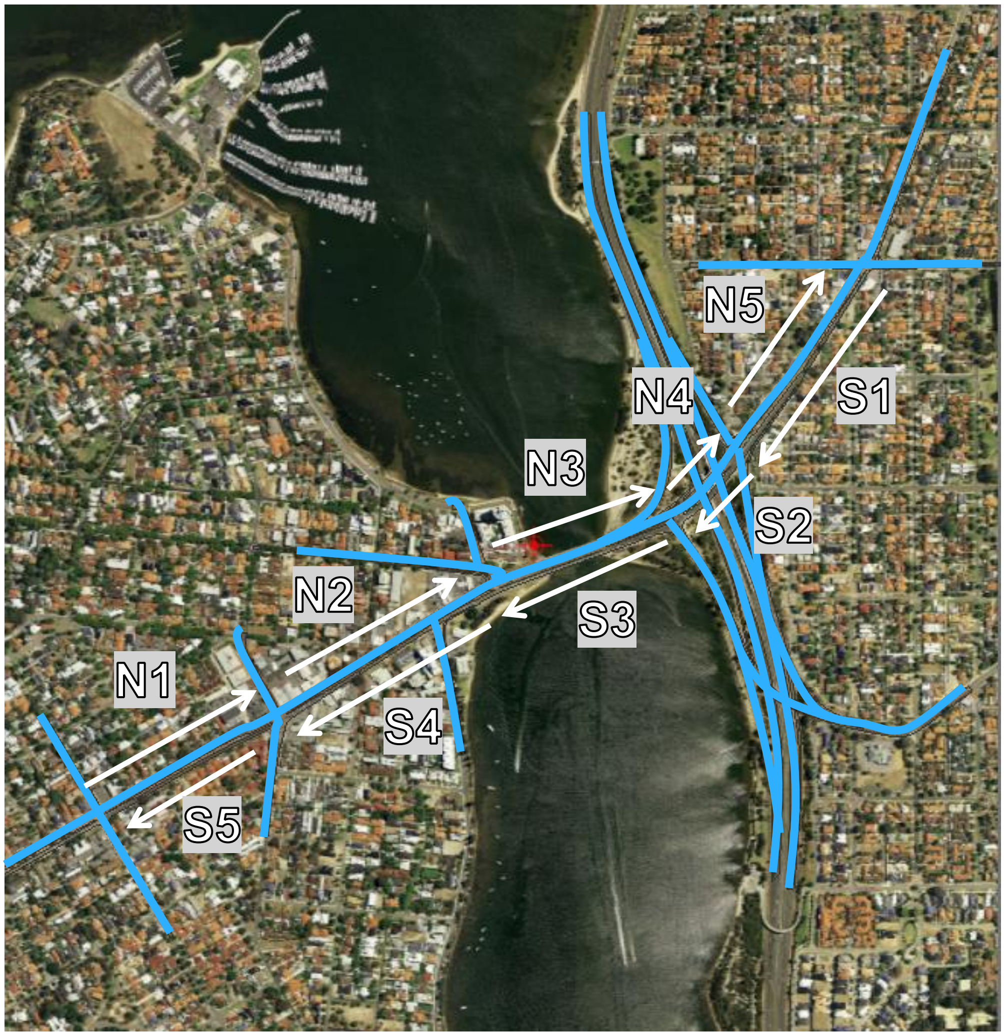


Table 1 Travel Time Section Descriptions

Movement	Description
Northbound movements	
N1	Canning Highway between Reynolds Road and Sleat Road
N2	Canning Highway between Sleat Road and Kintail Road
N3	Canning Highway between Kintail Road and Kwinana Freeway northbound exit ramp
N4	Canning Highway between Kwinana Freeway northbound exit ramp and southbound exit ramp
N5	Canning Highway between Kwinana Freeway southbound exit ramp and Henley Street
Southbound movements	
S1	Canning Highway between Henley Street and Kwinana Freeway southbound entry ramp
S2	Canning Highway between Kwinana Freeway southbound entry ramp and northbound exit ramp
S3	Canning Highway between Kwinana Freeway northbound exit ramp and Kintail Road
S4	Canning Highway between Kintail Road and Sleat Road
S5	Canning Highway between Sleat Road and Reynolds Road

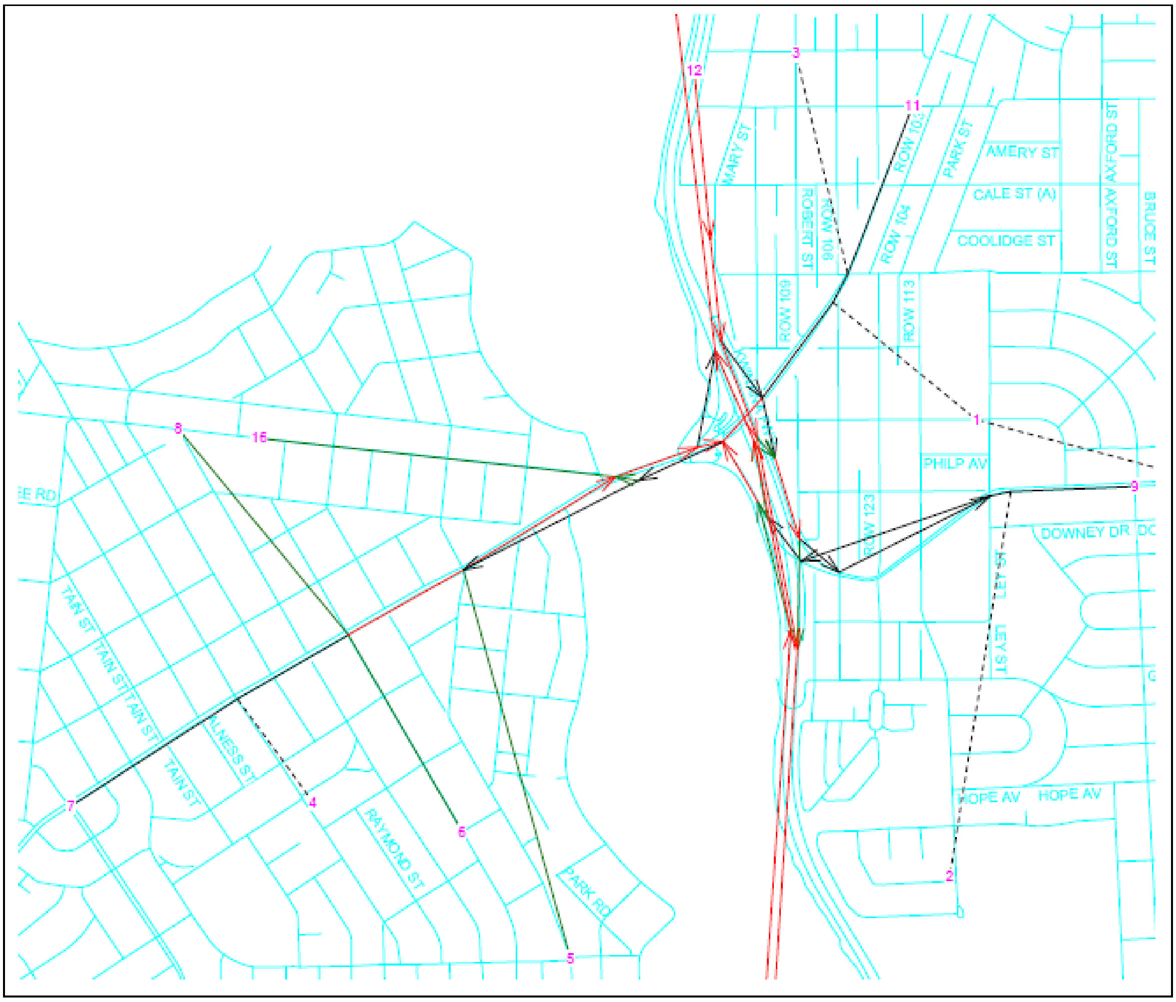
2.5 ROM Strategic Model Outputs

Main Roads provided outputs from the Regional Operations Model (ROM) to assist with the study. The outputs requested by GHD and provided by Main Roads consisted of the following:

- ROM network layout and zoning structure around the Canning Bridge study area; and
- Sub-area cordon trip matrices from ROM for the 2011 Base scenario (as well as the 2031 scenario matrices) for the traffic model area.

The ROM model of the sub-area network is shown in Figure 3.

Figure 3 ROM Sub-area Network



3. Model Development

3.1 Introduction

The microsimulation modelling for the Canning Bridge study area has been developed using Quadstone Paramics software (version 6). Paramics is a traffic simulation software package that can be used to analyse a connected network of road links and signal controlled intersections, roundabouts, priority junctions in a single model network and to a high level of detail. The simulated driver behaviour is based on lane changing and vehicle following models and can provide an accurate reflection of on-site driver and vehicle behaviour.

3.2 Model Definition

The model runs for two discrete one-hour time periods as per the following:

- AM Peak Model: 7.45-8.45 with preceding warm-up period between 6.45 and 7.45; and
- PM Peak Model: 17.00-18.00 with preceding warm-up period between 16.00 and 17.00.

The time periods above were found to be the critical peak periods with regards to the highest traffic volumes following a review of the available traffic data for the study area. The warm-up periods are in place to ensure that an appropriate volume of vehicles are on the network at the commencement of the evaluation period.

The Base model is simulated using five variable ‘seed values’ with the resultant outputs analysed for discrepancies and ultimately averaged for output purposes. The seed value affects the generation of the random numbers that influence the model operation and variability. Therefore each time the model is run with a different seed value a slightly different set of outputs is generated. It would generally be expected that these outputs would be very similar (but not identical), and can loosely be thought of as day-to-day on-site fluctuations. The use of multiple seed values therefore provides confidence that the model results are not based upon a single outlying model run, but the result of a larger sample of model runs.

3.3 Model Network

The core model network was coded through the assistance of aerial photography and on-site observations to ensure the following attributes were included into the network:

- Intersection configurations;
- Number of lanes and lane allocations;
- Roadway widths, kerb locations and stopline positions;
- Road speed limits;
- Bus stop locations;
- Unsignalised intersection priority controls; and
- Turning lane storage lengths.

An overview of the model network is shown in Figure 4 and Appendix A shows the model coding of each of the key junctions.

Figure 4 Model Network

3.4 Signalised Intersections

Signalised junctions have been coded into the model to function under fixed time operation consistent with the phasing structure and times recorded in the IDM files, as well as offsets between adjacent junctions. A review of the signal information provided by Main Roads revealed that phase and cycle times remained very consistent between consecutive days, as such these timings were coded into the model for the AM and PM peak periods.

3.5 Public Transport

The inclusion of bus services into the model was a critical aspect of the study as many services utilise the Canning Highway corridor and the Canning Bridge interchange. As such data was compiled relating to the service numbers, routes and timetables of buses currently utilising the study area network. These bus services, along with the corresponding bus stop locations, were included into the modelling, as were the bus-only ramps to/from Kwinana Freeway. The services identified as being relevant to the study area included: 30, 105, 106, 150, 160, 111, 881, 940, 148, 158, 100, and 101. Data was not available regarding recorded dwell times; as such notional 30 second and 15 second dwell times were applied to the Canning Bridge interchange stops and all other on-road bus stops respectively.

3.6 Trip Matrices

Microsimulation models require accurate trip matrices (origin-destination demand matrices) in order to produce an indicative simulation of existing traffic movements. The AM and PM peak trip sets were developed through a detailed matrix estimation process using the comprehensive set of turning movement surveys available to the study. The methodology implemented involved the following key steps:

- Development of a schematic layout presenting each of the recorded turning movements;
- Identification of any significant discrepancies within recorded traffic volumes e.g. mid-block sections exhibiting large differences between adjacent sites with no (or minimal) mid-block access points;
- Determination of origin-destination movements based upon initial model entry volumes and subsequent turning proportions at each junction along the corridor;
- Manual assessment of the resulting matrices sensibility and removal of unrealistic trips; and
- Heavy vehicle matrices were specified separately by applying the corresponding heavy vehicle proportion recorded for each surveyed location to trip origins.

3.7 Vehicle Release Profiling

Demand release profiles were developed for each of the key model entry locations (where the necessary data was available). These profiles are used to specify the staged release of vehicles into the models across the hourly periods i.e. vehicles do not necessarily arrive at a constant rate across a one hour peak period. Profiles were developed for 15-minute intervals from observed turning movement counts. Individual profiles were applied to external zones which connect directly to an intersection where a turning movement survey was undertaken (and hence 15-minute data was available). For entry zones where data was not available in 15-minute intervals, the average profile was applied to these releases.

3.8 Model Assignment

Paramics has a number of alternative assignment methods to distribute trips across a given network. However, as the Canning Bridge study area network does not contain any alternate route choices for vehicles within the simulation, the applied assignment method is inconsequential to the operation of the model. (Notwithstanding, the 'all-or-nothing' (AON) assignment option is active in the model).

3.9 Model Plugins

Azalient Ceejazz model plugins have been utilised within the model. These third party plugins operate in conjunction with the core Paramics software and enhance its functionality. The specific plugin modules which have been used on the Canning Bridge model network consist of the following:

- Validator: Used to extract results relating to modelled traffic volumes and travel times; and
- Lane Choice: Used to ensure sensible and accurate lane discipline of vehicles on approach to junctions.

4. Model Calibration

4.1 Introduction

Model calibration is the process whereby data that has been used in the model building process is checked against the model output to ensure that the model has been accurately coded and is representing the measured on-site conditions. Turning movement traffic volumes have been used as the calibration measure in this instance. As such, the calibration process involved ensuring traffic volumes output by the model were sufficiently accurate when compared against traffic volumes observed on site.

4.2 Turning Count Calibration

A turning count calibration was undertaken for each of the major intersections within the model study area. The purpose of this calibration was to check that traffic volumes collected from the model were representative of traffic volumes measured on site for each traffic movement at each intersection. The GEH statistic was used to compare observed and modelled traffic volumes.

The GEH statistic is a self scaling indicator developed to sensibly compare observed and modelled flows. Rather than directly comparing flows by measure of either absolute or relative differences, the GEH statistic considers both of these measures within thresholds that are appropriate for traffic flow. For instance, the GEH statistic reflects that while an absolute difference of 100 vehicles/hr can be important in the context of a flow of 200 vehicles/hr, it is much less relevant in a flow of several thousand vehicles/hr.

GEH compares the differences between hourly observed flows and hourly modelled flows by using the following formula:

$$GEH = \sqrt{\left(V_O - V_A\right)^2 / \left(0.5 \times \left(V_O + V_A\right)\right)}$$

Where:

V_O = Observed traffic flow (vehicles/hour)

V_A = Assigned (or modelled) hourly traffic flow (vehicles/hour)

The following criteria were used during the turning count calibration process:

- 85% of GEH statistics for individual junction turning-movement total volumes should be less than 5;
- R^2 statistic between 0.9 and 1.0 and slope factors between 0.9 and 1.1, of modelled vs. observed flow plots.

Table 2 provides a summary of the turning movement GEH criteria results. It can be seen that a total of 50 and 49 individual movements were assessed within each of the AM and PM time periods respectively. (Note, one recorded count was removed from the PM assessment pool due to an erroneous survey count at this location. The recorded count was compared to the counts at adjacent intersections which revealed a very large discrepancy). The turning movements included as part of the calibration assessment include only movements which were directly known from recent survey information i.e. manual counts and selected SCATS detector recordings.

Table 2 demonstrates that during both peak periods, the model provides a close match of modelled and observed traffic flows.

Table 2 Summary of GEH Criteria Results

Time Period	Number of Observations	Observations with GEH < 5	Average GEH	R^2 and Slope	Exceeds Criteria?
AM Peak	50	50 (*100%*)	0.90	0.99, 0.99	Yes
PM Peak	49	49 (*100%*)	0.78	0.99, 1.01	Yes

Figure 5 and Figure 6 show plots of modelled traffic volumes compared with observed traffic volumes for each turning movement. It can be seen from these charts that there is a close fit between observed and modelled traffic volumes across each of the time periods surveyed.

It should be noted that the raw surveyed traffic volumes have been adopted directly for this assessment. That is, there has not been any manual smoothing or manipulation of the surveyed data, as such there exist some minor discrepancies between adjacent sites due to inherent survey errors and inconsistencies. Consequently, under this approach it is not possible to match each and every count precisely.

Appendix B provides fully tabulated results of the turning count calibration assessment for each individual turning movement.

Figure 5 AM Peak Traffic Volume Comparison

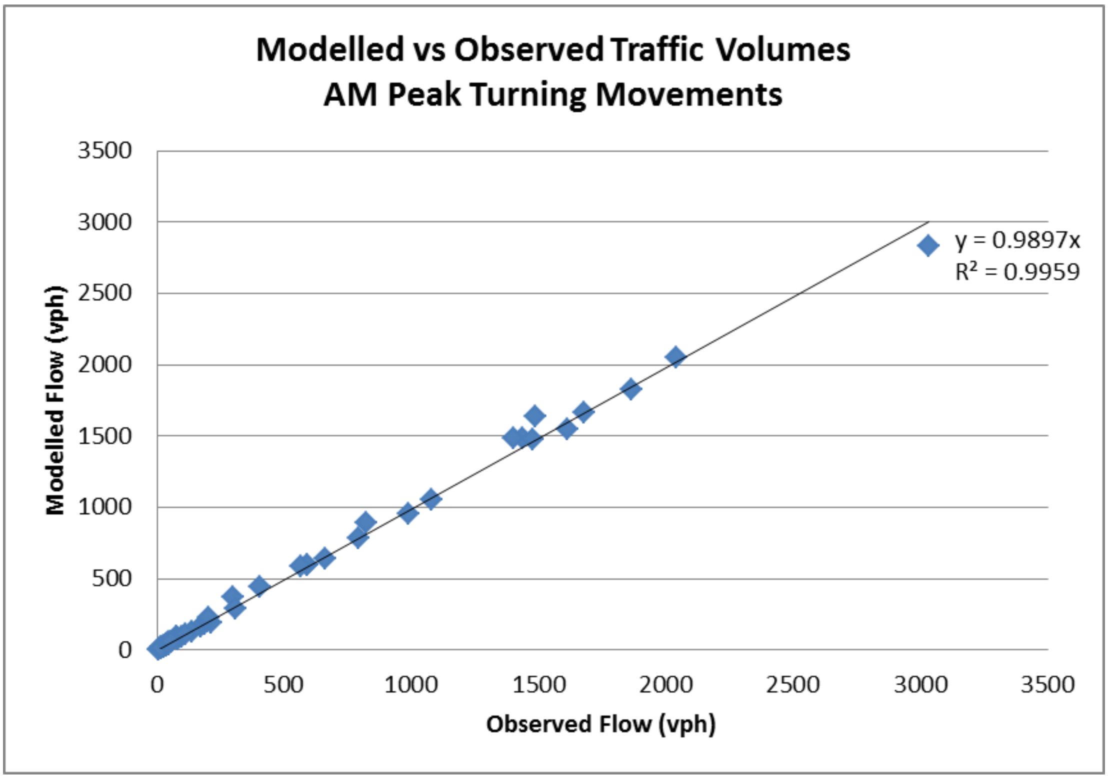
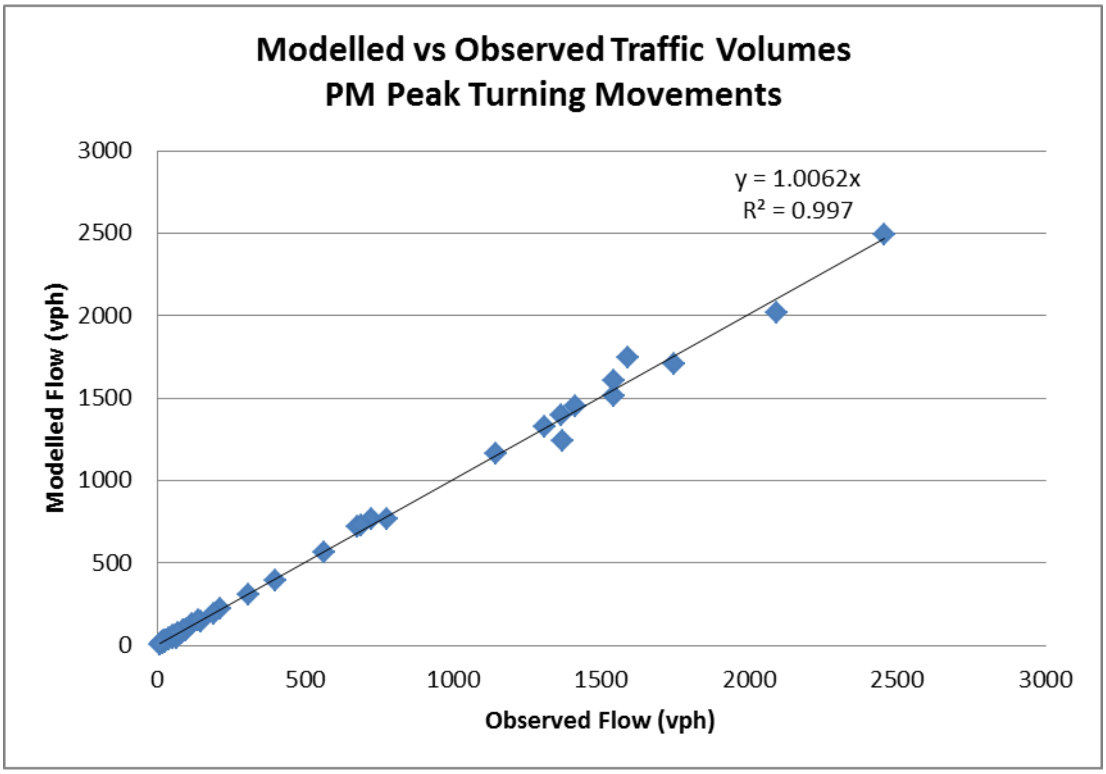


Figure 6 PM Peak Traffic Volume Comparison



5. Model Validation

5.1 Introduction

This section details the results from the validation of the base model. The purpose of model validation is to ensure that statistical results in the model accurately reflect data collected during the survey period, but have not been explicitly used as model inputs during the development stages. The validation measure used in this instance was travel time data.

In addition to the travel time validation, an assessment of model stability has also been presented which shows model output variations across multiple seed value runs.

5.2 Travel Time Validation

As part of the validation process GHD undertook an analysis of journey times for vehicles in the model along Canning Highway and compared these against journey time observations recorded on site. Average travel times across five seed runs were collected from the model outputs and analysed. The following criteria was used to assess whether the modelled journey times were representative of conditions on site:

- Percentage difference between total observed and total modelled journey times for each route should be less than 15% or 1-minute (whichever is greater).

Figure 7 displays the travel time routes surveyed and compared with modelled outputs.

Table 3 and Table 4 show a summary of the travel time validation results for the various sections of the network for the AM and PM periods respectively. It is clear that the model closely replicates the recorded travel times along the critical corridors for both the AM and PM periods.

Figure 7 Surveyed Travel Time Sections

Table 3 AM Peak Travel Time Comparison

Location	Modelled (seconds)	Observed (seconds)	Difference (seconds)	Meets Criteria?
Northbound movements				
N1	127	136	9	*Yes*
N2	62	38	-24	*Yes*
N3	23	55	32	*Yes*
N4	30	19	-11	*Yes*
N5	48	34	-14	*Yes*
Total	**290**	**282**	**-8 (3%)**	***Yes***
Southbound movements				
S1	75	70	-5	*Yes*
S2	25	14	-11	*Yes*
S3	26	25	-1	*Yes*
S4	86	100	14	*Yes*
S5	19	31	12	*Yes*
Total	**231**	**240**	**9 (4%)**	***Yes***

Table 4 PM Peak Travel Time Comparison

Location	Modelled (seconds)	Observed (seconds)	Difference (seconds)	Meets Criteria?
Northbound movements				
N1	45	37	-8	*Yes*
N2	65	89	24	*Yes*
N3	55	51	-4	*Yes*
N4	33	16	-17	*Yes*
N5	51	80	29	*Yes*
Total	**249**	**273**	**24 (9%)**	***Yes***
Southbound movements				
S1	46	56	10	*Yes*
S2	28	27	-1	*Yes*
S3	37	37	0	*Yes*
S4	118	114	-4	*Yes*
S5	55	48	-7	*Yes*
Total	**284**	**282**	**-2 (1%)**	***Yes***

It can be seen from Table 3 and Table 4 that the difference between the observed and modelled journey times is significantly less than the 1-minute threshold for all comparisons.

The total progress journey time comparisons are presented in Figure 8 to Figure 11 for the AM and PM periods separately by direction. These charts demonstrate close comparisons between the modelled and observed journey times.

Figure 8 AM Peak Northbound Travel Time Comparison

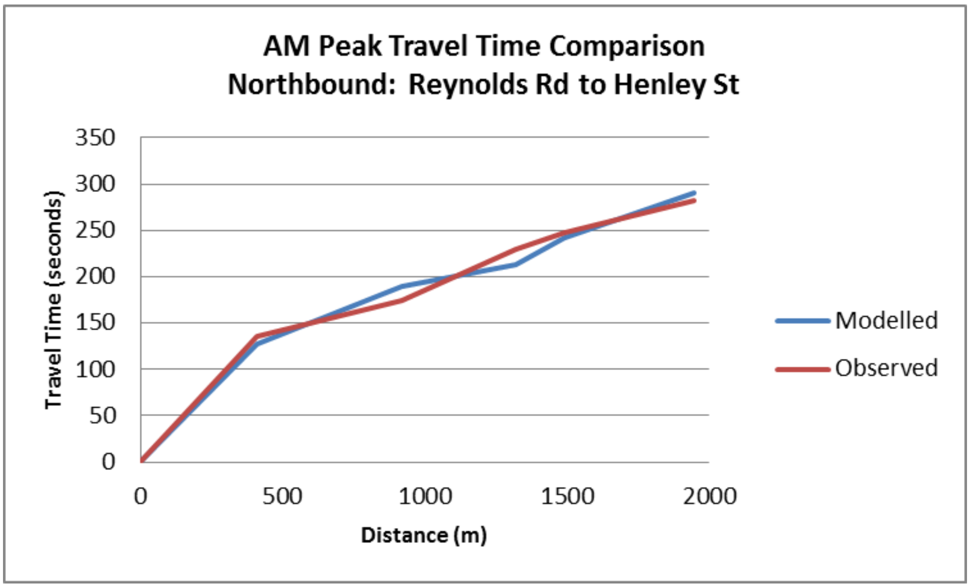


Figure 9 AM Peak Southbound Travel Time Comparison

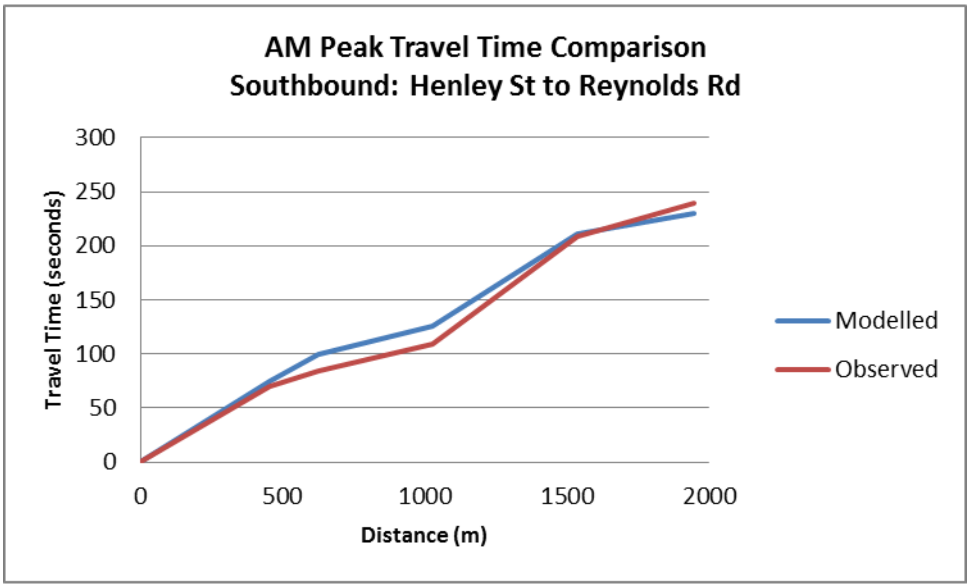


Figure 10 PM Peak Northbound Travel Time Comparison

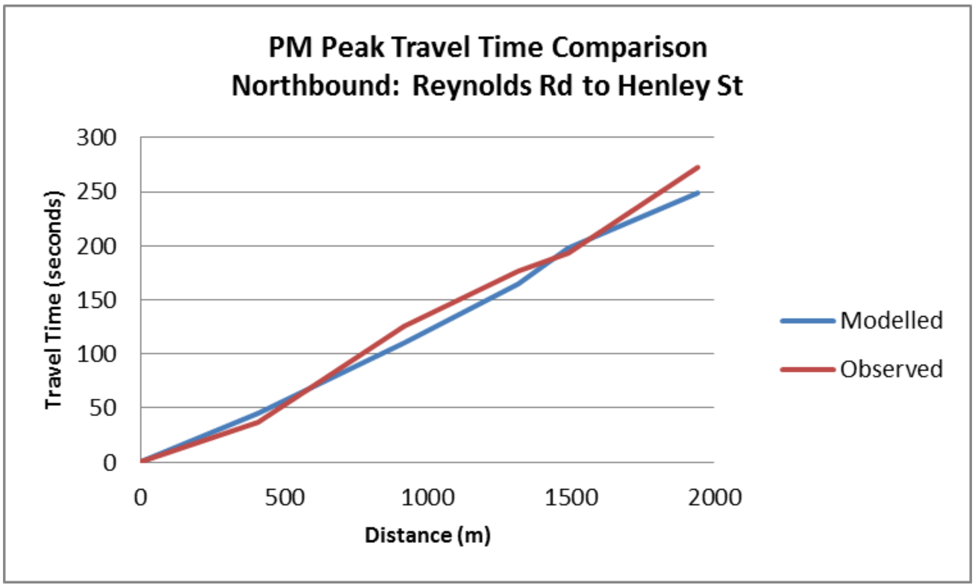
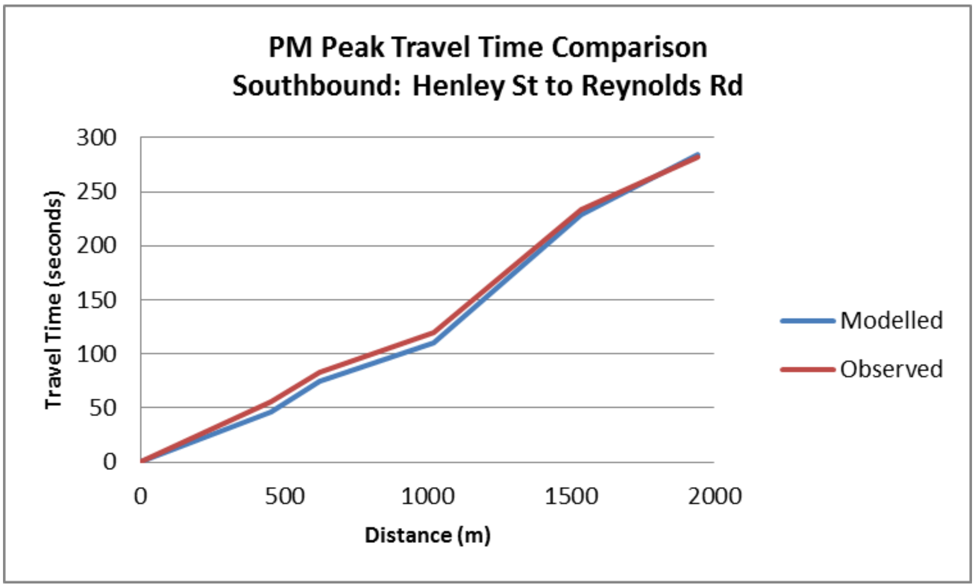


Figure 11 PM Peak Southbound Travel Time Comparison



5.3 Model Stability

The base model has been run with five 'seed' values (as discussed in Section 3.2 of this report) and the results of these model runs have been averaged for the calibration and validation outputs. However, it is important to ensure that the model runs are providing a stable and consistent model platform to take forward to the option testing stage. This requires the assessment of output statistics from each seed run to ensure that the variability of the outputs appears to be within reasonable limits.

In order to assess model stability for this study, two network wide statistics have been extracted and presented comparing each of the five individual seed value runs. The two assessment statistics are as follows:

- Average vehicle speed (veh/hr) of all vehicles currently in the model network; and
- Current number of vehicles being serviced by the network.

Figure 12 and Figure 13 show the stability test outputs for the AM and PM models respectively. These figures display variations between seed vales (as expected), but do not highlight any substantial outlying or rogue results.

Figure 12 AM Peak Model Stability Test Results

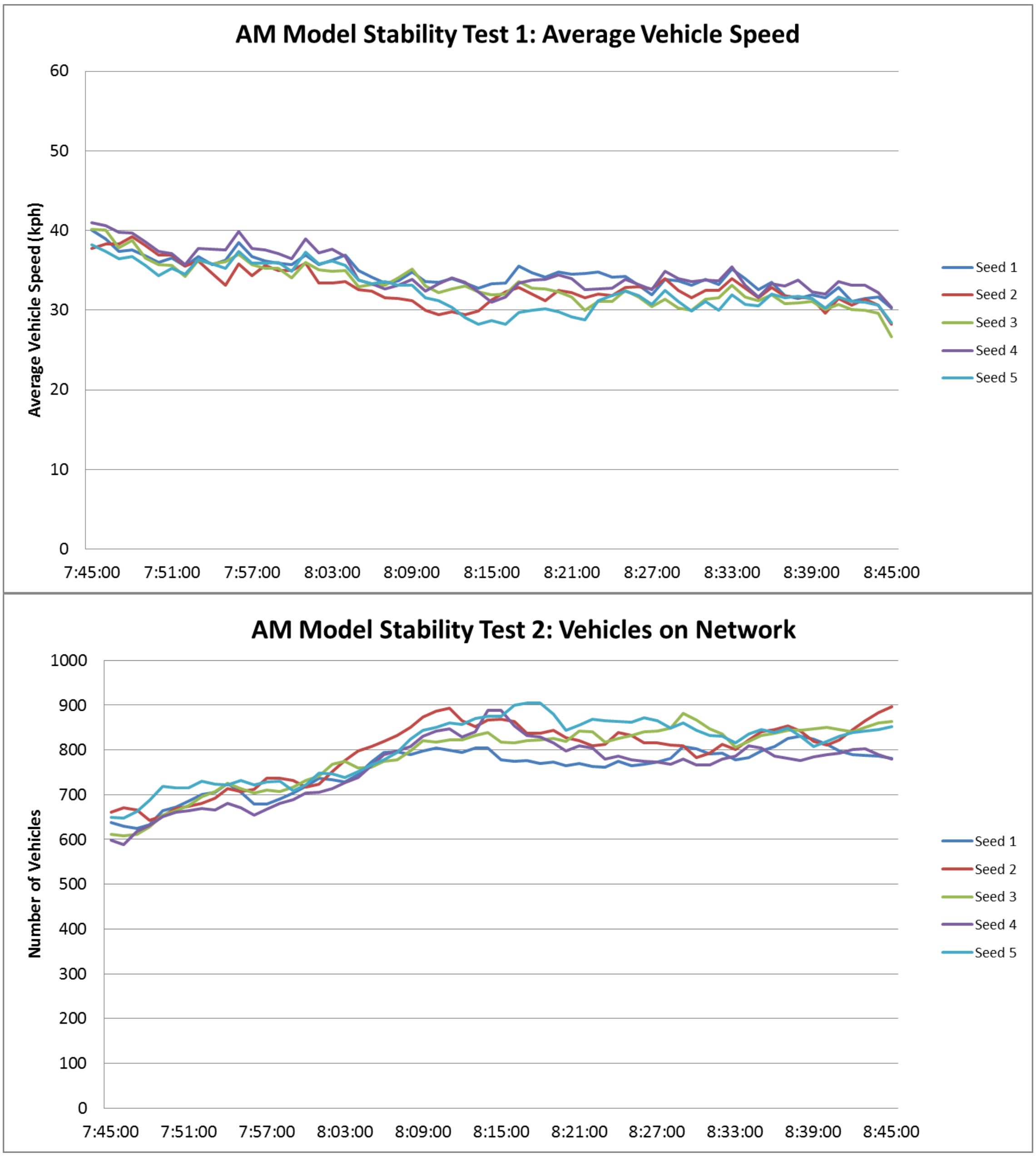
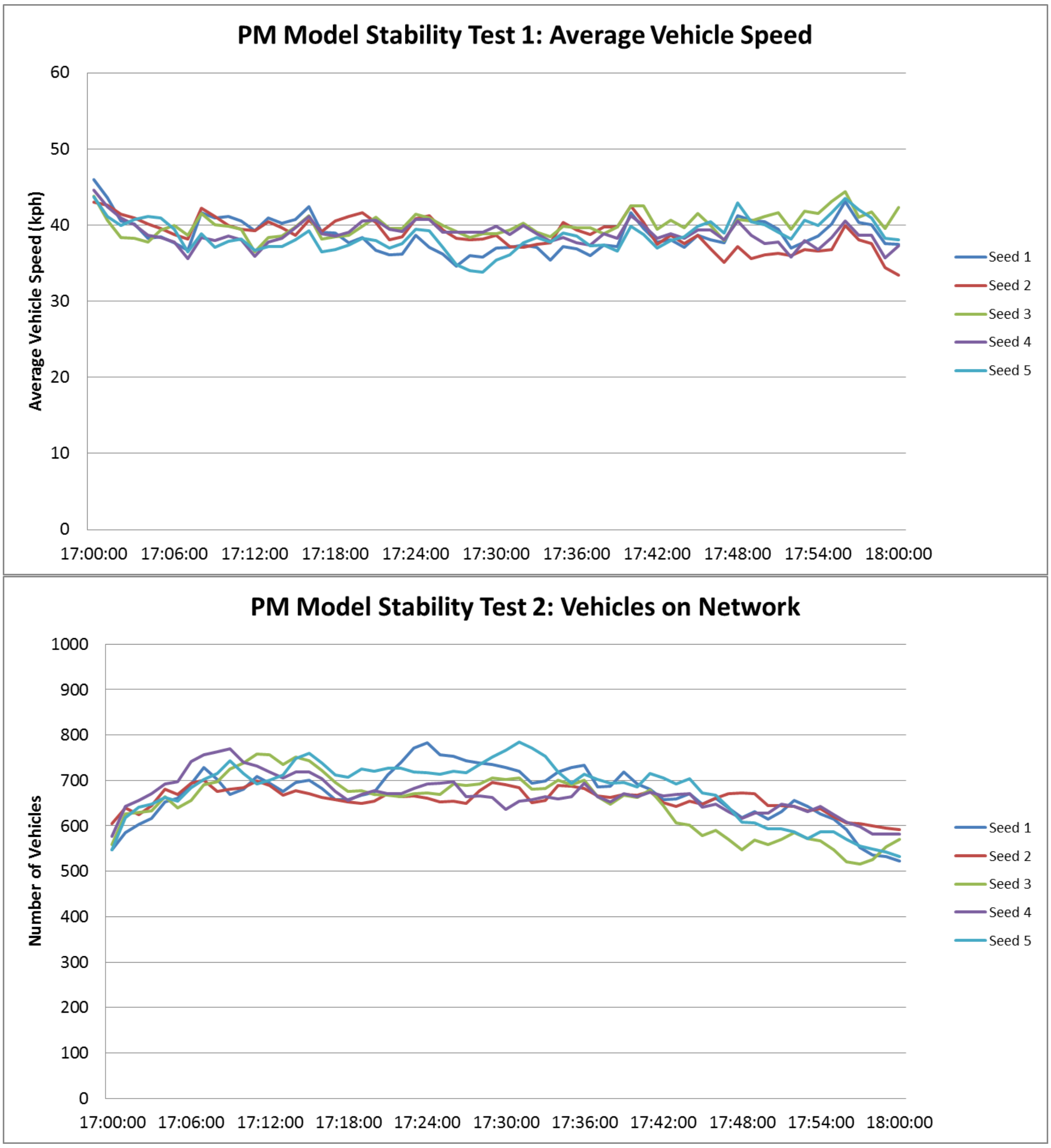


Figure 13 PM Peak Model Stability Test Results



6. Conclusion

6.1 Summary

This document has outlined the development of the microsimulation Base model for the Canning Bridge study area, specifically Canning Highway between Reynolds Road and Henley Street. Paramics (version 6) in conjunction with Azalient plugins has been used to simulate the traffic movements of vehicles on the network during the critical AM and PM peak periods of an average weekday.

The report has detailed the calibration process used to ensure that the model is representative of observed on-site turning movement traffic volumes. These have been shown to meet and significantly exceed industry standard guidelines.

In addition, the validation process for travel times has been outlined. All modelled travel time data has been shown to meet the target criteria. Furthermore, both the AM and PM models have been found to exhibit stable results across different seed value runs.

Given the results of the calibration and validation process, the model is now considered a robust representation of the study area during the AM and PM peak time periods. As such, these models are considered suitable to be used as the foundation for future year scenario testing.

DRAFT

Appendices

Appendix A Model Network of Key Junctions

Henley Street

Kwinana Freeway

Kintail Road

Sleat Road

Reynolds Road

Appendix B Turning Movement Calibration Results

AM Turning Movement Comparison

Note: Orientation of Canning Highway has been adopted as east-west between Reynolds Road and Kwinana Freeway (inclusive), and north-south at Henley Street.

Intersection	Movement	Observed	Modelled	GEH
Canning Hwy/Reynolds Rd	West to North	36	33	0.44
Canning Hwy/Reynolds Rd	West to East	1484	1634	3.79
Canning Hwy/Reynolds Rd	West to South	26	24	0.44
Canning Hwy/Reynolds Rd	North to West	47	53	0.88
Canning Hwy/Reynolds Rd	North to South	31	27	0.78
Canning Hwy/Reynolds Rd	North to East	78	96	1.91
Canning Hwy/Reynolds Rd	East to North	16	18	0.53
Canning Hwy/Reynolds Rd	East to West	1438	1484	1.19
Canning Hwy/Reynolds Rd	East to South	76	88	1.37
Canning Hwy/Reynolds Rd	South to West	97	94	0.31
Canning Hwy/Reynolds Rd	South to North	38	37	0.16
Canning Hwy/Reynolds Rd	South to East	297	369	3.94
Canning Hwy/Sleat Rd	West to North	15	16	0.20
Canning Hwy/Sleat Rd	West to East	2042	2049	0.16
Canning Hwy/Sleat Rd	West to South	4	3	0.42
Canning Hwy/Sleat Rd	North to West	58	60	0.23
Canning Hwy/Sleat Rd	North to South	43	47	0.60
Canning Hwy/Sleat Rd	North to East	186	179	0.55
Canning Hwy/Sleat Rd	East to North	172	166	0.48
Canning Hwy/Sleat Rd	East to West	1474	1479	0.13
Canning Hwy/Sleat Rd	East to South	35	32	0.52
Canning Hwy/Sleat Rd	South to West	9	9	0.13
Canning Hwy/Sleat Rd	South to North	25	26	0.12
Canning Hwy/Sleat Rd	South to East	591	598	0.30
Canning Hwy/Kintail Rd	West to North	4	2	1.15
Canning Hwy/Kintail Rd	West to East	3033	2827	3.80
Canning Hwy/Kintail Rd	North to East	989	952	1.17
Canning Hwy/Kintail Rd	East to North	406	443	1.81
Canning Hwy/Kintail Rd	East to West	1863	1829	0.78
Canning Hwy/Kwinana Fwy North facing ramps	West to East	1613	1546	1.70
Canning Hwy/Kwinana Fwy North facing ramps	East to West	1678	1667	0.27
Canning Hwy/Kwinana Fwy North facing ramps	South to West	591	594	0.14
Canning Hwy/Kwinana Fwy North facing ramps	South to East	661	640	0.82
Canning Hwy/Kwinana Fwy South facing ramps	North to West	793	781	0.44
Canning Hwy/Kwinana Fwy South facing ramps	East to West	824	891	2.29
Canning Hwy/Kwinana Fwy South facing ramps	East to South	565	582	0.69
Canning Hwy/Henley St	South to West	80	72	0.92
Canning Hwy/Henley St	South to North	1399	1484	2.23
Canning Hwy/Henley St	South to East	211	193	1.27
Canning Hwy/Henley St	West to South	137	132	0.45
Canning Hwy/Henley St	West to East	82	81	0.11
Canning Hwy/Henley St	West to North	16	14	0.46
Canning Hwy/Henley St	North to West	14	14	0.05
Canning Hwy/Henley St	North to South	1079	1051	0.86
Canning Hwy/Henley St	North to East	45	42	0.42
Canning Hwy/Henley St	East to North	195	201	0.41
Canning Hwy/Henley St	East to West	56	54	0.27
Canning Hwy/Henley St	East to South	308	291	1.01
Canning Hwy/The Esplanade	South to West	113	113	0.04
Canning Hwy/The Esplanade	East to South	201	231	2.01

PM Turning Movement Comparison

Note: Orientation of Canning Highway has been adopted as east-west between Reynolds Road and Kwinana Freeway (inclusive), and north-south at Henley Street.

Intersection	Movement	Observed	Modelled	GEH
Canning Hwy/Reynolds Rd	West to North	72	69	0.00
Canning Hwy/Reynolds Rd	West to East	1543	1511	0.83
Canning Hwy/Reynolds Rd	West to South	20	18	0.51
Canning Hwy/Reynolds Rd	North to West	23	26	0.61
Canning Hwy/Reynolds Rd	North to South	15	14	0.26
Canning Hwy/Reynolds Rd	North to East	39	40	0.16
Canning Hwy/Reynolds Rd	East to North	17	17	0.05
Canning Hwy/Reynolds Rd	East to West	1589	1746	3.84
Canning Hwy/Reynolds Rd	East to South	81	71	1.19
Canning Hwy/Reynolds Rd	South to West	61	58	0.36
Canning Hwy/Reynolds Rd	South to North	24	23	0.29
Canning Hwy/Reynolds Rd	South to East	146	148	0.13
Canning Hwy/Sleat Rd	West to North	54	60	0.82
Canning Hwy/Sleat Rd	West to East	1541	1605	1.62
Canning Hwy/Sleat Rd	West to South	29	27	0.46
Canning Hwy/Sleat Rd	North to West	86	90	0.47
Canning Hwy/Sleat Rd	North to South	99	97	0.18
Canning Hwy/Sleat Rd	North to East	94	88	0.59
Canning Hwy/Sleat Rd	East to North	64	45	2.54
Canning Hwy/Sleat Rd	East to West	1744	1703	0.98
Canning Hwy/Sleat Rd	East to South	52	40	1.71
Canning Hwy/Sleat Rd	South to West	29	28	0.19
Canning Hwy/Sleat Rd	South to North	39	37	0.26
Canning Hwy/Sleat Rd	South to East	309	309	0.01
Canning Hwy/Kintail Rd	West to North	26	24	0.48
Canning Hwy/Kintail Rd	West to East	2093	2014	1.75
Canning Hwy/Kintail Rd	North to East	397	394	0.13
Canning Hwy/Kintail Rd	East to North	678	717	1.49
Canning Hwy/Kwinana Fwy North facing ramps	West to East	1411	1450	1.04
Canning Hwy/Kwinana Fwy North facing ramps	East to West	2456	2492	0.72
Canning Hwy/Kwinana Fwy North facing ramps	South to West	722	762	1.48
Canning Hwy/Kwinana Fwy North facing ramps	South to East	775	767	0.28
Canning Hwy/Kwinana Fwy South facing ramps	North to West	1308	1326	0.50
Canning Hwy/Kwinana Fwy South facing ramps	East to West	1143	1166	0.68
Canning Hwy/Kwinana Fwy South facing ramps	East to South	563	565	0.08
Canning Hwy/Henley St	South to West	119	126	0.61
Canning Hwy/Henley St	South to North	1368	1242	3.49
Canning Hwy/Henley St	South to East	214	219	0.37
Canning Hwy/Henley St	West to South	138	148	0.87
Canning Hwy/Henley St	West to East	68	69	0.10
Canning Hwy/Henley St	West to North	17	14	0.87
Canning Hwy/Henley St	North to West	13	10	0.95
Canning Hwy/Henley St	North to South	1366	1396	0.81
Canning Hwy/Henley St	North to East	90	91	0.06
Canning Hwy/Henley St	East to North	90	91	0.15
Canning Hwy/Henley St	East to West	68	73	0.57
Canning Hwy/Henley St	East to South	192	191	0.07
Canning Hwy/The Esplanade	South to West	10	7	0.95
Canning Hwy/The Esplanade	East to South	687	728	1.53

Appendix E – Current public transport hours of service

Table 34: Hours of service for existing public transport services

Routes	Destination	Hours of Service (at Canning Bridge Station Interchange)			Comments
		Monday – Friday	Saturday	Sunday	
Mandurah Line	Perth	5:45 am – 12:00 am[1]	6:20 am – 1:40 am	7:20 am – 11:30 pm	[1] Last service at 1:40 am on Friday night/Saturday morning
	Mandurah	5:40 am – 12:20 am[2]	6:10 am – 2:20 am	7:30 am – 11:50 pm	[2] Last service at 2:20 am on Friday night/Saturday morning
Route 881	Perth	6:20 am – 10:45 pm	7:15 am – 10:45 pm	9:45 am – 10:45 pm	-
	Munster	7:00 am – 11:25 pm	7:55 am – 11:25 pm	10:25 am – 11:25 pm	-
Route 940	Perth	6:10 am – 11:25 pm	7:00 am – 11:30 pm	7:30 am – 11:30 pm	Limited Stops service
	Hamilton Hill	7:10 am – 12:10 am	7:40 am – 12:10 am	8:10 am – 12:10 am	
Route 106	Perth	5:20 am – 11:35 pm	6:35 am – 11:40 pm	8:05 am – 11:35 pm	-
	Fremantle	6:25 am – 11:40 pm	7:05 am – 11:35 pm	9:10 am – 11:35 pm	-
Route 105	Perth	6:30 am – 8:05 am	No Service	No Service	Routes 105, 111 supplement route 106 services along Canning Highway during weekday peak periods
	Applecross	3:45 pm – 6:30 pm	No Service	No Service	
Route 111	East Perth	5:50 am – 3:55 pm	No Service	No Service	
	Fremantle	9:45 am – 7:25 pm	No Service	No Service	
Route 30		5:55 am – 11:56 pm*	7:07 am – 12:25 am*	9:06 am – 8:57 pm*	*Does not go to the Interchange – travels between Curtin and Wellington Street

Routes	Destination	Hours of Service (at Canning Bridge Station Interchange)			Comments
		Monday – Friday	Saturday	Sunday	
Routes 150 and 160	Perth	6:00 am – 11:20 pm	6:40 am – 10:40 pm	8:05 am – 11:35 pm	Routes run parallel through the CBSP area Route 160 runs via Booragoon to Fremantle
	Booragoon (150) Fremantle (160)	7:00 am – 11:55 pm	7:30 am – 11:30 pm	8:30 am – 9:30 pm	
Route 158	Perth	6:40 am – 5:55 pm	No Service	No Service	Route 148 runs same route as 158 but terminates in Como instead of continuing to Perth Route 148 operates on weekends and in early morning/late evenings weekdays in place of Route 158
	Fremantle	7:30 am – 6:10 pm	No Service	No Service	
Route 148	Como	5:30 pm – 7:00 pm	9:40 pm – 6:10 pm	9:35 pm – 5:40 pm	
	Fremantle	6:05 am, 7:00 am & 6:45 pm	8:25 am – 5:25 pm	9:55 am – 5:55 pm	
Routes 100 and 101	Canning Bridge Station	6:05 am – 10:55 pm	8:25 am – 7:55 pm	8:25 am – 7:55 pm[3]	Routes run parallel through the CBSP area [3] Does not include additional early morning and late night services on Curtin University public holidays
	Curtin University	6:05 am – 10:30 pm	8:30 am – 8:00 pm	8:30 am – 8:00 pm[3]	

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